Primary Corridor Transportation Project

FINAL ENVIRONMENTAL IMPACT STATEMENT

SUBMITTED PURSUANT TO:

National Environmental Policy Act of 1969, §102, 42 U.S.C. §4332; Federal Transit Laws, Title 49 U.S.C. Chapter 53, §5301(e), §5323(b) and §5324(b); Title 49 U.S.C. §303, formerly Department of Transportation Act of 1966, §4(f); National Historic Preservation Act of 1966, §106, 16 U.S.C. §470f; Executive Order 11990 (Protection of Wetlands); Executive Order 11988 (Floodplain Management); and Executive Order 12898 (Environmental Justice).

by the

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL TRANSIT ADMINISTRATION

CITY AND COUNTY OF HONOLULU
DEPARTMENT OF TRANSPORTATION SERVICES

Cooperating Agencies

U.S. Army Corps of Engineers
U.S. Department of Transportation, Federal Highway Administration
State of Hawaii, Department of Transportation

JUL 25 2003
Date of Approval

Regional Administrator, Region IX
For Federal Transit Administration

JUL 23 2003
Date of Approval

Director
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Abstract

This Primary Corridor Transportation Project, Final Environmental Impact Statement (FEIS) responds to the comments received on the Major Investment Study/Draft Environmental Impact Statement (MIS/DEIS) published in August 2000 and the Supplemental Draft Environmental Impact Statement (SDEIS) published in March 2002. It also reaffirms selecting the Bus Rapid Transit (BRT) Alternative as the Locally Preferred Alternative (LPA).

Actions described in this FEIS are intended to address existing and future mobility constraints in Oahu's primary transportation corridor. The primary transportation corridor extends from Kapolei in the Ewa District to the University of Hawaii-Manoa and Waikiki in the Primary Urban Center (PUC). Three alternatives are presented in this document: (1) The No-Build Alternative consists of a reconfiguration of the present bus network to a hub-and-spoke pattern, with modest expansion of bus service in developing areas (e.g., Kapolei) to maintain existing service levels; (2) The Transportation System Management (TSM) Alternative which features the reconfiguration of the present bus route network to a hub-and-spoke network, expansion of service by 14 percent over the No-Build Alternative, plus some bus priority treatments on arterials in the Primary Urban Center (PUC) and in Leeward Oahu; and (3) Refined Locally Preferred Alternative (Refined LPA): This alternative builds on the hub-and-spoke bus system in the other alternatives, and adds Regional and In-Town Bus Rapid Transit (BRT) routes. The Regional BRT element includes a continuous H-1 BRT Corridor from Kapolei to Downtown using a.m. and p.m. contraflow zipper lanes and express lanes. The In-Town BRT component is a high capacity transit spine from Middle Street to Iwilei, an Iwilei to Waikiki Branch via Kakaako Makai, a University Branch from Downtown to UH-Manoa, and a Kakaako Mauka Branch. All three alternatives include the recently updated regional highway plan contained in the Oahu Metropolitan Planning Organization's Transportation for Oahu Plan (TOP 2025).

The first segment of the Refined LPA to be constructed is a 5.6-mile section between Iwilei and Waikiki. Funds for this Initial Operating Segment (IOS) are fully appropriated. Construction is expected in 2004-2005, with service projected to start at the end of 2005. The impacts of the IOS are described in this FEIS for its first year of service, 2006. The remainder of the Refined LPA will be phased over a period of 12 years after construction of the IOS.

This document includes copies of comments received on the MIS/DEIS and SDEIS plus the letters responding to those comments. In addition, this document presents the final analyses of these three alternatives in terms of transportation and environmental impacts, financial feasibility and funding sources, and cost-effectiveness. Transportation analyses include effects on transit service and other surface transportation systems, and transit ridership. Environmental parameters examined include land use, displacements and relocations, neighborhood setting, natural resources, air quality, noise, parklands, historic sites, visual resources and impacts during construction. This FEIS presents a description and impact analysis

for the IOS between Iwilei and Waikiki in each chapter as well as in a stand-alone chapter. If deemed appropriate, FTA will issue a Record of Decision (ROD) for the IOS. The remainder of the Refined LPA is planned to be the subject of a separate ROD at a future time.

Copies of this document are available for review at the Department of Transportation Services, Office of Environmental Quality Control, Legislative Reference Bureau Library, Municipal Reference and Records Center, University of Hawaii Hamilton Library, and State Main and Regional Libraries on Oahu.

COMMENTS:

Public comments will be accepted on this FEIS for 30 days after the Notice of Availability is published in the Federal Register. Written comments should be submitted to:

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Comments are due by September 8, 2003.

PREFACE

This Final Environmental Impact Statement (FEIS) is prepared in compliance with the National Environmental Policy Act (NEPA). The U.S. Department of Transportation (USDOT), Federal Transit Administration (FTA) is the lead federal agency for this project, and the City and County of Honolulu's Department of Transportation Services (DTS) is the local lead agency. The U.S. Army Corps of Engineers (ACOE), the USDOT Federal Highway Administration, and Hawaii Department of Transportation are cooperating agencies. This FEIS has been prepared in accordance with the National Environmental Policy Act of 1969, §102, 42 U.S.C. §4332; Federal Transit Laws, Title 49 U.S.C. Chapter 53, §5301(e), §5323(b) and §5324(b); Title 49 U.S.C. §303, formerly Department of Transportation Act of 1966, §4(f); National Historic Preservation Act of 1966, §106, 16 U.S.C. §470(f); Executive Order 11990 (Protection of Wetlands); Executive Order 11988 (Flood Plain Management); Executive Order 12898 (Environmental Justice); and FTA guidelines, Procedures and Technical Methods for Transit Project Planning; FTA/FHWA regulations, Environmental Impact and Related Procedures (August 1987); and Council on Environmental Quality's Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (July 1986).

This document is a major milestone in a public process that began with alternatives analysis in 1998. The Department of Transportation Services (DTS) distributed the Primary Corridor Transportation Project Major Investment Study/Draft Environmental Impact Statement (MIS/DEIS) to agencies and the public in August 2000. Following the release of the MIS/DEIS, there was an agency and public review period from August 23, 2000 to November 6, 2000. The MIS/DEIS analyzed and compared the environmental, social, transportation, and financial impacts of three alternatives: No-Build, Transportation System Management (TSM), and Bus Rapid Transit (BRT).

In addition to the MIS/DEIS public hearing (held on October 12, 2000), special public hearings were conducted by the Honolulu City Council Transportation Committee on September 25 and October 5, 19, and 26, and November 14, 2000. On November 29, 2000, the Honolulu City Council selected the BRT Alternative as the Locally Preferred Alternative (LPA).

At the time of adopting the LPA, the City Council asked the DTS to continue public dialogue on the project. Community working groups were formed to provide a forum for open dialogue between project sponsors and neighborhood, civic, business, government and other organizations so that environmental and transportation issues and refinements to project proposals could be discussed. The working groups also provided the community with an opportunity to obtain a greater in-depth understanding about BRT and what it means for their communities.

On August 1, 2001, the Honolulu City Council, responding to input from the Working Groups and comments received on the MIS/DEIS, refined the LPA to include new and modified components. The major change proposed was an additional line to serve the Kakaako Makai area, which by then had been selected as the site of the University of Hawaii Medical School and related facilities (currently under construction). The Supplemental Draft Environmental Impact Statement (SDEIS) prepared was approved for distribution by the State of Hawaii, Office of Environmental Quality Control (OEQC) and copies were distributed to the public, libraries, community groups, and local, State, and federal agencies for review and comment. The agency and public review period was from March 23, 2002 to May 7, 2002. The SDEIS public hearing was held on April 20, 2002.

For the MIS/DEIS, 152 comment letters were received from federal, state, and local agencies; elected officials; neighborhood boards; businesses; civic organizations; and citizens. Twenty-three people presented oral testimony at the MIS/DEIS public hearing. At the special Transportation Committee public hearings, 86 people presented oral and/or written testimony regarding the project. Many people commented in more than one method.

For the SDEIS, 95 comment letters were received and 63 people gave oral testimony at the public hearing.

Many comments received expressed support or opposition to a particular alternative. Numerous substantive comments were also received during the MIS/DEIS and SDEIS public comment periods. The most frequently expressed concerns related to the following issues:

1. Costs and methods of financing a BRT alternative;
2. Traffic and transportation issues;
3. Community and social concerns; and
4. Anticipated ridership.

Project refinements that address the public and agency comments received on the MIS/DEIS and SDEIS made the Refined LPA more cost-effective and increased its service. These refinements are: 1)substituting North-South Road for Kunia Road as the park-and-ride location serving the Ewa Plains area; 2)replacing the direct connector ramps at Kapolei, Kunia (now North-South Road), and Middle Street with less costly Bus Rapid Transit (BRT) priority treatments at these same locations using existing and planned freeway ramps; and 3)shifting a short section of the Kakaako Makai branch alignment to Forrest Avenue rather than Channel Street as the connection between Ala Moana Boulevard and Ilalo Street. The refinements will either not change the impact of the proposed action, or will result in a lessening of impacts.

The FEIS incorporates updates to land use forecasts for Oahu prepared subsequent to the MIS/DEIS. Also reflected in the FEIS is the set of highway projects established in the recently updated Oahu regional transportation plan (ORTP), or Transportation for Oahu Plan 2025 (TOP 2025). The Oahu Metropolitan Planning Organization (OMPO) Policy Committee adopted the updated ORTP, including the LPA transit project, on April 6, 2001. The OMPO Policy Committee adopted the Oahu Transportation Improvement Program (OTIP, project code C28) on September 19, 2001, with both the Regional and In-Town elements of the BRT Alternative as approved projects.

Implementation of the Refined LPA will be phased over 14 years, with DTS being the implementing agency for the entire project. A memorandum of agreement will be formalized with the SDOT for improvements to the H-1 Freeway that are part of the Regional BRT. In 2002, the Honolulu City Council selected the segment from Iwilei to Waikiki as the Initial Operating Segment (IOS) and appropriated $31 million in local funding. Local funding, along with $20 million in federal New Starts funds will pay for the full cost of the IOS.

A State FEIS was prepared pursuant to Hawaii Revised Statutes (HRS) Chapter 343. The State FEIS was approved by Governor Benjamin Cayetano on November 29, 2002.

Like the State FEIS, this Federal FEIS (under NEPA) addresses the comments received on the MIS/DEIS and SDEIS. It also places special attention to the section of the Refined LPA that will be constructed first, the IOS. The IOS is the 5.6 miles between Iwilei and Waikiki.

Public comments will be accepted by DTS and FTA on this NEPA FEIS for 30 days after its Notice of Availability is published in the Federal Register. The FTA will consider these comments in its determination on the issuance of the Record of Decision for the IOS of the Refined LPA. The project sponsor plans to request that FTA consider a separate ROD to cover the remainder of the Refined LPA at a future time.

ORGANIZATION OF THE FEIS

The FEIS consists of an Executive Summary, seven chapters, plus one chapter specific to the Initial Operating Segment (IOS Chapter), and three appendices. Impacts of the IOS are stated within each FEIS chapter as well as in a self-contained chapter, which has been added for the convenience of readers. Due to the number of pages of the FEIS, this document was divided into four volumes. Volume One includes the Executive Summary, Chapters One through Six and the IOS Chapter. Volume Two includes Appendices A and C, the Glossary, a List of Acronyms used in the FEIS, the Bibliography, a List of the FEIS Preparers and a List of FEIS Recipients. Volume Three consists of only Chapter Seven, which contains agency and public comments on the MIS/DEIS and the SDEIS. Volume Four contains the preliminary engineering drawings of the Refined LPA and the IOS.

The Executive Summary presents the major findings in summary form. The Executive Summary is intended to provide the reader with a basic understanding of the mobility constraints in the primary transportation corridor, the alternatives considered to address these mobility constraints, and the major impacts associated with the alternatives.

Chapter 1, Purpose and Need, provides a description of the mobility problems in the primary transportation corridor, leading to a statement of the goals and objectives that this investment in transportation improvements is meant to achieve.

Chapter 2, Alternatives Considered, provides an overview of the screening and selection process that was applied to alternative transportation investments. Three alternatives are described and subjected to detailed assessment. This chapter discusses the capital and the operating and maintenance costs of each alternative. Alternatives considered, but not ultimately included, are also discussed here.

Chapter 3, Affected Environment, describes the existing social and natural environmental conditions in the primary transportation corridor. This discussion provides an understanding of the environment in which the transportation investments would take place, identifies sensitive resources, and benchmarks the environmental conditions so that an assessment may be made of the impacts that alternative transportation investments could create.

Chapter 4, Transportation Impacts, describes impacts on the transportation system that would result from the alternative transportation investments. Conditions are assessed based on projections to year 2025. The chapter emphasizes the performance of the transit and roadway systems.

Chapter 5, Environmental Consequences, discusses potential impacts of the alternatives on the built and natural environment, both during project construction and upon completion. Mitigation measures to reduce the level of adverse impact are described where appropriate. Specific elements analyzed in the chapter include:

- Land Use and Economic Development
- Displacements and Relocations
- Neighborhoods
- Visual and Aesthetic Resources
- Air Quality
- Noise and Vibration
- Ecosystems
- Water
- Energy
- Historic and Archaeological Resources
- Parklands
- Construction
- Conformance with Sections 106 and 4(f)

The IOS Chapter describes the first phase of the project that will be implemented, and describes the transportation and environmental impacts of that portion of the project.

Chapter 6, Financial Analysis and Alternatives Comparison, presents information on the financial feasibility and funding sources for each alternative plus evaluates how well each alternative satisfies the project purposes and needs and compares the cost-effectiveness and equity of the alternatives.

Chapter 7, Responses to Comments, presents the oral and written comments received on the MIS/DEIS and SDEIS and the responses to those comments.

Appendix A summarizes public involvement activities and agency coordination processes. Appendix B contains preliminary engineering drawings of the IOS and the Refined LPA. Appendix C contains the project's cash flow analysis.

PRIMARY CORRIDOR TRANSPORTATION PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT

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EXECUTIVE SUMMARY

OVERVIEW

The Department of Transportation Services (DTS) for the City and County of Honolulu and the Federal Transit Administration (FTA) have prepared this Final Environmental Impact Statement (FEIS) for the Primary Corridor Transportation Project (PCTP) in accordance with the National Environmental Policy Act of 1969 (NEPA). Comments will be accepted by DTS and FTA on this FEIS for 30 days after its Notice of Availability is published in the Federal Register. FTA will consider these comments in its determination on whether to issue a Record of Decision (ROD) for the Initial Operating Segment (IOS) of the Refined Locally Preferred Alternative (Refined LPA). Impacts of the IOS are stated within each FEIS chapter as well as in a separate chapter.

A Notice of Intent was published on April 27, 1999 to inform the public and affected agencies that an EIS was to be prepared. A formal scoping meeting was held on May 11, 1999. A Major Investment Study/Draft Environmental Impact Statement (MIS/DEIS) was published in August 2000 and the LPA was selected in November 2000. A Supplemental Draft Environmental Impact Statement (SDEIS) was published in March 2002 to consider service to the Kakaako Makai area, which by then had been selected as the site of the University of Hawaii Medical School. The alignment to Kakaako Makai was also added to the LPA in August 2001.

This FEIS addresses the comments on the MIS/DEIS and SDEIS and places special attention to the Initial Operating Segment (IOS) which has been identified as the first phase for construction. For each phase of the total project to be implemented, there needs to be appropriations by the City Council and a commitment of federal matching funds. These appropriations exist for the IOS, and will need to be obtained for the balance of the project.

The 5.6-mile IOS is located between Iwilei and Waikiki, along the Kakaako Makai alignment and construction will consist of concrete lanes, signal priority, and widening of sections of Ala Moana Boulevard and Kalia Road. Construction at the transit stops will include a 13-inch high raised platform, benches, and canopies (except in historically sensitive locations). The IOS will be served by hybrid diesel-electric vehicles operating at-grade in exclusive or semi-exclusive lanes for 2.5-miles and in mixed traffic for 3.1- miles. Bus service will operate every six minutes during peak hours and every ten minutes during off-peak hours. The IOS will improve travel time between its end points in Downtown (Beretania Street/Aala Park stop) and Waikiki (Kapahulu Avenue stop) by 8-10 minutes over comparable existing routes that travel along the Ala Moana Boulevard corridor (Routes 19, 20, or 42). It will also provide improved travel times for points in between. The IOS will provide service to an area of Kakaako where currently no service exists.

The total capital cost for the IOS components is estimated to be $50.9 million in year of expenditure dollars and is fully funded. The estimated $4-5 million cost of the ten hybrid diesel-electric BRT vehicles that are required for IOS operations is not included in the capital cost of the IOS, since all of the vehicles will be purchased with already allocated City funds as part of the fleet replacement program, with or without IOS implementation.

Construction of the IOS will take two years. Passenger service will begin in 2005 and may begin with available diesel buses until new hybrid diesel buses are delivered. No significant impacts would result from implementing the IOS.

In response to comments received on the MIS/DEIS and SDEIS, the Refined LPA includes the following changes: 1) substituting North-South Road for Kunia Road as the park-and-ride location serving the Ewa Plains area; 2) replacing the direct connector ramps at Kapolei, Kunia (now North-South Road), and Middle Street with less costly Bus Rapid Transit (BRT) priority treatments at these same locations using existing and planned freeway ramps; and, 3) shifting a short section of the Kakaako Makai branch alignment to Forrest

Avenue rather than Channel Street as the connection between Ala Moana Boulevard and Ilalo Street. The refinements will either not change the impact of the proposed action, or will result in a lessening of impacts.

This FEIS does not address requirements under Hawaii Revised Statutes Chapter 343. A separate State FEIS was prepared and filed in November 2002 for the purposes of complying with Chapter 343.

S.0 ORGANIZATION

The purpose of this FEIS is to identify potential impacts resulting from the proposed implementation of the Refined LPA with a focus on the IOS between Iwilei and Waikiki. Figure S-1 shows the elements of the Refined LPA and Figure S-2 shows the IOS elements.

The Executive Summary is organized in three parts. The first is a synopsis of the Iwilei to Waikiki section, called the IOS in this document. It will be the first section constructed with operations set for 2005. The impacts described are for one year after operations are initiated (2006). The second part of the Executive Summary is a synopsis of the Refined LPA, both the Regional and In-Town components. The IOS is a subset of the In-Town component. The Regional and In-Town components are expected to be constructed over a 14-year period (due primarily to financial planning and to minimize impacts due to disruptions during construction). Impacts are shown for the Year 2025, which is after all components are constructed and in full operation for several years.

The third part of the Executive Summary provides summary synopses of the major findings of each of the chapters of this FEIS. Section S.1 summarizes the purpose and need for the project followed by Section S.2, which describes the alternatives that were considered, their evolution and the capital and operating and maintenance costs. Section S.3 summarizes the environmental impacts and analyses. Section S.4 discusses the financial analysis and cost-effectiveness analysis. Section S.5 summarizes the analysis of equity and environmental justice. Section S.6 describes trade-offs between the alternatives and issues for future consideration. Section S.7 lists the permits and approvals that are required. Section S.8 summarizes the unresolved issues.

<u>EXECUTIVE SYNOPSIS OF IWILEI TO WAIKIKI SEGMENT (INITIAL OPERATING SEGMENT)</u>

The IOS alignment, shown in Figure S-2, will help to provide transportation connections between emerging redevelopment areas such as Kakaako Makai, located between Downtown and Ala Moana, and other major activity locations along the IOS alignment. Many of these areas are not currently served with direct transit linkages. The IOS not only provides direct connecting service between these areas, but it will provide a higher level of schedule reliability due to priority treatments for the BRT service along the IOS alignment. Regular buses in mixed traffic cannot operate faster than other traffic and can be delayed depending on traffic conditions; but the BRT, in semi-exclusive lanes and with the use of an advanced priority signal system, can operate with less interference from general traffic. Therefore, the resulting travel time savings and reliability of such travel are significant.

The IOS will have travel time between its end points in Downtown (Aala Park stop on Beretania Street) and Waikiki (Kapahulu Avenue stop) via the Ala Moana Boulevard corridor of between 28 and 33 minutes, including average wait and walk times. Of this, between 25 and 30 minutes are in-vehicle time. This compares to travel time between these same points using either the existing Route 19, Route 20, or Route 42 local buses of approximately 38 to 48 minutes.

The IOS will provide transportation connections between emerging redevelopment areas such as Kakaako Makai, located between Downtown and Ala Moana, and other major activity locations along the IOS alignment. The IOS will provide new direct service to Waikiki for the Kakaako Makai and Victoria Ward areas. Currently, transit riders need to walk from the Kakaako Makai area to Ala Moana Boulevard to catch a local bus to

FIGURE S-1
REFINED LOCALLY PREFERRED ALTERNATIVE (LPA)

FIGURE S-2
INITIAL OPERATING SEGMENT (IOS)

Waikiki area, and transit riders need to transfer from a Route 6 to a Route 8 bus to reach Waikiki from the Victoria Ward area. From the UH Medical School in Kakaako Makai, the IOS will provide an eight (five in-vehicle) minute travel time to the Union Mall stop in Downtown, while it takes 16 (9 in-vehicle) minutes today, including walk time and average wait time for TheBus.

Similarly, travel time using the IOS between the the Waikiki Trade Center (Kuhio/Seaside stop) and Harbor Square (Alakea Street stop) will be 21 (18 in-vehicle) minutes versus 33 (30 in-vehicle) minutes using today's transit service. Travel time between Ward Centre (Kamakee Street stop) and Waikiki Beach is 33 (27 in-vehicle) minutes by today's transit service. This travel time will be shortened by 15 minutes to 18 (15 in-vehicle) minutes with the IOS, including average wait and walk times.

Convenient connections between the IOS and circulator, local, and express buses will occur at Aala Park, along Hotel Street in Downtown, at Ala Moana Center, and along Kuhio Avenue in Waikiki. The BRT stops will provide more amenities than the typical bus stop with 13-inch high raised platforms that provide level boarding to low-floor vehicles and covered waiting areas with seating, lighting and landscaping. Some variations will occur due to space limitations. A rendering of the proposed Hobron Stop in Waikiki is provided in Figure S-3A; a drawing of a typical stop is shown in Figure S-3B. Some of the stops will also be provided with signs indicating the waiting time until the next vehicle arrives. The entire IOS system will be designed in compliance with the Americans with Disabilities Act (ADA).

1) IOS Alignment

The IOS alignment shown in Figures S-4A and S-4B depict the locations of priority lanes and the 20 transit stops along the route. Travelling in the Koko Head direction, the IOS will start at Aala Park and proceed to the Hotel Street Transit Mall via Beretania and River Streets. From Hotel Street it will continue in the makai direction on Bishop Street to Aloha Tower Drive. From Aloha Tower Drive, the IOS will continue in the Koko Head direction on Ala Moana Boulevard and then turn in the makai direction onto Forrest Avenue. It will then turn in the Koko Head direction onto Ilalo Street which becomes Ward Avenue on the mauka side of Ala Moana Boulevard.

From Ward Avenue, the alignment turns Koko Head onto Auahi Street, where the BRT will be in extra-wide semi-exclusive curb lanes that permit the on-street parking to remain. At the Koko Head end of Auahi Street, the route will turn onto the short Queen Street segment to rejoin Ala Moana Boulevard and head Koko Head towards Waikiki. Along Ala Moana Boulevard, between Queen Street and the Ala Wai Canal, the BRT will operate in the curb lane in mixed traffic. Between the Ala Wai Canal and Kalia Road, Ala Moana Boulevard will be reconfigured to allow an additional lane in each direction. These lanes, formed by reducing the median and narrowing the travel lanes, will be semi-exclusive curb lanes shared with local buses, private buses and right-turning vehicles

From Ala Moana Boulevard, the route will turn makai on Kalia Road and enter Fort DeRussy. The route will continue along Kalia Road to Saratoga Road, with Kalia Road being widened by one lane in each direction between the Hale Koa Hotel and Saratoga Road. The alignment will turn mauka on Saratoga Road. The BRT will be in semi-exclusive lanes on Kalia Road from Maluhia Street to Saratoga Road, and on Saratoga Road from Kalia Road to Kalakaua Avenue. At the intersection of Saratoga Road and Kalakaua Avenue, the route will split into a one-way couplet on Kalakaua and Kuhio Avenues. The Koko Head-bound transit lane will be semi-exclusive, using the makai curb lane of Kalakaua Avenue until after the stop at Uluniu Street where it will transition mauka in mixed traffic to turn onto Kapahulu Avenue. The Kapahulu Transit Stop will be on the Koko Head side of Kapahulu Avenue and will not affect Kapiolani Park. The transit stop improvements at this site will be within the 18-foot-wide public sidewalk area. The return loop will turn Ewa onto Kuhio Avenue, and the Ewa-bound buses will operate in mixed traffic using the mauka curb lane of Kuhio Avenue. The alignment will turn onto the Ewa side of Kalaimoku Street to return to Saratoga Road. Within Waikiki, the BRT lanes will mostly be curbside semi-exclusive lanes shared with local buses and private transit vehicles. The exceptions

FIGURE S-3A
RENDERINGS OF HOBRON LANE STOPS

FIGURE S-3B
TYPICAL SECTION OF TRANSIT STOPS

FIGURE S-4A
IOS PRIORITY LANES AND TRANSIT STOPS

FIGURE S-4B
IOS PRIORITY LANES AND TRANSIT STOPS

will be the Kalaimoku contra-flow lane which will be an exclusive BRT lane; and Kapahulu and Kuhio Avenues which will be mixed-flow operations. In the Ewa direction, the IOS will travel Ewa from Kalaimoku Street in Waikiki following the reverse routing described for the Koko Head-bound direction, except that, at the intersection of Bishop Street/Nimitz Highway, the branch will turn Koko Head onto Nimitz Highway, then mauka onto Alakea Street, left on Hotel Street and then travel along Hotel Street to the North King Transit Stop at Aala Park.

2) Places Served

Existing attractions that will be served by the IOS include Chinatown, the Central Business District, Aloha Tower Marketplace, Hawaii Maritime Museum, Piers 10 and 11 cruise ship terminal, Restaurant Row, Kakaako Waterfront Park, Children's Discovery Center, Ward Centre and Entertainment Complex, Ala Moana Center, Ala Moana Beach Park, Fort DeRussy, Kapiolani Park, and major hotels, high-rise residences, offices, and commercial/recreation destinations in Waikiki. Future land uses that would be served include future phases of Aloha Tower Marketplace, a new cruise ship terminal at Pier 2, the University of Hawaii School of Medicine and related bio-medical research facilities, the proposed Hawaii Science and Technology Center, commercial plus retail development at Kewalo Basin, and the Waikikian and Outrigger redevelopment projects in Waikiki.

3) Estimated Cost

The capital cost of the IOS is $48.1 million in 2002 dollars ($50.9 million in YOE dollars). The project is fully funded through a combination of FTA sources matched by City General Obligation bonds. The IOS capital cost will come from a $31.0 million City appropriation (FY 2003) and from two FTA appropriations in FY 2002 and FY 2003 totaling $19.85 million.

The IOS construction is scheduled to be completed by 2005. The FY 2006 system wide bus operating and maintenance (O&M) cost, excluding TheHandi-Van, is estimated to be $119.3 million in 2002 dollars. This is a $264,700 savings because of corollary service changes compared to the No-Build condition. The system wide O&M costs excluding TheHandi-Van in 2006 YOE dollars will be $131.7 million. Similar to today, this will be financed through a combination of passenger fares, FTA formula funds and City general funds.

4) Vehicles

The City plans to use hybrid diesel-electric BRT vehicles for the IOS operation. These vehicles will be electric-powered buses with low floors that match the height of the stop raised platforms and will have traffic signal priority at selected intersections.

The cost of the ten hybrid diesel-electric vehicles that are required for IOS operations is not included in the capital cost of the IOS since the vehicles will be purchased with City (non-Federal) funds as part of the regular fleet replacement program that will occur with or without IOS being implemented. Because some of the existing bus routes are proposed to be modified to avoid service duplication with the IOS, the total size of the City's bus fleet will not change with implementation of the IOS and will remain at 525 buses, including the ten hybrid diesel-electric vehicles.

5) Construction Elements

Construction is scheduled to commence before the end of 2003, with completion projected in 2005. The major construction elements of each roadway segment are summarized in Table S-1. The improvements include construction of transit stops, concrete bus lanes, pavement rehabilitation, transit priority traffic signal improvements, roadway widening, landscaping, utility relocations, modifications to wheelchair ramps, sidewalks, and driveways, signage, striping, roadway lighting, and other work related to signal prioritization.

TABLE S-1
SUMMARY OF MAJOR ITEMS OF WORK

Roadway Segment	Major Items of Work
Hotel Street	Curbside modifications at Bishop St. and Alakea St. intersections.
Bishop Street	Transit stop construction with a 13-inch high raised platform.
Alakea Street	Transit stop construction with a 13-inch high raised platform.
Aloha Tower Drive	Transit stop construction with a 13-inch high raised platform and pavement rehabilitation.
Richards Street Extension	Pavement rehabilitation.
Nimitz Highway/Ala Moana Blvd.	Transit stop construction with 13-inch high raised platforms and pavement rehabilitation
Ilalo Street	Transit stop construction with 13-inch high raised platforms.
Auahi Street	Transit stop construction with 13-inch high raised platforms, concrete pavement construction, and pavement rehabilitation.
Queen Street	Concrete pavement construction.
Ala Moana Boulevard (Ala Wai Canal to Kalia Road)	Roadway widening to accommodate two semi-exclusive bus lanes, transit stop construction with 13-inch high raised platforms, concrete pavement construction, pavement rehabilitation, utility relocations, landscaping, and roadway lighting improvements.
Kalia Road	Roadway widening to accommodate two semi-exclusive bus lanes, transit stop construction with 13-inch high raised platforms, concrete pavement construction, pavement rehabilitation, landscaping, and roadway lighting improvements.
Saratoga Road	Transit stop construction with 13-inch high raised platforms, concrete pavement construction, and pavement rehabilitation.
Kalakaua Avenue	Concrete pavement and transit stop construction with 13-inch high raised platforms.
Kapahulu Avenue	Transit stop construction with a 13-inch high raised platform.
Kuhio Avenue	Transit stop construction with 13-inch high raised platforms, concrete pavement construction between Seaside Avenue and Kanekapolei Street, concrete pavement rehabilitation, roadway lighting improvements, and traffic signal modifications.
Kalaimoku Street	Concrete pavement construction.

Source: Parsons Brinckerhoff, June 2003.

The transit stops will provide more amenities than the typical bus stop, with 13-inch high raised platforms for level boarding of low-floor vehicles and covered waiting areas with seating, lighting, landscaping and canopies, which will be attractive and unobtrusive. Some variations will occur due to space limitations. The architectural design of transit stops in sensitive areas, such as the Kalakaua/Uluniu and Kapahulu Transit Stops, will involve public and agency consultation. All of the transit stops will be designed in compliance with the Americans with Disabilities Act.

6) IOS Environmental Impacts and Mitigation Measures

The transportation and environmental impacts of the IOS were evaluated within a 2006 time frame, a year after its expected implementation. Table S-2 summarizes the transportation and environmental impacts that are anticipated in 2006 as a result of implementing the IOS. It should be noted that no significant adverse impacts will result from implementing the IOS. The permits and approvals listed in Section S.7 will be required specifically for the IOS. The two unresolved issues described in Section S.8 that apply to the development of the IOS are the architectural design of transit stops and tree relocations.

EXECUTIVE SYNOPSIS OF REFINED LPA

The Refined LPA for the primary transportation corridor is comprised of the Regional BRT and the In-Town BRT. The DTS will be the implementing agency for the entire Refined LPA. A memorandum of agreement will be formalized with the SDOT for improvements to the H-1 Freeway that are part of the Regional BRT. The following provides a brief description of the Refined LPA components.

The Regional BRT component of the corridor makes more effective use of the existing priority lanes on the H-1 Freeway by extending the existing morning peak period zipper lane three miles from Radford Drive onto the H-1 airport viaduct to the Keehi Interchange (Nimitz Highway), and by constructing an approximately 6.5 mile long outbound, afternoon peak period contraflow zipper lane between Radford Drive and the Waiawa Interchange. Approximately 90 buses per hour will be using the zipper lanes during the peak periods to by-pass the congestion on H-1. To provide access for larger numbers of riders, the Regional BRT also includes constructing an exclusive BRT access-controlled ramp at Luapele Drive, and incorporating bus priority treatments to planned freeway ramps at Palailai Interchange in Kapolei and at the North-South Road Interchange. When combined, the existing and planned priority lanes on H-1 will create a 17.5 mile long transit/HOV corridor free from the congestion in the general purpose lanes.

The BRT improvements will be complemented by a series of other improvements identified in the Oahu Regional Transportation Plan (ORTP), including a network of 20 transit centers and park-and-rides. Seven of these transit centers and/or park-and rides already exist, two will be added as part of the Refined LPA, and eleven new ones will be added as part of the hub-and-spoke program independent of the Refined LPA. The Kapolei Transit Center and North-South Road Park-and-Ride are the two hub transit centers that will be built as part of the Refined LPA. (Note: An interim Kapolei Transit Center off of Kamokila Boulevard has been completed recently.) Other projects assumed to be implemented separately that will complement the Refined LPA include the addition of an express lane in both directions for high occupancy vehicles on H-1 between Kapolei and Managers Drive. A peak period contra-flow lane for buses in the median of Kamehameha Highway between Waimano Home Road and Salt Lake Boulevard in Pearl City/Aiea is also assumed to be implemented.

The In-Town BRT will be a 12.8 route mile high-capacity transit system providing frequent service and direct access to major activity destinations and residential neighborhoods throughout Honolulu's urban core. It consists of four segments: Middle Street to Iwilei, Iwilei-Waikiki via Kakaako Makai, Downtown to University of Hawaii–Manoa (UH-Manoa), and the Kakaako Mauka Branch. The In-Town BRT will have 32 transit stops, and will operate in exclusive median lanes or curbside contra-flow lanes along 38 percent of its length. Along the rest of the alignment it will operate in semi-exclusive curb lanes (29 percent) or in mixed traffic (33 percent). Semi-exclusive lanes are shared with local buses and right-turning vehicles (as well as private buses in Waikiki). During peak periods, the In-Town BRT vehicles will operate at two-minute intervals between Middle Street and Downtown, at four-minute intervals between Downtown and UH, and at three-minute intervals between Downtown and Waikiki (where both Kakaako branches are combined). Off peak service will generally be half as often.

TABLE S-2
SUMMARY OF IOS IMPACT ASSESSMENTS AND MITIGATION MEASURES

	IOS IMPACTS	MITIGATION
TRANSPORTATION FACTORS		
Transit	Because the IOS will serve the same function as the existing Route 8, Route 8 will be replaced by the IOS. The segments of Routes 55, 56, and 57 between Downtown and Ala Moana Center are also redundant and these routes will terminate in Downtown, allowing quicker turnaround of these buses. The IOS is forecast to result in approximately 4,500 new transit riders per day in 2006.	None necessary.
Urban Intersections	Very little change in intersection operations are proposed, so there will be minimal changes in delays at intersections and in the LOS at any of the intersections analyzed along the IOS route.	None necessary.
Parking	The IOS will displace unrestricted parking spaces on Queen Street (5 marked spaces), Saratoga Road (5 marked spaces), and Kapahulu Avenue (12 marked spaces).	There are large existing off-street parking facilities with reserve capacity near each location where on-street parking will be removed. Therefore, parking displaced by the IOS will not be replaced.
Loading Zones	Preliminary engineering for the IOS has taken into consideration the need to avoid impacts to as many passenger and freight loading zones as possible. The IOS will not result in any loading zone impacts.	None necessary.
Bicycling	Due to the provision of exclusive and semi-exclusive BRT lanes, the IOS will improve bicycle transportation on Auahi Street, portions of Ala Moana Boulevard, Kalia Road, Saratoga Road in the vicinity of Fort DeRussy, and a segment of Kalakaua Avenue between Saratoga Road and Uluniu Street.	None necessary.
Pedestrians	All transit stops will be in conformance with the Americans with Disabilities Act (ADA). The IOS will contribute to an improved urban walking experience through the use of environmentally friendly transit vehicles that produce less noise and air pollution.	None necessary.

TABLE S-2 (CONTINUED.)
SUMMARY OF IOS IMPACT ASSESSMENTS AND MITIGATION MEASURES

	IOS IMPACTS	MITIGATION
ENVIRONMENTAL FACTORS		
Land Use, Development, and Plan Consistency	Consistent with HCDA Kakaako Makai Plan. Serves UH Medical School and related facilities currently under construction.	None necessary.
Business and Residential Displacements	Displacement of some landscaped areas at Fort DeRussy. No buildings or structures will be affected.	Landscaping removed at Fort DeRussy will be replaced with similar landscaping nearby along Kalia Road.
Neighborhoods and Environmental Justice	The IOS will not cause disproportionately high and adverse health or environmental effects on any minority and low-income population and will provide many positive transit benefits.	None necessary.
Visual Character	IOS transit stops located in areas with high visual or aesthetic value may cause adverse visual impacts. Landscaping altered by the project may cause changes to the visual environment at certain locations.	IOS transit stops located in areas with high visual or aesthetic value will be designed to be appropriate in each setting and where possible will enhance the aesthetics of the area. Any existing landscaping affected by the IOS will be mitigated through provision of new street plantings and tree replacements.
Air Quality	No impact.	None necessary.
Noise/Vibration	No impact.	None necessary.
Ecosystems – Faunal Species	White terns (State of Hawaii endangered species on Oahu) occur in the IOS corridor, but no adverse impacts are expected.	Even though no adverse impacts are expected, a survey of the IOS corridor will be conducted for white terns and their eggs prior to completing final design. If sensitive trees or areas are identified, they will be monitored immediately prior to and/or during construction. Relocation and/or trimming of trees will be coordinated with the City's Department of Parks and Recreation.
Ecosystems – Botanical Resources	Construction of the IOS will displace 47 trees, of which nine are "notable" trees on Kalia Road. Some tree trimming will be required. No designated exceptional trees will be affected.	A tree preservation plan will be prepared. Affected trees will be relocated near their original locations or replaced in accordance with the tree preservation program.
Water	No impact.	None necessary.
Energy Consumption	No adverse impact.	None necessary.

TABLE S-2 (CONTINUED.)
SUMMARY OF IOS IMPACT ASSESSMENTS AND MITIGATION MEASURES

	IOS IMPACTS	MITIGATION
Historic and Archaeological Resources	Development of the Alakea and Saratoga Transit Stops may "adversely affect" lava rock curbs, which are considered historic. Development of the IOS is not expected to uncover buried archaeological resources or native-Hawaiian ancestral burial sites.	In accordance with the project's Memorandum of Agreement, DTS will work with the State Historic Preservation Division (SHPD) and other interested parties to explore using the lava rock curb material in the design of the two IOS transit stops affected. If burials or archaeological artifacts are uncovered during construction, work will stop and the SHPD will be notified immediately for appropriate action.
Parklands	The IOS will generally improve transit access to parks in the study area. Transit stops adjacent to parks could adversely affect their visual and aesthetic characteristics, even though no park property is used.	The transit stops near parks will require special design treatment.
Indirect and Cumulative	Substantial land use changes are not anticipated. The IOS may stimulate planned transit-oriented commercial and residential development. The IOS will be an important addition to the transportation infrastructure, supporting planned developments in Kakaako and Waikiki. The IOS and other planned developments will enhance short- and long-term employment.	None necessary.
Construction Impacts	Construction impacts will be temporary. Construction activities on streets will likely result in temporary traffic delays, detours, and bus stop relocation. Construction equipment and vehicles delayed by construction activities will increase emissions of fugitive dust and automotive air pollutants, such as carbon monoxide. Construction equipment also emits relatively high noise emissions, which could disturb nearby residences, schools, office buildings, and other noise-sensitive uses. Impacts to surface and groundwater resources are not expected due to best management practices. Utility services may be disrupted causing inconveniences to affected residences and businesses.	The Construction Management Program for the IOS will address all standard construction-period traffic and transportation issues. In addition, contractors will be required to comply with all applicable air quality, noise, and water quality laws. Substantial planning, including resident and business notifications, will be conducted to minimize inconveniences should interruptions in utility service be required.

Source: Parsons Brinckerhoff, Inc., April 2003.

The In-Town BRT will use environmentally friendly, state-of–the-art technologies to provide fast, reliable service to riders. Its advanced features include electric powered, 60-foot long articulated buses with low floors that match the height of the station raised platforms and traffic signal priority at selected intersections that allow the BRT to miss getting caught just as the traffic light is changing. These advanced features, coupled with limited stop spacing (between ¼ and ½ mile apart), priority lane treatments, and very frequent service will offer superior service to choice riders.

The In-Town BRT system will use hybrid diesel-electric powered vehicles, unless a superior and cost-effective alternative is found. The DTS continues to track development of an all-electric touchable embedded plate system; and its impacts are discussed in this FEIS. However, no decision on using such as system would be made until it is proven revenue service-worthy and additional environmental review is conducted.

S.1 PURPOSE AND NEED FOR ACTION

Oahu's primary transportation corridor, which stretches from Kapolei in the west to the UH-Manoa and Waikiki in the east (see Figure S.1-1), is the location of the vast share of the total travel occurring on the island. Existing transportation infrastructure in this corridor is overburdened handling current travel demand. Further investment is required to improve the effectiveness of the corridor's transportation infrastructure. Transportation improvements in the corridor will enhance mobility, reduce travel time and improve the quality of life for Oahu's residents and visitors.

Through continual public involvement and technical analysis, the following set of purposes and needs for a major transportation investment in the primary transportation corridor was identified:

1. Increase the people-carrying capacity of the transportation system in the primary transportation corridor by providing attractive alternatives to the private automobile.
2. Support desired development patterns.
3. Improve the transportation linkage between Kapolei, which is designated as a "New City", and Honolulu's Urban Core.
4. Improve the transportation linkages between communities in the Primary Urban Center (PUC) to increase the attractiveness of in-town living.

S.2 ALTERNATIVES CONSIDERED AND THEIR EVOLUTION

S.2.1 Evolution of the Alternatives

The alternatives which are presented in the FEIS evolved through an iterative process wherein a wide range of options was progressively analyzed in increasing detail. The final result of this extensive process is the Refined LPA.

Even after the initial alternatives were narrowed down to the three best fit alternatives presented in the MIS/DEIS, these alternatives underwent continual refinement using input from many sources, including the Oahu Trans 2K meetings, formal "scoping" meetings held for the general public and agencies, working group meetings and additional agency and public input.

The first step in the evolution of the alternatives involved combining information gathered from public and agency outreach with the results of prior studies in order to identify a broad range of alternatives for consideration. Public input was obtained primarily through the 21st Century Oahu Visioning Process and its transportation component, Oahu Trans 2K. The 21st Century Oahu Visioning process began in September 1998, and consisted of a series of neighborhood-based community meetings designed to enhance

FIGURE S.1-1
PRIMARY TRANSPORTATION CORRIDOR AND INITIAL OPERATING SEGMENT

opportunities for public input in planning a vision for Oahu's communities. The Oahu Trans 2K process involved four rounds of public meetings in 19 districts throughout the island and a fifth round islandwide meeting. In addition, a series of meetings were held with working groups representing six geographic subdivisions of the primary transportation corridor. Since project inception, over 500 meetings have been conducted for Oahu Trans 2K, community working groups, and outreach with agencies, individuals, businesses, institutions, and organizations.

In addition to public and agency input, alternatives were developed based on site visits, review of City and State plans, existing and projected land use and travel demand patterns, environmental constraints, and other research. Transportation alternatives were configured to support land uses that would facilitate transit ridership and contribute to sustainable, livable communities. This will maximize the efficiency and effectiveness of the transportation system, and create a mutually supportive transportation system and land use development pattern.

In August 2000 the Primary Corridor Transportation Project, Major Investment Study/Draft Environmental Impact Statement (MIS/DEIS) was published. Three alternatives were analyzed in the MIS/DEIS: the No-Build Alternative, Transportation System Management (TSM) Alternative, and Bus Rapid Transit (BRT) Alternative.

Following publication of the MIS/DEIS, there was a public review period from August 23, 2000 to November 6, 2000. In addition to the MIS/DEIS public hearing, five special public hearings were conducted by the Honolulu City Council Transportation Committee. On November 29, 2000, the Honolulu City Council selected the BRT Alternative as the LPA.

At the time of adopting the LPA, the City Council directed the Department of Transportation Services (DTS) to continue public dialogue on the project. Community working groups were formed to provide a forum for open dialogue between project sponsors and neighborhood, civic, business, government and other organizations to discuss environmental and transportation issues, and refinements to project proposals. The working groups were generally organized by the following geographic areas: Pearl City/Aiea, Aliamanu/Salt Lake/Foster Village, Kalihi, Downtown/Kakaako, Mid-Town/University, and Waikiki.

Working Group members were responsible for attending meetings, reporting back to their representative organizations, and bringing the resulting feedback to the Working Group meetings. The Pearl City/Aiea, Kalihi, Downtown/Kakaako, and Mid-Town/University Working Groups each had a series of meetings between February and June 2001. The Waikiki Working Group meetings were conducted from August 2001 through April 2002. The Aliamanu/Salt Lake/Foster Village Working Group met in July 2002.

As a result of the working groups and comments received on the MIS/DEIS, the DTS proposed refinements to the LPA to include new and modified components (see Figure S-1), which the City Council endorsed on August 1, 2001. The refinements included the addition of a new In-Town BRT branch to serve Aloha Tower Marketplace and the Kakaako Makai area; realignment of a small segment of the UH-Manoa Branch from Ward Avenue to Pensacola Street between South King Street and Kapiolani Boulevard, with a new transit stop along South King Street at Pensacola Street; and elimination of the proposed H-1 Regional BRT ramps at Kaonohi Street and Radford Drive to be replaced by a new H-1 BRT ramp near Aloha Stadium at Luapele Drive. Additionally, it was decided that the Kakaako Mauka Branch and Kakaako Makai Branch would use Alakea and Bishop Streets instead of Richards Street in response to comments received from area residents. Realigning the Kakaako Mauka Branch also provided the opportunity for two new transit stops, one on Alakea Street and one on Bishop Street.

Since the refinements were being proposed after completion and distribution of the MIS/DEIS and because the refinements were anticipated to have environmental impacts that were not disclosed in the MIS/DEIS, a Supplemental Draft Environmental Impact Statement (SDEIS) was prepared. A public hearing on the SDEIS was held on April 20, 2002.

In response to comments received on the SDEIS during the public comment period, several additional refinements have been incorporated into the Refined LPA. These include substituting North-South Road for Kunia Road as the park-and-ride location serving the Ewa Plains area; replacing the direct connector ramps at Kapolei, Kunia (now North-South Road), and Middle Street with less costly BRT priority treatments at these same locations using existing and planned freeway ramps; and, shifting a short section of the Kakaako Makai branch alignment to Forrest Avenue rather than Channel Street as the connection between Ala Moana Boulevard and Ilalo Street.

Implementation of the Refined LPA will be phased over 14 years starting in late 2003 with the award of a construction contract for the Initial Operating Segment (IOS) between Iwilei and Waikiki.

S.2.2 Description of Alternatives

The three alternatives analyzed in the FEIS are the following:

No-Build Alternative. This alternative includes existing transportation facilities and conversion of the present predominately radial bus system to a hub-and-spoke configuration. Expansion of the bus fleet to maintain current transit service levels, especially in developing areas such as Kapolei, is also part of this alternative. The No-Build Alternative serves as a reference point against which the build alternatives can be compared in terms of environmental impacts.

Transportation Systems Management (TSM) Alternative. Typically, TSM strategies are low to moderate cost improvements designed to increase the efficiency of the existing transportation infrastructure. TSM measures include elements such as traffic engineering and signalization, transit operational changes and modest capital improvements. Besides being a potential alternative for selection by decision makers, the TSM Alternative serves as a benchmark against which more extensive build alternatives can be evaluated for their cost-effectiveness.

The TSM Alternative includes reorientation of the present bus route structure from a predominantly radial service pattern to a hub-and-spoke network, extension of the H-1 A.M. zipper lane, bus priority treatments on selected arterials, and a significantly expanded bus fleet over the No-Build Alternative. There would also be two additional transit centers and one more park-and-ride facility with the TSM Alternative. Additionally, many of the other transit centers would be larger compared to those proposed under the No-Build Alternative.

Refined LPA (BRT Alternative). The Refined LPA will provide a more balanced transportation system than the present automobile-oriented transportation infrastructure. A hub-and-spoke bus network would connect with the Regional and In-Town BRT elements, integrating the hub-and-spoke network with a fast, high-capacity transit system spanning the primary transportation corridor. The In-Town BRT will provide high capacity, frequent, in-town transit service throughout Honolulu's Urban Core (Middle Street, through Downtown Honolulu, to UH-Manoa and Waikiki). The Regional BRT will incorporate regional transit routes that utilize bus priority facilities (express lanes) on the H-1 Freeway, creating an H-1 Freeway BRT Corridor, with priority treatment for regional transit vehicles at selected ramps and arterials to facilitate movement between the H-1 Freeway BRT Corridor and the corridor's transit centers. The Refined LPA will utilize expanded capacity, increased frequency, and enhanced service quality to attract commuters and mid-day riders.

The Regional BRT will complement and augment the In-Town BRT. At the Middle Street Transit Center, some of the regional local buses will terminate, while others of the regional express routes will continue into town using the In-Town BRT priority lanes. The Regional BRT vehicles that continue into town will continue along the UH-Manoa and Kakaako Mauka branches and operate as In-Town BRT vehicles to the termini of these routes. With this approach, many passengers commuting from outlying areas will not have to transfer at Middle Street. Through integrated planning and use of timed-transfers at outlying transit centers, route duplication will be reduced, system capacity will be increased and schedule reliability will be improved. These operational attributes are key ingredients of effectiveness. Together, the Regional BRT and In-Town BRT will provide an integrated transit system enhancing mobility within the primary transportation corridor, and between the primary transportation corridor and other parts of the island.

So that the evaluation of impacts and costs focus strictly on the differences in the proposed transit improvements, each of the three alternatives also include all of the highway improvement projects which are contained in OMPO's Transportation for Oahu Plan 2025 (TOP 2025).

S.2.3 Capital Costs

Table S.2-1 shows the capital cost estimates for the transit portion of the alternatives, by project component. These cost estimates include the normal replacement of buses, TheHandi-Van vehicles, and BRT vehicles over the 23-year analysis period. For comparison purposes, the costs in this section are presented in constant Year 2002 dollars, while the financial analysis in Section S.4 of this Executive Summary and Chapter 6 of this Final Environmental Impacts Statement are in year of expenditure dollars. Therefore, the readers of this document are advised to be cognizant of the differences in the two ways that costs are being presented.

TABLE S.2-1
CAPITAL COST SUMMARY-2003 TO 2025
(MILLIONS OF 2002 DOLLARS)

Project Component	No-Build	TSM	Refined LPA	
			With Hybrid-Electric	With EPT*
Bus & TheHandi-Van Acquisition	$394.1	$461.9	$512.5	$512.5
Regional Bus Rapid Transit	$10.3	$78.9	$203.0	$203.0
In-Town Bus Rapid Transit	$0.0	$0.0	$239.4	$322.7
Total	**$404.4**	**$540.8**	**$954.9**	**$1,038.2**

Sources: Parsons Brinckerhoff for No-Build and TSM Alternatives. Rider Hunt Levett & Bailey Ltd. for Refined LPA. June 2002.
* EPT: Embedded Plate Technology

It is estimated that the total capital costs over the 23-year period would range from about $404 million for the No-Build Alternative, to $955 million for the Refined LPA with hybrid diesel-electric buses, in constant 2002 dollars. The EPT would add $83 million in cost. As shown in Table S.2-1, the biggest cost item for all the alternatives would be the acquisition of buses and TheHandi-Van vehicles to serve island-wide transit needs. The cost of the BRT components represents only about half of the total cost of the Refined LPA, or $442 million.

S.2.4 Operating and Maintenance (O&M) Costs

Table S.2-2 presents annual operating and maintenance (O&M) cost estimates for the alternatives. The costs are for the forecast year 2025, assuming full development of each alternative, and are expressed in 2002 dollars.

It is estimated that O&M costs for the No-Build Alternative in 2025 would be about $121 million (in 2002 dollars). This compares to current operating costs for the existing bus system of about $118 million. Comparing the TSM Alternative to the No-Build Alternative, O&M costs in 2025 are estimated to increase to about $140 million as a result of the increase in the size of the bus fleet. The $151 million O&M cost in 2025 for the Refined LPA includes two components, the cost of expanded systemwide bus service and the cost of the In-Town BRT. None of the dollar costs described here include TheHandi-Van operations.

TABLE S.2-2
ANNUAL OPERATING AND MAINTENANCE COST SUMMARY, 2025
(MILLIONS OF 2002 DOLLARS, EXCLUDING THEHANDI-VAN O&M COSTS)

Alternative	Bus O&M Cost	In-Town BRT O&M Cost	Total Project O&M Cost
No-Build	$120.7	--	$120.7
TSM	$139.8	--	$139.8
Refined LPA	$144.3	$7.0	$151.2

Source: Parsons Brinckerhoff, June 2002.

S.3 IMPACTS AND MITIGATION

This section presents a summary of the significant transportation and environmental impacts associated with each of the alternatives.

S.3.1 Transportation Impacts

Because of the geographical constraints of the primary transportation corridor (mountains on one side and ocean on the other), travel is concentrated within a linear corridor and focused onto a limited number of parallel highway and arterial streets. Even with the planned widenings and other improvements to the highway system, because of projected growth, congestion is forecast to get even worse than today. Community feedback from outreach activities such as the Oahu Trans 2K workshops has indicated that grade-separated structures and extensive roadway widening as means to reduce traffic congestion are unacceptable. Instead people indicated that they are in favor of solutions that increase the people carrying capacity of the existing transportation infrastructure. Building upon the already successful bus system in Honolulu by taking it to the next level with a bus rapid transit system is a key element in solving future travel needs while preserving Oahu's idyllic environment. The Refined LPA will offer a fast, efficient travel mode through the congestion for those choosing to travel by transit, because transit vehicles will use the un-congested exclusive and semi-exclusive transit lanes.

A significant indicator of regional travel conditions is Vehicle Hours of Delay (VHD), which is the difference in vehicle travel time between free-flow and congested conditions. In 2025 the Refined LPA is projected to have substantially lower daily VHD than the No-Build or TSM Alternatives (17.3 percent less VHD than the No-Build Alternative and 14.8 percent less VHD than the TSM Alternative). This reduced VHD is indicative of less congestion on roadways.

In 2025 the Refined LPA is forecast to attract 20 percent more riders than the No-Build Alternative and 12 percent more riders than the TSM Alternative. This translates into over 51,400 more transit trips per day than the No-Build and 33,200 more than the TSM Alternative. The greater number of transit riders for the Refined LPA represents less cars on the road. Less cars would result in a notable reduction in traffic congestion. The benefits would accrue to all traffic on the freeway by shortening the length of time the freeway is congested.

Additionally, expanding the zipper lane operation to the P.M. peak period will benefit transit riders and carpool occupants with 2 or more riders by providing a less congested path through the heavily traveled H-1 Freeway corridor. An analysis determined that the contra-flow zipper lane could be implemented during the P.M. peak period, while maintaining acceptable traffic flow in the off-peak direction lanes on H-1.

Traffic impacts were analyzed at intersections all along the In-Town BRT alignment where the BRT will be operating in exclusive or semi-exclusive lanes. The findings are the following:

Dillingham Boulevard Corridor. After one lane in each direction converted to exclusive transit use, intersection level of service (LOS) for the Refined LPA will be equal to or better than for the No-Build and TSM Alternatives. This is possible primarily because the Refined LPA is projected to achieve sufficiently higher transit usage to decrease the peak hour, peak direction traffic along Dillingham Boulevard by almost 3,000 vehicles per hour (vph).

South King Street Corridor. Peak traffic during the P.M. peak period in 2025 will continue to be Koko Head-bound along South King Street. Similar to the Dillingham Boulevard Corridor, there is projected to be a reduction of traffic volume along the section of South King Street where the BRT will operate due to the diversion of some auto drivers to transit. This diversion will enable the Refined LPA to perform at comparable intersection LOS to the No-Build and TSM Alternatives, after the conversion of two general-purpose lanes; one to semi-exclusive transit use and one to exclusive transit use.

Kapiolani Boulevard Corridor. The Refined LPA will convert two general-purpose traffic lanes to exclusive transit lanes in the middle of Kapiolani Boulevard generally between Pensacola Street and Atkinson Drive, leaving two general-purpose traffic lanes in each direction regardless of the time period. Contra-flow coning for all traffic will continue Koko Head of Atkinson Drive, but will be discontinued between Atkinson Drive and South Street. The Refined LPA is projected to have a worse intersection LOS in 2025 compared to the No-Build and TSM Alternatives, mainly due to the two fewer lanes available to carry traffic in the peak direction. It is projected, however, that Kapiolani Boulevard traffic will still be operating acceptably for urban peak period conditions in the section with BRT lanes.

Ala Moana Boulevard Corridor. During both A.M. and P.M. peak periods in 2025, the Ala Moana Boulevard/Atkinson Drive intersection is projected to be congested for all the alternatives. Given the physical constraints of Ala Moana Center on the mauka side and Ala Moana Regional Park on the makai side, roadway widening is not an option. Only the Refined LPA with its semi-exclusive lane Koko Head-bound and exclusive lane Ewa-bound will allow BRT vehicles, local buses, and tour buses to bypass the congestion and continue to provide service for their patrons. For the section of Ala Moana Boulevard between the Ala Wai Canal and Kalia Road, the Refined LPA proposes a 5-10 foot widening by reducing the width of the raised median and narrowing the existing traffic lanes to provide an additional lane in both Ewa-bound and Koko Head-bound directions. The additional lanes would be for BRT vehicles, local buses, tour buses and trolleys, and right turning vehicles. Because of the added capacity of these lanes the congestion will be substantially less with the Refined LPA for all traffic along this section.

Kalia Road Corridor. The Refined LPA proposes to widen Kalia Road by one lane in each direction, with these lanes being designated as semi-exclusive lanes. BRT vehicles, local buses, private buses, and vehicles turning right into driveways on Kalia Road will be able to use these lanes. Because of the new lanes proposed for Kalia Road, traffic operations are projected to be better in 2025 with the Refined LPA compared to the No-Build or TSM Alternatives.

Kalakaua Avenue Corridor. Kalakaua Avenue will be used as the Koko Head-bound segment of the counter-clockwise BRT Loop within Waikiki. During normal peak traffic hours Kalakaua Avenue is not projected to be congested with any of the alternatives. During special events, which occur frequently in Waikiki, Kalakaua Avenue will continue to be congested. During these times the semi-exclusive curb lane will allow the BRT vehicles, tour buses, and trolleys a clearer path through the congestion. During special events such as parades where all or sections of Kalakaua are closed, the BRT vehicles will be re-routed to Kuhio Avenue.

Kuhio Avenue Corridor. The Waikiki Livable Communities project has proposed that the existing sidewalks be widened on Kuhio Avenue. With sidewalk widening, what would remain is enough roadway width to provide two traffic lanes in one direction, one traffic lane in the other direction, and space for median left-turn lanes at selected locations. Turnouts would be provided for commercial truck and tour bus loading and for local bus stops. In the Refined LPA, two lanes would be oriented in the Ewa-bound direction with the curb lane designated as a semi-exclusive lane for BRT vehicles, local City buses, tour buses, trolleys, and right-turning vehicles. Koko Head-bound there would be a single general-purpose traffic lane.

On-Street Parking Impacts

With regard to parking impacts, an efficient transit system will encourage people to use transit rather than drive automobiles. As a result, parking demand in the PUC with the Refined LPA should decline along the transit spine. Where on-street parking is removed to permit transit lanes for the Refined LPA, new neighborhood parking facilities will be considered to replace the on-street parking, but only if they meet other livable community objectives and are the result of community-based planning.

Loading Zone Impacts

Minor loading zone impacts will occur with the Refined LPA in Downtown and in Iwilei. There would be no loading zone impacts in Waikiki. For the Downtown and Iwilei loading zones affected, substitute loading areas will be developed and coordinated through a community-based planning process.

Pedestrian Impacts

The Refined LPA will provide benefits for pedestrians in a number of ways. Improved transit will reduce the number of autos circulating, and environmentally friendly transit vehicles will produce less noise and air pollution. These factors will contribute to an improved urban walking experience. Additionally, the Refined LPA will positively affect the pedestrian environment by providing new Americans with Disabilities Act (ADA) ramps, and safer crosswalks and sidewalks in the vicinity of the BRT stops.

S.3.2 Environmental Impacts

The environmental analyses that were conducted looked at those parameters pertinent to transportation projects, including potential impacts on sensitive resources and issues identified during the scoping process. Environmental analyses also included other studies required by law.

Land Use

The In-Town BRT will provide a permanent, fixed transportation infrastructure within the urban core of Honolulu. Its high level of transit service will facilitate transit-oriented development, a mix of residential and commercial uses in a pedestrian friendly environment, which is consistent with the Draft Primary Urban Center Development Plan (May 2002).

The Refined LPA will provide the strengthened transit connection between Kapolei and the PUC that is necessary to facilitate continuing business, commercial and residential development in Kapolei and the Ewa Plain. The City's Ewa Development Plan (1997) calls for the development of Kapolei as a "New City".

In contrast, it is unlikely that the TSM or No-Build Alternatives would encourage and support transit-oriented development in the urban core, and these alternatives would be generally less supportive of land use goals of the Ewa Development Plan than the Refined LPA.

Economic Impacts During Construction

Analyses were conducted to estimate the effects of project construction on the local economy. Using the Hawaii Department of Business, Economic Development, and Tourism forecasting methodology it is estimated that the elements of the No-Build and TSM Alternatives involving construction would generate 279 and 713 person-years of construction jobs, respectively. In contrast, it is estimated that 3,737 person-years of construction jobs would be created through implementation of the Refined LPA. Since it is expected that construction of the Refined LPA would be financed in part by federal discretionary (New Starts) grants, 1,106 person-years of construction jobs resulting from the Refined LPA would be "new" jobs that would not occur in the absence of the Refined LPA. The No-Build and TSM Alternatives are assumed to utilize federal formula funds, and therefore would not qualify for FTA New Starts funding. As a result, no new construction jobs would result from the use of federal dollars.

In addition to considering the jobs created directly in construction, analyses were also conducted to estimate the indirect and induced jobs. The indirect and induced person-years of jobs that would be created by the No-Build and TSM Alternatives are estimated to be 704 and 1,797, respectively, whereas it is estimated that the Refined LPA would create 9,418 indirect and induced person-years of jobs.

Economic Impacts Directly Attributable To Transit System

It is estimated that the Refined LPA will increase employment for bus drivers (bus and In-Town BRT) and mechanics from 1,181 today to 1,760 by 2025, an increase of approximately 600 jobs or 49 percent. The expanded fleet and new BRT system will also generate additional administrative and management jobs.

Displacements

None of the alternatives will cause displacement of any residences; however, one property will be affected under the Refined LPA. Kapalama Makai, an apartment complex on the corner of Dillingham Boulevard and McNeill Street (1514 Dillingham Boulevard), will need to have its driveway reconfigured and will lose one to two parking stalls.

The No-Build Alternative, TSM Alternative, and the Refined LPA all assume the construction of the North-South Road park-and-ride facility. The North-South Road Park-and-Ride will require about four acres of agricultural land currently used by an active farm, but the farm would remain viable. There would be no other displacements with the No-Build and TSM Alternatives. The Refined LPA will affect 22 businesses or institutions, which will experience minor losses of parking and/or land area due to street widening.

Equity And Environmental Justice

The Refined LPA will not cause disproportionately high and adverse health or environmental effects on minority and low-income populations. Some of the minority and low-income populations would be located near elements of the Refined LPA, such as the In-Town BRT. However, the alignment was selected to minimize adverse impacts while maximizing travel benefits for the primary corridor's neighborhoods, including those occupied by minority and low-income residents. In addition, the improved transit service provided by the Refined LPA will improve mobility for minority and low-income residents throughout the primary transportation corridor. The No-Build and TSM Alternatives would also not cause disproportionately high and adverse health or environmental effects with respect to minority and low-income populations.

Visual And Aesthetic Resources

The Refined LPA provides opportunities to enhance the urban form, not only in the urban core, but also wherever transit improvements are proposed. Many of the elements of the Refined LPA, such as the In-Town and Regional BRT priority lanes, will involve few physical changes other than to the street surface resulting in little or no visual impact to the existing landscape, regardless of land use. Through the use of streetscape improvements (e.g. sidewalk paving, landscaping, and street lighting) and passenger amenities at BRT stops, the Refined LPA offers an opportunity to enhance the visual quality of the streetscape and improve the pedestrian experience. As a result of the project, there would be a greater sense of visual order and unity because of the physical improvements and landscape treatments along the alignment.

Those project elements potentially causing visual impacts will be designed and landscaped to have the least possible visual impact by blending in with their surroundings. Project elements such as transit centers and transit stops provide urban design opportunities to improve existing streetscapes with cohesively designed architectural elements, landscaping, street furniture, street trees and lighting.

Energy Consumption

The Refined LPA will result in the least amount of direct energy consumption because it would lead to a substantial decrease in the vehicle miles of travel (VMT) by autos. In comparison to the No-Build Alternative, the Refined LPA will reduce energy consumption by about 215,000 barrels of oil in the design year 2025, assuming that hybrid diesel/electric In-Town BRT vehicles are used. In comparison to the TSM Alternative, the Refined LPA will reduce energy consumption by about 250,000 barrels of oil under the same conditions.

Air Quality

Air quality was analyzed at the intersection or microscale level using computer models to predict future carbon monoxide (CO) concentrations. Under worst-case meteorology conditions, all three alternatives would result in CO concentrations above the stringent State ambient air quality standards at most locations or intersections studied. However, it should be noted that the predicted concentrations are probably conservatively high for all scenarios. This is because EPA's projections for emissions from motor vehicles have generally been revised downward since these studies were completed, as discussed in Section 5.5.2.

When the results of the microscale analyses are viewed as a whole, the Refined LPA provides the lowest worst-case carbon monoxide concentrations, although not all areas would benefit. Of the 23 intersections studied, 16 would experience reduced concentrations under the Refined LPA compared to the No-Build Alternative during the AM peak hour, while five intersections would see increases, and two intersections would see no change. The change in concentrations during the PM peak hour would be similar with 15 intersections showing a decrease, six showing an increase, and two with no change. No mitigation is proposed since the overall situation across the project area would improve with the Refined LPA.

The TSM Alternative and Refined LPA would not worsen regional air quality in comparison to the No-Build Alternative.

Noise and Vibration

Future noise levels along the alignment of the In-Town BRT component of the Refined LPA will be lower than with the TSM and No-Build Alternatives because of the use of electric or hybrid-electric vehicles, which produce substantially less noise than standard diesel buses.

There are no severe noise impacts projected for any sites along the Refined LPA alignment. Assuming use of hybrid diesel/electric vehicles, moderate noise impact is projected for one location on the In-Town BRT alignment, the Bishop Garden Apartments at 1470 Dillingham Boulevard in Kalihi. If the embedded plate technology is chosen, no impacts are projected.

Using the diesel and hybrid diesel/electric technologies in the Regional BRT, the BRT vehicles traveling to and from the Aloha Stadium Transit Center are expected to result in moderate noise impacts at the Puuwai Momi Apartments on Salt Lake Boulevard and Kamehameha Highway (99-102 Kalaloa Street), and at least one single-family residence on Luaole Street, including 4509 Luaole Street where a noise measurement was taken. The final design phase will include studies to determine more specific noise impacts.

Ground vibration levels caused by the rubber-tired electric or hybrid diesel/electric bus would be minimal and would not exceed FTA criteria. Therefore, no vibration impacts are expected under any alternative.

Ecosystems

No state or federally listed, proposed, or candidate threatened or endangered plant or animal species, except the white tern, is likely to be affected within areas proposed for construction under the Refined LPA. The State of Hawaii lists the Oahu population of the white tern (*Gygis alba*) as endangered. White terns are also a federally protected species under the Migratory Bird Treaty Act. No impacts to these birds are expected under the No-Build and TSM Alternatives.

A tree survey and impact analysis for the Refined LPA identified that 154 street tree impacts may occur along the In-Town BRT alignment, of which 34 trees were classified by the project's qualified certified arborist as being notable trees, or trees deemed important to the urban landscape character. The impacts will mostly involve moving trees further back from the curb along those sections of the alignment where the street needs to be widened. Wherever a tree needs to be removed, a similar species as that tree will be planted in its place. No tree impacts are expected under the No-Build and TSM Alternatives.

Water

No major impacts on water resources are expected for any of the proposed alternatives. Increasing transit ridership would reduce non-point source water pollution generated by automobiles.

Historical Resources

Adverse effects to archaeological sites are not expected under the No-Build and TSM Alternatives. Also, there are no historic-period resources (historic buildings, structures and objects constructed or erected after western contact) or traditional cultural properties within the Area of Potential Effect (APE) of either alternative.

Under the Refined LPA, construction of the In-Town BRT may require excavation about two to three feet in depth along the alignment if embedded plate technology is used. This activity would have a moderate to high probability of uncovering subsurface archaeological resources along certain segments, such as in Chinatown, Kakaako, Ala Moana and Waikiki. The APE of the Refined LPA contains several historic-period resources. Most of them will not be adversely affected because right-of-way is not needed at these sites, nor will they be affected by being in proximity to transit stops. The Refined LPA may cause an "adverse effect" on Chinatown, the Hawaii Capital Historic District and Thomas Square because these resources have visual integrity, which may be affected by the transit stops. Other historic-period resources that may be adversely affected by the Refined LPA include the Kapiolani Boulevard historic landscape because of tree relocations, and lava rock curbs, which are considered historic by the State Historic Preservation Division (SHPD), because they will be temporarily removed during construction of certain transit stops.

Parklands

In general, the Refined LPA, and to a lesser extent the TSM Alternative, would enhance the value of the park and recreational resources in the study area by improving their accessibility for transit users. For example, the Kakaako Makai Branch of the In-Town BRT would provide improved transit service to recreation resources in the Kakaako Makai Community Development District.

Construction Impacts

The Refined LPA will have the most new construction, therefore having the greatest impact of the three alternatives. For example, transit lanes will be constructed along the alignment of the In-Town BRT within existing streets. Construction impacts will be temporary and detailed mitigation plans will be developed, including a plan for maintenance of traffic. An archaeological contingency procedure will be prepared, should unanticipated resources be encountered during construction.

The TSM Alternative would include some construction, but mainly involves operational changes to the bus system. The No-Build Alternative has the fewest impacts, because it assumes no additional construction from the future No-Build condition.

S.3.3 Mitigation Commitments

This section summarizes the mitigation measures proposed by the City to minimize any adverse impacts.

Relocations

Since federal funds would be used to assist project construction, the project would be subject to provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (49 CFR Part 24, 42 U.S.C. 4601, et seq.). Although no displacement of businesses or residents is expected, should it become necessary, State law on relocations is provided in Hawaii Revised Statutes (HRS) Chapter 111, Assistance to Displaced Persons.

Fair market compensation for land, buildings and uses would be provided to property owners directly affected by right-of-way requirements. For properties that would experience partial displacement but not relocation, mitigation would be provided at project cost, such as reconstruction of a driveway or parking area.

Visual and Aesthetic Resources

Project elements such as transit centers and transit stops will be designed to visually blend in with their surroundings. In particular, transit stops in or near Chinatown, the Hawaii Capital Historic District, Thomas Square, Kapiolani Boulevard, Waikiki Beach, Kapiolani Park and UH-Manoa are considered to be in potentially sensitive areas and will be designed with sensitivity to be compatible with their surrounding contexts, based on public input and conformance with appropriate design standards.

Noise

Noise mitigation for the Bishop Garden Apartments (1470 Dillingham Boulevard) is not deemed to be feasible and will not be included as part of this project, because a wall at this location would impair driver visibility and interfere with pedestrian and traffic movements. Interior sound insulation of the affected apartment units could be a reasonable alternative to a noise barrier, including air-conditioning installation and replacement of windows and doors facing the BRT alignment.

Property line noise barriers would be effective in mitigating the noise impacts to the Puuwai Momi Apartments (99-102 Kalaloa Street). A 10-foot high noise barrier wall is proposed along the affected section of Salt Lake Boulevard. Noise barriers would not be feasible in mitigating noise impacts at the single-family residences on Luaole Street (including, but not limited to, 4509 Luaole Street), because a barrier would likely interfere with traffic and pedestrian movements. Interior sound insulation and installation of air-conditioning in affected homes could be a reasonable alternative to a noise barrier for this area. The extent of potential noise impacts to other residences near the Luapele Ramp will be studied in the final design phase.

Ecosystems

A survey of the project area will be conducted for white terns and their nests prior to final design. Sensitive trees and areas will also be monitored immediately prior to and/or during construction activities that involve tree relocation, removal, and/or trimming. All monitoring will be coordinated with the U.S. Fish and Wildlife Service (USFWS). DTS will also coordinate tree trimming with the City's Department of Parks and Recreation (DPR), which has standard procedures to avoid impacts to white terns and their eggs.

A tree preservation program will be developed in conjunction with a qualified certified arborist to mitigate unavoidable impacts. The tree preservation program will be in accordance with standard procedures used by the DPR, and community input will play a role in identifying key components of the program. On-site tree relocation is the preferred mitigation option wherever possible, but land acquisition by the City may be necessary. If a tree must be relocated off-site, the project team under direction from DTS and input from the appropriate working groups will identify suitable sites for relocating each individual tree. DTS will replace trees that must be removed altogether at a minimum of a one-to-one ratio.

The City's Department of Design and Construction (DDC) also has plans for a construction project that will affect trees on Kapiolani Boulevard. In order to ensure that the monkeypod trees have enough time to recover in between construction projects, any In-Town BRT-related construction activities affecting those trees on Kapiolani Boulevard will not be started until at least two years have passed since the completion of the DDC project.

Water Resources

Although no impact on water resources is expected, specific sediment and erosion control measures would be resolved during final design, and a best management practices plan would be developed to control roadway contaminants resulting from additional impervious surfaces as a preventative measure.

Historic/Archaeological Resources

A memorandum of agreement (MOA) pursuant to Section 106 of the National Historic Preservation Act has been prepared and is included in Appendix A. The MOA specifies that archaeological monitoring will be conducted during excavation in areas along the In-Town BRT alignment with moderate to high levels of probability of uncovering archaeological resources. Potential impacts would mostly be related to construction of the embedded plate technology.

The MOA will also contain stipulations that require consultation with the SHPD and other stakeholders on the design of those transit stops that may adversely affect historic properties. The consultation will focus on the type, number and size of structures, architectural style, and protection of important viewsheds and historic characteristics of affected properties.

Parking and Loading Zones

It is expected that an efficient transit system will encourage people to use transit rather than driving private vehicles. Parking demand in the PUC is expected to decline in general under the TSM Alternative and Refined LPA, but especially along the In-Town BRT alignment in the Refined LPA.

In areas where a large concentration of on-street parking spaces will be affected by In-Town BRT operations, replacement parking in new off-street parking facilities will be considered, but only if they meet other livable community objectives and are the result of community-based planning. Areas of concern will be addressed on a case-by-case basis during the project's final design phase.

As with parking impacts, loading zone impacts will be addressed in the final design phase using community-based planning as an integral part of the decision-making process.

Bicycle Facilities

The Refined LPA will not affect the provision of bicycling facilities as identified in the State's Bike Plan Hawaii: A State of Hawaii Master Plan (May 2003), which updates the 1994 version of the plan, and the City's Honolulu Bicycle Master Plan (April 1999). In addition, the Refined LPA will allow curbside semi-exclusive

BRT lanes at various locations to be shared with cyclists. Specific mitigation that is proposed includes widening the curbside lanes on Dillingham Boulevard from 14 feet to 18 feet between Middle Street and Waiakamilo Road to provide more room for cyclists and motorists to share the lane, and providing a bike lane on South King Street between Alapai Street and Pensacola Street.

Construction

Coordination between project planners and the community will continue during the development and implementation of a Construction Management Plan and Mitigation Program that would address in detail the project's construction and construction impact mitigation.

A public information program will include education; the presence of representatives at public gatherings; informational materials describing the construction process and its progress; dissemination of information on significant construction activities, detours, and recommended alternative routes; and information pertinent to methods of minimizing public inconvenience. A community advocacy forum will be retained through the construction process to facilitate solutions to specific construction impacts and concerns expressed by affected businesses, organizations and individuals.

An overall project Maintenance of Traffic Plan will include measures to reduce the need for total street closures during construction, detailed traffic flow patterns and traffic detours, measures to minimize the impact of loss of parking during construction, and programs to increase transit ridership.

Detailed pedestrian flow patterns will be developed and alternative pedestrian routes will be provided around or through construction areas to provide access to all adjacent structures and affected facilities.

Access to docks, terminals and other water-related facilities will be maintained through close coordination with all public agencies having harbor-related responsibilities.

Abatement measures tailored to the source will be implemented for the control of fugitive dust, emissions, noise and vibration.

Specific plans will be developed during final design for:

- Sediment and Erosion Control Plan incorporating Best Management Practices (BMPs) to control runoff;
- Spill Containment Control and Countermeasure Plan;
- Solid Waste Management Plan;
- Contaminant Management Plan detailing contaminant handling procedures and remedial response actions; and
- Emergency Response Plan to establish procedures should contaminated materials be encountered.

If a burial or archaeological artifact is uncovered during construction, work will stop and the SHPD will be notified immediately and the procedures detailed in the MOA will be followed.

S.4 FINANCIAL ANALYSIS AND COST-EFFECTIVENESS ANALYSIS

A comprehensive financial analysis was conducted to identify the major differences in capital and operating costs among the alternatives. The analysis also identified the timing and level of financial commitments needed from federal and local sources, and assessed the City's ability to operate and maintain the transportation network. The financial plans were developed based on the assumptions that the full scope of each alternative must be completed without raising taxes, and that the City's high bond rating must not be affected.

Funding would be sought from multiple federal and local sources. Construction schedules would be phased according to the availability of funds. Therefore, the construction schedule would be flexible.

To determine the adequacy of funding sources for the capital and operating requirements of the alternatives, major existing revenue sources were examined. Costs were then compared to the revenues projected to be available from these sources over the 14-year period of Fiscal Year (FY) 2003 to FY 2016 which is the period within which all of the capital improvements, except vehicle replacements and an additional bus maintenance facility in the Refined LPA and TSM Alternatives would be implemented. Costs and revenues were also compared over the 23-year period of FY 2003 to FY 2025. The City and County of Honolulu's fiscal year extends from July 1 through June 30.

Capital Cost Financing

The Bus Rapid Transit (BRT) systems in the Refined LPA will be implemented between FY 2003-2016. Over the 14-year implementation period, the capital cost of the Refined LPA BRT Program is projected to be $487.6 million in Year of Expenditure dollars (YOE $). Of this total, $243.2 million will be for the In-Town BRT and $244.4 million will be for the Regional BRT. If EPT was to be implemented, $129.1 million in YOE $ would be added to the capital cost.

Also included in the Refined LPA's financial analysis are the capital costs required for the acquisition and replacement of the entire bus and TheHandi-Van fleet and other system-wide improvements. These amount to $426.0 million (in YOE $) over the 2003 - 2016 period in which the Refined LPA BRT Program is implemented. For the 2003 through 2025 forecasting period used for environmental analyses in this FEIS the capital cost of the bus and TheHandi-Van acquisition and replacement program and other system-wide improvements is projected to be $723.3 million (in YOE $). The fleet would be replaced twice during this time period. The total estimated capital cost for the Refined LPA including vehicle acquisition and system-wide improvements is therefore $1.04 billion for the period 2003 through 2016, and $1.34 billion for the period 2003 through 2025. These costs are in YOE dollars.

Table S.4-1 summarizes the capital funding required by source for the No-Build Alternative, TSM Alternative, and Refined LPA without EPT over the 14-year, FYs 2003-2016 implementation period. The EPT would add $129 million (YOE) to the cost of the Refined LPA.

TABLE S.4-1
FUNDING SOURCES FOR CAPITAL COSTS, BY ALTERNATIVE
FISCAL YEARS 2003- 2016 (YOE $, 000)

	NO-BUILD	TSM	Refined LPA*
CAPITAL SOURCES			
Federal Transit Administration			
Sec. 5307 UZA Formula	$143,200	$152,513	$222,514
Sec. 5309 FGM	$20,839	$20,839	$20,839
Sec 5309 Bus Capital	$8,665	$8,665	$38,370
Sec. 5309 New Starts	--	--	$177,464
Federal Highway Funds			
FHWA	--	$11,985	$139,659
Local Funds			
G.O. Bonds *	$138,899	$259,48	$314,755
TOTAL CAPITAL FUNDS	**$311,602**	**$453,486**	**$913,600**

Source: Sharon Greene & Associates, November 2002.
YOE = Year of Expenditure
*Without embedded plate technology

The alternatives differ with regard to their relative reliance on individual funding sources. Some sources, such as FTA Section 5307 UZA Grant and Section 5309 FGM Grant are common to all alternatives and are relatively comparable in terms of funding levels. Other sources such as FTA Section 5309 New Starts, GO Bonds, and BRT fare revenues, are specific to the TSM Alternative and/or Refined LPA.

In accordance with City Council policy guidance, the financial plan was designed to accommodate as much federal funding as possible. City General Obligation (GO) bonds would be used to fund the balance of the cost of these alternatives. The financing plan focuses on the initial capital implementation period (through the year 2016). All of the amounts shown are in YOE dollars.

About $172.7 million of funding for the No-Build Alternative would come from Federal Transit Administration (FTA) formula grants. About $138.9 million would be from issuing City GO bonds.

Financing for the TSM Alternative would require $259.5 million in GO bonds and another $182.0 million in FTA formula grants. About $12.0 million would be needed from federal highway sources.

The Refined LPA would require $291.1 million in FTA formula funds and $242.0 million in FTA New Starts grants. A total of $369.9 million in GO bonds would be issued. Federal highway funds would provide another $139.7 million, for the Regional BRT improvements.

No other major capital projects for the City would be deferred if either the TSM Alternative or Refined LPA were selected. One condition of the financial analysis was that adequate capital improvement funds remain for other City projects.

Operating and Maintenance Financing

Estimates of operating and maintenance (O&M) costs were based on the proposed transit fleet and travel characteristics under each alternative. The budget for bus and paratransit operations during FY 2002 was about $130.3 million. Using constant year 2002 dollars for comparison, under the No-Build Alternative, $135.4 million would need to be budgeted in FY 2017; the TSM Alternative would cost an estimated $145.8 million in FY 2017 to operate; and under the Refined LPA, the estimated operating cost would be $157.4 million. Expressed in YOE dollars, the corresponding O&M costs in 2017 would be $196.0 million for the No-Build Alternative, $211.2 million for the TSM Alternative and $228.0 million for the Refined LPA.

Table S.4-2 shows the amount of General Fund Revenues and other revenues by source would be required to pay for the O&M costs in the selected representative years of 2007 and 2017.

Annual Debt Service Required

The average annual debt service payments required on post-2003 bond issues for the No-Build and TSM Alternatives are $10.0 million and $13.8 million, respectively. The average annual debt service payment required for the Refined LPA is $17.7 million.

FTA Cost-Effectiveness

The Federal Transit Administration measures a project's cost-effectiveness by comparing the cost of a transit investment in relation to its ability to attract new riders to transit. Table S.4-3 shows the factors used to develop the FTA's Cost-Effectiveness Index (CEI). This index is used by FTA only to compare projects throughout the country, and is not an indicator of costs and benefits.

TABLE S.4-2
FUNDING SOURCES FOR O&M COSTS, BY ALTERNATIVE
FISCAL YEARS 2007 AND 2017 (YOE $, 000)

	NO-BUILD	TSM	Refined LPA
FY 2007 OPERATING REVENUES			
Passenger Fares (Bus)	$37,195	$37,252	$39,199
TheHandi-Van Fares	$1,705	$1,705	$1,705
FTA Sec. 5307 UZA Funds (Preventive Mtnce.)	$18,760	$19,995	$12,838
General Fund Revenues (for transit support)	$93,632	$94,519	$105,645
TOTAL O&M REVENUES	**$151,292**	**$153,471**	**$159,387**
FY 2017 OPERATING REVENUES			
Passenger Fares (Bus)	$49,976	$51,649	$57,621
TheHandi-Van Fares	$2,346	$2,346	$2,346
FTA Sec. 5307 UZA Funds (Preventive Mtnce.)	$16,114	$16,114	$11,133
General Fund Revenues (for transit support)	$127,608	$141,093	$156,885
TOTAL O&M REVENUES	**$196,045**	**$211,202**	**$227,984**

Source: Sharon Greene & Associates, November 2002.
YOE = Year of Expenditure

TABLE S.4-3
FACTORS USED TO DEVELOP FTA COST-EFFECTIVENESS INDEX

Factor	Alternative		
	No-Build	**TSM**	**Refined LPA**
Annualized Capital Cost (2002 dollars)	$ 28,760,000	$ 37,910,000	$ 78,400,000
Total Systemwide Annual Operating and Maintenance Cost (2002 dollars)	$ 120,700,000	$ 139,800,000	$ 151,200,000
Total Annualized Cost in Forecast Year (2002 dollars)	$149,460,000	$ 177,710,000	$ 229,600,000
Total Annual Ridership (2025)	80,428,040	86,055,200	96,271,560

Source: Parsons Brinckerhoff, Inc., October 2002.

When alternatives are compared using the CEI, the one with the lower cost per new rider represents the more cost-effective alternative. As shown in Table S.4-4, the cost per new rider for the TSM Alternative is $6.25, which is more than the cost per new rider for the Refined LPA of $5.01. Therefore, the Refined LPA is more cost-effective than the TSM Alternative in terms of capturing new transit ridership over the level of the No-Build Alternative. In comparison to the transit ridership level that would be achieved with the TSM Alternative, the CEI of further boosting transit ridership to the level forecast to occur with the Refined LPA would be $4.52.

S.5 EQUITY/ENVIRONMENTAL JUSTICE

Equity is defined as the fairness of the distribution of costs, benefits, and impacts across various population subgroups. Fairness is determined by the extent to which the costs and impacts are distributed in a way that is consistent with regional goals.

TABLE S.4-4
FTA COST-EFFECTIVENESS INDEX

Factor	Comparison		
	TSM vs. No-Build	**Refined LPA vs. No-Build**	**Refined LPA vs. TSM**
Incremental Annualized Cost	$ 28,000,000	$80,000,000	$ 52,000,000
Incremental Annual Ridership	6,000,000	16,000,000	10,000,000
Cost-Effectiveness (incremental cost per new rider)	$ 6.25	$ 5.01	$ 4.52

Source: Parsons Brinckerhoff, Inc., October 2002.

S.5.1 Impact on Low Income Areas

None of the alternatives would cause disproportionately high and adverse health or environmental effects on minority and low-income populations. Since a substantial number of people from minority and low-income populations will be located near elements of the Refined LPA, these populations will see transit service improve substantially and receive those benefits.

S.5.2 Environmental/Socioeconomic Equity and Benefit (Environmental Justice)

The equity and benefit analysis from an environmental and socioeconomic perspective based on the relative balance between environmental and/or socioeconomic impacts and change in transit accessibility shows that the Refined LPA would result in improved transit accessibility relative to the No-Build and TSM Alternatives.

S.6 SIGNIFICANT TRADE-OFFS AMONG ALTERNATIVES

Table S.6-1 summarizes key evaluation factors that best distinguish the alternatives presented in the MIS/DEIS and this FEIS. What is particularly important are the relative trade-offs between the costs of the alternatives and the benefits received for those costs or investments.

S.6.1 No-Build Alternative

The direct costs and level of some environmental impacts of the No-Build Alternative would be the least of all the alternatives studied, while travel delays, energy consumption, air pollutant emissions, and quality of life would be the worst.

Moreover, the No-Build Alternative would not adequately support the purposes and needs of the project. It would not provide a transportation system that would effectively handle present or future levels of travel demand. It would not even maintain current mobility levels. It would not develop attractive travel alternatives to the private automobile, encourage land use development in desired patterns, support implementation of an urban growth strategy that integrates land use and infrastructure planning, nor maintain the existing quality of life. It would only minimally increase the linkage between Kapolei and the Urban Core, and would not improve mobility within the Urban Core.

The No-Build Alternative would cost $404.4 million in 2002 dollars, which includes replacing buses over a 23-year period. Because the No-Build Alternative would not generate new federal funds, no additional employment would be created.

TABLE S.6-1
SUMMARY OF KEY EVALUATION MEASURES

Measures	No-Build	TSM	Refined LPA
CAPITAL AND O&M COSTS			
Total Capital Cost (FY2003-2025) (Millions of 2002 $)	$404.4	$540.8	$954.9-$1,038.2*
Annual Operating and Maintenance Cost at Full System Operation (Millions of 2002 $)	$120.7	$139.8	$151.2
Impact on City Budget (Average Annual Costs for Debt Service and O&M Net of Fare Revenue) FY 2003-2016 (YOE)	$118.3 million	$129.3 million	$146.9 million
MOBILITY			
Daily Transit Trips Within the Primary Transportation Corridor (2025) (Daily Linked Trips)	261,130	279,400	312,570
Increase in Transit Trips Over the No-Build Within the Primary Transportation Corridor (2025)	N.A.	18,270	51,440
Daily Transit Mode Share Within the Primary Transportation Corridor (2025) (Work Trips)	19.2%	19.5%	22.6%
Daily Revenue Bus Miles (2025)	62,560	77,790	84,450
Comfort Level (Passengers Per Transit Seat) (2025)	1.31	1.01	0.90
Daily Reduction in Vehicle Miles of Travel (Compared to No-Build) (2025)	N.A.	1,080	718,530
Daily Reduction in Vehicle Hours of Delay (2025) (Compared to No-Build)	N.A.	13,285	78,080
Projected Transit Travel Time Between Downtown and Kapolei (2025)	83.1 minutes	78.0 minutes	58.2 minutes
Projected Transit Travel Time between Downtown and Waikiki (2025)	24.4 minutes	25.0 minutes	23.1 minutes
Projected Transit Travel Time between Downtown and UH-Manoa (2025)	24.4 minutes	23.3 minutes	22.6 minutes
Projected Transit Travel Time between Downtown and Kalihi (2025)	17.6 minutes	16.3 minutes	13.3 minutes
Typical Levels of Service on In-Town Roads (Transit)	E/F	E/F	B/C
Typical Levels of Service on In-Town Roads (Autos)	E/F	E/F	E/F
New Parking Spaces Provided at Transit Centers/Park-and-Rides	0	2,700	3,620
On-Street Parking Spaces Removed (Unrestricted/Restricted) (U/R)	0	166 (U)	IOS: 22 (U) Middle St. to Iwilei: 27 (U) Iwilei to Waikiki: 124 (R) Kakaako Mauka: 69 (U) / 66(R) UH-Manoa: 199 (U) / 343 (R)
Number of Loading Zones to be Mitigated	0	14	24
LAND USE DEVELOPMENT			
Support of transit-oriented development	Not supportive	Somewhat supportive	Most supportive
ECONOMIC IMPACT			
Employment (direct and indirect person-years jobs)	704	1,797	9,418

TABLE S.6-1 (CONTINUED)
SUMMARY OF KEY EVALUATION MEASURES

Measures	No-Build	TSM	Refined LPA
QUALITY OF LIFE AND LIVABILITY			
In-Town Transit Technology	Diesel Buses	Diesel Buses	Hybrid diesel/electric or EPT for In-Town BRT
Visual Character	No Changes	Development of transit centers provide opportunities to improve the visual environment	Development of transit centers and In-Town BRT stops provide opportunities to improve the visual environment. The sound barrier near future Aloha Stadium Transit Center will cause visual impact.
Noise/Vibration (In-Town)	No or very little perceptible difference from existing conditions	Similar to the No-Build Alternative	Moderate noise impacts at residences from In-Town BRT operations on Dillingham Boulevard, using the hybrid diesel/electric vehicle. Use of hybrid diesel/electric or electric In-Town BRT vehicles generally less noisy than diesel buses.
Noise/Vibration (Regional)	No Impacts	No Impacts	Moderate noise impacts to nearby residences from increase in bus operations at future Aloha Stadium Transit Center and associated Luapele Ramp.
ENVIRONMENTAL IMPACTS			
Number of Business and Residential Displacements	Loss of two to four acres of agricultural land.	Loss of two to four acres of agricultural land.	Removal of two parking spaces at an apartment complex. Displacement of parking stalls, landscaping, and/or driveway effects on 22 businesses. Loss of two to four acres of agricultural land.

TABLE S.6-1 (CONTINUED)
SUMMARY OF KEY EVALUATION MEASURES

Measures	No-Build	TSM	Refined LPA
Street Trees	No Impact	No Impact	Some tree trimming will be required. 32 "notable" and 68 non-notable trees will be relocated near their original locations. Roughly 50 other trees will be replaced. No designated exceptional trees will be affected.
Change in Energy Consumption Compared to No-Build (in thousands of barrels of oil per year)	N/A	35	-215
Historical Resources	No Impacts	No Impacts	Construction of an EPT system may uncover archaeological resources or native-Hawaiian ancestral burial sites along certain segments. In-Town BRT stops located within or near historic districts or properties with high visual integrity have the potential to affect historic characteristics.
Parkland Impacts	Joint-use of Aloha Stadium Kamehameha Highway parking lot as a transit center/park-and-ride	Same as No-Build Alternative	Same as No-Build Alternative
COST-EFFECTIVENESS			
Incremental Cost Per New Rider (compared to No-Build Alternative)	N/A	$6.25	$5.01
EQUITY			
Impacts/benefits to minority or low-income populations	No adverse impacts/ No increased benefits	No adverse impacts/ Some improvement in transit service	No adverse impacts/ Substantial improvement in transit service

Source: Parsons Brinckerhoff, Inc., November 2002.
Note: *If hybrid diesel/electric vehicles are used, the estimated cost is $954.9 million. If EPT vehicles are used, the estimated cost is $1,038.2 million.

S.6.2 TSM Alternative

Compared to the No-Build Alternative, the TSM Alternative, with its emphasis on enhancing and restructuring bus service, would provide some support to the project's purposes and needs in terms of enhancing people-carrying capacity within the corridor. However, this alternative would not go far in providing an attractive alternative to the private automobile, nor in enhancing desired land use development patterns or the City's urban growth strategy that integrates land use and infrastructure planning. There would be some improvement in the linkage between Kapolei and the Urban Core, but it would not significantly improve mobility within the Urban Core.

Without the implementation of significant transit-oriented infrastructures, transit operation under the TSM Alternative would not be able to maintain current mobility levels.

The level of environmental impact would be greater than under the No-Build Alternative. This alternative would limit the use of an estimated 166 unrestricted parking spaces, mostly on King and Beretania Streets, and affect a number of loading zones. Travel delays would still be lengthy, and energy consumption and air pollutant emissions would increase.

This Alternative would cost $540.8 million in 2002 dollars, which includes replacing buses over a 23-year period. Since there would be no FTA discretionary (New Starts) funding available for use with the TSM Alternative, there would be no additional jobs created beyond those that would occur with the normal in-flow of federal formula funds to the State.

S.6.3 Refined LPA

The Refined LPA represents a major improvement over the No-Build and TSM Alternatives in meeting the project purposes and needs. It would substantially increase people-carrying capacity within the corridor and help focus growth along the alignment of the In-Town BRT. Higher density redevelopment in a transit-supportive manner, particularly at transit centers and transit stops, would be encouraged. This alternative would be more effective than the TSM and No-Build Alternatives in supporting implementation of an urban growth strategy that integrates land use and infrastructure planning. It would help facilitate desired land use development patterns consistent with the vision for the island.

This alternative would establish transit as an attractive, viable alternative to the automobile. Transit patrons would reap travel time savings. The Refined LPA would cause less motorist delay than either the TSM or No-Build Alternative. The Refined LPA would establish an attractive, high capacity linkage between Kapolei and the Urban Core. It would improve mobility within the Urban Core by improving linkages between key destinations such as Downtown, Kakaako, Kalihi, UH-Manoa, and Waikiki, and would decrease transit travel times between these key destinations.

There would be no relocations of businesses or residents with the Refined LPA, though some partial displacements will be necessary. Parking provided at transit centers and park-and-ride lots would be greater than with the TSM Alternative, as would the loss of on-street spaces. Interference with loading zones would be greater than with the TSM Alternative. Regional air pollutant emissions would decrease. Impacts on historic resources would be minor. Impacts during project construction would be greater than for the TSM Alternative because of the larger scope and longer duration of construction, particularly the building of the In-Town BRT transit lanes on arterial streets. The Refined LPA will require standard construction mitigation measures including noise, dust, sediment, and erosion control. In addition, permanent noise mitigation would be required in certain areas along the BRT corridor, if using hybrid diesel-electric vehicles. No noise impacts are anticipated wherever embedded plate technology (EPT) vehicles are implemented.

As part of the Refined LPA, transit centers, transit stops, and other project elements would be designed to maintain or improve visual conditions through cohesively designed structures, street furniture, landscaping and lighting. The quality of urban living would improve.

The cost of this alternative would be $954.9 million with hybrid diesel/electric powered In-Town BRT vehicles and $1,038.2 million with EPT. These costs are in 2002 dollars, and include replacing buses and In-Town BRT vehicles over a 23-year period. The additional federal funds that would be provided under this alternative would create an estimated 3,737 new jobs during construction. Using FTA criteria, the Refined LPA would be more cost-effective in attracting new transit riders compared to the TSM Alternative.

S.7 REQUIRED PERMITS AND APPROVALS

The following regulatory approvals and permits for the Refined LPA will be applied for during the project's final design phase.

Federal

- U.S. Coast Guard – Bridge Permit
- U.S. Department of Transportation Notice of Proposed Construction Near Airports
- U.S. Department of Transportation FHWA Approval of Modifications Within Limits of Interstate Highways
- U.S. Army Corps of Engineers – Clean Water Act Section 404 permit (Nationwide)

State

- State Department of Transportation Permit to Perform Work Upon a State Highway
- State Department of Health Clean Water Act Section 401 Water Quality Certification
- State Department of Health Noise Permit/Variance
- National Pollutant Discharge Elimination System (NPDES) Permit - Stormwater Associated with Construction Activity
- Commission on Water Resource Management – Stream Channel Alteration Permit
- Disability and Communication Access Board Approval

County

- Special Design District Permit
- Zoning Waivers for Public Uses, Public Utilities and Walls
- Building Permit
- Development Application in Flood Hazard Districts
- Special Management Area Use Permit
- Construction Dewatering Permit (Temporary)
- Grubbing, Grading, Excavation, and Stockpiling Permit
- Street Tree Review
- Permit to Excavate on Public Right-of-Way (Trenching)
- Street Usage Permit

S.8 UNRESOLVED ISSUES

Most issues raised during the extensive public involvement, coordination, and consultation conducted for this project have been addressed in the FEIS, although some issues remain unresolved. The unresolved issues are presented below with a brief discussion regarding resolution of the issue.

1. BRT Vehicle Technology. The In-Town BRT vehicles will be hybrid diesel-electric. The City is tracking the development of an all-electric touchable embedded plate system; and its impacts are included in this FEIS. However, no decision on using such a system would be made until it is proven revenue service-worthy and additional environmental review is conducted. If embedded plate technology is selected, the locations of traction power supply stations will need to be identified and their impacts disclosed in a separate document prior to its implementation.

2. BRT Stop Design. The detailed design of the architectural elements of the BRT stops will be completed during the next project phase, final design. The final design of BRT stops will continue to involve public and agency input.

3. Noise Wall Design. The detailed design of the 10-foot high noise wall required at the Puuwai Momi Apartments will be completed during the next project phase, final design. The final design of the noise wall will involve public input.

4. Tree Relocations. The exact locations where affected trees will be replanted will be determined during final design.

5. Hazardous Materials. Phase I investigations of hazardous material sites will be completed where appropriate during the next project phase, final design. As a result of that investigation, specific recommendations, which could include Phase II sampling would be prepared and executed.

6. Parking and Loading Zone Mitigation. In areas where a large concentration of on-street parking spaces will be affected, replacement parking in new off-street parking facilities will be considered during final design, but only if they meet other livable community objectives and are the result of community-based planning. Likewise, loading zone impact mitigation will be considered during final design and community-based planning will be an integral part of the final design phase to address mitigation measures for loading zone impacts.

7. Section 404 permit (Nationwide). New piers will be necessary for a bridge widening at the Waiawa Interchange and therefore, a Clean Water Act Section 404 permit will be required from the U.S. Army Corps of Engineers. The retrofit of the Ala Moana Boulevard bridge over the Ala Wai Canal proposed for the Refined LPA subsequent to the IOS may require new piers, but the need for the piers will not be determined until consultation with the State during the final design phase. If necessary, a Clean Water Act Section 404 permit will be obtained.

CHAPTER 1 PURPOSE AND NEED

CHAPTER OVERVIEW AND ORGANIZATION

Overview

Oahu's primary transportation corridor, which stretches from Kapolei in the west to the University of Hawaii-Manoa (UH-Manoa) and Waikiki in the east (see Figure 1.0-1), is the location of the vast share of the total travel occurring on the island. Existing transportation infrastructure in this corridor is overburdened handling current levels of travel demand. Travelers experience substantial traffic congestion and delay at most times of the day, on weekdays and weekends.

The Initial Operating Segment (IOS) will be the 5.6 miles between Iwilei and Waikiki. The IOS connects several important economic districts: Downtown office and financial district, Aloha Tower retail area and cruise ship piers, Kakaako University of Hawaii Medical School and biotech park, Kakaako retail and entertainment district, Ala Moana Center, and Waikiki resort and residential communities. These significant and diverse sectors are currently without a continuous transit connection; a situation that will be corrected with the implementation of the IOS BRT line. The Primary Urban Center goal of intensified development requires a reliable and efficient transit system to serve mobility needs.

Congestion, such as is experienced at both the regional level and in the IOS segment, takes time away from other activities and creates a burden on the economy. Congestion wastes fuel, produces excess air pollutants, decreases roadway safety and causes stress. It reduces Oahu's attractiveness as a visitor destination and lowers residents' quality of life. Future growth will further increase traffic congestion and delay. The quality of life for Oahu's residents and visitors will continue to decrease unless the transportation system in the primary transportation corridor is modified to better accommodate existing and future travel necessary for daily life.

Investment is required to improve the efficiency of the corridor's transportation infrastructure. A more efficient transportation system in the corridor will enhance mobility, reduce travel time and improve the quality of life for Oahu's residents and visitors. The purpose of the Primary Corridor Transportation Project is to examine candidate investments that would improve the efficiency of the transportation system in the primary transportation corridor, and the connections between the corridor and the rest of the island.

For the past four years, the City and County of Honolulu (City) has conducted the 21st Century Oahu visioning process, including its transportation component, Oahu Trans 2K. Oahu Trans 2K has been the most extensive community-based transportation planning effort in the City's history and it is the principal public outreach medium for the Primary Corridor Transportation Project. (More information on Oahu Trans 2K is provided in Appendix A). Thousands of people from every community on Oahu attended over 100 Oahu Trans 2K meetings and workshops, and worked to find solutions to mobility problems that have grown steadily worse over the past three decades. Participants studied maps, identified their unmet mobility needs and discussed ways to meet them.

From the outset, the Oahu Trans 2K workshops produced widespread agreement on certain fundamental issues. First, participants agreed that traffic congestion in the primary transportation corridor is a problem. This perception was confirmed by the traffic analysis performed subsequently. There was agreement that something must be done to make it better. Second, people felt strongly that improvements must be reasonably affordable. Third, while there is an important role for roadways, there was agreement that building new or widening existing highways cannot solve the traffic problem because there is inadequate space for new or wider streets. Moreover, participants agreed that extensive double-decking of existing streets is unacceptable for aesthetic and environmental reasons. Fourth and finally, participants agreed that transportation must be viewed within a framework that includes quality of life and other benefits. Any

FIGURE 1.0-1
PRIMARY TRANSPORTATION CORRIDOR STUDY AREA

particular transportation investment is not seen as an end in itself; it is viewed as one component in a network of islandwide transportation improvements that will help improve mobility, shape the island's growth patterns, and stimulate livable communities.

Mobility and transportation must be combined with livability goals. Oahu's citizens have supported a vision of the City's future that focuses on preserving the quality of life, protecting the health of the environment, and providing for growth necessary for prosperity. A network of transportation improvements is needed to address mobility and growth objectives of each of the island's communities.

Organization

This Chapter is organized to provide the reader with an understanding of the overall project purposes and the needs being addressed. Section 1.1 provides a summary of the purposes that a transportation investment in Oahu's primary transportation corridor should satisfy. Section 1.2 establishes the basis for concluding that transportation improvements are needed. Section 1.2 begins by describing existing and future land use in the corridor. Land use is described because travel behavior and the demand for travel are derived from the spatial pattern of land uses. Section 1.2.2 describes the existing transportation infrastructure in the corridor because it is this infrastructure that must satisfy the travel demand created by the land use pattern. Section 1.2.3 then presents measures of transportation system performance used to assess how well the existing infrastructure handles travel demand, now and in the future. Analyses are provided for roadway infrastructure and the public transit system. This Section concludes that an investment in transportation infrastructure must be made to handle present and future levels of travel.

Based, then, on the shortcomings of the existing transportation infrastructure, Section 1.2.4 elaborates on the requirements that an investment in transportation infrastructure should satisfy to remedy deficiencies. Section 1.3 discusses how an investment in transportation infrastructure in the primary transportation corridor is consistent with prior government plans and is derived from an extensive public outreach program. Section 1.4 closes the Chapter with a description of the formal process now underway to implement the Refined LPA.

1.1 PURPOSE

The early Oahu Trans 2K workshops established the broad points of agreement that a transportation investment is needed to achieve mobility, growth, and livability objectives. Working from these points of broad agreement, project planners have applied engineering, technology and operational approaches to develop a program that reflects the community consensus on transportation policy. The first product of this effort was the Islandwide Mobility Concept Plan (IMCP) March 1999 [1], which laid out a comprehensive framework for future transportation on Oahu. The IMCP identified three prime goals, and nine subgoals, for any transportation plan for Honolulu:

1. Improve In-Town Mobility
    - Subgoal A: Enhance urban roadways to embrace pedestrians, cyclists and transit users
    - Subgoal B: Develop high-capacity, frequent transit service through the urban core
2. Strengthen Islandwide Connections

[1] The IMPC was updated in August 2001.

- Subgoal A: Maximize the efficiency of the public transportation system
- Subgoal B: Manage existing roadway capacity
- Subgoal C: Maintain and strengthen regional highway connections
- Subgoal D: Improve the linkage between city centers in the PUC and Kapolei

3. Foster Livable Communities

   - Subgoal A: Connect and reinforce local neighborhoods
   - Subgoal B: Improve accessibility for all
   - Subgoal C: Leverage transportation investments to promote economic development

Guided by the three goals in the IMCP, and through continued public involvement and technical analysis, the following set of purposes was identified for the Primary Corridor Transportation Project.

1. Increase the people-carrying capacity of the transportation system in the primary transportation corridor by providing attractive alternatives to the private automobile

With the sheer number of people living and working in Honolulu's urban core, a key strategy to mitigate traffic congestion is to get people out of their cars while they move around.   This requires that alternative modes such as walking, bicycling and using public transit be given greater priority. Major destinations in the urban core include Downtown, Waikiki, Kalihi, Kakaako and UH Manoa. Providing improved transit, bicycle, and pedestrian linkages to, from and between these major destinations is crucial to Honolulu's future.

If current levels of mobility and quality of life are to be maintained or improved, we need strategies to increase people-carrying capacity instead of increasing vehicle capacity. Ever-increasing demands will be placed on the primary transportation corridor's roadways, which are already congested by existing levels of transportation demand. Unless trends toward higher automobile usage can be altered, travel times and hours spent on congested highways will increase. Conversion of land from agriculture and open space into suburbs will require more and more local streets, and major roadway expansion. Caught in traffic, buses will operate more slowly and less efficiently than today, decreasing in reliability and attractiveness. This is the negative scenario to be avoided through enlightened investment.

Transportation capacity can be increased through multi-modal solutions planned in an integrated fashion. These include roadway, transit, bicycle, pedestrian and other elements. In order to increase the people-carrying capacity of the transportation system, the present automobile orientation must move to a more balanced mix of transportation modes.

Increased travel demand can be accommodated through roadway construction, and roadway improvements are often the most appropriate response to a transportation problem. However, roadway widening or adding multiple roadway levels in the dense and geographically constrained PUC would be costly and disruptive, and would consume valuable land. Public input overwhelmingly indicates that for the PUC, roadway construction on the scale that would be required to satisfy projected travel demand is not a preferred alternative.

In a preferred scenario, public transit is used in higher proportion to move people in a more space-efficient manner. Improved transit offers the ability to expand people-carrying capacity sufficiently to meet rising levels of future travel demand. The transit system must be made convenient for the user, offering reasonable and dependable travel times. This will allow transit to be attractive and compete successfully with the automobile to slow the growth in demand for highway travel.

The transit system needs to operate as independently as possible from the congestion affecting general-purpose traffic. Then, transit can achieve the speeds and reliability required to attract ridership to transit, and to provide the additional people-carrying capacity needed to improve the overall level of transportation service within the primary transportation corridor. Freed from the congestion and delays of the roadway network, transit vehicles would be able to move quickly, reliably, and efficiently, and would be an attractive alternative to automobile travel.

Increasing the people-carrying capacity of the transportation system in the primary transportation corridor by providing attractive alternatives to the private automobile would satisfy Goal 1 in the IMCP – Improve In-Town Mobility and subgoals A and B. It would also meet the IMCP's Goal 2 – Strengthen Islandwide Connections, subgoals A and B. It would also meet the IMCP's Goal 3 – Foster Livable Communities, subgoals A and B.

2. Support desired development patterns

The City's land use policy for the primary transportation corridor requires that transportation and land use be planned and developed together to implement a comprehensive urban growth strategy. Integrated land use and transportation development will result in a pattern of land uses where many more trips than at present could be made by walking, bicycle, or neighborhood transit systems.

Transportation projects provide urban design opportunities to reinforce community livability. Transit-oriented planning targets a shift from auto-oriented, dispersed, single-use development to a land use pattern with a mix of activities that promotes walking and that focuses on a central transit facility. Transit-oriented, mixed-use developments can reduce vehicular travel and congestion by making it easier to make trips on foot or bicycle.

Transportation facilities and services are needed that can serve as the nucleus of new development in conformance with the land use visions articulated in the Ewa and the draft Primary Urban Center (PUC) Development Plans (DPs). The PUC DP Public Review Draft states that an improved transit system can help re-focus growth in the desired development pattern. It calls for pedestrian-scale development, which has convenient walking access to transit. The PUC DP Public Review Draft states: "A tight integration of land use and transportation policies is required to attain the full development of the Primary Urban Center."

New transportation infrastructure must be built at a human scale, generally within the existing streets. The goal is livable, mixed-use communities provided with improved mobility and with less need to use an automobile.

The Kakaako Makai line was added to the LPA after the MIS/DEIS was published and its impacts were disclosed in the SDEIS. The purpose of the Kakaako Makai line is to satisfy the development needs of an area, which by then had been selected as the site of the UH Medical School, biotech park and several other uses. Because of the accelerated construction timetable for these projects, this section was selected as the IOS.

Supporting desired development patterns would satisfy Goal 1 in the IMCP – Improve In-Town Mobility and subgoals A and B. It would also meet the IMCP's Goal 2 – Strengthen Islandwide Connections, subgoals A, C and D. It would also meet the IMCP's Goal 3 – Foster Livable Communities, subgoals A and C.

3. Improve the transportation linkage between Kapolei and Honolulu's Urban Core

Kapolei is intended by the State and the City to be a center of growth and development, as it becomes the "Secondary Urban Center" of Oahu. The emergence of Kapolei as a new city center represents a fundamental shift in travel patterns. Now is the time to ensure this is done in a multi-modal manner.

Designation of Kapolei to be a fully developed city is in itself a traffic mitigation strategy, designed to reduce the dominant travel pattern in and out of Honolulu. Kapolei already contains vibrant and unique neighborhoods, high quality design, diversified employment, parks, open space and recreational resources, and further development is expected to continue these trends. The vision for Kapolei is a place where people live, work, shop, socialize, and recreate within the area and where alternative forms of transportation to the private automobile can access these facilities. Already the State has completed an office building for over 1,000 State employees relocated from other areas on Oahu. With a new civic center, the City has also relocated many employees to Kapolei. Other existing and future economic development activities include hotel and recreational facilities in Ko Olina, expansion of Kalaeloa-Barbers Point Harbor, redevelopment of Kalaeloa (the former Barbers Point Naval Air Station), world-class sports facilities, and a new University of Hawaii (UH) West Oahu campus. Jobs and other attractions in Kapolei will attract “reverse travel” to this part of Oahu from outside areas.

A transit-based travel option, with frequent express service to and from Downtown and connections to strategically located transit centers, is a necessary transportation element to link Oahu’s first and second cities, and will encourage their coordinated growth.

An improved transportation linkage between Kapolei and Honolulu’s Urban Core would satisfy Goal 2 in the IMCP – Strengthen Islandwide Connections and each of its four subgoals. It would also meet the IMCP’s Goal 3 – Foster Livable Communities, subgoals B and C. Goal 3 is the only goal that the IOS does not directly serve.

4. Improve the transportation linkages among communities in the PUC

Improving transportation linkages within the PUC is key to increasing the attractiveness of in-town living, thereby helping to focus growth in the PUC. Mobility within the PUC must be convenient and efficient to meet current and future travel demands.

The 1992 City and County of Honolulu General Plan has a policy that would result in the PUC having almost half of Oahu’s 2010 population. In addition, over 50 percent of the projected new job growth will be concentrated within the PUC. The PUC will remain the center for employment, cultural activities, educational opportunities, regional shopping, and recreation. It will continue to serve as a major hub for commuters, students and other individuals from all parts of the island.

The IOS will provide new service to areas of Kakaako not previously served, and will do an excellent job of linking multiple PUC communities. A high capacity transit spine through the PUC will enhance in-town mobility and provide transit connections between the many travel markets that exist within the Urban Core. The transit spine would support existing activities and assist in creating new ones through redevelopment.

Improving the linkages among communities in the PUC satisfies Goal 1 of the IMCP – Improve In-Town Mobility and both of its subgoals. It will also address Goal 2 – Strengthen Islandwide Connections (subgoals A & B), and Goal 3 – Foster Livable Communities, including each of its three subgoals.

1.2 NEED FOR TRANSPORTATION IMPROVEMENTS

1.2.1 Description of the Study Corridor

The primary transportation corridor is a mix of existing residential and economic centers and areas designated by government plans to become residential and economic centers. The level of transportation service within the corridor, and between the corridor and other parts of Oahu, is vital to the economic well being of the island and the quality of life of Oahu’s residents. With future growth being directed by government plans to occur in this corridor, the level of activity within the corridor, already substantial, is expected to increase.

The primary transportation corridor extends from Kapolei in the Ewa District of Oahu to the University of Hawaii at Manoa and Waikiki in the east. The east/west (Koko Head/Ewa) length of the corridor is approximately 26 miles. The north/south (mauka/makai) width is a maximum of four miles, bounded by the Koolau Mountain Range and the coastline. The corridor is by far the most urban region on Oahu and in the State, encompassing more than 56 percent of the island's population and more than 80 percent of its employment.

1) Existing Land Use

Oahu is divided into eight community oriented planning areas. The primary transportation corridor includes portions of three planning areas – the Primary Urban Center (PUC), Ewa, and Central Oahu (see Figure 1.2-1). These community oriented planning areas are either already substantial centers of population and employment (e.g., PUC), or are on their way to becoming urban centers in the future (e.g., Ewa). The Ewa and PUC plans are called Development Plans (DP) because growth in these areas is anticipated over the next 20 years. The Central Oahu plan is called a Sustainable Community Plan (SCP) because it is a relatively stable area.

Figure 1.2-2 shows the locations of the neighborhoods discussed in this Section.

Primary Urban Center (PUC) Development Plan (DP) Area

The PUC extends from Waialae-Kahala to Pearl City and lies between the Koolau Mountain Range and the coastline. The PUC features the most diverse land uses on the island, including residential, military, industrial, commercial, and open space.

The PUC is by far the most populated planning area with 426,313 people (over 48 percent of the island total) in 2000. The PUC is also the center of government, business, economic, and cultural activities in the State, including most of the major employment centers on the island, such as much of the Pearl Harbor Naval Station, Honolulu International Airport, Downtown Honolulu, Fort Shafter, Hickam Air Force Base, Ala Moana Center, and Waikiki. Economic activity is located primarily in the relatively narrow strip between Kalihi-Palama and Kaimuki, the urban core of Honolulu ("Urban Core" or "Heart of Honolulu"). In 2000, the PUC contained 379,802 jobs, or 78 percent of the total employment on the island.

Central Oahu Sustainable Community Plan (SCP) Area

The Central Oahu SCP Area contains the wide, plateau between the Waianae and Koolau mountain ranges. While only the makai portion of the Central Oahu SCP Area is within the primary transportation corridor, this portion includes Waipahu, Kunia, Waikele, and Waipio. These are some of the fastest growing parts of the Central Oahu SCP Area where much new housing has been developed. In addition, Waipio, Waikele, and Kunia each contain a large commercial shopping center: Waipio Shopping Center, Costco, Waikele Center/Waikele Premium Outlets, and Royal Kunia Shopping Center. The latter three draw tourists and shoppers from other parts of the island.

Ewa Development Plan (DP) Area

Much of the Ewa DP Area is within the primary transportation corridor, and is now experiencing urban growth. The State of Hawaii and the City are encouraging the development of this region as Oahu's "Secondary Urban Center", largely with new master-planned communities. Destinations include Barbers Point Harbor, Kalaeloa (the former Barbers Point Naval Air Station), a civic center with State and City offices, schools, the Ko Olina Resort, and a water theme park.

FIGURE 1.2-1
DEVELOPMENT PLAN AREAS WITHIN THE PRIMARY TRANSPORTATION CORRIDOR

FIGURE 1.2-2
NEIGHBORHOODS

2) Future Development

The State and City have a development policy encouraging growth in only two areas: the PUC and Ewa. One of the objectives of this policy is to minimize suburban sprawl and the associated costs of extending public infrastructure and services into presently undeveloped areas. The goal of preserving open space given the limited land area of Oahu, is not only a governmental policy, it is a widespread public sentiment frequently repeated during the public outreach activities that have been conducted during project planning. It is captured by the slogan “Keep the Country Country”.

Oahu’s population increased at an average annual rate of 1.63 percent during the twenty-year period from 1970 to 1990. Although this growth rate has slowed to less than one percent per year between 1990 and 2000, the population of Oahu is still expected to exceed one million people by 2025 (see Table 1.2-1).

TABLE 1.2-1
PROJECTED POPULATION SUMMARY FOR OAHU

		Forecast	
	2000	**2025**	**Increase From 2000**
PUC			
Waikiki	21,900	24,120	2,220
Other PUC	404,413	470,311	65,898
Ewa	68,092	114,005	45,913
Other	378,510	421,371	42,861
Total	**872,915**	**1,029,807**	**156,892**

Source: Transportation for Oahu Plan, TOP 2025, April 6, 2001.

The majority of the population growth between now and 2025 is forecasted to occur at the two ends of the primary transportation corridor. As shown in Table 1.2-1, the fastest growing area will be Ewa/Kapolei. More than 114,000 people are expected to be living in the Ewa DP area in 2025, a growth of 67 percent in 25 years. The PUC will also experience significant growth, increasing by over 68,000 people. The Central Oahu population is projected to increase from 148,380 in 2000 to 172,977 in 2025, a gain of over 16 percent (Transportation for Oahu Plan, TOP 2025, April 6, 2001).

Accompanying the anticipated growth in population will be an increase in employment. Employment increased at an average annual rate of 4.13 percent from 1970 to 1990. The present employment projection is based on a 1.1 percent annual increase, resulting in forecasted job growth of over 30 percent between 2000 and 2025.

As shown in Table 1.2-2, the number of jobs on Oahu is projected to increase by approximately 152,000 between 2000 and 2025. About 51 percent of these new jobs will be located in the PUC. Almost 30 percent of the employment growth islandwide is also expected to occur in Ewa/Kapolei, consistent with government growth policies to concentrate development in the PUC and Kapolei.

The PUC Development Plan (PUC DP) Public Review Draft includes the forecast that the PUC will capture 45 to almost 50 percent of Oahu’s population growth over the next ten years (approximately 43,500 new households and 70,000 new residents). Directing residential growth to the PUC requires development of a high-quality, attractive urban lifestyle including opportunities for people to live, shop, work, and socialize all within a particular neighborhood or geographic area, without the need to travel long distances. A consequence of preserving open space in the country is that existing urban areas in the PUC must be redeveloped, and become attractive urban areas for living and working.

TABLE 1.2-2
PROJECTED EMPLOYMENT SUMMARY FOR OAHU

		Forecast	
	2000	**2025**	**Increase From 2000**
PUC			
Waikiki	40,997	49,175	8,178
Other PUC	338,805	408,670	69,865
Ewa	14,898	56,634	41,736
Other	90,792	122,998	32,206
Total	**485,492**	**637,477**	**151,985**

Source: Transportation for Oahu Plan, TOP 2025, April 6, 2001.

To achieve this vision, improvements must be encouraged in older neighborhoods to attract new residents. The PUC DP introduces the concept of higher-density housing supported by extensive urban amenities.

Primary Urban Center (PUC) Development Plan (DP) Area

Elements of urban life that must be enhanced to attract new residents include quality housing; high-quality public spaces that are used as neighborhood focal points; livable neighborhoods where streets are used as public places; and enhanced transportation service, including pedestrian and bicycle facilities, so one does not have to use a car to have mobility and perform the daily functions of work, shopping, education and recreation.

Redevelopment in the PUC is designated primarily for the area makai of the H-1 Freeway between Middle Street and Kapahulu Avenue. A secondary growth/redevelopment area is located between Aiea and Pearl City. These areas have the most favorable conditions for accommodating new housing, and 90 to 95 percent of the expected growth in population by 2025 is expected to occur within these redevelopment areas.

Central Oahu Sustainable Community Plan (SCP) Area

A revised Central Oahu Sustainable Communities Plan (Central Oahu SCP) has gone through the Planning Commission review and approval process and is at the City Council for adoption. The Waipahu portion of the Central SCP Area that is in the primary transportation corridor is slated for development.

Ewa Development Plan (DP) Area

Kapolei is intended by the State and the City to be a center of growth and development, as it becomes the "Secondary Urban Center" of Oahu. The vision for Kapolei is a place where people live, work, shop, socialize, and recreate within the area, without needing to travel long distances, and where alternative forms of transportation to the private automobile can access these facilities.

Designation of Kapolei to be a fully developed city is in itself a traffic mitigation measure, reducing the dominant flow to and from Honolulu. The intent is that Kapolei's economic development will complement and support economic activity in the Urban Core, not compete with it. Therefore, the transportation linkage between Kapolei and the Urban Core, already important, will grow in importance.

1.2.2 Existing Transportation Facilities And Services In The Corridor

This Section discusses the existing infrastructure responsible for satisfying the travel demand in the corridor, and the next Section assesses how well this infrastructure is satisfying current travel demand. In brief, transportation service is provided by roadways, public bus service and special transportation facilities, which encourage high-occupancy vehicles. Maps of the existing roadways, bus routes and other elements of the transportation system are provided in Chapter 3.

1) Roadway Network

The roadway network in the primary transportation corridor is concentrated in the area between the mountains and ocean, with the dominant highways generally paralleling the coastline. The principal Ewa/Koko Head roadway is the Interstate H-1 Freeway, which runs from Kapolei to Kahala. Moanalua Freeway, which runs from the Halawa Interchange to Kahauiki Interchange, also runs Ewa-Koko Head. The H-2 Freeway services traffic between Mililani/Wahiawa and Pearl City, and the H-3 Freeway is a trans-Koolau roadway between Windward Oahu and Halawa. In addition, there is an extensive network of arterial and local roadways.

2) Public Transit System

The City currently provides fixed-route public transit service on Oahu. It is converting from a radial route structure to a hub-and-spoke structure. This hub-and spoke program is a major overhaul of the existing bus service operations. Starting with Leeward Oahu, the program goal is to convert the existing, primarily radial bus route architecture into a hub-and-spoke system that connects the different communities throughout the island. Such a system includes limited stop bus service all day long and enhanced neighborhood shuttle services. All 18 Leeward routes were converted in 2000. All 20 Central routes will be converted in 2003.

TheBus, as this service is called, maintains a current fleet of 525 buses deployed on 88 routes extending to urban, suburban and rural areas throughout the island. The bus network includes five route types:

- Urban Trunk service is the direct bus service along the Ewa/Koko Head arterials of the central portion of the PUC, operating with a high level-of-service and connecting neighborhoods on both sides of Downtown. More than half of the system's daily boardings are on urban trunk routes. A special type of urban trunk service is the new Route A and Route B service (called "CityExpress!"), which provides limited stop service from Waipahu to UH-Manoa, and the Route C "CountryExpress!" service that provides limited stop service along the Waianae coast.
- Urban Collector service provides access to the transit system from neighborhoods surrounding Downtown Honolulu that are not directly served by urban trunk routes.
- Suburban Trunk service provides a direct connection between suburban neighborhoods and Downtown Honolulu.
- Suburban Feeder service provides access to the transit system for neighborhoods outside the PUC not served by suburban trunk routes.
- Express routes provide direct, limited stop service between certain suburban neighborhoods and major activity centers within the PUC, generally limited to peak hours.

TheBus route network focuses transit service to dominant employment and retail centers in the PUC, while providing service along major arterial streets en route to these centers. Because of the locations of these centers, the area from Middle Street to Kahala has the most frequent bus coverage, with many of the bus lines coming together on a few parallel roadways.

Transit service to/from suburban areas is served by express bus service during the morning and afternoon peak periods, while these areas are served by regular route trunk lines during off-peak periods.

In addition, the City provides a comparable paratransit service, called TheHandi-Van, to complement the fixed route bus service. TheHandi-Van serves semi- and non-ambulatory disabled persons who cannot utilize TheBus.

TheBus vehicles are serviced at two maintenance facilities, one in Pearl City and the other in Kalihi-Palama.

3) Special Transportation Facilities

To facilitate bus service and improve the person-carrying capacity of major roadways, special lanes have been constructed for buses and other high-occupancy vehicles (HOVs). H-1 includes a Koko Head-bound contraflow lane (zipper lane) that operates during the a.m. peak period from Managers Drive to the Pearl Harbor Interchange, with a concurrent flow shoulder lane extension to Keehi Interchange. Several major arterial roadways are coned to create contraflow travel lanes during peak periods, and there are exclusive bus only lanes on Hotel Street in Downtown and on a section of Kalakaua Avenue in Waikiki.

4) Bicycle Facilities

Bicycle facilities in the study area include a collection of routes, lanes, and paths. The longest, and one of the most heavily used, is the Pearl Harbor Bike Path. Other major bike facilities include a path on Bougainville Drive/Nimitz Highway from Radford Drive to Middle Street; lanes on Nimitz Highway from Waiakamilo Road to Bishop Street; a route on Young Street; lanes on University Avenue from Kapiolani Boulevard to Dole Street; paths along the Ala Wai Golf Course and Park; and paths along Kapiolani Park. Bike Plan Hawaii (April 1994), prepared by the State of Hawaii Department of Transportation (HDOT), and the Honolulu Bicycle Master Plan (April 1999), prepared by the DTS, link existing and future bicycle facilities to create a network that can be used for recreation and commuting. A Draft Bike Plan Hawaii: A State of Hawaii Master Plan (May 2003) has also been prepared by HDOT.

Other bicycle facilities include bicycle parking in many areas in Downtown Honolulu. The City has placed bike racks on all of the City buses, with hookups to the bus bicycle racks now at 1,100 per day.

1.2.3 Measures of Transportation System Performance

This Section describes the quality of current and future service provided by the roadway and transit components of the primary transportation corridor's system. The assessment of future performance assumes growth and development occur as predicted, and implementation of highway improvements expected to occur as discussed in the TOP 2025. The assessment of future system performance assumes transit system coverage would be expanded to accommodate population growth.

1) Roadway Performance

Existing Roadway Performance

Travel demand within the primary transportation corridor currently overburdens the roadway system, particularly for the travel markets between suburban/Ewa/Kapolei areas and the Urban Core, and within the Urban Core. Symptoms of system inadequacy include congestion, delay, fuel waste, excess air pollutants and other detractions from the quality of life.

While resident households, port operations, airport activities, other commercial activities and visitors all generate travel on Oahu, travel by members of resident households represents over 90 percent of total traffic volume and transit ridership. In 2000, Oahu residents made more than 2.7 million trips on an average weekday. Of these, approximately 962,000 were work trips (TOP 2025, April 6, 2001). Downtown Honolulu, by far the largest single employment concentration on Oahu, attracted 105,000 of the work trips (11 percent). Many work trips were also attracted to the Airport/Pearl Harbor area, Kakaako, and Waikiki. Many trips to work began in the residential areas of Aiea, Ewa, Kalihi, and Kaneohe. Over the next 25 years, these travel origin-destination combinations will continue to be important as the PUC grows and develops.

Historically, travel on Oahu has increased more rapidly than population. As shown in Table 1.2-3, while Oahu's population increased 14.9 percent from 1980 to 2000, daily vehicle miles traveled increased by more than 47.5 percent. This rapid increase in travel has caused roadway congestion, as demonstrated by the over 36 percent growth in daily vehicle hours traveled during the same period.

TABLE 1.2-3
OAHU POPULATION AND DAILY TRAVEL CHARACTERISTICS

Year	Population	Vehicle Miles Traveled	Vehicle Hours Traveled
1960	500,409	4,301,370	N/A
1980	762,565	8,741,110	328,900
2000	876,156	12,900,015	449,910

Source: Oahu Metropolitan Planning Organization from US Census Data and Travel Demand Model; Parsons Brinckerhoff, Inc., 1999 and 2001; and http://quickfacts.census.gov/gfd/meta/long68166.htm.

Table 1.2-4 shows Honolulu compared to similar sized urban areas. The travel rate index (TRI) measures how much longer a trip takes on a congested facility compared to the travel time when the road is not congested. For the 17 years between 1982 and 1999, Honolulu travelers experienced more roadway congestion than similar-sized cities across the U.S. Congestion has gotten progressively worse in Honolulu, increasing from nine percent in 1982 to 22 percent in 1999.

TABLE 1.2-4
TRAVEL RATE INDEX[1]

	1982	1986	1990	1996	1997	1999
Honolulu	1.09	1.12	1.21	1.21	1.22	1.22
Average Medium-Sized Urban Area[2]	1.05	1.07	1.11	1.16	1.17	1.18

Source: Texas Transportation Institute, Urban Roadway Congestion-Annual Report, 1998 and The 2001 Urban Mobility Report, Texas A&M University, 1999 and May 2001.

Notes: [1] TRI is a measure of how much longer a trip takes during congested conditions compared to the same trip during uncongested conditions. A TRI of 1.2 means the trip during a congested period takes 20 percent longer than during an uncongested time.
[2] Population between 500,000 and 1,000,000.

Honolulu's arterial street system reflects the same high levels of congestion when measured in person-miles (one person traveling one mile on a roadway). In 1990, 71 percent of person-miles traveled on arterial streets were on congested roadways, but by 1996 the percentage had increased to 78 percent.

Delays resulting from roadway congestion are equivalent to the loss of almost three working days for every Oahu resident each year, or roughly four working days for every driver in Honolulu in the past few years. The annual delay per resident for Honolulu is shown in Table 1.2-5.

TABLE 1.2-5
ANNUAL DELAY PER OAHU RESIDENT (HOURS)

	1982	1986	1990	1995	1997	1999
Honolulu	6	10	17	19	19	19

Source: Texas Transportation Institute, The 2001 Urban Mobility Report, Texas A&M University, May 2001.

Further, vehicles idling on congested roadways waste fuel, costing money and contributing to air pollution and global warming. In 1999, 19 million gallons of fuel were wasted by cars stuck in traffic in Honolulu, amounting to 30 gallons of fuel wasted for every Oahu resident (see Table 1.2-6). This fuel waste is up from 11 gallons per resident in 1982.

TABLE 1.2-6
ANNUAL WASTED FUEL (MILLIONS OF GALLONS)

	1982	1986	1990	1995	1997	1999
Honolulu	6	10	18	21	21	21

Source: Texas Transportation Institute, The 2001 Urban Mobility Report, Texas A&M University, May 2001.

Combining these various measures of transportation system performance produces a "cost of congestion." The annual "cost of congestion" in 1999 for Honolulu was $240 million (The 2001 Urban Mobility Report, Texas Transportation Institute, May 2001).

Stepping this cost down to a per capita basis, the annual cost of congestion was $345 in 1999 per capita in Honolulu. This cost represents a substantial drag on the local economy. The annual cost of congestion was only $90 per capita in 1982.

Reliance on the automobile has also resulted in the demand to convert land for parking. Based on an average of 2.17 automobiles per household, 350,000 private automobiles are estimated to be based in the PUC. On average, every vehicle requires 350 square feet for parking, totaling 2,800 acres of land in residential areas for parking, some of which could otherwise be used for parks and affordable housing, or other purposes. This 2,800 acres figure does not include parking lots at employment sites, retail outlets, or recreation venues.

In summary, the existing transportation system struggles to serve the present level of travel demand in the primary transportation corridor, subjecting travelers to substantial congestion, delay and waste of fuel. Existing shortcomings will become more pronounced with growth.

Future Highway Performance

Travel demand between suburban/Ewa/Kapolei areas and the Urban Core, and within the Urban Core, will continue to tax the highway system, even with the roadway improvements presently planned. Growth in resident travel relates to growth in population and employment. Table 1.2-7 summarizes the projected growth in resident vehicular travel demand between 2000 and 2025. (In accordance with FTA guidelines, the planning horizon for a possible transit investment is 25 years from the present.) Travel demands in the a.m. and p.m. peak periods (which vary by roadway segment) are projected to grow by over 22 percent.

TABLE 1.2-7
TOTAL RESIDENT VEHICLE TRIP TRAVEL DEMAND

	A.M. Peak Period	P.M. Peak Period
2000	393,864	489,125
2025	485,199	604,429
Growth	91,335	115,304
Percent Growth	23%	24%

Source: Oahu Metropolitan Planning Organization Travel Demand Model and Parsons Brinckerhoff, 2002.

Table 1.2-8 shows the projected growth in travel by Oahu residents between 2000 and 2025 categorized by key travel markets.

TABLE 1.2-8
RESIDENT PERSON TRIP TRAVEL DEMAND WITHIN SELECTED TRAVEL MARKETS

Travel Market	Daily Person Trips			
	2000	2025	Difference	Percent Change
Within Urban Core	1,112,243	1,420,592	308,349	28%
Suburban to Urban Core	622,023	664,842	42,819	7%
Ewa/Kapolei to Urban Core	54,182	69,156	14,974	28%
Suburban to Ewa/Kapolei	81,602	167,917	86,315	106%

Source: Oahu Metropolitan Planning Organization Travel Demand Model and Parsons Brinckerhoff, 2002.

The travel market between suburban areas and Ewa/Kapolei will be the most rapidly growing on a percentage basis. However, over one-half of the island's travel will continue to occur wholly within the PUC, heavily concentrated in an Ewa-Koko Head direction, with intra-PUC travel expected to increase by over 300,000 trips per day. Even with the significant reorientation of travel patterns to and from the Ewa/Kapolei area, there is substantial projected growth in travel between the PUC and Kapolei, and within the PUC. This large increase in travel within the PUC is a major reason why the capacity to handle in-town mobility must substantially increase through the improvement of transit service. The relationship between travel demand and roadway capacity may be illustrated through the analysis of screenlines, imaginary lines drawn at strategic locations. Traffic volumes on roadways crossing the defined screenlines are summed to produce a total travel demand across a screenline. This screenline travel demand is compared to the total roadway capacity across the screenline, derived by summing the capacities of the key roadways as they cross the screenlines. Ratios of travel demand to roadway capacity (volume/capacity ratios) are then calculated to assess highway performance at the screenlines. A volume/capacity ratio of 1.00 indicates that the roadway capacity of the screenline is completely utilized, while a volume/capacity ratio greater than 1.00 indicates that significant vehicular delay would occur because of roadway congestion. These volume/capacity ratios are frequently related to an index called level-of-service (LOS), which ranges from A (free-flow) to F (congested flow).

Tables 1.2-9 and 1.2-10 summarize 2000 and 2025 peak period data at selected screenlines, focusing on traffic flowing in the Ewa-Koko Head direction. Figure 1.2-3 illustrates the location of these screenlines.

TABLE 1.2-9
COMPARISON OF YEAR 2000 AND YEAR 2025 SCREENLINE LOS
A.M. PEAK HOUR INBOUND TO DOWNTOWN

Screenline	Year 2000				Year 2025			
	Vehicle Volume	Capacity	V/C Ratio	LOS	Vehicle Volume	Capacity	V/C Ratio	LOS
Kahe Pt.	1,892	3,200	0.59	A	3,004	3,200	0.94	E
Ewa	4,783	6,800	0.70	C	8,617	11,700	0.74	C
Waikele	7,278	9,750	0.75	C	12,973	11,500	1.13	F
Kalauao	16,030	15,900	1.00	F	25,089	17,650	1.42	F
Moanalua	17,527	20,400	0.86	F[1]	22,072	22,100	1.00	F[1]
Kapalama	15,758	16,800	0.94	E	23,595	20,500	1.15	F
Nuuanu	15,627	18,600	0.84	F[1]	21,196	18,600	1.14	F
Ward	12,097	18,900	0.67	F[1]	21,132	18,900	1.09	F
Manoa-Palolo	15,332	21,150	0.72	F[1]	20,800	21,150	0.98	F
Kapakahi	5,296	5,400	0.98	E	6,039	5,400	1.12	F

Source: Parsons Brinckerhoff, Inc., May 2002.
Note: LOS F caused by downstream congestion backing up across screenline.

FIGURE 1.2-3
SCREENLINES AT OR NEAR THE PRIMARY TRANSPORTATION CORRIDOR

TABLE 1.2-10
COMPARISON OF YEAR 2000 AND YEAR 2025 SCREENLINE LOS
P.M. PEAK HOUR OUTBOUND FROM DOWNTOWN

Screenline	Year 2000				Year 2025			
	Vehicle Volume	Capacity	V/C Ratio	LOS	Vehicle Volume	Capacity	V/C Ratio	LOS
Kahe Pt.	1,875	3,200	0.59	A	3,683	3,200	1.15	F
Ewa	4,435	6,800	0.65	B	9,497	11,700	0.81	D
Waikele	7,011	9,750	0.72	C	10,489	12,500	0.84	D
Kalauao	14,677	14,150	1.04	F	21,936	17,650	1.24	F
Moanalua	14,620	18,200	0.80	F[1]	20,599	19,900	1.04	F
Kapalama	14,535	17,700	0.82	F[1]	21,266	21,800	0.98	E
Nuuanu	15,628	18,100	0.86	F[1]	21,193	18,100	1.17	F
Ward	15,329	22,200	0.74	F[1]	21,592	22,200	1.00	F
Manoa-Palolo	12,643	21,050	0.60	F[1]	21,994	21,050	1.04	F
Kapakahi	4,348	4,050	1.07	F	4,963	4,050	1.23	F

Source: Parsons Brinckerhoff, Inc., May 2002.

Note: [1] LOS F caused by downstream congestion backing up across the screenline.

At key screenlines between the Waiawa Interchange (H-1/H-2 junction), through the Urban Core and into East Honolulu, the LOS analysis indicates that many roadways are significantly over capacity under existing conditions. This finding on the current level of transportation service supports the analysis reported in the previous section, that the existing transportation infrastructure is severely taxed even under current levels of travel demand. Further, even including the near-term improvements to the transportation system presently programmed, volume/capacity ratios are projected to worsen between 2000 and 2025.

Within the Urban Core of Honolulu, much of the roadway performance is controlled by conditions at key intersections. If intersections are congested, the total trip time is lengthened even if traffic flows smoothly between the intersections.

Table 1.2-11 summarizes 2000 and projected 2025 peak hour intersection LOS at key intersections within the Urban Core. Many of the intersections are approaching capacity under existing conditions, and intersection performance is projected to worsen between 2000 and 2025 because travel within the Urban Core is projected to grow.

In summary, the highway screenline and the Urban Core intersection analyses indicate that highway users currently experience substantial traffic congestion. Even with the assumed improvements to the transportation system (these assumed improvements are contained in the No-Build Alternative as discussed further in Chapter 2), peak hour conditions for 2025 vehicular traffic would be even worse than 2000 conditions because of growth in travel demand. Thus, an approach of increasing person-capacity is needed.

The travel conditions indicated by the screenline and intersection LOS results in average islandwide auto speeds of 28.95 miles per hour (mph) and 29.01 mph during the A.M. peak period and P.M. peak period, respectively. Table 1.2-12 summarizes projected year 2025 peak period auto travel times between selected origins and destinations.

The regional auto travel times are lower during the A.M. peak period than during the P.M. peak period, because autos traveling during the A.M. peak period would benefit from the contra-flow zipper lane/shoulder lane operation on H-1 Freeway, between the Paiwa Interchange and the Keehi Interchange. The zipper lane/shoulder lane operation does not currently operate during the P.M. peak period and is not assumed to operate in this time period in the future.

TABLE 1.2-11
COMPARISON OF EXISTING AND FUTURE INTERSECTION LOS

Intersection	Peak Time Period	2000	2025
Kalihi Street & Dillingham Boulevard	A.M.	C	F
	P.M.	E	F
Kalihi Street & N. King Street	A.M.	D	F
	P.M.	D	F
Bishop Street & S. King Street	A.M.	D	F
	P.M.	D	F
Punchbowl Street & S. King Street	A.M.	D	F
	P.M.	C	F
Punchbowl Street & Ala Moana Boulevard	A.M.	B	C
	P.M.	D	F
Kalakaua Avenue & Kapiolani Boulevard	A.M.	C	F
	P.M.	E	F
Nimitz Highway & Sand Island Access Road	A.M.	F	F
	P.M.	F	F

Source: Parsons Brinckerhoff, Inc., May 2002.

TABLE 1.2-12
YEAR 2025 PEAK PERIOD AUTO TRAVEL TIMES
(Travel Time in Minutes)

Trip Origins/Destinations	A.M. Peak Period	P.M. Peak Period
Downtown-Kapolei	44.6	57.1
Downtown-Mililani	46.4	58.4
Downtown-Waikiki	12.7	13.8
Downtown-U.H.-Manoa	12.9	12.7
Downtown-Middle St. TC	13.4	11.0

Source: Parsons Brinckerhoff, Inc., November 2002.
Note: TC = Transit Center
Travel time direction is inbound to Downtown in the A.M. peak period and outbound from Downtown in the P.M. peak period.

2) Public Transit Performance

TheBus had approximately 213,000 boardings per day in 2000. Measured in passengers per revenue-mile and operating expenses per passenger, TheBus is one of the most productive and efficient bus systems in the U.S. In 1994 and again in 2000 the City bus system received a “Best Transit System in America Award” from the American Public Transit Association.

TheBus has excellent service coverage and there is significant passenger demand. Many express and trunk routes experience substantial overcrowding. On an average day across the system, there are over 30 instances of waiting passengers being passed up because buses are full. Bunching of buses caught in traffic congestion causes schedules to be unreliable. Because buses must compete for roadway space with other vehicles, increasing capacity on bus routes is difficult. With the high level of traffic congestion on today’s highway system, and increased traffic congestion forecasted for the future, the ability of the bus system to continue providing the service it does today is limited. The ability of the system to improve the level of service to reduce current overloads and meet future travel demand would be even more limited.

In summary, unless significant changes are made to enhance the transit system, increasing congestion on the roadway system will constrain the ability of TheBus to provide convenient and reliable mobility options for those who can choose between transit and driving. With roadway congestion continuing to worsen, average bus speeds and on time performance will be poor as long as buses operate in mixed traffic. Ridership growth will be more difficult to achieve under such circumstances. The ability of TheBus to absorb future travel demand, much less improve the current level of service for transit patrons, is limited if the system continues to be operated in congested traffic.

1.2.4 Zonal Requirements for Travel Within the Corridor

Not only must the network increase its capacity to move people, but the types of transportation service to be provided must be reflective of the unique transportation needs that exist on a subarea basis.

Figure 1.2-4 displays three distinct travel zones or market areas within the primary transportation corridor. Zone I extends from Kapolei to Middle Street, and contains three subzones: Kapolei/Ewa, Waipahu/Waikele/Pearl City, and Salt Lake/Airport. Zone II encompasses Downtown Honolulu, extending from Middle Street to the University of Hawaii. Zone III covers Waikiki as well as overlapping with parts of the Urban Core. A fourth zone includes the rest of the island outside of the primary transportation corridor. In developing transportation alternatives to address future demand, the travel patterns and unique needs of the individual zones and subzones must be understood so the alternatives that address the mobility issues of the corridor also match localized needs for transportation service.

Zone I, the region of the Secondary Urban Center, has the principal travel requirements of more frequent express service from Kapolei to Downtown Honolulu, intrazonal circulation, and connections to the rest of Oahu. Since Kapolei will support jobs and a range of cultural, educational, and other activities, residents need to be able to meet many of their needs by traveling wholly within the City of Kapolei. In addition, jobs and other attractions in Kapolei will attract “reverse travel” to this part of Oahu from outside areas.

The Waipahu/Waikele/Pearl City subzone of Zone I is a suburban area, including the regional shopping hubs of Waikele Center/Waikele Premium Outlets and Pearlridge Center. Therefore, the Waipahu/Waikele/Pearl City subzone’s primary travel needs are connections to the Urban Core for residents who work in town, a connection to Kapolei, and connections into this subzone to access the shopping centers.

The Salt Lake/Airport subzone of Zone I contains the largest housing areas for military families, and employment centers such as the Honolulu International Airport and the Mapunapuna industrial area. Pearl Harbor is a major employer and visitor attraction. Connections to this subzone from all parts of the island will continue to be critical for commuters and airport users, and connections from all over Oahu to Pearl Harbor will be important.

Zone II is Honolulu’s Urban Core, where the travel needs relate to convenient and efficient in-town mobility associated with “in-town” living. Many trips could be made by walking, bicycling or public transportation. Since Zone II will remain the primary center for employment, cultural activities, educational opportunities, regional shopping, and recreation, it will continue to serve as a major hub for commuters, students, and other individuals from all parts of the island. With major redevelopment planned for Kakaako, an opportunity exists to coordinate transit plans with Kakaako development plans so that mobility and livability objectives are fully realized.

FIGURE 1.2-4
TRAVEL ZONES WITHIN THE PRIMARY TRANSPORTATION CORRIDOR

Zone III comprises Waikiki and its 21,900 residents, 31,300 hotel rooms, 40,997 employees, plus numerous retail, entertainment, and recreational attractions. Waikiki has the highest concentration of trip making per square mile of any area on the island, with population and employment projected to increase further by 2025. While many trips stay within Waikiki and are made by walking or transit, most Waikiki residents work, go to school or have health care and other needs outside of Waikiki. They therefore require good connections to Downtown and other parts of the PUC. Also, most of the employees who work in Waikiki live elsewhere, and need good transportation access to places of employment. Waikiki's concentration of recreational activities, restaurants, nightlife, parks and beaches attract residents from around the island.

1.3 PLANNING CONTEXT

This Section discusses the context within which planning for transportation improvements in the primary transportation corridor has been occurring. Section 1.3.1 discusses how an investment in transportation infrastructure in the primary transportation corridor would be consistent with government plans. Section 1.3.2 was added to the FEIS and explains the transportation planning process. Section 1.3.3 discusses the public outreach activities that DTS has conducted, starting in the Fall of 1998. Input from the Oahu Trans 2K series of meetings has been critical in establishing consensus on key issues and in developing and evaluating alternative transportation solutions for the corridor, as described in more detail in Chapter 2. Section 1.3.2 also describes the development of the Islandwide Mobility Concept Plan (IMCP), an important document that integrated public input into transportation goals and objectives for the island.

1.3.1 Transportation Improvements in Relation to Government Plans

The purposes and needs presented so far in this Chapter have been discussed for many years, and government planning has long recognized them in transportation goals and objectives for the island, although not necessarily stated in the current terminology of sustainability.

Transportation planning in the primary transportation corridor involves several local, State, and federal agencies, primarily the DTS, the HDOT, and the Oahu Metropolitan Planning Organization. The transportation-related goals and objectives developed by planning agencies are summarized in Table 1.3-1.

Since the 1960s, public transit has been acknowledged as a key component of local and State plans to meet transportation demands in urban Honolulu. Therefore, in addition to the previously presented quantitative analysis showing the need for transit to address the inadequacy of the existing roadway system to satisfy existing and future travel demand, improvements in the transit system conform to long-standing government policies. Specifically, the Transportation for Oahu Plan, TOP 2025 (April 6, 2001) includes the Regional and

In-Town Bus Rapid Transit (BRT) components. The need for the BRT in the PUC corridor emerged from a transportation system planning process.

In addition to the goals in Table 1.3-1, the goals and objectives in the City and County of Honolulu's Islandwide Mobility Concept Plan (March 1999, updated August 2001) present a vision for integrating transportation and land use planning. This plan, which grew out of the public involvement activities conducted for this project (described further in Appendix A), emphasizes the role of transportation in helping build, strengthen, and connect communities throughout Oahu; focusing growth in designated areas; and enhancing the island's overall quality of life.

The range of government goals and objectives reflected in Table 1.3-1 were used to evaluate the alternatives before the Refined LPA was selected for implementation.

TABLE 1.3-1

LOCAL AND STATE TRANSPORTATION GOALS AND OBJECTIVES FROM PLANS

City and County of Honolulu, General Plan for the City and County of Honolulu (Adopted 1992)
• To create a transportation system which will enable people and goods to move safely, efficiently, and at a reasonable cost; serve all people, including the poor, the elderly, and the physically handicapped; and offer a variety of attractive and convenient modes of travel. • To maintain transportation and utility systems that will help Oahu continue to be a desirable place to live and visit.
City and County of Honolulu, Primary Urban Center Development Plan (Public Review Draft, May 2002)
· Develop a balanced transportation system that reduces reliance on cars and improves alternate modes connecting neighborhoods and activity centers. · Implement land use strategies to achieve a balanced transportation system. · Improve the public transit system, including development of a rapid transit component. · Implement Transportation Demand Management (TDM) strategies. · Review existing plans and establish priorities for roads and road improvements. • Implement the Honolulu Bicycle Master Plan. · Enhance and improve pedestrian mobility.
City and County of Honolulu, Ewa Development Plan (Adopted August 1997)
• Certification of adequate transportation access and services before zoning approval of new residential and commercial development. • Planned rapid transit corridor to connect the City of Kapolei with Waipahu and onward to the Primary Urban Center. • Improved linkages within the region, including to and across the former Barbers Point Naval Air Station. • Design master planned residential communities to support non-automotive travel.
State of Hawaii, Hawaii State Plan (Adopted January 30, 1989)
• An integrated multi-modal transportation system that services statewide needs and promotes the efficient, economical, safe, and convenient movement of people and goods. • A statewide transportation system consistent with planned growth objectives throughout the State. • Design, program, and develop a multi-modal system in conformance with desired growth and physical development as stated in Chapter 226, HRS. • Coordinate State, County, Federal, and private transportation activities and programs toward the achievement of statewide objectives. • Encourage a reasonable distribution of financial responsibilities for transportation among participating governmental and private parties. • Promote a reasonable level and variety of mass transportation services that adequately meet statewide and community needs. • Encourage transportation systems that serve to accommodate present and future development needs of communities. • Promote programs to reduce dependence on the use of automobiles. • Encourage the design and development of transportation systems sensitive to the needs of affected communities and the quality of Hawaii's natural environment. • Encourage safe and convenient uses of low-cost, energy-efficient, non-polluting means of transportation.

TABLE 1.3-1 (CONTINUED)
LOCAL AND STATE TRANSPORTATION GOALS AND OBJECTIVES FROM PLANS

Oahu Metropolitan Planning Organization Transportation for Oahu Plan, TOP 2025 (Adopted April 6, 2001)
• Develop and maintain Oahu's islandwide transportation system to ensure safe, convenient, and economical movement of people and goods. • Develop and maintain Oahu's transportation system in a manner that maintains environmental quality and community cohesiveness. • Develop and maintain Oahu's transportation system in a manner that is sensitive to community needs and desires. • Develop a travel demand management system for Oahu that optimizes use of existing transportation resources.

1.3.2 Oahu's Transportation Planning Process

This section presents a brief explanation of the transportation planning process in Oahu. This section was added to the FEIS in response to comments received on the MIS/DEIS and SDEIS. The information presented was extracted from the Transportation for Oahu Plan, TOP 2025, which was approved by the Oahu Metropolitan Planning Organization (OMPO) on April 6, 2001.

1.3.2.1 Transportation for Oahu Plan (TOP) 2025 Background

The OMPO, the designated metropolitan planning organization for Oahu, is responsible for the metropolitan transportation planning process requirements. The United States Department of Transportation mandates these requirements for establishing the eligibility of metropolitan areas for federal funds earmarked for ground transportation systems. One requirement is that each major urban area develops a multi-modal long-range plan that documents ground transportation projects selected for federal funding for a minimum time horizon of 20 years. The TOP 2025 was developed within the context of the comprehensive, cooperative and continuing (3C) planning process established and carried out by OMPO and its participating agencies. OMPO is the officially designated regional agency that must ensure that the 3C process addresses all federal concerns regarding various transportation modes on Oahu while satisfying the transportation needs of the state and county.

Current federal surface transportation legislation, enacted in 1998 as the Transportation Equity Act for the 21st Century (TEA-21), requires transportation strategies in metropolitan regions to address several planning factors. This federal law also expanded public participation in the transportation planning process and required increased cooperation among the jurisdictions that own and operate the region's transportation system.

TEA-21 requires that the following seven planning factors be considered (*Title 23, U.S.C., Section 134, Metropolitan Planning, (f) Scope of Planning Process)*:

1. Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity and efficiency.

2. Increase the safety and security of the transportation system for motorized and non-motorized users.

3. Increase the accessibility and mobility options available to people and for freight.

4. Protect and enhance the environment, promote energy conservation and improve quality of life.

5. Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight.

6. Promote efficient system management and operation.

7. Emphasize the preservation of the existing transportation system.

Federal regulations require Oahu's regional transportation plan to have a minimum 20-year planning horizon, be fiscally constrained and be updated at least every five years. (Refer to 23 CFR, Part 450 for details of the federal regulations.) To conform to the requirement for a 20-year planning horizon, the TOP 2025 has a planning horizon of the year 2025. To comply with the requirements that the regional transportation plan be fiscally constrained, the plan includes an analysis of financial resources reasonably expected to be available to fund the transportation infrastructure projects that are included in the plan. Lastly, the TOP 2025 will need to be updated during 2005.

The TOP 2025 goals and objectives were developed at the study outset and reflect the issues and concerns raised by study participants. The following issues were part of the previous long-range transportation plan for Oahu, *2020 Oahu Regional Transportation Plan* (*2020 ORTP)* and were judged to continue to be reasonable for the TOP 2025 planning process:

- Transportation Services
- Quality of Life
- Community Responsibility
- Demand Management

The OMPO Policy Committee adopted a system goal for each of the four major issues for the TOP 2025. A series of objectives were then developed that would accomplish each of the system goals. The *2020 ORTP* System Goals and Objectives were used as a starting point for the discussions; the objectives adopted by the OMPO Policy Committee for the TOP 2025 reflect the current philosophy of OMPO for the future transportation network of Oahu. The seven planning factors dictated by the TEA-21 legislation were also reviewed in formulating the final goals and objectives for the TOP 2025.

The TOP 2025 consists of projects that fall into the following general categories to help achieve the adopted goals and objectives for the TOP 2025:

- Congestion Relief Projects
- Transit and Alternative Modes Projects
- Operations and Safety Projects
- Second Access Projects
- Second Access Projects
- Projects that Support Community Planning Goals
- Projects that Provide Local Circulation and/or Community Access

1.3.2.2 Identifying Projects for Consideration in the TOP 2025

One hundred fifty-three (153) projects were identified as candidate projects using recommendations from the technical staffs of several involved agencies (including projects from the *2020 ORTP*), public comments and a technical analysis of future travel demand with the 2025 Baseline condition.

Based on a future travel demand forecast, the projects to address the capacity deficiencies were identified. A project description was developed for each identified project (in many instances, this project description consisted of a refined definition based on previous planning efforts), and the entire list of potential projects was reviewed. Similar and related projects were combined into a single project. As a result, the initial list of 153 projects was consolidated into a list of 101 projects. This list of projects and the associated projects descriptions were presented to the public in a series of Regional Meetings.

1.3.2.3 The Transportation for Oahu Plan (TOP) 2025

The candidate projects were grouped into six categories based on the project intent. The intent responds directly to project goals and objectives and serves as a useful means for organizing the projects for discussion. These six categories are used in the following paragraphs to describe the projects selected for the TOP 2025. The OMPO Policy Committee also included consideration of system preservation needs in their deliberations.

Many projects addressed goals and objectives that overlap the categories that were used for the TOP 2025 evaluation. For example, a project that relieves congestion will often improve safety and operations. Similarly, a project that provides improved transit service and offers an alternative mode to the traveling public will often divert trips from autos to transit, thus relieving traffic congestion. This discussion recognizes the overlap of project intent but focuses on the primary purpose of each project.

At the same time, while a primary purpose of a project may be to relieve automotive congestion or improve automotive safety and operations of existing streets, any and all improvements funded in the TOP 2025 will be constructed so that transportation efficiency and safety is improved for all roadway users, including motorists, bicyclists, pedestrians and transit riders. These projects include, but are not limited to placement of guard rails, curbing, signage, lane or road widenings and street realignments.

Congestion Relief Projects

Congestion Relief projects were conceived primarily to increase the vehicle-carrying capacity of Oahu streets and highways. They are proposed for facilities and areas with existing levels of severe congestion and locations where travel demand projections show that congestion will worsen over the next 20 years. Adding lanes to freeways and arterials or making improvements to major interchanges are typical of this category of projects.

Transit and Alternative Mode Projects

A number of projects were proposed to provide alternative modes of transportation to the single-occupancy automobile and to use the street and highway infrastructure more efficiently. Bus Rapid Transit (BRT), expanded bus service, paratransit service, vanpool programs, ferry service, bike paths and routes and pedestrian facilities are in this category. Managing travel demand includes many of these alternative modes but also includes strategies to change work behavior (telecommuting, variable work hours and four-day workweeks, among others).

Operations and Safety Projects

Many of the projects were proposed to improve the safety and operations of existing streets and freeways. Intersection improvements, the addition of continuous left turn lanes, street realignments, street or highway widenings, Intelligent Transportation Systems, interchange modifications, freeway ramp and transition lane modifications and general safety improvements fall in this category.

Second Access Projects

Portions of Oahu have limited access to the remainder of the island. Oftentimes, a single facility connects numerous homes and businesses to the larger community. A hostage incident, a major traffic accident, high water or a landslide have and continue to isolate citizens from emergency services, work, school and grocery shopping. In some instances, projects to connect minor "back" roads can provide a second way into and out of an area at a relatively low cost. In other instances, a major new facility would be required to cross one of Oahu's mountain ranges. These projects were not generally perceived as having large traffic carrying capacity, being capable of moving traffic at high speeds, or generally being used on a daily basis. Rather, these projects would provide second access to an area when the primary access is out of service.

Projects in Support of Community Planning Goals

Several types of projects were considered to support a diverse set of community planning goals. This diversity of goals is entirely appropriate given the varied nature of the communities on Oahu, such as new residential and commercial areas, expanding industrial facilities, growing retail areas, and existing developed areas.

Community planning efforts for the Ewa area have identified the need for additional street and highway facilities in the high growth Ewa and Kapolei areas. Projects that are most likely to be consistent with the master plan under development for this area were proposed for TOP 2025, and many are included in the final TOP 2025.

Another type of project within this category is the replacement of the bridge crossing the Kalihi Channel to Sand Island with a tunnel to facilitate movement of freighters into and out of Honolulu Harbor with greater efficiency and capacity.

Beautification projects also may relieve traffic congestion or improve safety or operations, but have as their primary goal the support of community planning goals.

Projects that Provide Local Circulation and/or Community Access

A number of projects were conceived to improve local circulation. In some instances, these projects add new access to an area, such as the Waikiki access from H-1 Ewa-bound or the second access to Leeward Community College. In other instances, the proposed projects close a gap in the street network, such as the Moanalua Road extension, or revise circulation patterns, such as the changes in one-way/two-way operations for Punchbowl and the Piikoi/Pensacola pair. These projects are designed to improve local traffic flow rather than affect regional travel patterns. However, since these projects play an important role in local circulation and access to communities, they merit inclusion in the regional plan.

Projects Included in the TOP 2025

Table 1.3-2 lists the projects selected for inclusion in the TOP 2025 as those that should be given the highest priority for implementation within the constraint of project revenues. The table identifies the general geographic area of the island where the proposed project will be located.

TABLE 1.3-2
TOP 2025 PROJECTS

Area*	Category**	Project Number	Project Description	Estimated Cost (Millions of Year 2000 $)
Oahu	Transit/Alt	I-1	Implement State Bicycle Plan	$ 70.2
Oahu	Transit/Alt	I-2	Implement Van Pool Program	$ 2.5
Oahu	Ops/Safety	I-3	Intelligent Transportation Systems	$ 110.0
Oahu	Ops/Safety	I-4	Travel Demand management	$ 114.7
CO*	Ops/Safety	C-5	Farrington Hwy. EB vertical realignment near Waipahu Dept Rd.	$ 20.0
CO	Ops/Safety	C-7	Kamehameha Hwy. widening Ka Uka to Lanikuhana	$ 97.5
CO	C Relief	C-10	Kunia Rd. widening H-1 to vicinity of Anonui St.	$ 25.9
CO	Local Circ	C-15	Waipahu Depot Rd. widening makai of Farrington Hwy.	$ 3.6
CO	Local Circ	C-16	Waipahu St. eastward extension to Waihona St.	$ 4.5
CO	Ops/ Safety	C-17	Waipahu St. left turn lanes	$ 9.4
EHon*	C Relief	P-38	Kalanianaole Hwy. extend A.M. contraflow lane to Keahole St.	$ 1.2
EHon	Ops/Safety	P-47	Kalanianaole Hwy. Rock fall Protection at Makapuu	$ 20.0
Ewa	Ops/Safety	E-1	H-1 Makakilo Interchange new WB on-ramp	$ 10.9
Ewa	C Relief	E-2	H-1 Kapolei Interchange new interchange	$ 44.3
Ewa	Comm. Plan	E-3	H-1 Palailai Interchange improvements (connects to E-10)	$ 8.5
Ewa	Comm. Plan	E-5	Farrington Hwy. widening Kalaeloa to Kamokila	$ 4.9
Ewa	Ops/Safety	E-6	Farrington Hwy. widening Kapolei Golf Course to Fort Weaver Rd.	$ 31.6
Ewa	Comm. Plan	E-8	Fort Barrette Rd. widening Farrington Hwy. to F.D. Roosevelt Blvd.	$ 21.5
Ewa	C Relief	E-9	Fort Weaver Rd. widening Farrington Hwy. to Geiger Rd.	$ 38.6
Ewa	Comm. Plan	E-10	Hanua St. new roadway Malakole St. to Farrington Hwy.	$ 13.1
Ewa	Comm. Plan	E-11	Kalaeloa roadway improvements	$ 26.9
Ewa	Comm. Plan	E-12	Kalaeloa Blvd. corridor improvements	$ 13.1
Ewa	Comm. Plan	E-13	Kapolei Pkwy. completion (Kapolei to Ewa Bch.)	$ 28.5
Ewa	Comm. Plan	E-14	Makakilo Dr. extension (second access)	$ 8.5
Ewa	Comm. Plan	E-15	Mauka Frontage Rd. Makakilo Dr. to Kalaeloa Blvd.	$ 6.4
Ewa	Comm. Plan	E-17	North-South Road Kapolei Parkway to H-1 (includes new interchange with H-1)	$ 90.0
Koolau. (Wind-ward)	Ops/Safety	K-2	Kahekili Hwy. improvements Haiku Rd. to Kamehameha Hwy. (Note: Improvements will include contraflow in existing right-of-way between Haiku Road and Hui Iwa Street, intersection improvements at Hui Iwa and Kamehameha Highway and other improvements.)	$ 3.5
Koolau. & NS* (Wind-ward)	Ops/Safety	K-15	Kamehameha Hwy. Safety Improvements (Note: Safety improvements to include turn lanes, guardrails, signage, crosswalks, etc. to improve safety and do not include widening except where needed for storage/turn lanes safety improvements.)	$ 100.0

TABLE 1.3-2 (CONTINUED)
TOP 2025 PROJECTS

Area*	Category**	Project Number	Project Description	Estimated Cost (Millions of Year 2000 $)
NS	2nd Access	N-3	Waimea Bay Access Rd. emergency connectors	$ 20.0
PUC*	Ops/Safety	P-0 Baseline	Interstate Route H-1, EB off-ramp to Punahou St. (funded before 2001 but included for completeness	Funding completed
PUC	Transit/Alt	P-1	Honolulu Bicycle Master Plan (Note: $20 million cost shown for TOP 2025 is a portion of the $78.7 million for all elements of the Master Plan	$ 20.0
PUC	Transit/Alt	P-2a	Regional Bus Rapid Transit	$ 268.0
PUC	Transit/Alt	P-2b	In-town Bus Rapid Transit and Bus/Handi-Vans	$ 821.1
PUC	Transit/Alt	P-3	Express Commuter Ferry	$ 20.0
PUC	C Relief	P-6 Baseline	H-1 WB Widening Waimalu viaduct to Pearl City off-ramp	$ 45.0
PUC	C Relief	P-7	H-1 EB widening Waiawa to Halawa	$ 216.8
PUC	C Relief	P-8	H-1 WB widening Vineyard to Middle	$ 121.3
PUC	Ops/Safety	P-9	H-1 WB weaver modification Lunalilo to Vineyard off-ramp	$ 21.0
PUC	Ops/Safety	P-10	H-1 EB widening Ward to Punahou, close Piikoi on-ramp	$ 21.0
PUC	Ops/Safety	P-11	H-1 University Interchange modification	$ 20.7
PUC	Ops/Safety	P-12	H-1 WB widen Waipahu off-ramp	$ 8.4
PUC	Local Circ	P-14	Second access to Leeward Community College	$ 6.0
PUC	Local Circ	P-22	Moanalua Rd. extension Waimano Home Rd. to Waihona St.	$ 4.9
PUC	C Relief	P-23	Nimitz Hwy. improvements Keehi to Pacific St.	$ 192.7
PUC	Local Circ	P-28	Piikoi Pensacola one-way couplet (reverse)	$ 3.6
PUC	Local Circ	P-29	Punchbowl Street conversion to two-way operation	$ 2.0
PUC	C Relief	P-32	Fort Armstrong Tunnel	$ 300.0
PUC	Ops/Safety	P-34	Sand Island Access Rd. widening	$ 4.4
PUC	Comm. Plan	P-35	Sand Island Bridge (replace with tunnel)	$ 200.0
PUC	Local Circ	P-36***	Waikiki access from H-1 Ewa-Bound	$ 90.9
PUC	Comm. Plan	P-40	Kamehameha Hwy. beautification project (Waiawa to Pearl Harbor)	$ 30.1
PUC	C Relief	P-41 Baseline	Puuloa Rd. widening – Salt Lake Blvd. to Nimitz Hwy.	$ 21.6
PUC	C Relief	P-42	H-1 Widening (westbound) through Waiawa Interchange	$ 21.3
PUC	C Relief	P-43	H-1 Widening (westbound) Waiau to Waiawa Interchange	$ 59.5
PUC	C Relief	P-44	Waiawa Interchange Improvements	$ 21.3
PUC	C Relief	P-45 Baseline	H-1 Eastbound: Widen by one lane from Middle St. to Vineyard Blvd	$ 30.0
PUC	C Relief	P-46 Baseline	Salt Lake Blvd. widening: Lawehana St. to Ala Lilikoi (widen from 2 to 4 lanes)	$ 31.0
Waianae	2nd Access	W-2	Waianae Emergency Access Road system	$ 9.3
Waianae	Ops/ Safety	W-5	Farrington Hwy. realignment around Makaha Bch. Park	$ 35.1

TABLE 1.3-2 (CONTINUED)
TOP 2025 PROJECTS

Area*	Category**	Project Number	Project Description	Estimated Cost (Millions of Year 2000 $)
Waianae	Transit/Alt	W-7 Baseline	Leeward Bikeway, Waipio Point Access Rd. to Lualualei	$ 3.0
Waianae	Ops/Safety	W-8	Farrington Hwy. Safety Improvements (Note: Cost estimate reflects intersections improvements only.	$ 25.0
			Total for All Projects:	**$ 3,624.8**

Source: Transportation of Oahu Plan, TOP 2025, Oahu Metropolitan Planning Organization, April 6, 2001.
Notes: * CO = Central Oahu
PUC = Primary Urban Center
NS = North Shore
EHon = East Honolulu
NB = Northbound
SB = Southbound
EB = Eastbound
WB = Westbound

** Categories:
C Relief = Congestion Relief Projects
Transit/Alt = Transit and Alternative Modes Projects
Ops/Safety = Operations and Safety Projects
2nd Access = Second Access Projects
Comm. Plan = Projects that Support Community Planning Goals
Local Circ = Projects that Provide Local Circulation and/or Community Access

***P-36
Project P-36 was designated by the Policy Committee as the lowest priority for selected projects, and extensive review and study will be required.

1.3.2.4 Conclusion

With the TOP 2025 improvements, the future transportation system on Oahu is projected to perform substantially better than a scenario without the proposed improvements. Transit ridership increased by more than 14 percent under the scenario with the TOP 2025 improvements. For the two strongest indicators of congestion on the roadway system (vehicle hours traveled and vehicle hours of delay), the TOP 2025 transportation system performs at congestion levels that are significantly less than the scenario without the improvements. Under the scenario with the TOP 2025 improvements, vehicle hours traveled are projected to decline by 12 percent and the vehicle hours of delay on the roadway system are projected to decline by 23 percent.

Performance of the TOP 2025 with respect to meeting the identified goals and objectives was also evaluated. All objectives were met by the proposed list of transportation improvements.

The financial analysis demonstrates that the TOP 2025 highway and transit projects for the fiscally constrained regional transportation plan will have sufficient revenues through a combination of existing revenue sources and additional revenue assumed to be in place over the next 20 years. The total identified funding needs included the estimated cost of the TOP 2025 projects of slightly more than $3.6 billion along with system preservation needs for state highways identified as an additional $1.05 billion over the life of the 25-year plan.

The total identified need of almost $4.7 billion exceeded the revenues that could be assumed to be in place from only existing sources.

In addition to the traditional FHWA, FTA, state and local contributions to TOP 2025 projects, two other sources of revenues were identified. The first is developer contributions, which may involve private financing of selected elements of projects, facilities or land donations. The other additional revenue source results from the typical increases in the tax rates of state highway funding.

The assumptions used to project the additional State Highway Special Fund revenues are reasonable based on historical trends in tax rate increases over the last 25 years. Likewise, the assumption of an average developer contribution of 20 percent of potential developer-funded projects, which will be developed in a forum outside of the TOP 2025, is also valid. As a result of these assumptions and the projections of federal, state and local highway funding levels, the revenues are sufficient to fund the TOP 2025 recommendations.

The TOP 2025 recommendations define a transportation system for Oahu's future that will help to achieve the four goals adopted for the plan. The projects included in the TOP 2025 achieve these goals within the fiscal constraints of funding that will be available within the 25-year time frame of the plan.

1.3.3 Oahu Trans 2K Public Outreach Planning Process

The Oahu Trans 2K series of participatory workshops (the islandwide transportation component of the 21st Century Oahu visioning program) began in the Fall of 1998, and has thus far included five rounds of community outreach meetings. Together, DTS and HDOT went out to the public to provide background information on mobility issues and listen to the public. The meetings were widely advertised and well attended. These meetings represented a continuation and acceleration of public outreach meetings that had begun on a more informal basis a year earlier.

During Round 1 of the meetings (September/October 1998), participants viewed an introductory video and presentation boards showing possible solutions to transportation problems. Participants were then encouraged to brainstorm about neighborhood and islandwide transportation issues and possible solutions. They made comments directly onto large area maps. The results of this round of meetings were compiled into a database of 2,400 specific ideas, and were used to develop a draft islandwide mobility concept.

In Round 2 of the meetings (November/December 1998), participants viewed a video summarizing the Round 1 process and a short presentation that outlined the draft islandwide mobility concept, which was developed from the Round 1 input. With the assistance of trained facilitators, participants gathered in groups organized by neighborhood to review workbooks tailored to each transportation planning zone.

After two rounds of community-based meetings, the input obtained was incorporated into the Islandwide Mobility Concept Plan, which was prepared and issued in March 1999 and reprinted with updates in August 2001. This plan articulated three central goals:

- Improve in-town mobility;
- Strengthen islandwide connections; and
- Foster livable communities.

The Round 3 meetings were held during March/April 1999 in combination with the meetings of 19 vision teams across the island. Information presented included the Islandwide Mobility Concept Plan and transit alternatives for a high-capacity transit spine in the primary transportation corridor. The Round 3 meetings also announced the upcoming formal scoping for the Major Investment Study/Draft Environmental Impact Statement (MIS/DEIS), which occurred in May 1999.

In Round 4 of the meetings (October 1999), the plans for public transit, as discussed in the first three rounds of meetings, were presented for questions and discussion. Discussion included the operation of the passenger loading platforms in the middle of the street, center-running transit operations in comparison to curbside-running, the use of "high-tech" approaches to provide schedule and waiting time information to transit users, possible features of transit vehicles, and route alignment details.

A Round 5 Oahu Trans 2K meeting was held on August 14, 2001 at Neal Blaisdell Center (NBC). This community open house included informational displays on different aspects of the BRT system and the Oahu Trans 2K program, specifically the project refinements developed by the Pearl City/Aiea, Kalihi, Downtown/Kakaako, and Mid-Town/University Working Groups. An informational briefing on the Working Group process and BRT project refinements was presented.

Five rounds of community-based meetings showed that there is a strong interest in transit technology, how a new transit technology would integrate into the community and with the existing bus system, and the funding aspect of the project.

1.4 ROLE OF THE FEIS IN PROJECT DEVELOPMENT

This Section provides a brief overview of the formal transportation project development process and the role of the FEIS in that process in compliance with the statutory requirements of the National Environmental Policy Act (NEPA) and the Hawaii Environmental Impact Statement (EIS) Law (Chapter 343, Hawaii Revised Statutes [HRS]).

An MIS was a prescribed federal planning study that is conducted as one of the first steps in project development when a need for a major metropolitan transportation investment is identified and federal funding is potentially involved. A transportation solution can consist of roadway, transit, pedestrian, and other elements singly or in combination. The MIS evaluates alternative transportation solutions to the mobility problems of the corridor.

A DEIS addresses the potential environmental impact of a project, and meets the environmental review requirements of the NEPA and the Hawaii EIS Law. Combining the MIS with the DEIS allows for a more comprehensive analysis of possible environmental impacts and alternatives, and facilitates project delivery. No program decisions can be finalized until these processes are completed.

The DEIS process begins with scoping, followed by preparation of the document. The Notice Of Intent (NOI) for the DEIS was published in the April 27, 1999 Federal Register. The NOI informed the public and agencies that an EIS would be prepared, and formally announced the beginning of the scoping process. The formal scoping meeting for the DEIS was held on May 11, 1999.

In accordance with the Hawaii EIS Law, the EIS Preparation Notice was published in the April 23, 1999 The Environmental Notice.

The DTS and FTA distributed the Primary Corridor Transportation Project, Major Investment Study/Draft Environmental Impact Statement [MIS/DEIS] (August 2000) to agencies and the public in August 2000. Following the release of the MIS/DEIS, there was an agency and public review period from August 23, 2000 to November 6, 2000.

The Locally Preferred Alternative (LPA) may be one of the alternatives addressed in the DEIS, a modification of one of those alternatives, or a hybrid combining the best features of several. Subsequent to the release of the MIS/DEIS and the public and agency comment period, the City Council selected the BRT Alternative as the LPA. The identification of the LPA is a signal to the FTA that sufficient local consensus exists on a particular project alternative to proceed to the Preliminary Engineering/Final Environmental Impact Statement (PE/FEIS) phase and beyond the environmental review process.

The City Council approved local funds for the PE/FEIS effort in the 2001 City Capital Improvement Program budget. Federal funds were programmed in the 2001 OMPO Overall Work Program and TIP, and FTA has approved grants for the work. Financial analysis determined that sufficient revenues will be available for TOP 2025 highway and transit projects including the BRT project. By being included in the TOP 2025, the BRT Alternative is eligible to be included in future TIPs.

As a result of the Working Groups and comments received on the MIS/DEIS, the DTS proposed to amend the LPA to include new and modified components, which the City Council approved on August 1, 2001. Since the refinements were proposed after the MIS/DEIS was completed and distributed and because the refinements were anticipated to have environmental impacts that were not disclosed in the MIS/DEIS, a Supplemental Draft Environmental Impact Statement (SDEIS) was prepared.

The SDEIS was distributed in March 2002. The public and agency review period was from March 22, 2002 to May 7, 2002. The public hearing was held on April 20, 2002.

Following the public comment period for the SDEIS, a State FEIS complying with Chapter 343 HRS was prepared. The State FEIS responded to all comments received on the MIS/DEIS and SDEIS. The release of the State FEIS was announced by publishing a Notice of Availability (NOA) in The Environmental Notice on December 8, 2002. The Governor of the State of Hawaii accepted the State FEIS on November 29, 2002, completing the environmental review process under the State EIS Law. Publication of acceptance of the State FEIS by the Governor was followed by a 60-day legal challenge period.

This separate federal FEIS has been prepared to comply with NEPA requirements. Similar to the State FEIS, this FEIS responds to all comments received on the MIS/DEIS and SDEIS. The release of this FEIS and the acceptance of comments on the FEIS within a 30-day comment period will be announced through publication of a Notice of Availability (NOA) in the Federal Register, The Environmental Notice, special City publications, and local newspapers. The FTA will consider these comments in its determination on the issuance of the Record of Decision (ROD) for the IOS of the Refined LPA.

A 30-day minimum waiting period after publication of the FEIS is required by NEPA before the ROD of for the IOS can be issued. The ROD, which will be published in the Federal Register, will document the decision made on the proposed action and the reasons for that decision. A separate ROD will cover the remainder of the Refined LPA at a future time.

CHAPTER 2 ALTERNATIVES CONSIDERED

CHAPTER OVERVIEW AND ORGANIZATION

This chapter is organized in two parts. Section I is a summary of the Initial Operating Segment (IOS) from Iwilei to Waikiki, which will be the first component of the Refined Locally Preferred Alternative (Refined LPA) to be implemented. Operation of the IOS will begin in 2005; project details and analyses provided are for the Year 2006, the first year after implementation of the IOS.

Section II is a description of the three alternatives analyzed for the entire primary transportation corridor in this FEIS, the No-Build Alternative, the TSM Alternative, and the Refined LPA.

I. IWILEI TO WAIKIKI (IOS)

The first segment of the Refined LPA that will be constructed is between Iwilei and Waikiki and it is called the IOS in this document. It is shown in Figure 2-1. Construction will consist of concrete lanes, signal priority, and widening of sections of Ala Moana Boulevard and Kalia Road. Construction at the transit stops will include a 13-inch high platform, benches and canopies (except in historically sensitive locations). The IOS will use hybrid diesel-electric vehicles operating at-grade in exclusive or semi-exclusive lanes for 2.5 miles and in mixed traffic for 3.1 miles. The IOS will provide frequent service and direct access to major activity destinations and residential neighborhoods. BRT service will operate every six minutes during peak hours and every ten minutes during off-peak hours.

The IOS will have a travel time between Downtown and Waikiki via the Ala Moana Boulevard corridor of 25 to 30 minutes. This compares to travel time between Downtown and Waikiki using either the existing Route 19, Route 20, or Route 42 local buses of approximately 35 to 45 minutes. The IOS will also provide transportation connections between emerging redevelopment areas such as Kakaako Makai, located between Downtown and Ala Moana, and other major activity locations along the IOS alignment. From the proposed UH Medical School in Kakaako Makai, the IOS will provide an eight minute travel time to Downtown, while it takes sixteen minutes today, including walk time and average wait time for TheBus. Similarly, travel time using the IOS between the UH Medical School and Ala Moana Center will be eight minutes versus ten minutes using today's transit service. Travel time between Ward Center and Waikiki Beach is thirty-three minutes by today's transit service. This travel time will be shortened by fifteen minutes to eighteen minutes with the IOS, including average wait and walk times.

Convenient connections between the IOS and circulator, local, and express buses will occur at Aala Park, along Hotel Street in Downtown, at Ala Moana Center, and along Kuhio Avenue in Waikiki.

Along a portion of the IOS's length, BRT vehicles will operate at-grade in exclusive or semi-exclusive transit lanes. In other locations, the IOS will operate in mixed traffic. Figures 2-2A and 2-2B depict the locations of the IOS exclusive and semi-exclusive lanes.

The transit stops will have more amenities than the typical bus stop with 13-inch high raised platforms that provide level boarding to low-floor buses, and covered waiting areas with seating, lighting, and landscaping. Some variations will occur due to space limitations. A rendering of the proposed Hobron Stop in Waikiki is provided in Figure 2-3A, as an example. Some of the stops will also be provided with signs indicating the waiting time until the next vehicle arrives. Figure 2-3B depicts a typical BRT stop. The entire IOS system will be designed for compliance with the Americans with Disabilities Act (ADA).

FIGURE 2-1
INITIAL OPERATING SEGMENT

COPY FROM FIGURE IN IOS CHAPTER

FIGURE 2-2A
IOS PRIORITY LANES AND TRANSIT STOPS

COPY FROM FIGURE IN IOS CHAPTER

FIGURE 2-2B
IOS PRIORITY LANES AND TRANSIT STOPS

COPY FROM FIGURE IN IOS CHAPTER

FIGURE 2-3A
RENDERINGS OF HOBRON LANE STOPS

COPY FROM FIGURE IN IOS CHAPTER

FIGURE 2-3B
TYPICAL SECTION OF BRT STOPS

COPY FROM FIGURE IN IOS CHAPTER

1) IOS Routing

Traveling in the Koko Head direction, the IOS will start at Aala Park and proceed to the Hotel Street Transit Mall via River Street. From Hotel Street it will continue in the makai direction on Bishop Street to Aloha Tower Drive. From Aloha Tower Drive, the IOS will continue in the Koko Head direction on Ala Moana Boulevard and then turn in the makai direction onto Forrest Avenue. It will then turn in the Koko Head direction onto Ilalo Street and then turn in the mauka direction which becomes Ward Avenue on the mauka side of Ala Moana Boulevard and then Koko Head at Auahi Street.

Along Auahi Street the BRT will be in extra-wide semi-exclusive curb lanes that permit the on-street parking to remain. At the Koko Head end of Auahi Street, the route will turn onto the short Queen Street segment to rejoin Ala Moana Boulevard and head Koko Head towards Waikiki. Along Ala Moana Boulevard, between Queen Street and the Ala Wai Canal, the BRT will operate in the curb lane in mixed traffic. Between the Ala Wai Canal and Kalia Road, Ala Moana Boulevard will be reconfigured to allow an additional lane in each direction. These lanes, formed by reducing the median and narrowing the travel lanes, will be semi-exclusive curb lanes shared with local buses, private buses and right-turning vehicles.

From Ala Moana Boulevard, the route will turn makai on Kalia Road and enter Fort DeRussy. The route will continue along Kalia Road to Saratoga Road, with Kalia Road being widened by one lane in each direction between the Hale Koa Hotel and Saratoga Road. The alignment will turn mauka on Saratoga Road. The BRT will be in semi-exclusive lanes on Kalia Road from Maluhia Street to Saratoga Road, and on Saratoga Road from Kalia Road to Kalakaua Avenue. At the intersection of Saratoga Road and Kalakaua Avenue, the route will split into a one-way couplet on Kalakaua and Kuhio Avenues. The Koko Head-bound transit lane will be semi-exclusive, using the makai curb lane of Kalakaua Avenue until after the stop at Uluniu Street where it will transition mauka in mixed traffic to turn onto Kapahulu Avenue. The Kapahulu transit stop will be on the Koko Head side of Kapahulu Avenue and will not affect Kapiolani Park. The transit stop improvements at this site will be within the 18-foot-wide public sidewalk area. The return loop will turn Ewa onto Kuhio Avenue, and the Ewa-bound buses will operate in mixed traffic using the mauka curb lane of Kuhio Avenue. The alignment will turn onto the Ewa side of Kalaimoku Street to return to Saratoga Road. Within Waikiki, the BRT lanes will mostly be curbside semi-exclusive lanes shared with local buses and private transit vehicles. The exceptions will be the Kalaimoku contra-flow lane which will be an exclusive BRT lane; and Kapahulu and Kuhio Avenues which will be mixed-flow operations.

In the Ewa direction, the IOS will travel Ewa from Kalaimoku Street in Waikiki following the reverse routing described for the Koko Head-bound direction, except that, at the intersection of Bishop Street/Nimitz Highway, the branch will turn Koko Head onto Nimitz Highway, then mauka onto Alakea Street, left on Hotel Street and then travel along Hotel Street to the N. King Street Transit Stop at Aala Park.

Existing attractions that will be served by the IOS include Chinatown, the Central Business District, Aloha Tower Marketplace, Hawaii Maritime Museum, Piers 10 and 11 cruise ship terminal, Restaurant Row, Kakaako Waterfront Park, Children's Discovery Center, Ward Centre and Entertainment Complex, Ala Moana Center, Ala Moana Beach Park, Fort DeRussy, Kapiolani Park, and major hotels, high-rise residences, offices, and commercial/recreation destinations in Waikiki. Future land uses that would be served include future phases of Aloha Tower Marketplace, a new cruise ship terminal at Pier 2, the proposed University of Hawaii School of Medicine and related bio-medical research facilities, the proposed Hawaii Science and Technology Center, commercial plus retail development at Kewalo Basin, and the Waikikian and Outrigger redevelopment projects in Waikiki.

2) Construction Elements

Construction is scheduled to commence before the end of 2003, with completion projected in 2005. The major construction elements of each roadway segment are summarized in Table 2-1. The improvements include construction of transit stops, concrete bus lanes, pavement rehabilitation, transit priority traffic signal

TABLE 2-1
SUMMARY OF MAJOR ITEMS OF WORK

Roadway Segment	Major Items of Work
Hotel Street	Curb/sidewalk modifications at Bishop St. and Alakea St. intersections.
Bishop Street	Transit stop construction with a 13-inch high raised platform.
Alakea Street	Transit stop construction with a 13-inch high raised platform.
Aloha Tower Drive	Transit stop construction with a 13-inch high raised platform and pavement rehabilitation.
Richards Street Extension	Pavement rehabilitation.
Nimitz Highway/Ala Moana Blvd.	Transit stop construction with 13-inch high raised platforms and pavement rehabilitation.
Ilalo Street	Transit stop construction with 13-inch high raised platforms.
Auahi Street	Transit stop construction with 13-inch high raised platforms, concrete pavement construction, and pavement rehabilitation.
Queen Street	Concrete pavement construction.
Ala Moana Boulevard (Ala Wai Canal to Kalia Road)	Roadway widening to accommodate two semi-exclusive bus lanes, transit stop construction with 13-inch high raised platforms, concrete pavement construction, pavement rehabilitation, utility relocations, landscaping, and roadway lighting improvements.
Kalia Road	Roadway widening to accommodate two semi-exclusive bus lanes, transit stop construction with 13-inch high raised platforms, concrete pavement construction, pavement rehabilitation, landscaping, and roadway lighting improvements.
Saratoga Road	Transit stop construction with 13-inch high raised platforms, concrete pavement construction, and pavement rehabilitation.
Kalakaua Avenue	Concrete pavement and transit stop construction with 13-inch high raised platforms.
Kapahulu Avenue	Transit stop construction with a 13-inch high raised platform.
Kuhio Avenue	Transit stop construction with 13-inch high raised platforms, concrete pavement construction between Seaside Avenue and Kanekapolei Street, concrete pavement rehabilitation, roadway lighting improvements, and traffic signal modifications.
Kalaimoku Street	Concrete pavement construction.

Source: Parsons Brinckerhoff, June 2003.

improvements, roadway widening, landscaping, utility relocations, modifications to wheelchair ramps, sidewalks, and driveways, signage, striping, roadway lighting, and other work related to prioritization.

3) Transit Technology for IOS

The City plans to use hybrid diesel-electric BRT buses, replacing the existing diesel buses, to operate on the IOS because this technology harmonizes with the higher densities and pedestrian orientation of Honolulu's Urban Core. A key objective is to enhance the quality of urban life by minimizing adverse noise and air pollution impacts from buses. The City intends to order new low-floor hybrid diesel-electric buses prior to the start of IOS operations in 2005.

4) Capital Costs

The total capital cost for the IOS components is estimated to be $48.1 million in 2002 dollars and $51.0 million in Year of Expenditure (YOE) dollars. Components include site preparation, sidewalks and roadways, landscaping and utility work, BRT stops, and restoration of adjacent utility infrastructure. The project is fully funded through a combination of FTA sources matched by City General Obligation Bonds. The IOS capital cost funding will come from a $31 million city appropriation (FY 2003) and two FTA appropriations in FY 2002 and FY 2003 totaling $20 million. The IOS construction will be completed by 2005.

The cost of the ten buses is not included since these vehicles will be acquired as part of the normal fleet expansion and replacement program. Some of the existing bus routes are proposed to be modified to avoid service duplication with the IOS. This modification will result in a reduction of the buses required for these routes such that the total size of the City's bus fleet is not expected to change with implementation of the IOS. The cost of the IOS vehicles is separate from the capital cost of the IOS since all ten vehicles needed for the IOS operation will be purchased with City (non-Federal) funds as part of the regular fleet replacement program that will occur with or without IOS implementation. Engineering design, owner administration, taxes and contingencies are included in the total. The cost by component in 2002 dollars is shown in Table 2-2.

TABLE 2-2
CAPITAL COST SUMMARY
(MILLIONS OF 2002 DOLLARS)

Project Component	Estimated Cost
Sidewalks/ Roadways	$20.57
BRT stops	$6.91
Landscaping	$6.03
Traffic Signal Improvements	$8.23
Utilities	$6.34
Total	**$48.08**

Sources: Rider Hunt Levett & Bailey Ltd., November 2002.
Note: The cost of the ten vehicles needed for the IOS operation is not included, because the vehicles are part of the existing fleet replacement program."

5) O & M Costs

Table 2-3 presents the annual O&M costs in 2002 dollars.

TABLE 2-3
ANNUAL OPERATING AND MAINTENANCE COST SUMMARY, 2006[1]
(2002 DOLLARS)

No-Build Condition	IOS	Difference
$119,595,000	$119,330,279	$264,721

Source: Parsons Brinckerhoff, March 2003.
Note: 1) Excludes TheHandi-Van O&M cost.

As indicated in Table 2-3, O&M costs for the entire bus system, including the IOS in 2006, but not TheHandi-Van operations, would be about $119.6 million (in 2002 dollars). This compares to current 2002 operating costs for the existing bus system of an estimated $117.6 million, not including TheHandi-Van operations.

The proposed bus system with the IOS will yield about $264,700 in annual O&M savings, expressed in 2002 dollars. The amount of new BRT service will be offset by a slightly larger reduction in existing services. The O&M costs in 2006 will be financed through a combination of passenger fares, FTA formula funds and City general funds, as is the case today.

II. 2025 ALTERNATIVES

This part of the Chapter defines the three alternatives analyzed for the entire primary transportation corridor in this FEIS. It also describes other alternatives that were considered but eliminated due to failure to satisfy purpose and need requirements and/or due to other concerns such as public opposition, significant environmental impacts and lack of financial feasibility.

The three alternatives that meet the four purpose and need requirements stated in Chapter 1, although to varying degrees, are:

- The No-Build Alternative: The No-Build Alternative consists of a reconfiguration of the present bus network to a hub-and-spoke pattern, with modest expansion of bus service in developing areas (e.g., Kapolei) to maintain existing service levels.
- Transportation System Management (TSM) Alternative: This was a required alternative in the Federal Transit Administration (FTA) New Starts process when the project started. It is no longer required. The TSM Alternative has been retained in the FEIS so that the comparison to the TSM Alternative that led to the selection of the Refined LPA is available to the reader. In addition to the reconfiguration of the present bus route network to a hub-and-spoke network, this alternative includes expansion of service by 14 percent over the No-Build Alternative, plus some bus priority treatments on arterials in the Primary Urban Center (PUC) and in Leeward Oahu.
- Refined Locally Preferred Alternative (Refined LPA): This alternative builds on the hub-and-spoke bus system in the other alternatives, and adds Regional and In-Town Bus Rapid Transit (BRT) routes. The Regional BRT element includes a continuous H-1 BRT Corridor from Kapolei to Downtown using a.m. and p.m. contraflow zipper lanes and express lanes. The In-Town BRT component consists of a high capacity transit spine from Middle Street to Iwilei, an Iwilei-Waikiki Branch via Kakaako Makai, a University Branch between Downtown and UH-Manoa, and a Downtown-Waikiki Branch via Kakaako Mauka.

All three alternatives include the recently updated regional highway plan contained in the Oahu Metropolitan Planning Organization's (OMPO's) Transportation for Oahu Plan (TOP 2025).

Section 2.1 summarizes the development and evaluation of candidate alternatives that were considered to meet the purpose and need requirements. It describes the development of the three alternatives carried forward for detailed assessment. Section 2.2 provides a physical description of the three alternatives. Sections 2.3 and 2.4 present capital and operating cost information on each alternative. Section 2.5 presents the proposed implementation schedule for each alternative. Section 2.6 describes the alternatives that were analyzed and eliminated.

2.1 EVOLUTION OF THE ALTERNATIVES CARRIED FORWARD

The alternatives described in this Chapter evolved over the course of developing the FEIS through an iterative process wherein a wide-range of options was progressively analyzed in increasing detail until it was winnowed down to the three "best fit" alternatives.

Even after the initial alternatives were winnowed down to the best fit alternatives, they underwent continual refinement using input from many sources including the Oahu Trans 2K meetings, formal "scoping" meetings held for the general public and agencies (described in Chapter 1), and working group meetings and other agency and public input. Public and agency involvement activities that have been conducted to date are discussed in more detail in Appendix A. Section 2.6 provides additional information on the evaluation of options, and how the options being carried forward were selected.

The first step in the evolution of the alternatives involved combining information gathered from public and agency outreach with the results of prior studies to identify a broad range of alternatives for consideration in addressing the project purposes and needs. Public input was obtained primarily through the 21st Century Oahu Visioning Process and its transportation component, Oahu Trans 2K. The 21st Century Oahu Visioning process began in September 1998, and consisted of a series of neighborhood-based community meetings designed to enhance public input in planning a vision for Oahu communities.

The Oahu Trans 2K process has involved four rounds of public meetings in 19 districts throughout the island, a single, fifth round meeting held at Neal Blaisdell Center, and a series of meetings with working groups representing five geographic subdivisions of the primary transportation corridor. The first two rounds of meetings resulted in the Islandwide Mobility Concept Plan (1999, Updated in August 2001). This Plan, described in Chapter 1, crystallized transportation goals and objectives for the island, and outlined transportation alternatives for the primary transportation corridor.

In addition to public and agency input, alternatives were developed based on site visits, review of City and State plans, existing and projected land use and travel demand patterns, environmental constraints, and other research. Transportation alternatives were configured to support land uses that would boost transit ridership and sustain livable communities. This will maximize the efficiency and effectiveness of the transportation system, and create a mutually supportive transportation system and land use development pattern.

After Rounds 1 and 2 of the Oahu Trans 2K meetings, public and agency input was combined with technical analysis to define an initial set of alternatives: No-Build, Enhanced Bus/Transportation System Management (TSM), Bus Rapid Transit (BRT), and Light Rail Transit (LRT) (see Figure 2.1-1). These alternatives were defined as follows:

- The No-Build Alternative consisted of the existing bus system plus expansion of bus service in developing areas (e.g., Kapolei) to maintain as consistent a level of bus service as today.
- Transportation System Management, or TSM, refers to a package of relatively low to moderate cost measures designed to make more efficient use of the existing transportation infrastructure. The Enhanced Bus/TSM Alternative reconfigured the present predominately radial bus route network to a hub-and-spoke network.
- The BRT Alternative built on the TSM Alternative, and included bus priority measures and a trolley system between Downtown Honolulu and Waikiki.
- The LRT Alternative introduced a new mode, an at-grade light rail system. Three alignment alternatives were analyzed. The base alternative routing was between Middle Street and UH-Manoa. A second alternative extended the route from Middle Street to Pearlridge, and a third extended the route still farther to Waipahu. An alignment along Nimitz Highway fronting the Airport was also compared to an alignment on Salt Lake Boulevard.
- The concept for a direct connection between Keehi Interchange and Kakaako via Sand Island was developed to provide a more direct and scenic gateway entry to Waikiki and Kakaako for visitors and others from the Airport and points Ewa. This was called the Sand Island Scenic Parkway, or SISP. Options were analyzed for pairing SISP with the BRT and LRT Alternatives.

Transportation Demand Management (TDM) measures were included in all the alternatives being developed. TDM measures are strategies that reduce or shift the time of travel by private automobile, and include such measures as vanpooling (subsidized vehicles used for commuter ride-sharing), and parking constraints or surcharges. The same TDM assumptions are incorporated in all of the alternatives, such as continued growth of the vanpool program and growth in bicycle and pedestrian travel.

The initial alternatives above (No-Build, Enhanced Bus/TSM, BRT and LRT, and the SISP concept) were described in the Environmental Impact Statement Preparation Notice (EISPN) and Notice of Intent to Prepare

FIGURE 2.1-1
ALTERNATIVES DEVELOPMENT AND SCREENING PROCESS

an EIS (NOI), both of which were published in April 1999. These are formal public notifications that are a part of the environmental review process, and are discussed in more detail in Chapter 1.

After publication of the EISPN and NOI, public comments were reviewed and detailed technical analyses were performed to evaluate these alternatives. This included route alignment engineering, travel demand forecasting, environmental studies, cost estimating, and preliminary financial studies. Based on these technical studies and the comments received on the EISPN, the initial alternatives were reconfigured to enhance their efficiency, cost-effectiveness, and ability to support mobility, land use and quality of life goals.

Section 2.6 contains a discussion of the comments pertaining to alternatives that were received in response to the EISPN. The best features of the initial alternatives were combined to create improved alternatives. A new BRT Alternative was developed as a hybrid, containing the best features of the initial BRT and LRT Alternatives. The LRT Alternative was dropped because analyses revealed that BRT using electric-powered or hybrid-electric-powered vehicles could accomplish virtually all of the objectives of LRT at substantially less cost. In addition, highway alternatives to the Regional and In-Town BRT and LRT systems were identified and subsequently eliminated from further consideration as alternatives.

The alternatives carried forward through Rounds 3 and 4 of the Oahu Trans 2K process were:
1. No-Build: Similar to the initial No-Build Alternative;
2. TSM: A refinement of the initial Enhanced Bus/TSM Alternative;
3. BRT: A hybrid alternative containing the best features of the initial BRT and LRT Alternatives; and
4. BRT/SISP: A combination of the BRT Alternative with Sand Island Scenic Parkway.

In Rounds 3 and 4 of the Oahu Trans 2K meetings, the above revised alternatives were presented, and public input confirmed the major concepts and provided additional input on the alternatives that were used to further refine them.

Subsequent to the Round 4 Oahu Trans 2K meetings it was decided, based upon input from coordinating public agencies, to move the Sand Island Scenic Parkway element forward apart from the transit alternatives being considered in the MIS/DEIS. Separating SISP from the transit element permitted a decision on the "Locally Preferred" transit alternative while SISP moves through the regional planning and then project development processes.

The three alternatives that were studied in the MIS/DEIS were:

- No-Build Alternative: The No-Build Alternative consisted of expansion of bus service in developing areas to maintain existing service levels by adding buses and developing new routes.
- Transportation System Management (TSM) Alternative: The primary features of this alternative were the reconfiguration of the present bus route network to a hub-and-spoke network, and bus priority treatment on some In-Town streets.
- Bus Rapid Transit (BRT) Alternative: This alternative built on the hub-and-spoke bus system in the TSM Alternative, and added Regional and In-Town BRT routes. The Regional BRT element included a continuous H-1 BRT Corridor from Kapolei to Downtown using a.m. and p.m. zipper lanes and new express lanes. The In-Town BRT component was comprised of a high capacity transit spine from Middle Street to Downtown, a University Branch from Downtown to UH-Manoa, and a Downtown to Waikiki Branch via Kakaako Mauka.

Since the update to the highway element of the OMPO regional transportation plan was still under study at that time, only short-term highway projects included in OMPO's Transportation Improvement Program were reflected in the MIS/DEIS.

Following publication of the Primary Corridor Transportation Project, Major Investment Study/Draft Environmental Impact Statement [MIS/DEIS] (August 2000), there was a public review period from August 23, 2000 to November 6, 2000. In addition to the MIS/DEIS public hearing, special public hearings were conducted by the Honolulu City Council Transportation Committee on September 25 and October 5, 19, and 26, and November 14, 2000. On November 29, 2000, the Honolulu City Council selected the BRT Alternative as the Locally Preferred Alternative (LPA).

At the time of adopting the LPA, the City Council asked the DTS to continue public dialogue on the project. Community working groups were formed to provide a forum for open discussion between project sponsors and neighborhood, civic, business, government and other organizations so that environmental and transportation issues and refinements to project proposals could be discussed. The working groups also provided the community with an opportunity to obtain a greater in-depth understanding about BRT and what it means for their community. The working groups were generally organized by geographic area. They included Pearl City/Aiea, Aliamanu/Salt Lake/Foster Village, Kalihi, Downtown/Kakaako, Mid-Town/University, and Waikiki.

Working Group members were responsible for attending meetings, reporting back to their representative organizations, and bringing that feedback to the Working Group meetings. The Pearl City/Aiea, Kalihi, Downtown/Kakaako, and Mid-Town/University Working Groups had several, separate meetings between February and June 2001. Waikiki Working Group meetings were conducted from August 2001 through April 2002 and the Aliamanu/Salt Lake/Foster Village Working Group had one meeting in July 2002.

As a result of the Working Groups and comments received on the MIS/DEIS, the DTS proposed to refine the LPA to include new and modified components, which the City Council endorsed on August 1, 2001. It was decided that a new In-Town BRT branch be added between Iwilei and Waikiki to serve Aloha Tower Marketplace and the Kakaako Makai area; that a small segment of the UH-Manoa Branch should be realigned from Ward Avenue to Pensacola Street between South King Street and Kapiolani Boulevard with a new transit stop along South King Street at Pensacola Street; and to eliminate the proposed H-1 Regional BRT ramps at Kaonohi Street and Radford Drive and replace them with a new H-1 BRT ramp near Aloha Stadium at Luapele Drive. Additionally, it was decided that the Kakaako Mauka Branch and Iwilei-Waikiki Branch would use Alakea and Bishop Streets instead of Richards Street in response to comments received from area residents. Realigning the Kakaako Mauka Branch will also create two new transit stops, one on Alakea Street and one on Bishop Street.

Since the refinements were being proposed after completion and distribution of the MIS/DEIS and because the refinements were anticipated to have environmental impacts that were not disclosed in the MIS/DEIS, a Supplemental Draft Environmental Impact Statement (SDEIS) was prepared. Its content and process followed Section 11-200-26 of the Hawaii Administrative Rules (HAR) and Part 23 Code of Federal Regulations, § 771.130. The results of the SDEIS are reflected in this FEIS.

Part of the SDEIS process is the acceptance of written comments received during the legal public comment period and oral comments received at the public hearing held on April 20, 2002. Responses to the comments received are contained in Chapter 7. Some of the comments led to additional refinements being incorporated into the project. These refinements are reflected in this FEIS and consist of the relocation of a park-and-ride facility from Kunia Road to North-South Road; elimination of the Kapolei Direct BRT/HOV ramp, Kunia Direct BRT ramp, and Middle Street Direct BRT/ Park-and-Ride ramp; and, rerouting of a short section of the Iwilei-Waikiki branch of the In-Town BRT from Channel Street to Forrest Avenue. Rather than using the direct ramps, BRT buses will use the existing ramps in Kapolei and at Middle Street and ramps planned by HDOT at North-South Road. Since these additional refinements were found to result in no increase in adverse environmental impacts or in reduced adverse impacts, while saving costs, they have been incorporated into the Refined Locally Preferred Alternative (LPA) as defined along with the other Alternatives in Section 2.2. Impact analyses of these refinements are presented in Chapter 5.

2.2 DEFINITION OF ALTERNATIVES

This section contains detailed descriptions of the physical features of the three alternatives.

2.2.1 No-Build Alternative

The No-Build Alternative (see Figure 2.2-1) serves as a possible alternative for selection by decision makers as well as the baseline against which to compare the other alternatives. It includes existing transportation facilities and conversion of the present predominately radial route structure to a hub-and-spoke configuration. Also included are highway improvement projects, which have been identified by OMPO in the TOP 2025. Expansion of the bus fleet to maintain current transit service levels, especially in developing areas such as Kapolei, is also part of this alternative. The term "No-Build" is somewhat misleading, because this alternative includes the construction of long-range highway projects and modest expansion of transit service to accommodate future growth.

1) Baseline Transportation Improvement Projects

The No-Build Alternative includes the highway projects identified in OMPO's TOP 2025. This baseline highway network is also part of the TSM and Refined LPA Alternatives. (See Figure 2.2-1A.) The 2025 highway network is included even in the No-Build Alternative so that the impact assessments are focused only on the differences in the transit elements amongst the Alternatives. Included in the baseline highway improvements is the extension of express (HOV) lanes (town bound and outbound) in the median of the H-1 Freeway between Managers Drive and Kapolei. These express lanes were shown in the MIS/DEIS and SDEIS as part of the BRT Alternative. Since these lanes are now part of the OMPO TOP 2025 they are instead shown as a baseline highway project that will be implemented as a separate project from the Refined LPA.

The City and County of Honolulu's Department of Design and Construction also plans to install new concrete bus lanes on portions of Kapiolani Boulevard (Ward Avenue to Kalakaua Avenue), Kamakee Street (Kapiolani Boulevard to Auahi Street), Atkinson Drive (Kapiolani Boulevard to Ala Moana Boulevard), and Kalakaua Avenue (Kapiolani Boulevard to Ala Wai Bridge). This project to rehabilitate these streets will also include installing a new water main and other facilities related to roadways. Construction is scheduled during calendar year 2004.

The No-Build Alternative also includes implementation of the State and City bicycle master plans (shown later in Section 3.2.4) and various programmed pedestrian improvements. The No-Build Alternative and all of the other alternatives capture the intent to create a more bicycle and pedestrian-friendly environment. These pedestrian and bicycle improvements are part of the baseline condition included in all of the alternatives.

2) Transit Network

The No-Build Alternative (Figure 2.2-1) includes reorientation of the present bus route structure from a radial service pattern to a hub-and-spoke network. The reason reconfiguration to a hub-and-spoke network is included for the No-Build Alternative in the FEIS, yet was not included in the MIS/DEIS, is that the City has already started implementation of this reconfiguration. The conversion to a hub-and-spoke network had not been committed to when the MIS/DEIS was prepared. The hub-and-spoke network is also part of the TSM Alternative and the Refined LPA.

The objectives of the hub-and-spoke network are to reduce overall travel times, improve schedule reliability, improve operational efficiency and improve off-peak service. Other benefits of a hub-and-spoke network are expansion of corridor capacity and improved transit network connectivity. While a hub-and-spoke system can increase the number of transfers, this is mitigated by having timed-transfers and lower overall travel times for many trips.

FIGURE 2.2-1
NO-BUILD ALTERNATIVE

FIGURE 2.2-1A
HIGHWAY ELEMENTS FOR ALL ALTERNATIVES

Hub-and-spoke networks provide an integrated system of convenient and accessible circulator, local and express routes, organized around transit centers and transfer points. The bus routes are the "spokes" of the hub-and-spoke system, and the transit centers and transfer points are the "hubs" where people make intermodal and intramodal transfers. There would be a hierarchy of community and regional transit centers, and neighborhood transfer points, each drawing from different size service areas.

The transit centers that have already been committed as part of the hub-and-spoke network and have been include in the Oahu Transportation Improvement Program, FY 2002 – 2004, would remain a part of the No-Build and TSM Alternatives, and the Refined LPA. These transit centers are denoted in the description of alternatives as being implemented by DTS as a separate project.

Frequent express and limited-stop buses would operate between the regional transit centers. Circulator routes provide service between a transit center and a neighborhood or commercial district. The circulator buses would be smaller vehicles providing mobility within neighborhoods, and delivering transit patrons to a transit center or transfer point for connections to line haul routes. Local routes would link multiple transit centers or transfer points and provide service along major streets. Routes in Leeward Oahu have already been reconfigured to a hub-and-spoke configuration and routes in Central Oahu are in the process of conversion.

The size and mix of buses needed in the fleet that are shown in Table 2.2-1 are based on the number of buses needed for operations in the peak period as projected using the travel demand forecasting models. This "peak pull-out" can occur in either the morning or afternoon peak period. The peak pull-out is defined as the sum of the buses required in the peak period on each route. The total fleet size is the peak pull-out demand plus 15 percent spares.

<u>Methodology</u>

The peak pull-out on a route is determined by calculating the bus capacity needed to accommodate the forecasted passenger load at the peak load point on the route. The first step is to calculate the number of bus trips needed in the peak hour to accommodate the passenger load. If the peak load point demand can be handled at the assumed frequency of service with minibuses (assumed capacity of 42 for this analysis), then minibuses are assigned to the service. If standard buses are needed (assumed capacity of 70 for this analysis), then standard buses are assigned; if articulated buses are needed (assumed capacity of 100 for this analysis), then articulated buses are assigned. Since articulated buses cost more to operate than standard buses, articulated buses are assigned to a route only if more than one bus trip is saved in comparison with the number of trips required by standard buses. There are exceptions to this. First, some routes, because of topography, are assigned hill-climber minibuses, and standard buses and articulated buses are not considered. Second, some circulator routes are assigned minibuses automatically. Third, some routes, particularly those traveling on narrow streets, are identified as inappropriate for articulated buses.

If the demand at the peak load point is sufficiently low that even minibuses at the coded frequency of service provide too much capacity, then less frequent service (i.e. a fewer number of bus trips) may be assigned. However the frequency is not lowered below what is considered minimum service for the type of route.

If the demand at the peak load point is too high to be accommodated by an articulated bus at the frequency of service assumed in the travel demand model, then more frequent service (i.e. a larger number of bus trips) is assigned.

Once the number of bus trips and equipment is defined for a route, the number of vehicles that is required is calculated, based on the roundtrip travel time for the route, including layover time.

TABLE 2.2-1
NO-BUILD ALTERNATIVE 2025 FIXED-ROUTE BUS NETWORK

Route Structure	
Circulator Routes	28
Local Routes	25
Express Routes	33
Limited-Stop Routes	3
TOTAL	**89**
Fleet Size (including spares)	
Minibus (30-foot)	108
Standard 40-foot Bus	485
Articulated Bus (60-foot)	32
TOTAL	**625**
Daily Trips (weekday)	
A.M. Peak Period	1,284
Off-Peak Period	1,698
P.M. Peak Period	1,223
Daily Operations (weekday)	
Revenue Bus Miles	62,560
Revenue Bus Hours	4,470
Daily Ridership Forecast (weekday)	
Total Linked Trips	261, 130

Source: Parsons Brinckerhoff, June 2002.

Definitions

Circulator Routes: Circulator bus routes provide mobility within neighborhoods and connections to more regional bus routes. The No-Build Alternative includes the “Hub-and-Spoke” circulators recently implemented in the Waianae Coast, Kapolei-Makakilo, and Waipahu areas. Urban collector routes generally provide service within neighborhoods every 15 to 30 minutes during peak periods and every 30 to 60 minutes during off-peak periods. Suburban feeder routes generally operate every 60 minutes.

Local Routes: The existing urban and suburban trunk routes would continue to provide local service throughout Oahu. Urban trunk lines provide concentrated service through Honolulu, creating combined peak-period headways of less than five minutes along several major streets. Suburban trunk routes provide direct but multi-stop connections between the Primary Urban Center (PUC) and communities in Ewa, Central Oahu, Windward Oahu, and East Honolulu. They operate every 10 to 20 minutes during peak periods and every 20 to 30 minutes during off-peak periods.

Express Routes: Express routes between suburban communities and Honolulu/Kapolei during peak commute periods would continue to supplement local service. Express routes provide direct, non-stop connections between outlying suburban neighborhoods and major activity centers within the PUC and Kapolei. All express bus service is scheduled during or around peak periods.

Limited-Stop: The existing CityExpress! (Route A) would continue to provide limited-stop service every 7.5 minutes between Middle Street and the University of Hawaii (UH), and every 15 minutes between Waipahu and Middle Street. CityExpress! (Route B) would continue to offer limited-stop service between

Middle Street and Waikiki. Route B service frequency would be every 15 minutes, 7 days a week. CountryExpress! (Route C) would also maintain its limited-stop service between Makaha, Kapolei, Downtown Honolulu and Ala Moana Center, using the H-1 Freeway between Kapolei and Kalihi. A trip between Kapolei and Downtown would take approximately 35 minutes. Route C would continue to run every 30 minutes, 7 days a week.

Table 2.2-2 shows the transit centers and park-and-ride facilities incorporated into the No-Build Alternative. A hierarchy of regional and community transit centers and neighborhood transfer points would be established.

TABLE 2.2-2
NO-BUILD ALTERNATIVE TRANSIT CENTERS, TRANSFER POINTS AND PARK-AND-RIDE FACILITIES

Regional Transit Center	Community Transit Center	Neighborhood Transfer Points	Park-and-Ride Facility
Alapai *	*Middle Street* **	Wahiawa Town**	Wahiawa *
Ala Moana Center *	Waipahu *	Mililani Town**	Mililani Mauka *
*Aloha Stadium***	*Kapolei*	Kailua**	Royal Kunia *
	*Iwilei***	Kaimuki**	Hawaii Kai *
	Pearl City/Aiea**	*Waianae*	North-South Road
	*Kaneohe***		

Source: Parsons Brinckerhoff, June 2002.
*Denotes an existing facility
**Will be implemented by DTS as a separate project
Italicized Transit Centers denote that parking would be provided.

Regional transit centers would be large-scale facilities serving multiple trip purposes and would meet the needs of larger geographic areas of the island. These facilities would typically serve a variety of transit services including circulator, express and local bus routes. Typical amenities include numerous off-street bus bays around a waiting area, information kiosks, restrooms, commercial services, and kiss-and-ride areas. While there are no new Regional Transit Centers proposed in the No-Build Alternative, typically Regional Transit Centers when built in outlying locations would also include park-and-ride lots.

Community transit centers would be medium-sized facilities that meet the needs of a number of nearby neighborhoods. These facilities would primarily serve passengers transferring between different community circulators and one or more local and express services. A community transit center would typically be located off-street and proximate to larger-scale commercial activities such as shopping centers. Features typically include multiple bus bays around a sheltered structure, seating, route signage and information, and vending and other small-scale commercial services.

Neighborhood transfer points would be small facilities designed to meet the transit needs of nearby residents. They would primarily serve passengers transferring between neighborhood circulator routes and one or more local or express routes. Ideally a neighborhood transfer point would be located near other neighborhood services such as grocery stores, dry cleaners, and other convenience functions. These transfer points could be on-street with bus turnouts or off-street around an island platform. Key features would include bus turnout lanes, shelter for waiting transit patrons, lighting, sidewalks and bicycle racks.

3) Transit Technology

The No-Build Alternative assumes the continued use and expansion of the existing bus fleet, which presently consists mostly of 40-foot standard diesel buses and 60-foot articulated diesel buses. The technologies in the No-Build Alternative are minibuses, and standard and articulated buses with conventional diesel propulsion.

While minibuses could use alternative fuel sources, including electric batteries or propane, standard and articulated buses, particularly the ones on long-haul routes, would need to be diesel or hybrid diesel/electric because of the mountainous terrain and limited range of battery-powered vehicles. Hybrid diesel/electric buses are electrically propelled vehicles in which the electricity is produced by an on-board generator (alternator) powered by a diesel engine.

4) Park-And-Ride Lots

Intermodal access to the transit network would continue to be provided at four existing park-and-ride lots (Wahiawa Armory, Mililani Mauka, Royal Kunia, and Hawaii Kai). Parking would also be provided at some of the transit centers that DTS would implement as separate projects associated with the hub-and-spoke network. These include the Aloha Stadium, Iwilei, and Middle Street Transit Centers. A new park-and-ride lot would also be provided along North-South Road and at the Kapolei Transit Center.

5) Maintenance Facilities

The 2025 bus fleet would be accommodated at the Kalihi-Palama and Pearl City Bus Maintenance Facilities. To meet forecasted transit demand, the mix of equipment would change to the distribution shown in Table 2.2-1.

6) Vanpool

Vanpool Hawaii is an existing program that subsidizes the use of 7-passenger (and higher capacity) vans as a traffic alleviation measure. In 2001, the program supported 164 vehicles. Continued growth in the number of vans on Oahu is expected. For a $50 fee per passenger per month, vanpool participants receive the use of a vanpool van. Participating drivers are expected to recruit at the start-up of the vanpool group until it sustains a full ridership level within a few months after start-up. The program pays for all of the operational and maintenance expenses, including insurance (but not fuel and parking). The driver can use the van as a personal vehicle after commuting hours and on weekends. The program is currently funded with Federal Highway Administration (FHWA) and State of Hawaii matching funds. Passenger revenues are returned to the state to offset its costs. In 2001, the vanpool program cost $1.7 million and realized $642,000 in revenues.

The Hawaii Department of Transportation (HDOT) currently administers the vanpool program through a contract with a private operator. HDOT considers the vanpool program to be a demonstration program and is not interested in running the program permanently. Since the City could administer the vanpool program, management of the Oahu component of the vanpool program by the City is included as part of the No-Build and other alternatives. Since the combination of federal grants and participant revenues could potentially fully fund the vanpool program, the transfer of vanpool administration to the City is assumed not to impose any financial obligation on the City.

7) Mitigation Measures Requiring Permanent Construction

Mitigation measures would be implemented for the baseline highway projects. Because the detailed impacts have not yet been identified, many of these mitigation measures have not yet been developed. Since the baseline highway projects and their associated mitigation measures are included in all of the alternatives, the mitigation measures for these projects would be constant in all alternatives, and would not help differentiate among them.

2.2.2 Transportation System Management (TSM) Alternative

TSM strategies are low to moderate cost improvements designed to increase the efficiency of the existing transportation infrastructure. TSM measures typically include elements such as traffic engineering and signalization, transit operational changes and modest capital improvements. Besides being a potential alternative for selection by decision makers, the TSM Alternative serves as a benchmark against which more extensive build alternatives can be evaluated for their cost-effectiveness.

The TSM Alternative is an intermodal alternative (see Figure 2.2-2). It includes reorientation of the present bus route structure from a predominantly radial service pattern to a hub-and-spoke network, extension of the H-1 A.M. zipper lane, bus priority treatments on selected arterials, and a significantly expanded fleet over the No-Build Alternative to provide more convenient service. The objectives of the hub-and-spoke bus network are to reduce overall travel times, improve schedule reliability, improve operational efficiency and improve off-peak service.

The transit centers and transfer points that serve as hubs and are included in the No-Build Alternative are also included in the TSM Alternative. There would also be an additional transit center in Waianae. Additionally, the Middle Street and Kapolei transit centers would be larger.

Parking lots and garages at certain transit centers and stand-alone park-and-ride facilities would provide intermodal access to the hub-and-spoke network. Supplementing the existing park-and-ride lots (Wahiawa, Mililani Mauka, Royal Kunia, and Hawaii Kai) would be new parking facilities that are part of the new transit centers implemented as separate projects associated with the hub-and-spoke network. These include theWaianae, Kapolei, Aloha Stadium, Middle Street, Iwilei, and Kaneohe Transit Centers. In addition there would be a new park-and-ride lot near the proposed H-1 Interchange at North-South Road. Each facility would accommodate 100 to 750 parking spaces. Table 2.2-3 shows the transit centers, transfer points and park-and-ride facilities incorporated into the TSM Alternative.

1) Baseline Transportation Improvement Projects

The TSM Alternative assumes the same baseline highway projects included in the No-Build Alternative, in other words the highway improvements in OMPO's TOP 2025 (see Figure 2.2-1A).

The TSM Alternative also assumes implementation of the State and City bicycle master plans and various programmed pedestrian improvements. This Alternative captures the intent to create a more bicycle and pedestrian-friendly environment.

TABLE 2.2-3
TSM ALTERNATIVE TRANSIT CENTERS, TRANSFER POINTS, AND PARK-AND-RIDE FACILITIES

Regional Transit Center	Community Transit Center	Neighborhood Transfer Points	Park-and-Ride Facility
Alapai *	*Waianae***	Wahiawa Town**	Wahiawa *
Ala Moana Center *	Waipahu *	Mililani Town**	Mililani Mauka *
Kapolei	*Iwilei***	Kailua**	North-South Road
*Aloha Stadium***	*Kaneohe***	Kaimuki**	Royal Kunia *
Middle Street **	Pearl City/Aiea**		Hawaii Kai *

Source: Parsons Brinckerhoff, June 2002.
*Denotes an existing facility
**Will be implemented by DTS as a separate project from the TSM Alternative.
· *Italicized Transit Centers denote that parking would be provided.*

FIGURE 2.2-2
TSM ALTERNATIVE

2) Transit Network

Table 2.2-4 summarizes the 2025 Transit Network for the TSM Alternative. Under the TSM Alternative, the existing radial bus route structure would be converted to a hub-and-spoke system. The present long suburban trunk routes to Downtown would be converted to shorter circulator and local routes serving regional transit centers. Connections between local, express, and limited-stop services would be made at the regional transit centers. The community and neighborhood transit centers would also enhance access to the transit network by providing a convenient location for timed-transfers to longer distance routes.

TABLE 2.2-4
TSM ALTERNATIVE 2025 FIXED-ROUTE BUS NETWORK

Route Structure	
Circulator Routes	28
Local Routes	25
Express Routes	36
Limited-Stop Routes	3
TOTAL	**92**
Fleet Size (including spares)	
Minibus (30-foot)	129
Standard 40-foot Bus	518
Articulated Bus (60-foot)	53
TOTAL	**700**
Daily Trips (weekday)	
A.M. Peak Period	1,440
Off-Peak Period	1,952
P.M. Peak Period	1,388
Daily Operations (weekday)	
Revenue Bus Miles	77,790
Revenue Bus Hours	5,220
Daily Ridership Forecast (weekday)	
Total Linked Trips	270,060

Source: Parsons Brinckerhoff, June 2002.

<u>Circulators</u>

The TSM Alternative includes 28 circulator routes, including the 18 existing urban collector and suburban feeder routes. Recently implemented “Hub-and-Spoke” circulator routes within the Waianae Coast, Kapolei, and Waipahu areas are also included. Two existing urban and suburban trunk routes in Pearl City and Salt Lake would become circulators to feed improved limited-stop and express services. Circulators in commercial areas would generally offer service every 15 to 30 minutes, but neighborhood circulators could have up to one hour headways. Circulators would be scheduled to facilitate transfers with limited-stop and express services running between transit centers.

<u>Local Routes</u>

The 25 local routes in the TSM Alternative would be developed primarily from existing urban and suburban trunk routes. To access improved express and limited-stop services between transit centers, most of the existing suburban routes from Ewa and Central Oahu would terminate at the Waipahu, Aloha Stadium, or

Middle Street Transit Centers where patrons would transfer to express services into Downtown. Routes from Windward Oahu would end at Ala Moana Center. In general, local routes would provide peak-period service every 5 to 15 minutes, and off-peak service every 15 to 30 minutes.

Express Routes

The TSM Alternative includes 36 express routes that would provide direct service between suburban communities and major destinations in Kapolei and the PUC, primarily during peak periods. Targeted to long distance commuters, most express routes would operate only in the direction of peak commuter movements, although some would operate inbound and outbound during the same peak period. The Alapai Transit Center would remain the primary hub for peak-period express routes between suburban communities and Downtown Honolulu, and most of these services would operate every 10 to 30 minutes during the peak period. Lower-demand routes would operate two to four trips per day.

Consistent with the vision of Kapolei as a major employment center by 2025, new express services would operate every 20 to 40 minutes throughout the day to and from Kapolei.

Limited-Stop Services

The existing CityExpress! (Route A) from Waipahu to UH-Manoa via Pearlridge would continue to provide fast, frequent cross-town service through Downtown Honolulu. Service to UH-Manoa would be provided every 15 minutes from Waipahu and every 7.5 minutes from Middle Street. Route A would be supplemented by other limited-stop service through the entire PUC, including City Express! (Route B) and CountryExpress! (Route C). City Express! (Route B) would continue to offer limited stop service between Middle Street and Waikiki. Route B service frequency would be every 15 minutes, 7 days a week. CountryExpress! (Route C) provides fast service from Makaha to Downtown Honolulu and Ala Moana Center. Route C would operate every 30 minutes, every day. A trip between Kapolei and Downtown would take approximately 35 minutes.

3) Transit Technology

Similar to the No-Build Alternative, the transit technologies provided in the TSM Alternative are minibuses and 40-foot standard and 60-foot articulated buses. While minibuses could use alternative fuel sources, including electric batteries or propane, standard and articulated buses, particularly the ones used on long-haul routes, would need to be diesel or hybrid diesel/electric because of the mountainous terrain and limited range of battery-powered vehicles.

4) Bus Priority/Express Improvements

To give priority to buses and other transit vehicles, special lane and traffic signal improvements would be provided on H-1 and key segments of congested arterial streets. In the TSM Alternative there would be approximately 47 miles of bus priority lanes in the PUC and Ewa to provide faster and more reliable bus operations.

The proposed bus priority measures include the following:

- The existing zipper lane provides a morning peak period inbound contraflow lane for multiple occupant vehicles with three or more occupants from 5 to 7 a.m., and with two or more occupants from 7 to 8 a.m. between Managers Drive in Waipahu and the Pearl Harbor Interchange. With the TSM Alternative, the existing zipper lane would be extended an additional 2.8 miles from Radford Drive, onto the H-1 airport viaduct, to Keehi Interchange (Nimitz Highway), creating an 11.6-mile-long morning peak period zipper lane. The extended zipper lane would connect to the A.M. contraflow lane on Nimitz Highway proposed by HDOT.

- Semi-exclusive bus lanes would be placed on King Street and Beretania Street, between Middle Street and Kalakaua Avenue. They would also be implemented on Kapiolani Boulevard between South Street and Atkinson Drive in the peak direction only. (Semi-exclusive bus priority lanes are lanes that would be reserved for buses, although vehicles turning into and out of driveways and turning right at intersections would be permitted to use them.) These bus priority facilities would generally operate only during peak periods.
- Bus priority treatments such as queue jump lanes (a queue jump lane is a short exclusive lane that allows buses to move to the head of a line of traffic) and traffic signal priority would be implemented on Middle Street, King Street, Beretania Street, Kapiolani Boulevard, Ala Moana Boulevard, and Kuhio Avenue.
- In Ewa, bus priority lanes would be incorporated into Kapolei Parkway, North-South Road and a section of Farrington Highway between Fort Barrette Road and Kunia Road.
- A mauka-bound queue jump lane would be provided on Kunia Road between Farrington Highway and the H-1 Freeway.
- Preferential bus treatments, including queue jump lanes and a traffic signal priority system, would be provided on Kamehameha Highway between Waimano Home Road and Moanalua Freeway.
- Fort Weaver Road between Geiger Road and Farrington Highway would be widened to accommodate new express lanes for buses and vehicles carrying two or more persons.

5) Maintenance Facilities

The 2025 bus fleet would be maintained at the Kalihi-Palama and Pearl City Bus Maintenance Facilities. Construction of a third smaller facility would be needed to accommodate the larger fleet. The need for a third bus facility is not anticipated until approximately 2016. Therefore, site selection for the facility will be made at a later date.

6) Mitigation Measures Requiring Permanent Construction

Mitigation measures would be implemented for the baseline highway projects. Because the detailed impacts have not yet been identified, many of these mitigation measures have not yet been developed. Since the committed projects and their associated mitigation measures are included in all of the alternatives, the mitigation measures for these projects would be constant in all alternatives, and would not help differentiate among them.

No mitigation measures that could entail permanent construction are anticipated.

2.2.3 Refined Locally Preferred Alternative (LPA)

The Refined LPA is a multi-modal alternative that provides a more balanced transportation system than the present automobile-dominated situation. A hub-and-spoke bus network similar to the TSM Alternative would connect with the Regional and In-Town Bus Rapid Transit (BRT) systems, integrating the hub-and-spoke network with a fast, high-capacity transit system spanning the primary transportation corridor (see Figure 2.2-3). The In-Town BRT system will provide high capacity, frequent, in-town transit service spanning Honolulu's Urban Core (Middle Street, through Downtown Honolulu, to UH-Manoa and Waikiki). The Regional BRT system will incorporate regional transit routes that utilize bus priority facilities (express lanes) on the H-1 Freeway, creating an H-1 Freeway BRT Corridor, with priority treatment for regional transit vehicles at selected ramps and arterials to facilitate movement between the H-1 Freeway BRT Corridor and the corridor's transit centers. The Refined LPA incorporates a very aggressive level of transit service to attract commuters and mid-day riders.

The Regional BRT system will complement and augment the In-Town BRT system. At the Middle Street Transit Center, most of the regional local buses will terminate, while most of the regional express routes will

FIGURE 2.2-3
REFINED LOCALLY PREFERRED ALTERNATIVE (LPA)

continue into town using the In-Town BRT priority lanes. The Regional BRT vehicles that continue into town will continue along the UH-Manoa and Kakaako Mauka branches and operate as In-Town BRT vehicles to the termini of these routes. With this approach, many passengers will not have to transfer at Middle Street. Through integrated planning and use of timed-transfers at outlying transit centers, route duplication will be reduced, system capacity will be increased and schedule reliability will be improved. These operational attributes are key ingredients of effectiveness. Together, the Regional and In-Town BRT systems will provide an integrated transit system enhancing mobility within the primary transportation corridor, and between the primary transportation corridor and other parts of the island.

1) Committed Transportation Improvement Projects

The Refined LPA assumes the same baseline highway projects included in the No-Build Alternative (see Figure 2.2-1A).

The Refined LPA Alternative also assumes implementation of the State and City bicycle master plans and various programmed pedestrian improvements. This Alternative also captures the intent to create a more bicycle and pedestrian-friendly environment.

2) Transit Network

The Refined LPA includes the baseline reorientation of the present bus route structure from a radial service pattern to a hub-and-spoke network. Hub-and-spoke networks provide an integrated system of convenient and accessible circulator, local and express routes, organized around transit centers and transfer points. The bus routes are the “spokes” of the hub-and-spoke system, and the transit centers and transfer points are the “hubs” where people make intermodal and intramodal transfers.

There will be a hierarchy of community and regional transit centers, and neighborhood transfer points, each drawing from different size service areas. The transit centers that have already been committed as part of the hub-and-spoke network and have been included in the Oahu Transportation Improvement Program, FY 2002 – 2004, are assumed to be in place to support the Refined LPA. The projects denoted as being implemented by DTS as a separate project from the Refined LPA include these transit centers.

Integration of the Regional and In-Town BRT systems will occur through an islandwide network of transit centers. Four regional transit centers (Kapolei, Aloha Stadium, Middle Street, and Alapai) will provide high-capacity transfer points for patrons to access the Regional and In-Town BRT systems. The Waianae, Waipahu, Pearl City/Aiea, Waiau, and Kaneohe community transit centers will enhance connections to local and express buses into Downtown, while community transit centers on the In-Town BRT alignment (Iwilei and Ala Moana Center) will provide mauka-makai connections with the In-Town BRT system. Enhanced local circulation and access to the BRT system will be provided at four neighborhood transfer points (Wahiawa Town, Mililani Town, Kailua, and Kaimuki). Table 2.2-5 shows the transit centers and transfer points incorporated into the Refined LPA, and which ones will be implemented by DTS as separate projects associated with the hub-and-spoke network. These separate projects will be built independent of a decision to proceed with the Refined LPA. Also shown in Table 2.2-5 are five park-and-ride facilities that will be part of this alternative. Each park-and-ride facility will accommodate 100 to 1,000 parking spaces.

With the Refined LPA many of the transit centers and park-and-rides will be larger and/or take on a different role because of the higher level of service than with the TSM Alternative.

As part of the reconfiguration to a hub-and-spoke system, local bus routes through the Urban Core will be modified to minimize duplication of service with the In-Town BRT. A summary of the 2025 Transit Network for the Refined LPA is provided in Table 2.2-6.

TABLE 2.2-5
REFINED LPA TRANSIT CENTERS, TRANSFER POINTS AND PARK-AND-RIDE FACILITIES

Regional Transit Center	Community Transit Center	Neighborhood Transfer Points	Park-and-Ride Facility
Alapai *	*Waianae***	Wahiawa Town**	Wahiawa *
Kapolei	Waipahu *	Mililani Town**	Mililani Mauka *
Aloha Stadium **	Pearl City/Aiea**	Kailua**	North-South Road
Middle Street **	Waiau **	Kaimuki**	Royal Kunia *
	Iwilei **		Hawaii Kai *
	Ala Moana Center *		
	*Kaneohe***		

Source: Parsons Brinckerhoff, June 2002.
* Denotes an existing facility* * Will be implemented by DTS as a separate project from the Refined LPA
Italicized Transit Centers denote that parking would be provided.

TABLE 2.2-6
REFINED LPA 2025 FIXED-ROUTE BUS NETWORK

Route Structure	
Circulator Routes	30
Local Routes	20
Express Routes	30
Limited-Stop Routes	2
TOTAL	**82**
Fleet Size (including spares)	
Minibus (30-foot)	200
Standard 40-foot Bus	412
Articulated Bus (60-foot)	152
In-Town BRT Vehicles	30
TOTAL	**794**
Daily Trips (weekday)	
A.M. Peak Period	2,325
Off-Peak Period	2,942
P.M. Peak Period	2,145
Daily Operations (weekday)	
Revenue Bus Miles	84,440
Revenue Bus Hours	5,300
Daily Ridership Forecast (weekday)	
Total Linked Trips	312,570

Source: Parsons Brinckerhoff, June 2002.

Circulator Routes: Circulator bus routes will provide access from transit centers into neighborhoods and commercial districts and include existing urban collector and suburban feeder routes. Recently implemented "Hub-and-Spoke" circulator routes within the Waianae Coast, Kapolei, and Waipahu areas are also included. Certain local routes will be converted into circulators to feed the In-Town BRT. Circulator routes in rural and suburban areas will connect to express and local services, as they do today. In-town circulators will generally operate every 15 to 30 minutes, but some neighborhood circulators will have up to one-hour headways.

Local Routes: The Refined LPA includes local bus routes that will connect suburban communities with the In-Town BRT. Connections to the In-Town BRT will occur at the Middle Street Transit Center for the majority of bus service from Leeward and Central Oahu and at the Union Mall Transit Stop for bus service from Windward Oahu. Most local buses that currently enter Waikiki from its Koko Head side will terminate at Kapahulu Avenue near the Honolulu Zoo. Most local buses that currently enter Waikiki from its Ewa side will terminate at Saratoga Road. The In-Town BRT and the existing Routes B, 2, and 13 will service passengers from the terminating routes, thereby reducing the number of transit buses passing through Waikiki. Systemwide, peak-period local service will generally be provided every 5 to 15 minutes, with off-peak service every 15 to 30 minutes.

Express Routes: Express buses provide rapid point-to-point service, typically between suburban and downtown areas. Express buses can perform limited collection and distribution functions in suburban and downtown areas, but travel directly between these areas in the line-haul portion of the trip.

During peak periods, express routes will supplement local services from suburban communities to Downtown and Kapolei. Express service from Ewa and Central Oahu will use the H-1 Freeway BRT Corridor. Some of the express routes will continue into town along the In-Town BRT alignment (these are discussed under Regional BRT Routes), and others will continue via other routings (H-1 or Nimitz Highway). The express buses that use H-1 or Nimitz Highway will connect to the In-Town BRT in Downtown. Express routes from Windward Oahu and East Honolulu will continue to serve the Alapai Transit Center and UH-Manoa Transit Stop. Most express services will operate every 10 to 30 minutes during peak periods, although some express routes serving rural areas will operate less frequently (50- to 75-minute headways during peak periods).

Consistent with the vision of Kapolei as a major employment center, new express service will be provided between Kapolei and Pearl Harbor, Waikiki, Mililani and Wahiawa. This restructured network will replace five existing express routes to Aloha Stadium, Pearl City, Waipahu, and Kalihi.

Limited-Stop Services

The existing CityExpress! (Route A) from Waipahu to UH-Manoa via Pearlridge will continue to provide fast, frequent cross-town service through Downtown Honolulu. Service to UH-Manoa will be provided every 15 minutes from Waipahu and every 7.5 minutes from Middle Street. One change to Route A will be the use of King Street/Beretania Street instead of Kapiolani Boulevard between Downtown and U.H.-Manoa to avoid duplicating service provided by the In-Town BRT. City Express! (Route B) will continue to offer limited-stop service between Middle Street and Waikiki. Route B service frequency will be every 15 minutes, 7 days a week. The existing CountryExpress! (Route C) that provides fast service from Makaha to Downtown Honolulu and Ala Moana Center will become part of the Regional BRT, providing essentially the same service as it does today but having the benefit of becoming part of the BRT system within the Urban Core of Honolulu.

3) Regional BRT System

The Refined LPA will create an H-1 BRT Corridor consisting of existing and new express and zipper lanes, allowing Regional BRT and express buses from Ewa and Central Oahu to bypass peak period traffic congestion on their way to Downtown in the morning and returning from Downtown in the evening. Priority treatments at ramps will be provided for BRT vehicles to easily move between selected transit centers and the H-1 BRT Corridor. Other multiple occupancy vehicles will also benefit by being able to use the proposed improvements to the H-1 Corridor.

Regional BRT Routes

Several regional transit routes will serve as the Regional BRT. These routes will provide access to the Urban Core of Honolulu using freeway and arterial priority express lane treatments such as the zipper lane and contra-flow lanes. Once they reach the Middle Street Transit Center, these regional BRT routes will join and augment the In-Town BRT vehicles, essentially becoming part of the In-Town BRT system. They will operate along the In-Town BRT alignment in the priority lanes. Four regional routes are proposed: Makaha regional, Wahiawa regional, Ewa Beach/Waipahu regional, and Pearl City regional. The Makaha regional will be very similar to the existing CountryExpress! (Route C) but will have the advantage of utilizing the In-Town BRT priority lanes. The Wahiawa regional will provide regional service from Wahiawa and Mililani and continue as part of the UH-Manoa In-Town BRT branch. The Ewa Beach/Waipahu regional will provide Regional BRT service from Ewa Beach and Waipahu, continuing through town via the Kakaako Mauka alignment. The Pearl City regional will originate in the Waimano Home Road area of Pearl City and provide access into town via the Luapele Ramp at Aloha Stadium.

H-1 BRT Corridor

There are three physical improvement elements to the H-1 BRT Corridor: H-1 zipper lane extension, new afternoon zipper lane, and on/off ramp improvements to access the zipper lanes. These elements will create an H-1 BRT Corridor, a continuous, fast corridor between Kapolei and Middle Street for BRT vehicles. The elements of the H-1 BRT Corridor are:

1. The existing zipper lane provides a morning peak period inbound contraflow lane for multiple occupant vehicles with three or more occupants from 5 to 7 a.m. and with two or more occupants from 7 to 8 a.m., between Managers Drive in Waipahu and the Pearl Harbor Interchange. Under the Refined LPA, the existing zipper lane will be extended an additional 2.8 miles from Radford Drive, onto the H-1 airport viaduct, to Keehi Interchange (Nimitz Highway), creating an 11.6-mile-long morning peak period zipper lane.

2. An outbound, afternoon peak period contraflow zipper lane will be built for vehicles with multiple occupants. The outbound zipper lane will be created by providing a second movable barrier that will replace the existing fixed median barrier on H-1 in some places. The new afternoon peak period zipper lane on the makai side of the freeway will provide a 6.6-mile Ewa-bound zipper lane between Radford Drive and the Waiawa Interchange.

3. Special ramp improvements proposed as part of the Refined LPA and ramp improvements planned by the HDOT will allow Regional BRT buses to use the zipper lane and for these buses to easily move between the H-1 BRT Corridor and selected transit centers and park-and-rides. These ramp improvements are discussed below:

   Kapolei: New on- and off-ramps between the H-1 BRT Corridor and a proposed overpass at Wakea Street will serve Kapolei, facilitating access to the H-1 BRT Corridor all day long. These ramps are part of HDOT's planned improvements for H-1.

   North-South Road: A new park-and-ride located near the North-South Road/H-1 Interchange will be connected to the H-1 BRT Corridor via the new ramps planned for construction by HDOT.

   Waiawa Interchange: A new zipper lane for vehicles with multiple occupants will be added to the Waiawa Interchange to permit a direct connection between the H-1 p.m. zipper lane and the mauka-bound HOV lane on H-2.

   Luapele Drive: This ramp is the alternative site chosen with the assistance of the Pearl City/Aiea Working Group after the Kaonohi Street and Radford Drive ramp locations were dropped (see Figure 2.2-2). It will be a reversible ramp to-and-from the H-1 Freeway near the intersection of Salt Lake Boulevard and Kahuapaani Street. It will be for the exclusive use of buses.

   The ramp will begin on a section of Luapele Drive and will emerge in the median of H-1 connecting with the a.m. and p.m. zipper lanes. The ramp will require widening the freeway just Koko Head of the Aloha Stadium area viaduct by a minimum of ten feet on both sides. Appendix B includes the Luapele Drive ramp preliminary engineering design drawings. With deletion of the Kaonohi Street ramp, the proposed transit center/park-and-ride at Kamehameha Drive-In was dropped and the Aloha Stadium Transit Center/Park-and-Ride expanded. This ramp will provide a close-by connection to the transit center.

The Pearl City/Aiea Working Group also recommended serving the Pearl City/Aiea communities with a system of circulator buses focused on transit centers at the Pearl City Youth Complex (near Hale Mohalu) (Waiau) and former Jim Slemons auto dealership site (Pearl City/Aiea). These transit centers would be linked to the BRT system via express services operating along Kamehameha Highway using a contraflow lane during peak periods. Express buses would stop at the Waiau, Pearl City/Aiea Transit Centers as well as at the Aloha Stadium Transit Center before entering the H-1 zipper lane via the Luapele Drive ramp. The DTS is programming the Waiau and Pearl City/Aiea Transit Centers and Kamehameha Highway improvements into the City Capital Improvement Program (CIP) as separate projects from the Refined LPA since they have independent utility.

The contraflow zipper lane and reversible ramp at Luapele Drive will operate in the direction of peak traffic flow. Transit service will be provided in the reverse peak direction, but the contraflow lane and reversible ramps will only be used by vehicles traveling in the peak direction.

Preliminary engineering design drawings for those elements that are part of the Refined LPA are contained in Appendix B.

Design Exceptions

Because of right-of-way limitations and roadway constraints in the H-1 corridor where the Regional BRT is proposed, it is not possible to meet all desirable design standards in the American Association of State Highway and Transportation Officials (AASHTO), A Policy on Geometric Design of Highways and Streets, 1994. This is sometimes the case with projects that involve modifications to existing facilities and does not preclude these projects from being eligible for federal funding.

AASHTO, in cooperation with the Federal Highway Administration (FHWA), sponsored a research project, which produced design guidelines for high occupancy vehicle and bus rapid transit facilities. The product of this research, National Cooperative Highway Research Program (NCHRP) Report 414, HOV Systems Manual, 1998, includes suggested reduced design standards when desired design standards cannot be met. These reduced design standards have been accepted by FHWA on other projects through design exceptions.

Locations on the Regional BRT alignment where design exceptions may be required are shown in Table 2.2-7. For the most part, these design exceptions will be for reduced lane widths or the use of shoulder lanes for traffic lanes.

Implementing the Regional BRT improvements will require modifications of Interstate Route H-1 at various locations as follows:

Waiawa Interchange:

- Between the existing Interstate Route H-2 zipper lane crossover and the Pearl City viaduct, the median area and the makai side of the freeway would be widened by about 20 feet to provide p.m. zipper lane crossover facilities.
- The Interstate Route H-2 inbound roadway and bridges would be widened on the Koko Head side by about 12 feet to provide a p.m. zipper lane.

TABLE 2.2-7
REGIONAL BRT H-1 FREEWAY IMPROVEMENTS REQUIRING DESIGN EXCEPTIONS

Section	Existing Conditions	Proposed Conditions	AASHTO Minimum Standards	NCHRP "Reduced" Standards
H-2 Terminus to Halawa Interchange (P.M. zipper lane) (5.0 miles)				
Lane width	11'	11'	12'	11'
Median shoulder width	2'	2'	10'	2'
Zipper lane left shoulder width	--	4'	10'	2'
Right-side shoulder width	none w/ shoulder lane		10'	4'
Bridge structural capacity	No increase in load		Load Factor Design	
Halawa Interchange to Radford Drive (P.M. zipper lane) (0.8 miles)				
Zipper lane left shoulder width	--	4'	10'	2'
Zipper lane right-side shoulder width	--	8'	10'	8'
Ramp right-side shoulder width	--	4'	8'	4'
Radford Drive to Keehi Interchange (extended A.M. zipper lane) (5.0 miles)				
Zipper lane left shoulder width	--	6'	10'	2'
Zipper lane right-side shoulder width	--	4'	10'	8'[1]
Lane width	12'	11'	12'	11'

Source: R.M. Towill Corporation, May 2002.
Note: [1] Proposed barrier distance of 22.5 feet, which is greater than NCHRP "Reduced" distance of 22 feet.

Waiawa Interchange to Halawa Interchange:

- Between the Moanalua Road undercrossing and Halawa Interchange, the makai side of the freeway would be widened by about two feet to provide a p.m. zipper lane. Additional widening at various spot locations may also be desirable to provide breakdown refuge areas.

Halawa Interchange to Keehi Interchange:

- Koko Head of the Radford overpass, the median area and the mauka side of the freeway would be widened by approximately four feet to provide a p.m. zipper lane crossover.
- The Luapele Drive ramp would require widening the freeway just Koko Head of the stadium area viaduct by a minimum of 10 feet on both sides.

All of the above widenings will be done within the existing H-1 right-of-way.

Transit Technology for the Regional BRT System

The technology for the Regional BRT vehicles will be standard and articulated buses with conventional diesel or hybrid diesel/electric propulsion.

Transit Centers and Park-and-Rides

Intermodal access (e.g., automobile, pedestrian, bicycle) and intramodal access (e.g., connections between feeder and line haul transit routes) to the Regional and In-Town BRT systems will occur at transit centers and park-and-ride lots (see Table 2.2-5). Most of these will be built as part of the hub-and-spoke conversion rather than the Refined LPA. Transit centers with parking will be Waianae, Kapolei, Aloha Stadium, Middle

Street, Iwilei, and Kaneohe. Transit centers and transfer points without parking will be at Waipahu, Alapai, Ala Moana Center, Pearl City/Aiea, Waiau, Wahiawa Town, Mililani Town, Kailua, and Kaimuki. A new park-and-ride facility will be located at North-South Road. Existing park-and-ride lots are located at Wahiawa, Mililani Mauka, Royal Kunia, and Hawaii Kai.

<u>Maintenance Facilities</u>

Storage and maintenance of the Regional BRT transit fleet (and the regular bus fleet) for the next 10-12 years will occur at the existing Kalihi-Palama and Pearl City bus maintenance facilities. The Kalihi-Palama facility will need to be expanded for storage and servicing of the BRT vehicles. This expansion will be coordinated with development of the Middle Street Transit Center/Park-and-Ride. The proposed expansion site is adjacent to and makai of the existing Kalihi-Palama facility. The modifications to the existing facility to maintain BRT vehicles are part of the Refined LPA, whereas the transit center/park-and-ride functions on the new expansion site are advancing as an independent project.

In addition to the Pearl City and expanded Kalihi-Palama maintenance facilities, a new third bus maintenance facility will be required 10 to 12 years from now to serve a system-wide fleet of 794 buses. With a fleet of this size a third bus maintenance facility would be needed even without the BRT.

Since the third maintenance facility will not be needed for 10 to 12 years, identifying specific location options can be deferred until then.

4) In-Town BRT System

The In-Town BRT system will be a 12.8-mile high-capacity transit system providing frequent service and direct access to major activity destinations and residential neighborhoods throughout Honolulu's Urban Core. (See Figure 2.2-3A.) Convenient connections between the In-Town BRT system and circulator, local, and express buses will occur at selected BRT stops. Based on comments received on the MIS/DEIS and SDEIS and concerns from the public, three major project refinements have been made to the In-Town BRT system. These refinements are described and incorporated in the following discussion of the In-Town BRT system. Along a good portion of the system's length, In-Town BRT vehicles will operate at-grade in exclusive transit lanes along major arterial streets. In other locations, the In-Town BRT system will operate either in semi-exclusive curb lanes (i.e., lanes are also used by vehicles making turns) or in mixed traffic.

Starting at the Ewa terminus, the alignment will extend 2.0 miles from the Middle Street Transit Center to the Iwilei Transit Center along Dillingham Boulevard. The 5.7-mile Iwilei-Waikiki Branch alignment will start at the Iwilei Transit Center, and continue through Downtown to Aloha Tower Marketplace, along the waterfront to Kakaako Makai, Ala Moana and Waikiki. From Downtown, the UH-Manoa Branch alignment will run 4.1 miles to UH-Manoa via South King Street, Kapiolani Boulevard and University Avenue. Instead of heading makai on Ward Avenue as was proposed in the MIS/DEIS, the alignment has been modified to continue on South King Street, turn makai on Pensacola Street and then continue along Kapiolani Boulevard to University Avenue. A third branch will connect Downtown Honolulu with the mauka portion of Kakaako and Waikiki. . From Bishop Street and Nimitz Highway to the connection with the Kakaako Makai Branch at Ward Avenue and Auahi Street, the alignment extends approximately 1.0 mile.

An In-Town BRT vehicle will take 7.5 minutes to travel from Middle Street to Downtown Honolulu. From Downtown, it will take 14 minutes to reach UH-Manoa. Travel time from Downtown to Waikiki will be approximately 16 minutes via the Kakaako Mauka Branch and 18 minutes via the Iwilei-Waikiki Branch. In-Town BRT services will operate every two minutes during peak periods from Middle Street to Downtown, and about every four minutes during peak periods on each of the three branch segments.

Along 38 percent of its length, the In-Town BRT system will run in transit lanes in the median of existing arterial roads (e.g., Kapiolani and Dillingham Boulevards) or in exclusive curbside contra-flow lanes (e.g., S.

FIGURE 2.2-3A
IN-TOWN BRT BRANCH ALIGNMENTS

King Street). In other locations the system will run along the curb in semi-exclusive lanes (29 percent), or in mixed traffic (33 percent). Semi-exclusive lanes are shared with local buses and right-turning vehicles (as well as private buses in Waikiki). In general, running the In-Town BRT system in the roadway median avoids conflicts with vehicles making right-hand turns and turning into and out of driveways, resulting in faster speeds for the In-Town BRT vehicles.

Transit stops will have different configurations in median-running sections than in curb-running sections. In curb-running areas, the transit stop will resemble current bus stops, yet will have added features including raised waiting platforms for direct boarding of buses, and increased amenities including covered waiting areas, seating and landscaping, where space permits.

Median transit stops will have raised platforms in the median of the street, typically 13 inches higher than the street, eight feet wide and 160 feet long. The platforms will be accessed by well-marked, signal-controlled, safe, pedestrian crosswalks. The platforms will be accessible to persons with disabilities by ramps from the crosswalk to the raised platforms.

Platforms will be provided with covered waiting areas, seating, lighting and safety railings so that transit patrons can wait in safety and comfort for the next In-Town BRT vehicle. Some of the stops will also be provided with signs indicating the waiting time until the next vehicle. Ticketing machines could be provided to minimize the fare transactions conducted on-board the vehicle. Figure 2.2-4 shows typical median and curb transit stops for the In-Town BRT system. The system will be designed for accessibility by disabled riders in compliance with the Americans with Disabilities Act.

Middle Street to Iwilei Segment

Alignment

The alignment will begin at the Middle Street Transit Center, and proceed along the center median of Dillingham Boulevard through Kalihi. The reconfigured cross section will have a transit lane and a vehicular lane in each direction. Left-turn lanes will still be provided mauka-bound at Laumaka Street, and in both directions at Puuhale Road, Kalihi Street, McNeill Street, Waiakamilo Road, Kohou Street, Kokea Street, and Alakawa Street. At Kaaahi Street, the route will turn makai to reach the proposed Iwilei Transit Center located adjacent to the former Oahu Railway and Land Company (OR&L) Station building.

Proposed Transit Stops

- Middle Street Transit Center: The location of this transit center will be adjacent to and makai of the existing Kalihi-Palama Bus Maintenance Facility.
- Kalihi: This transit stop will be located at Dillingham and McNeill Street (near Dillingham Shopping Plaza).
- Honolulu Community College: This transit stop will be located at Alakawa Street.
- Iwilei Transit Center: This transit center will be located next to the former OR&L Station building.

The cross-section on Dillingham Boulevard was modified from that shown in the MIS/DEIS based on input from the Kalihi Working Group. In response to concerns about potential delays to motorists with only one 14-foot general-purpose lane in each direction, the general-purpose lanes were widened to be 18-foot lanes between Laumaka Street and Waiakamilo Road. Eighteen-foot lanes will permit vehicles to go around a local bus stopped at the curb or a right-turning vehicle without having to encroach into the BRT lane. Additionally, in response to the Working Group, additional U-turns and left turns were incorporated into the plan. To preserve the True Kamani trees along the section of Dillingham Boulevard from Waiakamilo Road to Kaaahi Street, the general-purpose lanes will be 14 feet wide, with turnouts at the local bus stops.

FIGURE 2.2-4
TYPICAL IN-TOWN BRT TRANSIT STOPS

Iwilei-Waikiki Branch

Based on comments received after completing the MIS/DEIS and input from the Downtown/Kakaako Working Group, it was determined that another In-Town BRT branch is warranted to serve Downtown, Aloha Tower Marketplace, the makai portion of Kakaako south of Ala Moana Boulevard, and Waikiki. Inclusion of the Iwilei-Waikiki Branch in the project is the result of the City Council's confirmation of this need.

Alignment

The Ewa end of the new branch will be the Iwilei Transit Center and the Koko Head end will be at Kapahulu Avenue in Waikiki. Starting from the Iwilei Transit Center, the new branch will travel mauka onto Iwilei Road, turn Koko Head onto North King Street, and proceed to the Hotel Street Transit Mall. It will continue in the makai direction on Bishop Street to Aloha Tower Drive. From Aloha Tower Drive, the branch will continue in the Koko Head direction on Ala Moana Boulevard and then turn in the makai direction onto Forrest Avenue. It will then turn in the Koko Head direction onto Ilalo Street and then turn in the mauka direction onto Ward Avenue and then Koko Head onto Auahi Street. At the Koko Head end of Auahi Street, the route will turn onto the short Queen Street segment to rejoin Ala Moana Boulevard and head Koko Head towards Waikiki. Along Ala Moana Boulevard, the Koko Head-bound vehicles will operate along the makai curb, while Ewa-bound vehicles will operate in the mauka curb lane between Kalia Road and Hobron Lane and on the mauka side of the center median between Hobron Lane and Queen Street.

From Ala Moana Boulevard, the route will turn makai on Kalia Road and enter Fort DeRussy. The route will continue along Kalia Road to Saratoga Road, with Kalia Road being widened by one lane in each direction between the Hale Koa Hotel and Saratoga Road. The alignment will turn mauka on Saratoga Road. The BRT will be in semi-exclusive lanes on Kalia Road from Maluhia Street to Saratoga Road, and on Saratoga Road from Kalia Road to Kalakaua Avenue. At the intersection of Saratoga Road and Kalakaua Avenue, the route will split into a one-way couplet. The Koko Head-bound transit lane will be in the makai curb lane of Kalakaua Avenue until after the stop at Uluniu Street where it will transition mauka to turn onto Kapahulu Avenue. The Kapahulu terminus will be a transit stop on the Koko Head side of Kapahulu Avenue. The transit stop improvements at this site will be within the 18-foot-wide sidewalk area. The return loop will turn Ewa onto Kuhio Avenue, and the Ewa-bound transit lane will be located along the mauka curb of Kuhio Avenue. The alignment will turn onto the Ewa side of Kalaimoku Street to return to Saratoga Road. Within Waikiki the BRT lanes will for the most part be shared with local buses and private transit vehicles. The exceptions will be the left-turn lane from Kalia Road to Ala Moana Boulevard, and the Kalaimoku contra-flow lane.

In the Ewa direction, the Iwilei-Waikiki Branch will travel Ewa in reverse of the Koko Head direction; except that, at the intersection of Bishop Street/Nimitz Highway, the branch will turn Koko Head onto Nimitz Highway, then mauka onto Alakea Street, Ewa on Hotel and back to the Iwilei Transit Center, where the new branch ends. Figure 2.2-5 shows the proposed Iwilei-Waikiki alignment.

The purpose of the Iwilei-Waikiki Branch is to better serve existing and future land uses in and along the downtown Honolulu and Kakaako waterfront. Existing attractions that will be served by the Kakaako Makai Branch include Chinatown, the Central Business District, Aloha Tower Marketplace, Hawaii Maritime Museum, Piers 10 and 11 cruise ship terminal, Kakaako Waterfront Park, Children's Discovery Center, Victoria Ward commercial/entertainment complex, Ala Moana Beach Park, Ala Moana Center, and Waikiki. Future land uses that would be served include future phases of Aloha Tower Marketplace, a new cruise ship terminal at Pier 2, the proposed University of Hawaii School of Medicine and related bio-medical research facilities, the proposed Hawaii Science and Technology Center, commercial plus retail development at Kewalo Basin, and the Waikikian and Outrigger developments in Waikiki.

FIGURE 2.2-5
IWILEI-WAIKIKI BRANCH

Proposed Transit Stops

The Iwilei-Waikiki Branch of the In-Town BRT will have 17 transit stops, thirteen of which will be shared with the other branches:

- Iwilei Transit Center: This stop will be adjacent to the former OR&L station building.
- Chinatown : This transit stop will be located at Kekaulike Street in Chinatown.
- Union Mall: This transit stop will be located between Fort Street and Union Malls and would serve the Central business District.
- Aloha Tower : This transit stop will be located on Aloha Tower Drive just to the Koko Head side of Bishop Street by the Hawaii Maritime Museum.
- Fort Armstrong: This transit stop will be located on Ala Moana Boulevard near the U.S. Immigration Station/Department of Health Building, Restaurant Row, and the site of a future passenger ship terminal at Pier 2.
- Coral: This transit stop will be located along Ilalo Street between Coral and Cooke Streets in the center of the Kakaako Community Development District Makai Area.
- Kewalo Basin: This transit stop will be located along Ilalo Street Koko Head of Ahui Street and will serve the Kewalo Basin.
- Kamakee: This transit stop will be located on Auahi Street and would provide access to the Victoria Ward developments.
- Ala Moana Park: This transit will would be located next to Ala Moana Beach Park and Ala Moana Center.
- Hobron: This transit stop will be located on Ala Moana Boulevard, serving the Hobron residential area and hotels.
- Fort DeRussy: This transit stop will be located on Kalia Road adjacent to Fort DeRussy and the Hilton Hawaiian Village and Hale Koa Hotels.
- Saratoga: This transit stop will be located near the Waikiki Post Office at the Koko Head end of Fort DeRussy, and hotels on Saratoga and Kalia Roads.
- Kalakaua/Seaside: This Koko Head-bound transit stop will be adjacent to the Royal Hawaiian Shopping Center, and surrounding hotel and retail areas.
- Kalakaua/Uluniu: This Koko Head-bound transit stop will be located near Kuhio Beach across from the Hyatt Regency Hotel.
- Kapahulu: This on-street transit stop will be located on the Koko Head side of the intersection of Lemon Road and Kapahulu Avenue. The stop will serve the Honolulu Zoo and Kapiolani Regional Park.
- Kuhio/Liliuokalani: This Ewa-bound transit stop will be located by the Radisson Waikiki Prince Kuhio Hotel.
- Kuhio/Seaside: This Ewa-bound transit stop will be located across from the Waikiki Trade Center.

UH-Manoa Branch

Alignment

The UH-Manoa Branch alignment has been refined. After running on Richards Street for one block, the UH-Manoa branch will turn onto the curbside lanes of South King Street. Instead of turning on Ward Avenue to access Kapiolani Boulevard, the route will continue on South King Street to Pensacola Street. At Pensacola Street, the route will turn makai to connect with Kapiolani Boulevard. This realignment is a direct result of the input from working group members that a BRT alignment on Pensacola Street will result in less traffic impacts than on the already congested Ward Avenue and will better serve McKinley High School and the Kaiser

Honolulu Clinic. On Pensacola Street, the BRT will operate in two exclusive lanes next to the Ewa side curb. A raised landscaped median will separate the BRT vehicles from the three lanes of auto traffic.

The In-Town BRT will operate mostly in the center median of Kapiolani Boulevard to Atkinson Drive. The Koko Head-bound BRT will be in an exclusive median lane from Pensacola Street to Atkinson Drive. In the Ewa-bound direction the BRT will be in mixed traffic from Atkinson Drive to just past Kaheka Street, then in an exclusive median lane to just east of Piikoi Street, where it will transition in mixed traffic to a right turn at Pensacola Street. On Kapiolani Boulevard, between Atkinson Drive and Kalakaua Avenue, the Koko Head-bound BRT vehicles will operate in mixed traffic as they transition from the median transit lanes to curbside lanes. From Kalakaua Avenue to Isenberg Street, BRT vehicles will be in the curbside lanes operating in mixed traffic. Between Isenberg Street and University Avenue, the BRT vehicles will transition from curbside lanes to median lanes. From Kapiolani Boulevard to King Street on University Avenue, the BRT vehicles will be in exclusive median lanes. At King Street the mauka-bound BRT will transition to a semi-exclusive curb lane. Between Varsity Place and Sinclair Circle the mauka-bound BRT will operate in a mixed-traffic curb lane. The makai-bound BRT will remain in an exclusive median lane from Sinclair Circle to Kapiolani Boulevard.

On Kapiolani Boulevard, exclusive left-turn lanes for motorists will be provided at Pensacola Street, Piikoi Street, Kaheka/Mahukona Street, Atkinson Drive, McCully Street, Paani Street, Hoawa Street, Isenberg Street, and University Avenue. On University Avenue, left-turn bays will be maintained at Date Street, King/Beretania Streets, Varsity Place, Puaena Place, and Dole Street. The route will terminate in a counter-clockwise turn back loop at Sinclair Circle.

Proposed Transit Stops

- Iolani Palace: This transit stop will provide convenient access to the Post Office, Hawaii State Library, Honolulu Hale, State Capitol and Iolani Palace. The Koko Head-bound stop will be in front of the Post Office. The Ewa-bound stop will be in front of the State Library.
- Alapai Transit Center: Modifications to the existing Alapai Transit Center will enable connections between the In-Town BRT system and express buses to Windward Oahu and East Honolulu. Both stops will be on the Koko Head side of the King/Alapai Streets intersection.
- Thomas Square/ Neal Blaisdell Center (NBC): This transit stop will provide service to the Honolulu Academy of Arts, Thomas Square, Straub Clinic & Hospital and Neil Blaisdell Center. Based on input from the Downtown/Kakaako/Ala Moana Working Group, the BRT stops have been relocated to Koko Head of Ward Avenue.
- King/Pensacola: This new transit stop will be located on South King Street at Pensacola Street. It will serve McKinley High School, the Kaiser Honolulu Clinic and nearby residential areas.
- Pensacola/Kapiolani: This stop formerly on Kapiolani Boulevard will now be on Pensacola Street. This transit stop will serve nearby residential areas and potential development, which may occur on the site of the former community college and vacant lot on the corner of Pensacola Street and Kapiolani Boulevard.
- Ala Moana/Keeaumoku: This transit stop will serve Ala Moana Center and existing and future developments in the Keeaumoku area.
- Convention Center: This transit stop will be located on Kapiolani Boulevard at Atkinson Drive and Kalakaua Avenue. The Koko Head-bound platform will be located just Ewa of Atkinson Drive, while the Ewa-bound platform will be located Ewa of Kalakaua Avenue.
- Isenberg: This transit stop will serve the McCully/Moiliili residential area.

- University/King: This transit stop will be located mauka of King Street in front of Varsity Theater and Puck's Alley. The mauka-bound stop will be curbside, whereas the makai-bound stop will be in the median.
- UH-Manoa: This transit stop, and the Koko Head terminus of the UH-Manoa Branch, will be located at Sinclair Circle to serve the UH campus, University High School and nearby residential areas.

Kakaako Mauka Branch

Alignment

The Kakaako Mauka Branch has also been refined. The Kakaako Mauka branch will extend from the Union Mall Transit Stop to Kapahulu Avenue at the Koko Head end of Waikiki, via the mauka portion of Kakaako. As a result of concerns from local residents and businesses, the alignment has been moved off Richards Street between Hotel and Halekauwila Streets. BRT vehicles traveling in the Koko Head direction will head makai on Bishop Street to Nimitz Highway, turn Koko Head and proceed along Nimitz Highway to connect with Halekauwila Street. BRT vehicles traveling in the Ewa direction will turn onto Ala Moana Boulevard from Halekauwila Street and turn mauka on Alakea Street to Hotel Street and the Union Mall Transit Stop. Two new transit stops will be added to the route. The first transit stop will be on Bishop Street between Queen Street and Nimitz Highway, and the second stop will be located on Alakea Street between Nimitz Highway and Queen Street.

The branch will run through Kakaako, just mauka of Ala Moana Boulevard on Halekauwila and Pohukaina Streets with a transition at South Street. The Ewa-bound lane on Halekauwila Street will be an exclusive lane between Punchbowl Street and Ala Moana Boulevard. Along the remainder of Halekauwila Street the BRT will operate in mixed traffic. In the Koko Head direction on Halekauwila Street, the BRT will be in mixed traffic all the way. At Kamani Street, the alignment will transition from Pohukaina Street and continue Koko Head on Auahi Street. Along Pohukaina and Auahi Streets the BRT will be in semi-exclusive curb lanes. Once it crosses Ward Avenue on Auahi Street the Kakaako Mauka Branch will continue to and through Waikiki using the same alignment as described for the Iwilei-Waikiki Branch.

Proposed Transit Stops

The following discusses transit stops that will be unique to the Kakaako Mauka Branch:

- Bishop: This Koko Head-bound transit stop will be located adjacent to the Topa Financial Center (previously known as Amfac Center) on Bishop Street just makai of Queen Street.
- Alakea: This Ewa-bound transit stop will be located adjacent to the Harbor Square tower on Alakea Street.
- Halekauwila: This transit stop at Punchbowl Street on Halekauwila will serve the Restaurant Row complex, Prince Kuhio Federal Building, and other nearby government and commercial centers.
- Cooke Street: This transit stop on Pohukaina Street will be adjacent to Mother Waldron Park and serve planned residential, retail and commercial uses in the area.

To give transit the priority necessary to make it an attractive alternative to the private automobile, some lanes along the proposed In-Town BRT alignment will need to be converted from general-purpose lanes to transit only lanes. This will result in an increase in the person-carrying capacity of these streets yet will result in a reduced number of lanes for general-purpose traffic. Table 2.2-8 summarizes the proposed redistribution of lanes. The table has been updated since the MIS/DEIS to reflect the Refined LPA.

TABLE 2.2-8
PROPOSED DISTRIBUTION OF LANES WITH REFINED LPA

	NUMBER OF LANES				
	EXISTING		PROPOSED		
Location	General Purpose	Exclusive Transit	General Purpose	Semi-Exclusive Transit	Exclusive Transit
Dillingham Boulevard					
Middle St. - Laumaka St.	6+1 turning	0	6+1 turning	0	0
Laumaka St. - Kaaahi St.	4+1 turning	0	2+1 turning	0	2
Kaaahi Street					
Dillingham Blvd. – Kaaahi Place	2+1 turning	0	2+1 turning	0	0
Kaaahi Place – Iwilei Road	0	0	2	0	2
Iwilei Road					
Kaaahi Street – N. King St.	4	0	3	0	1
N. King Street					
Iwilei Rd. - Hotel St.	4+1 turning	1	4	0	2
Hotel Street					
N. King St. - Richards St.	0	2	0	0	2
Richards Street					
Hotel St. - King St.	2	0	2	0	1
S. King Street					
Richards St. - Mililani St.	5	0	4	0	1
Mililani St. - Alapai St.	6	0	5	0	1
Alapai St. – Pensacola St.	6	0	4	1	1
Pensacola Street					
S. King St. - Kapiolani Blvd.	4	0	3	0	2
Kapiolani Blvd.					
Pensacola St. – Kaheka St.	6	0	4+1 turning	0	2
Kaheka St. – Atkinson Dr.	5+1 turning	0	4+1 turning	0	1
Atkinson Dr. - Kalakaua Ave.	6+1 turning	0	6+2 turning	0	0
Kalakaua Ave. – University Ave.	6+1 turning	0	6+1 turning	0	0
University Ave.					
Kapiolani Blvd. – King Street	6+1 turning	0	4+1 turning	0	2
King St. – Varsity Pl.	6+1 turning	0	4+1 turning	1	1
Varsity Pl. – Sinclair Circle	6	0	5	0	1
Alakea St.					
S. Hotel St. – S. King St.	6	0	5	1	0
S. King St. – Queen St.	4	0	4	0	0
Queen St. – Nimitz Highway.	4+1 turning	0	4	0	1
Nimitz Highway					
Alakea St. – Richards St.	6+1 turning	0	6+1 turning	0	0
Halekauwila St.					
Richards St. – Punchbowl St.	1	0	1	0	1
Punchbowl St. – South St.	2	0	2	0	0
South St.					
Halekauwila St. - Pohukaina St.	4	0	2	1	1
Pohukaina St.					
South St. – Kamani St.	2	0	2	2	0
Kamani St.					
Pohukaina St. - Auahi St.	2	0	2	0	0
Auahi St.					
Kamani St. - Ward Ave.	5	0	5	0	0
Ward Ave. – Queen St.	4	0	2	2	0
Queen St.					
Auahi St. - Ala Moana Blvd.	4+1 turning	0	3+1 turning	1	1
Ala Moana Blvd.					
Queen St. - Atkinson Dr.	6+1 turning	0	4+1 turning	1	1
Atkinson Dr. – Hobron Lane	6+1 turning	0	5+1 turning	1	1

TABLE 2.2-8 (CONT.)
PROPOSED DISTRIBUTION OF LANES WITH REFINED LPA

	NUMBER OF LANES				
	EXISTING		PROPOSED		
Location	General Purpose	Exclusive Transit	General Purpose	Semi-Exclusive Transit	Exclusive Transit
Hobron Lane – Kalia Road	6+1 turning	0	6+1 turning	2	0
Kalia Rd.					
Ala Moana Blvd. – Maluhia St.	5	0	4	0	1
Maluhia St. - Saratoga Rd.	2	0	2	2	0
Saratoga Rd.					
Kalia Rd. - Kalakaua Ave.	3	0	2	2	0
Kalakaua Ave.					
Saratoga Rd. - Kaiulani Ave.	4	0	3	1	0
Kaiulani Ave. – Uluniu Ave.	3	0	2	1	0
Uluniu Ave. – Kapahulu Ave.	3	0	3	0	0
Kapahulu Ave.					
Kalakaua Ave. - Kuhio Ave.	4	0	4	0	0
Kuhio Ave.					
Kapahulu Ave. - Kalaimoku St.	4+1 turning	0	2+1 turning	1	0
Kalaimoku St.					
Kuhio Ave. - Kalakaua Ave.	2	0	2	0	1
Bishop St.					
S. Hotel St. – Queen St.	5	0	5	0	0
Queen St. – Nimitz Highway	4	0	3	1	0
Nimitz Highway – Aloha Tower Dr.	4	0	4	0	0
Aloha Tower Dr.					
Bishop St. – Connector St.	3	0	3	0	0
Connector St. – Ala Moana Blvd.	1	0	1	0	0
Ala Moana Blvd.					
Connector St. – Forrest Ave.	6	0	6	0	0
Forrest Ave.					
Ala Moana Blvd. – Ilalo St.	4	0	4	0	0
Ilalo St.					
Forrest Ave. – Ahui St.	2	0	2	0	0
Ward Ave.					
Ahui St. – Auahi St.	5	0	5	0	0
Ala Moana Blvd.					
Forrest Ave. – Connector St.	6	0	6	0	0
Connector St. (Richard St. Extension)					
Ala Moana Blvd. – Aloha Tower Dr.	2	0	2	0	0
Nimitz Highway					
Bishop St. – Alakea St.	6+2 turning	0	6+2 turning	0	0

- Source: Parsons Brinckerhoff, September 2002.

5) Transit Technology for the In-Town BRT System

The In-Town BRT system will use hybrid diesel-electric powered vehicles unless a superior and cost-effective alternative is found. The City continues to track development of an all-electric touchable embedded plate system; and its impacts are discussed in this FEIS. However, no decision on using such a system would be made until it is proven revenue service-worthy and additional environmental review is conducted.

Selection of a transit technology that best harmonizes with the densities in Honolulu's Urban Core is a key decision. The technology must maximize beneficial impacts, such as facilitation of desired urban land use patterns and improvement of the quality of urban life, while minimizing adverse impacts. To help identify appropriate candidate technologies, ten criteria were established from community input and technical evaluation. These criteria are:

- Right-of-Way (ROW): Selected technologies must not require a new dedicated ROW or grade separation because urban Honolulu has insufficient space for a new dedicated ROW, and a grade-separated system was previously proposed but did not obtain the required City Council support. Suitable technologies must be able to operate at-grade on existing streets and highways. While vehicles may operate in exclusive lanes, the technology must permit at-grade cross traffic and pedestrian crossings.
- Line Capacity: Selected technologies must have the capacity to move more than 3,000 passengers per hour per direction because travel demand forecasting indicates that this is the approximate line haul requirement in 2025.
- Emissions and Noise: Air pollution emissions from selected technologies must be substantially lower than the 2004 EPA regulations provided in Table 2.2-9. Once adopted, the EPA's 2004 regulations will apply to all transit vehicles, including those powered by diesel engines. Noise emissions must not exceed those of a conventional light rail vehicle or trolley bus with electric propulsion.
- Service Proven: Selected technologies must either show sufficient maturity, or the technology must be in an advanced stage of development. If the technology is not yet "proven in revenue service", the risk associated with implementing a developmental technology must be carefully weighed.
- Affordability: Selected technologies must have system costs per unit length not exceeding that of an at-grade light-rail line of $60 million per mile in 2002 dollars.
- Safety: Selected technologies must meet local and national life/safety requirements.
- Accessibility: Selected technologies must comply with Americans with Disabilities Act (ADA) requirements.
- Visual Impact: Selected technologies must not require an overhead guideway or overhead contact system (overhead wires or catenaries) for wayside propulsion that disrupts mauka-makai views.
- Flexibility: Selected technologies must have the capability to be re-routed around blockages, and not preempt parades and other activities along the alignment.
- Sense of Permanence: Selected technologies must represent a substantial government commitment to a specific alignment in order to evoke the desired land use response from land developers.

TABLE 2.2-9
EPA URBAN BUS ENGINE STANDARDS (G/BHP-HR)

Year	HC	CO	NO_x	PM
2004 Proposed	0.5	15.5	2.5 (NMHC) or 2.4 NO_x	0.05

Source: EPA, 1999.
Notes: g/bhp-hr – grams per brake horsepower-hour, HC – Hydrocarbons, CO – Carbon Monoxide, NO_x – Nitrogen Oxides, PM – Particulate Matter, NMHC - Non-Methane Hydrocarbons

Technologies currently under consideration have the following features: (1) rubber-tired, (2) low floor, (3) driver operated, (4) located at-grade in a reserved right-of-way (street lane), (5) able to be crossed by pedestrians and other traffic, (6) single articulated, (7) capable of operating under their own power for short distances to avoid disruptions in the transit lane, and (8) electrically powered. Technologies rejected from further consideration are presented in Section 2.6.

The requirement for electric power is driven by concerns about air and noise emissions. Electric power would be provided either from power modules embedded in the street (touchable embedded plate technology), or on-board hybrid electric propulsion in which a diesel engine powers an alternator, which produces electricity. The electricity is stored in a battery, and the power is distributed by electric cable to “hub motors”, which are electric motors located on each wheel. In this manner, it is possible to eliminate the drive train, facilitating a “low floor” configuration.

Overhead wires (catenaries) would not be required under either technology option.

This FEIS was prepared to permit either option to be selected later in the project development process. This FEIS analysis reflects the 'worst case' impacts of both technologies. The degree to which the lesser impact technology would reduce impacts is also discussed in this FEIS.

The technologies under consideration are now described.

Embedded Plate Technology

An embedded plate technology (EPT) is a form of wayside traction power delivery in which a power strip is embedded in the roadway or installed in a track. The power strip does not cause electric shocks if touched by persons or by crossing traffic.

One design, STREAM by Ansaldo/Breda, employs a segmented power strip that is embedded in the street. Each segment of the power strip is energized only when the power collector below the transit vehicle is in contact with the segment. At all other points, the power strip is not energized, and therefore poses no hazard to pedestrians or other surface traffic crossing the alignment. The energized segment is always underneath the vehicle, and within its boundaries.

When the vehicle leaves the transitway lanes with the power strip, it shifts automatically to on-board batteries that are kept charged. The batteries are able to power the vehicle after it leaves the transitway, allowing the vehicle to cross difficult intersections, make tight turns, move during emergencies, and maneuver during maintenance. Since the batteries are charged during normal operation, the vehicle does not need to stop for the batteries to be changed or charged.

The STREAM technology was conceptualized in 1994 and underwent approximately 7 years of research, design, and testing at a test track in Rome. A 1.25-mile system has been constructed in Trieste, Italy and is under further testing in revenue service. The Trieste system uses both 40-foot and 60-foot buses. Each bus is equipped with Nickel Metal Hydride batteries that allow the buses to operate on non-energized portions of the line. The STREAM technology could provide quiet, comfortable, and environmentally clean transportation service with great user appeal in Honolulu.

The STREAM technology may require additional safety tests to qualify for U.S. safety certification. Based on progress to date, the earliest estimated date for use of the STREAM system in the U.S. would be no earlier than 2005.

Another design, by Wamplfler (a German firm), employs “inductive power transfer” (IPT), the same electrical principle as in a transformer. Insulated rails embedded in the road surface carry an electric current that induces a current in power pickups on board the vehicle. In contrast to STREAM, no surface contact is required. The pick-up on the vehicle captures a magnetic field generated by the power strip in the road. Power is received as alternating current that is rectified on board to become direct current.

With batteries on-board the vehicle, the power strip could be interrupted at intersections and other areas where its placement would be difficult or expensive. The batteries would provide power to cross areas without a power strip. IPT could also be used to charge the batteries of a transit vehicle at transit centers or stops. IPT is not yet available for the high-powered requirements of mass transit installations, such as monorails or BRTs. However, the IPT system is currently available for continuous loads of approximately 150 KW. Higher power transit applications are expected in the near future.

Alstom Transport is also currently developing a touchable embedded power supply system called ALISS, which is similar to STREAM and Wamplfer's IPT system. While STREAM uses a magnet to raise the conductor and power segments as the vehicle passes over it, ALISS has no moving parts. Radio communication between the vehicle and the embedded power supply system, and static switching results in segments being energized as the vehicle passes overhead. Unlike STREAM, ALISS is not integrated with a steering mechanism. ALISS requires the vehicle's power pick-up to be positioned over the units embedded in the roadway by independent means.

ALISS is still under development. Alstom has completed bench testing and is currently manufacturing some of the components for a test track at their manufacturing facility in La Rochelle, France.

Embedded plate systems will require the construction and operation of traction power supply stations (TPSS) that transmit the electricity to operate the vehicles. The approximately 15 TPSS sites to be located intermittently along the In-Town BRT alignment would each have a roughly 500 square-foot footprint and in most cases would be located out of sight inside existing or proposed buildings. Potential TPSS locations are designated on the preliminary engineering drawings provided in Appendix B (see Volume 4). However, since it would be 8 to 14 years before the EPT is installed depending on the segment, the locations shown on the design drawings are not site specific; each notation is intended only to indicate the general vicinity in which a TPSS would be placed. Site specific environmental assessments of each TPSS would be prepared prior to proceeding with implementation of EPT. Locations and design treatments would be established with community input.

Hybrid Diesel/Electric Propulsion

A hybrid propulsion system is one in which a diesel engine onboard the transit vehicle drives a generator (alternator) that produces electric power to charge batteries. In addition, the batteries are also charged during braking by operating the motors as generators (regenerative braking), which converts the kinetic energy of the vehicle into electrical energy that is stored in the battery.

Current is drawn from the batteries to run electric propulsion motors that drive the wheels, and the internal combustion engine is not directly coupled to the wheels. The configuration is similar to diesel/electric locomotives that have been in service for many years.

One advantage of this technology is that regardless of the speed of the vehicle, the internal combustion engine can be operated constantly at its most efficient speed and load. Running the engine at maximum efficiency maximizes fuel economy while minimizing air and noise emissions. The batteries can also be used to move the bus if there is a problem with the engine or alternator.

Diesel engine technology has advanced recently to reduce emissions, particularly in aspiration (i.e., getting air into the cylinders more efficiently), precise control of providing the fuel to the engine, and exhaust after-treatment. These developments, together with being able to operate the diesel engine at its most efficient speed and load, contribute to its lower exhaust emissions in comparison to conventional diesel technology.

It is expected that the emissions from diesel/electric hybrids will be significantly lower than the criteria presented earlier in Table 2.2-9, although the exact performance is still being established by government regulators.

New York City Transit Agency has extensively tested 40-foot hybrid electric buses for over 3 years and has ordered a fleet of 100 buses for revenue service. However, testing and manufacturing experience indicates that the battery technology is not easily extended to the larger 60-foot bus. If research efforts involving advanced electrical storage modules, such as the Super-Capacitor, are successful; a 60-foot hybrid prototype bus may be available to order in the 2004-2005 time frame (delivery is one to two years later). But, the share of the 60-foot bus market in the U.S. (5 percent) has not yet encouraged suppliers to focus on the research and development investment needed to produce a hybrid diesel/electric powered 60-foot model.

The use of Fuel Cell energy storage and propulsion technology has shown promising results in 40-foot bus testing by the Chicago Transit Authority (CTA). Fuel cells are energy storage devices that combine hydrogen and air to produce electricity. The only by-products are water vapor and carbon dioxide. CTA, along with other U.S. transit agencies, are currently expanding revenue service testing on these buses in limited numbers. Although a 60-foot bus has not yet been developed, the fuel cell technology will more easily lend itself to heavy-duty applications. Production quality revenue service 40-foot buses are expected in 2005, and 60-foot models may be available soon after.

Hydrogen can also be used as a fuel in the internal combustion engine. This technology is farther behind hydrogen fuel cell, although experiments using hydrogen in heavy-duty internal combustion engines have been ongoing for many years. There is currently no pure hydrogen fuels used in buses, and may not be for some time due to the difficulties in handling hydrogen gas.

The recent improvements in diesel engine technology (without hybrid drives) adequately meet the emission standards in Table 2.2-9 and provide the horsepower required for an articulated vehicle. Articulated buses using advanced diesel engine propulsion refer to this technology as “Clean Diesel” or “Diesel-Electric”. “Wheel-hub motors” built into the hubs of the wheels facilitate the design of articulated, low-floor buses by eliminating the need for a drive shaft and axle under the vehicle and allowing the power plant to be placed in the rear of the vehicle. The CiViS bus, by Matra/Renault, has been in revenue service in Rouen, France since 2000 and will operate in the BRT system under development in Las Vegas by the Clark County Regional Transit (RTC) system later this year. Neoplan will also produce an articulated vehicle using this propulsion technology, in a dual-mode configuration alongside overhead catenary power, for the Massachusetts Bay Transit Authority (MBTA) Silverline BRT service in 2004.

Technology Selection for In-Town BRT

The transit industry is in an era of rapid change in propulsion system technology. The two candidate technologies, embedded plate and hybrid diesel-electric propulsion, are in various stages of development. It is too early to anticipate whether either one will be capable of meeting all of the In-Town BRT system performance and functional requirements prior to 2004. Hence, the City is proposing to use commercially available 40-foot hybrid diesel–electric buses as the interim technology to operate the In-Town BRT system in the near term.

The final selection of the technology for the In-Town BRT system would be based on a detailed evaluation of the technology options. The designs, and test/demonstration results of each technology would be evaluated against specific performance and functional requirements for the In-Town BRT system. These requirements would be provided to the manufacturers and they would be asked to provide the City with design data and test/demonstration results, as well as prepare written comments on the City’s requirements.

An Industry Review would then be undertaken. Separate meetings would be held with each participating manufacturer to review their comments on the City’s requirements and discuss the City’s questions. Following these meetings and site visits, a transit technology would be selected.

6) Maintenance Facilities

Storage and maintenance of the In-Town BRT fleet would occur at the Kalihi-Palama Bus Maintenance Facility at Middle Street. No changes in the facility will be required to accommodate the IOS. As the In-Town

BRT fleet expands beyond the initial IOS fleet of 10 buses additional service bays will be necessary to accommodate the In-Town BRT vehicles, and the facility will need to be expanded. This expansion will be coordinated with development of the Middle Street Transit Center. The expansion site will be adjacent to and makai of the existing Kalihi-Palama Bus Maintenance Facility.

7) Other Features

From Kapiolani Boulevard/Atkinson Drive to Koko Head of University Avenue, the a.m. and p.m. (morning and evening) peak period contra-flow lanes would be preserved and operate as at present. At the Atkinson Drive intersection, there would be a total of three left-turn only lanes during the a.m. peak period. On Atkinson Drive, between Kapiolani and Ala Moana Boulevards, the a.m. and p.m. peak period contra-flow lanes would be maintained.

2.3 CAPITAL COSTS

This section presents capital cost estimates of the three alternatives (see Table 2.3-1). The costs of the standard set of highway projects that are included in all three alternatives are not included in these costs.

TABLE 2.3-1
CAPITAL COST SUMMARY
(MILLIONS OF 2002 DOLLARS)

Project Component	No-Build	TSM	Refined LPA With Hybrid-Electric	Refined LPA With EPT
Bus & TheHandi-Van Acquisition*	$394.1	$461.9	$512.5	$512.5
Regional Bus Rapid Transit	$10.3	$78.9	$203.0	$203.0
In-Town Bus Rapid Transit **	$0.0	$0.0	$239.4	$322.7
Total	**$404.4**	**$540.8**	**$954.9**	**$1,038.2**

* Includes new bus maintenance facility for TSM and Refined LPA Alternatives.
** Includes BRT vehicles net cost for advanced technology beyond standard bus cost.
Sources: Parsons Brinckerhoff for No-Build and TSM Alternatives. Rider Hunt Levett & Bailey Ltd. for Refined LPA. June, 2002.

2.3.1 Methodology

Cost estimates were prepared in 2002 dollars. Components include site preparation, roadways, ramp structures, pavements, landscaping and utility work, electrical and roadway work associated with the embedded-plate technology (EPT), restoration of adjacent infrastructure, and vehicles. Engineering design, owner administration, taxes and contingencies are also included. Land acquisition costs have now been included within the cost estimates as the specific locations for roadway improvements and EPT electrical substations have been identified during design development.

During this phase of the project, cost estimates are referred to as preliminary estimates, since they are based on preliminary design rather than detailed design. The level of design detail available for the project affects the accuracy of the cost estimates. Also, it should be understood that the cost estimates are applicable to the project description presented earlier in this Chapter. If features of the project change, the cost estimates would need to be adjusted accordingly.

Unit costs were derived from historical data from comparable transit systems, such as the BRT system in Orlando, Florida, and the recently completed H-3 Freeway project, as well as various private and public infrastructure projects recently bid within the State. Costs are based on in-place costs, including labor, construction, permanent equipment, and permanent materials. Prices for highly specialized systemwide components, including vehicles and the EPT within the roadway have been based on composite industry prices from recent transit projects. To account for differences between Hawaii and mainland costs, a Hawaii adjustment factor was applied to items such as the price of materials and the cost of labor.

Basic assumptions used in developing the capital cost data are:

- Estimates were prepared using 2002 dollars;
- No premium time on labor costs was included;
- Normal productivity rates as historically experienced were utilized; and
- Adequate experienced craft labor is assumed to be available.

Typical facility costs are based on the preliminary engineering developed for each work item. Costs are developed by combining the costs of components applicable to a typical cross-section into one unit cost. These parametric unit costs have detailed unit price development backup to substantiate the parametric unit costs. Special facilities costs were developed for the EPT within the roadway and associated electrical supply and distribution elements needed to operate the system. Systemwide elements are those elements necessary for operation, but whose costs can only be partly allocated to a specific geographic segment of the system (e.g., vehicles, storage and maintenance facilities, and so forth).

Once the typical and special facility and systemwide element costs have been determined, they are subject to add-on factors. Add-on factors cover engineering, program administration, insurance, and contingencies. They are referred to as add-on factors because they are added to the unit costs.

Capital costs were developed for each alternative utilizing both “bottom up” and “top down” estimating approaches. However, most of the unit costs were developed using a “bottom up” approach, meaning the cost of each major category of work is determined by totaling the cost of their component parts. Based on the preliminary engineering, the quantities of the major work elements are defined. Unit prices for each major work element are developed and combined with the estimated quantities to determine the cost of each major category of work, such as transit stops, park-and-ride facilities, access ramps, transit platforms, roadway pavement, and so forth. The advantages of this approach are the ability to adjust costs with engineering refinements, and a higher level of confidence.

The unit prices include contractor-supplied insurance. On many major projects, the owner supplies the insurance or assumes management risks in order to reduce costs.

As noted, the costs for design and construction administration have been added to the hard construction costs. This category also includes system start-up costs, as these activities are interrelated with the engineering and construction work. The allowance included is eight percent, and it was applied to all capital cost categories except right-of-way acquisition, relocation, and vehicles. Generally, six percent is for engineering and design, and two percent is for construction administration.

A contingency is included in the capital cost estimate to account for unforeseen items, quantity fluctuations and variances in unit costs as the project progresses. This percentage will be reduced as the project progresses, and reflects the degree of risk associated with the level of engineering data presently available. The civil and utility scope of construction work was reduced from the 25 percent contingency outlined in the MIS/DEIS to an amount consistent with the industry standard on the order of 15 percent given the development of the documentation during the preliminary engineering phase. However, the MIS/DEIS contingency of 25 percent was retained for the work associated with the EPT installation, as the level of information available for this area of work is considered more preliminary. The 25 percent MIS/DEIS contingency has been maintained for all land acquisition costs. A 10 percent contingency was applied to BRT vehicles.

The cost of the applicable general excise tax mandated by the State of Hawaii is included as a percentage (4.166) of the total capital cost of all categories.

2.3.2 Results

Table 2.3-1 shows the capital cost estimates for the transit portion of the three alternatives, by project component in 2002 dollars. They span a range from about $404 million for the No-Build Alternative, to $1.0 billion for the Refined LPA with embedded plate technology. The Refined LPA with hybrid diesel-electric technology would be around $960 million. These cost estimates exaggerate the initial capital costs since they reflect the replacement of the entire bus, TheHandi-Van, and In-Town BRT vehicles over the 23-year analysis period of the FEIS. Initial costs (first 16 years) in 2002 dollars would be $182 million for the No-Build Alternative, $266 million for the TSM Alternative, and $633 million for the Refined LPA, exclusive of EPT costs.

These cost estimates are different from the estimates shown in the MIS/DEIS and SDEIS due to the refinements incorporated into the Alternatives as the project has progressed. In the case of the Refined LPA, the refinements have included some cost saving measures that are estimated to result in a lowered capital cost for the project.

2.4 OPERATING AND MAINTENANCE COSTS

This section presents estimates of annual operating and maintenance (O&M) costs for the transit (fixed-route bus) elements of the three alternatives. For the purpose of this chapter, the operating and maintenance costs of the highway projects that are included in all three alternatives are not included in these costs, other DTS and HDOT O&M costs are not reflected (e.g., costs of coning contraflow lanes, maintaining traffic signals and bus priority measures) and the costs of operating and maintaining TheHandi-Van fleet are also not included. O&M costs including TheHandi-Van are discussed in Chapter 6. The costs of operating the Luapele Drive reversible ramp and the addition to the existing zipper lanes are not included in the estimates. The costs of administering the Vanpool Hawaii program are assumed to equal the direct revenues and federal funding (i.e. break-even operation). The costs are for the forecast year 2025, assuming full development of each alternative, and are expressed in 2002 dollars.

2.4.1 Cost Estimation Methodology

Costs are produced using an estimation methodology for bus supply characteristics, calibrated to Oahu Transit Services (OTS's) annual expenses for 2000, which is the most recent year for which very detailed itemizations of costs are available. Costs then are escalated to Year 2002 values using OTS's observed unit cost inflation during the two-year period, for the system as a whole. The inputs to the estimation are prepared by the travel demand forecasting models and consist of passenger loading assigned to the bus routes, as coded for the travel demand forecasting models, for the a.m. peak period, the p.m. peak period and the off-peak period, as well as the estimated running time and distance for each bus route. The bus supply estimation methodology takes these inputs and estimates the frequency of bus service and number of vehicles – either standard buses, minibuses, articulated buses, or BRT vehicles – needed to accommodate the estimated demand during each of the three time periods. It further estimates the vehicle hours and miles that would be provided for the entire day. These daily estimates are then increased to an annual estimate and used to estimate annual bus operating costs. All steps in the process rely on data provided by OTS about its operating practices on a daily and annual basis.

Annual operating and maintenance costs are estimated as a function of three variables: annual revenue vehicle miles, annual revenue vehicle hours, and peak vehicles. "Peak vehicles" represents the maximum number of vehicles required for providing peak period service, and provides the closest measure available for representing system size. Note that "peak vehicles" is not the same as "fleet size"; the latter additionally includes spare vehicles. A unit cost has been estimated for each variable. In addition, an amount for fixed costs is added to reflect administrative or overhead type costs incurred in operating the transit system. Based on experience elsewhere, different unit costs are used for standard 40-foot buses (or 30-foot minibuses) and 60-foot articulated buses. Annual costs are estimated using the following equation:

Annual O&M Cost	=	$ 52.08 x Annual Revenue Vehicle Hours
	+	$ 0.99 x Annual Standard or Minibus Revenue Vehicle Miles
	+	$ 1.38 x Annual Articulated Revenue Vehicle Miles
	+	$ 56,138 x Standard or Minibus Peak Vehicles
	+	$ 66,671 x Articulated Peak Vehicles
	+	$8,860,230 in Fixed Costs.

The variables above are estimated for each alternative's operating plan.

In addition, O&M costs for embedded plate and hybrid diesel-electric vehicles are estimated to be eight percent higher than articulated vehicles. This eight percent increase reflects the O&M cost differential that King County Metro Transit in Seattle has observed between normal articulated buses and the dual-power articulated buses that operate in the Downtown Seattle Transit Tunnel. These buses operate both on diesel power and electric power, with electric power picked up via trolley poles. The cost differential for these more-complicated buses is being used as a guide for the additional O&M costs that might be associated with embedded plate or hybrid diesel-electric vehicles.

2.4.2 Results

Table 2.4-1 presents the annual O&M costs in 2002 dollars using the methodology described above. The Handi-Van operations are not included in these costs.

TABLE 2.4-1
ANNUAL OPERATING AND MAINTENANCE COST SUMMARY, 2025[1]
(MILLIONS OF 2002 DOLLARS)

Alternative	Bus O&M Cost	In-Town BRT O&M Cost	Total Project O&M Cost
No-Build	$120.7	--	$120.7
TSM	$139.8	--	$139.8
Refined LPA	$144.3	$7.0	$151.2

Source: Parsons Brinckerhoff, June 2002.
Note: 1) Excludes TheHandi-Van O&M cost.

As indicated in Table 2.4-1, O&M costs for the No-Build Alternative in 2025 would be about $120.7 million (in 2002 dollars). This compares to current 2002 operating costs for the existing bus system of $114.1 million, not including TheHandi-Van operations. This increase is due to the fact that population growth between now and 2025 will require expanded service into areas not already served by transit.Comparing the TSM Alternative to the No-Build Alternative, one can observe that the TSM alternative would increase O&M costs by about $19.1 million, to about $139.8 million. The TSM Alternative attempts to accomplish as much as possible by expanding the bus system without making a major capital investment. The system expansion inevitably entails additional O&M costs.

The O&M cost for the Refined LPA includes two components: the cost of bus service and the cost of the In-Town BRT service. The In-Town BRT service includes $420,000 per year to maintain the electrical distribution infrastructure. The added cost of operating an extended a.m. zipper lane and the p.m. zipper lane on H-1 is assumed as a HDOT cost, not a PCTP cost.

2.5 IMPLEMENTATION SCHEDULE

This section presents the proposed implementation schedule for the alternatives. The proposed schedules for each alternative are shown in Figures 2.5-1 and 2.5-2.

The No-Build Alternative schedule consists of an ongoing, regular program of bus acquisition from the present through 2025. These acquisitions would both retire older vehicles, and increase the fleet size. Vehicle types would include those for TheBus and the TheHandi-Van programs. The baseline transit network includes the reorientation of the bus route structure to a hub-and-spoke network. The transit centers that have already been committed to the hub-and-spoke network and have been included in the Oahu Transportation Improvement Program, FY 2002-2004, would remain as part of the No-Build and TSM Alternatives, and the Refined LPA.

The No-Build Alternative also includes a new transit center with parking in Kapolei and a new park-and-ride along North-South Road.

The TSM Alternative also includes the No-Build Alternative elements and adds the following elements:

- Expansion of a bus maintenance facility between 2014 and 2015;
- Implementation of three bus priority measures, primarily between 2003 and 2005; and
- Construction of the a.m. zipper lane extension and Moanalua Freeway/Middle Street ramp improvements between 2006 and 2008.

The following factors were considered when developing the overall project schedule for the Refined LPA:

- Cash flow analysis;
- Geographically distributing project benefits at each phase of construction;
- Minimizing construction-stage impacts in one area at one time by geographically distributing the work at each stage of construction; and
- Synergies among different project elements.

Based on these considerations, the BRT project elements will be implemented as a series of manageable, discrete projects. At each stage of project development, including the initial IOS phase, the elements in place at that time would work with the rest of the transit network to improve transportation service. Benefits would start accruing immediately, and the level of benefit would increase as more components are added through time.

The resulting schedule includes the following time frames for the major Refined LPA project elements and other related projects:

- DTS is currently transforming the bus network to a hub-and-spoke network. The transit centers that would be constructed for the hub-and-spoke network are being implemented by DTS as separate projects from the Refined LPA and would be implemented from 2003 – 2005. These projects are designated in Table 2.5-2 as Hub-and-Spoke Transit Centers.
- Implementation of the In-Town BRT will begin with construction of the IOS (Iwilei-Waikiki Branch without EPT) from 2003 through 2005. There is further discussion on the Initial Operating Segment (IOS) between Iwilei and Waikiki in the IOS Supplement following Chapter 5 of this FEIS.
- The remainder of the In-Town BRT will be started shortly after the IOS, with concurrent implementation of the Kalihi Segment (2004 – 2006), Downtown – University segment (2005 – 2007) and Kakaako Mauka segment (2005 – 2006).

FIGURE 2.5-1
PRIMARY CORRIDOR TRANSPORTATION PROJECT IMPLEMENTATION SCHEDULE
NO-BUILD AND TSM ALTERNATIVES

FIGURE 2.5-2
PRIMARY CORRIDOR TRANSPORTATION PROJECT IMPLEMENTATION SCHEDULE
REFINED LPA

- During the initial years of operation, the Downtown – University segment of the BRT would operate in semi-exclusive curbside lanes on Kapiolani Boulevard before ultimately operating in exclusive lanes in the center of the street. Early year forecasts indicate that exclusive lanes will not be needed during the initial years.
- Other locations where priority lanes will be phased in over time are on Ala Moana Boulevard between Queen Street and the Ala Wai Canal and on Kuhio Avenue in Waikiki. Early year forecasts indicate that it would be preferable for the In-Town BRT to operate in mixed traffic along these segments until ridership levels support the conversion to semi-exclusive and exclusive lanes.
- Thirty hybrid-electric vehicles will be ordered for delivery in sync with completion of the fixed facilities so that operations can begin on the Iwilei-Waikiki branch in 2005 and in 2007 for the entire In-Town BRT. Ten of these needed for the Initial Operating Segment will be scheduled for arrival in 2005, ten for arrival in 2006 and ten in 2007. Additions to the existing Kalihi-Palama maintenance facility will not be needed to serve the ten IOS buses, but will be needed by 2007 to service and store the larger BRT fleet.
- Implementation of the embedded plate system, if selected as the long-term propulsion technology, would begin with construction along the Iwilei-Waikiki segment in 2010. The complete conversion to EPT on all In-Town segments would occur in 2016.
- Phasing of the Regional BRT will begin with the a.m. zipper lane extension in 2006. The p.m. zipper lane will be constructed between 2007 and 2009, with the extension of the zipper lane to H-2 via the Waiawa Interchange occurring between 2008 and 2011.
- Kapolei Transit Center will be built between 2009 and 2011; and the North-South Road Park-and-Ride and access improvements between 2011 and 2012.
- The Luapele Drive BRT ramp will be implemented between 2009 and 2012.

2.6 SCREENING OF ALTERNATIVES

The alternatives have evolved over the course of the Primary Corridor Transportation Project through an iterative process. A wide-range of options was progressively analyzed in increasing detail until it was winnowed down to the "best fit" alternatives described in Section 2.2. The evolution was based on conceptual engineering and cost analysis as well as public and agency review and comment. This Section summarizes the results of the various iterative steps in the development and screening of the alternatives:

- Section 2.6.1 describes the major alternatives that were eliminated early on. The initial alternatives, as presented in the project’s Environmental Impact Statement Preparation Notice (EISPN) and Notice of Intent to Prepare an EIS (NOI) were No-Build, Enhanced Bus/TSM, BRT and LRT with three LRT sub-alternatives (LRT 1, 2 and 3). Comments were received in response to the EISPN, and responses to those comments that addressed alternatives are listed in Section 2.6.1. Also listed in this section are comments received in response to the EISPN and NOI for the Supplemental DEIS.
- Section 2.6.2 discusses the alternative alignments for the In-Town BRT that were rejected.
- Section 2.6.3 sets forth the criteria for selection of the transit technology for the In-Town BRT and describes the candidate technologies no longer under consideration.

2.6.1 Alternatives Considered and Eliminated

Two alternatives often studied by other communities considering major transportation investments were eliminated early on by the public for Honolulu’s primary transportation corridor because they were deemed not responsive to the purpose and need statements in Chapter 1 and the stated goal of the City Council from the outset of the study, which was to keep the project affordable. These alternatives were a fully grade-separated transit alternative, and an all-highway alternative to transit. The public input and analytical process that led to elimination of these alternatives is discussed.

1) Fully Grade-Separated Transit Alternative

Advantages of a fully grade-separated transit alternative are:

- It would be completely buffered from the existing surface road network and its congestion, allowing transit vehicles to move quickly on a dedicated right-of-way, free from interference with any other transportation system; and
- It would not create a significant impediment to the operation of the surface road system.

A fully grade-separated transit system would offer the maximum performance possible with transit, and therefore provide transit patrons with the highest level of service.

Grade separation of a transit system in the primary transportation corridor could be achieved with an elevated guideway, an underground subway, or some combination of the two. Fully grade-separated transit systems for Honolulu have been seriously considered twice in the past three decades. In both instances, extensive analysis produced a strong and credible case for grade-separated transit investments. Nonetheless, the proposals ultimately were not built due to lack of sufficient support by the public and/or elected officials.

The concerns that led to the rejection of the most recently proposed elevated rapid transit system were primarily two: (1) its high cost and (2) its physical and visual impacts.

Previous studies have shown that construction of a subway through Honolulu's urban core would be prohibitively expensive. The extreme disruption of existing underground utilities and constant dewatering made necessary by a high water table and poor soils would drive construction costs to unacceptable levels ($3.6 billion in 2002 dollars for a 12.8-mile system along the presently proposed In-Town BRT alignment). While an elevated guideway would be less costly than a subway, such a system would still be substantially more expensive and visually more obtrusive than an at-grade system. The elevated system proposed most recently was abandoned when elected policymakers would not approve a local funding mechanism that required an increase in taxes. A 12.8-mile elevated rapid transit system along the presently proposed In-Town BRT alignment would cost on the order of $1.95 billion in 2002 dollars. By comparison, the In-Town BRT costs are estimated at approximately $240 million in 2002 dollars, assuming hybrid diesel-electric technology and approximately $325 million assuming embedded plate technology.

Public input received in hundreds of Vision Team and Oahu Trans 2K meetings and workshops attended by thousands of Oahu residents revealed widespread agreement that while an elevated transit system might serve the goals of improving in-town mobility and strengthening connections between communities, such a system would not foster livable communities. The predominant sentiment among thousands of participants was that a grade-separated transit system would be unacceptably: (1) intrusive on the visual environment; (2) divisive of communities; and (3) too expensive. These shortcomings were judged by public participants to outweigh the recognized benefits of a grade-separated system, i.e., high speed and capacity, increased reliability and reduced negative impact on the surface road system.

Honolulu's failure to complete the proposed elevated transit system a decade ago, and extensive public input into the current process, confirmed that a grade-separated system could not, because of its high costs, visual obtrusiveness, and community divisiveness, gain the level of local public and/or official acceptance necessary to sustain such an investment. All of the transit alternatives considered in the FEIS are therefore based on at-grade operation.

2) Highway Alternative to Transit Considered and Rejected

This section addresses the use of a highway solution to address the project's purposes and needs. The intent of the highway alternative is to provide people-carrying capacity comparable to the Regional and In-Town components of the transit system, and link the same origins and destinations.

Highway Alternative to the Regional Transit System

The construction and land acquisition costs to widen the H-1 freeway between Leeward Oahu and the PUC to serve commuter demands in single occupant vehicles rather than in BRT buses would be astronomical. The social and environmental impacts would also be intolerable. For comparison purposes therefore a greater shift to HOV usage was assumed for the all highway alternative to avoid these prohibitive costs and impacts. For the highway alternative, many of the features in the Refined LPA, including lane-use priority for multiple occupancy vehicles is assumed. An outbound, afternoon peak period contraflow zipper lane would be installed between Waiawa Interchange and Radford Drive and be available to vehicles with multiple occupants. The a.m. zipper lane would be extended to Middle Street, and the a.m. HOV/express lanes, and the p.m. HOV lanes currently in operation would be maintained. Ramp improvements at Waiawa Interchange would be provided. Park-and-rides would be constructed at Kapolei, North-South Road, and Aloha Stadium. Unlike the Regional BRT system, however, the proposed Luapele Drive bus priority ramp and the Middle Street Transit Center would not be provided. The cost of the highway only component from Kapolei to Middle Street in 2002 dollars would be approximately $150 million, in comparison to approximately $205 million for the Regional BRT system (exclusive of bus acquisitions and the cost of a new bus maintenance facility).

Roadway Alternative to the In-Town Transit Spine

To service commuter demands from the Ewa side of Oahu and travel demands from the Iwilei, Downtown and Kakaako communities equivalent to the In-Town BRT system, a highway alternative would require a two-lane viaduct on H-1 and North King Street would have to be widened to 6 lanes.

(1) Middle Street to Kalihi, Iwilei, Downtown and Kakaako Improvements
For the H-1 Viaduct, North King Street and other local roadway improvements listed below to provide comparable people-carrying capacity to the In-Town BRT system, the following would be required:

- Construct a two-lane H-1 viaduct (one lane in each direction separated by a median barrier) beginning about 1,000 feet before the tunnel under North King Street to just past the Vineyard Boulevard exit. The viaduct would be aligned along the side slope makai of H-1 (see Figure 2.6-1).
- Widen H-1 by one lane in each direction from the new viaduct to Punchbowl Street.
- Widen North King Street to six lanes between Middle Street and Liliha Street.
- Improve the North King Street/Liliha Street/Dillingham Boulevard intersection by adding lanes.
- Widen Liliha Street to six lanes from North King Street to H-1.
- Extend Queen Street and Pohukaina Street to Pensacola Street and convert to a one-way couplet.
- Reverse the one-way couplet direction of Pensacola Street and Piikoi Street.

These improvements from Middle Street to Downtown and Kakaako would cost a minimum of $950 million in 2002 dollars.

(2) Improvements to Access Waikiki
To service Waikiki at a level comparable to the BRT, the highway alternative would require an additional Koko Head-bound lane on H-1 between Ward Avenue and Punahou Street, a new interchange at McCully Street, a two-lane viaduct on McCully Street between H-1 and Waikiki, and various other interchange and highway improvements. The Piikoi Street Koko Head-bound on-ramp would be closed, thereby reducing the traffic volume on the H-1 segment between Ward Avenue and McCully Street. The elements to enhance access to Waikiki via roadway improvements would be as follows:

FIGURE 2.6-1
IMPROVEMENTS TO H-1 BETWEEN MIDDLE STREET AND PUNCHBOWL STREET REQUIRED WITH A HIGHWAY ALTERNATIVE TO IN-TOWN BRT

- Widen H-1 Ewa-bound by one lane between the Ward Avenue on-ramp to the Punahou Street off-ramp. Close the Piikoi Street on-ramp.
- Close the Lunalilo Street Ewa-bound on-ramp. Convert Magellan Avenue between Ward Avenue and Prospect Street to one-way operation. Construct Magellan Avenue braided on-ramp to connect just past the Pali Highway off-ramp.
- Construct a new H-1 interchange at McCully Street.
- Construct a new King Street Ewa-bound on-ramp (see discussion of Manoa interchange improvements that follow).

These improvements to access Waikiki would cost approximately $295 million in 2002 dollars.

(3) Improvements to Access UH-Manoa
Manoa interchange and other highway improvements are included in the highway only alternative to service the UH-Manoa area. In the Ewa-bound direction, traffic conditions would be improved by closing the H-1 Lunalilo Street on-ramp, eliminating the weave problem that creates congestion and backs up traffic beyond the Manoa interchange. A replacement on-ramp would be provided at Magellan Street, just prior to the Punchbowl on-ramp. These improvements would have operational benefits in the University to Downtown Ewa-bound H-1 segment. Roadway access improvements to the UH-Manoa area included in the highway alternative are:

- Close the Bingham Street Koko Head-bound and Wilder Avenue Ewa-bound off-ramps (to be replaced by the new McCully Street interchange).
- Construct Koko Head-bound collector-distributor (C-D) road starting just past the Bingham Street off-ramp. Redirect the University Avenue loop on- and off-ramps to connect to the C-D road.
- Reconstruct the University Avenue loop on- and off-ramps to connect to the C-D road.
- Construct new Lower Campus Road Koko Head-bound on-ramp and connect to new C-D road.
- Reconnect the new C-D road to H-1 just past the King Street off-ramp.
- Braid Ewa-bound University Avenue off-ramp with new two-lane King Street on-ramp
- Reconstruct University Avenue on-ramps to merge with H-1 just prior to the existing Wilder Avenue off-ramp (to be closed).

These improvements to access UH-Manoa would cost approximately $190 million in 2002 dollars.

The cost of the highway component from Kapolei to UH-Manoa in 2002 dollars would be approximately $1.6 billion, in comparison to approximately $445 million for the Regional and In-Town BRT system with hybrid diesel-electric technology and $525 million with embedded plate technology. It would therefore be significantly more expensive. Besides cost, there would be significant negative impacts to the environment as well as displacements if a highway alternative were to be substituted for the proposed BRT.

<u>Consistency with Project Purposes and Needs</u>

The project's purposes and needs are broader than just satisfying the suburban to Downtown commuter travel market. The purposes include fostering desired land use development patterns, enhancing the quality of in-town living and in-town mobility, and facilitating the development of livable communities throughout the island, but more importantly, in the PUC.

Given the project purposes and needs, a new or enhanced set of roads and highways that only provided for travel demand between suburban areas and Downtown would not satisfy the need of in-town travelers. For a highway to satisfy the project purposes and needs, it would need to perform the functions of the Regional and In-Town BRT system contained in the Refined LPA. A network of roadway improvements that attempts to provide this capacity is described above. However, a highway alternative, unlike the In-Town BRT would not enhance in-town mobility and the quality of in-town living by providing a high capacity transit system across Honolulu's Urban Core. A highway alternative would not provide an alternative travel mode to the automobile. A highway alternative would be counter to, not supportive of the desired redevelopment pattern in the PUC (livable communities). Additionally, the network of roadway improvements described above would adversely affect neighborhood cohesion.

Conclusion

Because a highway solution that encouraged suburban/Downtown commuter cars to enter Downtown would be inconsistent with the project purposes of enhancing in-town mobility, quality of life, and fostering desired land use development patterns, it has been rejected. As with grade-separated transit, highway investment alternatives in the primary transportation corridor have been well studied over the past three decades. The studies have consistently concluded that building only highways without a major investment in a transit system is not a viable approach to solve Oahu's travel needs. The reasons fall into three categories: (1) excessive cost; (2) traffic impacts; and (3) environmental and community impacts. Roadway construction on the scale to provide the capacity of the In-Town BRT system would adversely affect neighborhood cohesion, create substantial residential and business displacements, create visual intrusions, increase noise impacts, modify existing surface transportation patterns, and create major disruptions during construction.

Development in the primary transportation corridor is very dense and there are few if any potential routes for new highways. Construction and land acquisition costs for highways sufficient to meet the demand of commuters between Leeward and Central Oahu and the PUC would be astronomical. Any widening of the H-1 Freeway between Middle Street and University Avenue would also require rebuilding of overpasses and access ramps. Similarly, double-decking would be too expensive in both construction and environmental costs. The network of roadway improvements described above would cost approximately $1.6 billion or more and would be substantially more costly than the $445 to $525 million cost (excluding bus acquisition and maintenance facility costs) for the comparable BRT components that they would "replace".

Even if it were practical to construct sufficient new highway infrastructure to meet commuter demand, it would be virtually impossible to expand the capacity of downtown surface streets to efficiently absorb the increased traffic. Based on the projected growth in travel, the City and State would need to construct 13 freeway lane miles and eight principal arterial lane miles annually just to keep congestion at the present level. This is the equivalent of building a new H-3 Freeway every 5 years.

There is insufficient public support for an all highway alternative. The Oahu Trans 2K outreach meetings revealed a clear community consensus that an important goal of any transportation program in the primary transportation corridor must be to foster livable communities. This consensus included general agreement that extensive widening and/or double-decking of roads through existing neighborhoods is not an acceptable alternative to increasing people-carrying capacity with a higher level of transit. Elimination of these options, in effect, eliminates any highway only alternative, because any such alternative would require one or all of them.

3) Comments on the Alternatives from Responses to the MIS/DEIS EISPN and SDEIS EISPN

The initial No-Build, Enhanced Bus/TSM, BRT and LRT Alternatives were described in the project's original EISPN and NOI. No responses were generated by the NOI. Some of the comments received in response to the EISPN pertained to alternatives. Comments on the alternatives from the agency and public scoping meeting duplicated comments received in response to the EISPN. Table 2.6-1 lists the alternatives suggested for consideration by the public and government agencies commenting on the EISPN, and how those suggestions have been addressed in project planning. Comments were also received in response to the EISPN and NOI for the Supplemental DEIS. Table 2.6-1 also lists the alternatives suggested for consideration in to the SDEIS EISPN and NOI.

TABLE 2.6-1
EISPN COMMENTS RELATING TO ALTERNATIVES

Comment	Commenter	Response
Address Highway Alternatives	FHWA	1) The Refined LPA is a combined highway and transit alternative. 2) A highway only alternative is not sufficient to satisfy project purposes and needs, as addressed elsewhere in Section 2.6.1. A highway only alternative is inconsistent with the public's vision for the island's transportation system, as documented through the Oahu Trans 2K process. 3) Highway improvements are included in the OMPO regional transportation plan (TOP 2025).
Ensure multi-modal Alternatives – more than just cars and buses	FHWA, DBEDT-Office of Planning	The TSM Alternative and Refined LPA are multi-modal alternatives.
Identifying stand-alone components of Alternatives	SDOT	The components of the alternatives are described in Chapter 2.
Use of chartered/subsidized vehicles at peak hours	SDOT; Douglas Meller	TDM measures such as those proposed are incorporated in all alternatives. For example, all of the alternatives include a vanpool component (use of subsidized vehicles at peak hours) and subscription buses (such as LOTMA).
Ferry Alternative	DBEDT-Office of Planning	A ferry system does not represent a comprehensive alternative that satisfies all of the project's purposes and needs. While a ferry system may become an important element of the total transportation system, a ferry system alone could not serve existing or future travel demand in the primary transportation corridor.
TDM Alternatives – regulate parking fees, etc.; road pricing	DBEDT-Office of Planning; Douglas Meller; Bruce Plasch	TDM measures are included in the alternatives, but are not expected to fully address projected increases in travel demand in the primary transportation corridor.
Incentive and education programs on alternative transportation (e.g. various forms of HOV); disincentives on single-occupant private automobile transportation	Hawaii Bicycling League; Life of the Land	1) DTS and SDOT will continue to promote multi-modal transportation (e.g., SDOT will continue to promote the zipper lane and the vanpool program, and DTS will continue to promote its limited stop transit services, City Express! and Country Express!). 2) By using existing street capacity as a dedicated transitway, the Refined LPA will create incentives for the increased use of multiple-occupant vehicles along the alignment of the In-Town BRT.
Alternative with emphasis on servicing/improving access to Leeward areas, rather than getting to and from PUC	Leeward Oahu Transportation Management Association (LOTMA)	1) All of the alternatives include provisions for enhancing mobility within the Ewa area through increasing roadway connectivity and capacity, and enhanced transit service. All of the alternatives increase transit accessibility within, and to Kapolei/Ewa through the use of a "hub-and-spoke" bus network configuration. 2) All of the alternatives support the development of Kapolei as both a residential and employment center. 3) All of the alternatives would improve transit service along the Waianae coast. 4) Travel demand forecasting indicates that there will still be substantial travel between the PUC and other parts of the island, and within the PUC.

TABLE 2.6-1 (CONTINUED)
EISPN COMMENTS RELATING TO ALTERNATIVES

Comment	Commenter	Response
Segments of previously-indicated roadways for priority treatments do not appear to be included (e.g., Kamehameha Highway from Wahiawa to Radford Drive)	LOTMA	These measures are included in the No-Build, TSM, and Refined LPA Alternatives.
Alternative without Sand Island	LOTMA; Douglas Meller	The DEIS and SDEIS are both without the SISP. The SISP has become part of OMPO's TOP 2025 Plan.
Use double-decker buses	Hawaii Bicycling League	For reasons of operational efficiency and handicap accessibility, using longer articulated buses is a better way of increasing passenger capacity per vehicle than adding a second level of seating.
Why is an extension to Kahala not included?	Outdoor Circle; Life of the Land	The analysis of future travel demand and existing infrastructure capacity indicates that the major shortfall in transportation capacity extends from the PUC to the Ewa area.
Alternative focusing on safety measures to increase pedestrian, bicycle, disabled access. Such an alternative would increase demand for transit and other alternative transportation modes.	Life of the Land	The TSM and Refined LPA Alternatives are multimodal alternatives that increase pedestrian, bicycle and disabled access to transit and other alternative modes.
Do not create alternate freeway routes out of local streets	Hawaii Bicycling League	The highway only alternative was considered and rejected as discussed elsewhere in Section 2.6.1.
Enhanced Bus Alternative that increases both bus and auto efficiency	Life of the Land	The TSM and Refined LPA Alternatives enhance bus and auto efficiency to varying degrees.
Enhanced Bus Alternative that increases only bus efficiency, making buses more attractive than cars	Life of the Land	The TSM and Refined LPA Alternatives enhance bus and auto efficiency to varying degrees. The Refined LPA does more to increase bus and auto efficiency than the TSM Alternative. In the TSM Alternative, at some intersections, conditions for automobiles would be better than for transit vehicles.
Commuter-based Dedicated Bicycle Lane Alternative	Life of the Land	Both SDOT and DTS have developed master plans to enhance the network of bicycle facilities and increase bicycling as a serious transportation mode for some travel markets. Improvement of bicycle facilities is included in all of the alternatives.
Alternative eliminating some bus stops for more efficiency	Douglas Meller	Both the City Express! and Country Express! services are limited-stop bus services, and more limited stop services will be provided under the TSM and Refined LPA Alternatives.

TABLE 2.6-1 (CONTINUED)
EISPN COMMENTS RELATING TO ALTERNATIVES

Comment	Commenter	Response
Alternative promoting carpooling, and use of other unused equipment and capacity	Bruce Plasch	The TSM and Refined LPA Alternatives include incentives for HOV vehicles (carpooling), and other measures to enhance the operational efficiency of the existing transportation network including private sector transit services (using unused equipment and capacity).
Two separate, linked Express Bus systems: one to Honolulu and one to Kapolei, with circulator buses	Life of the Land	These features are included in the TSM and Refined LPA Alternatives.
Expansion of plans to elevated rail (1992 plan)	Life of the Land	A fully grade-separated transit system was considered but rejected, as discussed elsewhere in Section 2.6.1.
Employer Trip Reduction (ETR) plans	Life of the Land	These and other TDM measures are included in all of the alternatives.
Including express buses from outside PUC in a plan for PUC is beyond scope	Life of the Land	The PUC is so important in terms of islandwide trip generation and trip attraction that transportation planning for the PUC cannot be limited to only the PUC. Connections between the PUC and other parts of the island must also be considered.
Use of electric vehicles	Life of the Land	The Refined LPA includes the use of electric powered vehicles.
Consider a grade-separated light rail alternative.	Wendell Lum	A fully grade-separated transit system was considered and rejected since it was determined that the public was not in favor of an elevated transit system because of its high cost and its physical and visual impacts. This is discussed elsewhere in Section 2.6.1.
Do not operate the BRT on Richards Street.	Harbor Square Residents	The BRT alignment has been revised to travel on Alakea and Bishop Streets and will not travel on Richards Street between S. King Street and Nimitz Highway.
Include the proposed Farrington Highway transit corridor/BRT spur.	Gary H. Okino, Councilmember	A number of possible transit improvements are being considered for Waipahu. One of these would give priority to buses on Farrington Highway. Once a decision is reached on the type of improvement needed a separate environmental assessment will be undertaken.
Route the Kakaako-Mauka Branch continuing makai on South St. to Auahi St. turning left on Auahi and traveling straight on Auahi all the way to the Queen Street stub off Ala Moana.	Kakaako Improvement Association	The proposed Iwilei-Waikiki via Kakaako Makai Branch would provide convenient access to the “critical mass” area of Ala Moana Boulevard. The branch would operate along Ilalo Street, one block makai of Ala Moana Boulevard. Transit stops would be located at Coral Street and Ahui Street providing easy access to the businesses along Ala Moana Boulevard.
The Kakaako-UH Manoa branch should use Pensacola instead of Ward between S. King and Kapiolani.	Kakaako Improvement Association	One of the proposed refinements to the Refined LPA is to realign a portion of the Downtown-UH Manoa branch as suggested. The branch would continue along South King Street to Pensacola Street to Kapiolani.

Source: Parsons Brinckerhoff, June 2002.

2.6.2 Alignment Screening for the In-Town BRT

Numerous alignment options were considered between the termini at Middle Street, UH-Manoa and Waikiki. These options were generated and screened by the project technical staff through an intensive process that included extensive community outreach, and meetings with stakeholders. Options were located in existing street rights-of-way, but varied in terms of which streets would be used for the In-Town BRT. During the screening process, alignment options were contrasted with each other based on their ability to meet project purposes and needs (Chapter 1), ridership potential, and available right-of-way. Alignment options were then further refined through additional public input and more detailed technical studies. (Note: The currently proposed alignment for the In-Town BRT is described in Section 2.2.3.)

1) In-Town BRT Alignment Options

The following discussion summarizes the major alignment options considered but rejected from further consideration. Figure 2.6-2 shows the location of these alignment options.

1. North King Street: Greater business disruptions, greater traffic impacts, and fewer land use development opportunities in comparison to Dillingham Boulevard.
2. South Beretania Street: Too far mauka to serve the heart of Downtown, less land use development potential in comparison to Kapiolani Boulevard, narrow at Koko Head end.
3. King Street, Koko Head of Pensacola Street: Extensive impact to on-street parking in an area with many small business frontages requiring auto access. Less growth shaping opportunity.
4. Richards Street: The Kakaako Mauka and Makai alignments were shifted from Richards Street to Alakea and Bishop Streets in response to local residents' concerns that the alignment on Richards Street would have impacts on traffic, driveway access, pedestrian safety, and residential ambience.
5. Punchbowl Street: Punchbowl Street was analyzed as an alternative alignment to the Alakea and Bishop Streets couplet. It was rejected due to the traffic impacts it would produce at the S. King/Punchbowl Streets intersection, and its failure to serve the Aloha Tower area.
6. Nimitz Highway Koko Head of junction with Sand Island Access Road: Nimitz Highway is more of a regional highway facility than Dillingham Boulevard with higher speed, more through traffic, more control of access, etc. An alignment on Dillingham Boulevard would much better serve Kalihi residents, businesses and institutions. There is more opportunity to attract ridership on Dillingham Boulevard than on Nimitz Highway because of the types of land uses.
7. Ward Avenue: The In-Town BRT UH-Manoa Branch alignment was shifted from Ward Avenue to Pensacola Street between S. King Street and Kapiolani Boulevard based upon input from the Downtown/Kakaako and Mid-Town/University Working Groups. The Pensacola Street alignment would better serve McKinley High School and Kaiser Honolulu Clinic, and result in lessened traffic impacts than on the already congested Ward Avenue.
8. Auahi Street: Shifting the Kakaako Mauka Branch alignment from Pohukaina Street to Auahi Street was analyzed as an alternative to adding the Kakaako Makai Branch. This was rejected since it did not serve either Kakaako Mauka or Kakaako Makai very well, with excessive walking distances to many travel generators.
9. Ala Wai Boulevard: With right-side loading, all passengers would be required to cross Ala Wai Boulevard going to-and-from the transit stop. Also, it is removed from the densest areas of trip generation in Waikiki, which are towards Kalakaua and Kuhio Avenues. Because of this an extra 3 to 6 minutes (walking or on a bus) would be added to 83 percent of the BRT passenger trips when traveling Ewa bound.
10. Channel Street: Until HCDA and SDOT, Harbors Division decide on access improvements to serve the proposed cruise ship terminal at Pier 2, the BRT will use Forrest Avenue. Channel Street is a possible alternative routing in the future.

FIGURE 2.6-2
ALTERNATIVE ALIGNMENTS CONSIDERED FOR IN-TOWN BRT

2) In-Town BRT Terminus of UH-Manoa Branch

Two options for the terminus of the In-Town BRT UH-Manoa Branch were considered in addition to the proposed terminus at Sinclair Circle, as follows:

- Lower Campus: There is no available right-of-way for a transit stop or turnaround due to the narrowness of Varsity Place. The proposed terminus at Sinclair Circle serves the main campus better. Therefore this option was dropped.
- Varney Circle: This option would bring the In-Town BRT onto campus. Distances from the transit stop to most destinations at UH-Manoa would be decreased in comparison to the Sinclair Circle terminus, however, penetrating the campus with a transitway is inconsistent with master plans for UH-Manoa. Also, there would be a significant added cost for virtually no ridership gain. Therefore this option was dropped.

3) Waikiki Alternative Alignments Considered

Because many comments on the SDEIS were related to alternative alignments considered in Waikiki, this summary has been added in the FEIS.

Five alternative alignments were considered in Waikiki: (a) Kalakaua/Ala Wai Loop, (b) Kalakaua/Kuhio Loop (the LPA), (c) Kuhio/Ala Wai Loop, (d) Two-Way BRT on Kuhio, and (e) Kapiolani/Kalakaua/Ena Road.

a. The Kalakaua/Ala Wai Loop was eliminated because it would force 80% of the BRT users to walk an extra 650 to 800 feet or ride around a loop (when going Ewa bound), which would add an additional three minutes to their trip; it also would not serve the greatest amount of ridership. All the Ala Wai Boulevard origins and destinations are on one side of the street only; therefore, all BRT users would have to cross Ala Wai Boulevard to get to and from the Ala Wai Boulevard BRT stops.

b. The Kalakaua/Kuhio Loop (the LPA), would serve just as many residents as the Kalakaua/Ala Wai Loop (6,200), but is much closer to the jobs in Waikiki (14,300 on Kalakaua, 10,500 on Kuhio compared to 1,500 on Ala Wai). This alignment is closer to the places local residents from outside Waikiki want to go in Waikiki as represented by the location of hotel rooms, restaurants and shopping (12,200 hotel rooms on Kalakaua, 4,200 on Kuhio compared to 800 on Ala Wai Boulevard). This alignment will still permit sidewalks to be widened on Kuhio Avenue and maintain automobile access plus passenger and freight loading/unloading for hotels and businesses on Kalakaua and Kuhio Avenues. This alternative was selected as part of the LPA.

c. The two-way Kuhio Alignment would have all the BRT stops on one street, which would be less confusing for infrequent users. It would however displace passenger and freight loading zones on Kuhio Avenue and/or restrict them to late night/early morning hours. The Kuhio Avenue level of service would result in twice the delay compared to the Kalakaua/Kuhio Loop. The bicycle route would be substandard (i.e. shared lanes less than 14 feet) and it would preclude sidewalk widening on Kuhio Avenue.

d. The Kuhio/Ala Wai Loop would be closer to Waikiki residents (4,500 housing units on Ala Wai compared to 1,700 housing units on Kalakaua). This alignment would also result in less vehicle and pedestrian interference on Ala Wai Boulevard than on Kalakaua Avenue. However, this alignment would be inconvenient for Waikiki employees (14,300 jobs along Kalakaua compared to 1,500 jobs along Ala Wai). This alignment would also be inconvenient for local residents from outside Waikiki who want to visit the hotels, restaurants and shops in Waikiki (12,200 hotel rooms on Kalakaua compared to 800 along Ala Wai). This alignment would also require that all BRT users cross Ala Wai Boulevard to get to and from the Ala Wai Boulevard BRT stops.

e. The alignment entering Waikiki via Kapiolani/Kalakaua/Ena Road versus Ala Moana/Kalia would consolidate a portion of the UH and Waikiki BRT branches. It was rejected because it would require a grade separation at the Kapiolani/Kalakaua/Atkinson intersections, require widening the Kalakaua Avenue bridge, and would not serve major generators on Ala Moana Boulevard near Hobron Lane.

2.6.3 Evaluation of Technologies for the In-Town Transit Segment

A large number of comments were made on technology. This section addresses those comments.

The purpose of this Section is to explain the basis for rejecting technologies not presently under consideration for the In-Town segment of the transit spine. Section 2.2.3 discusses the technology selection criteria. In summary, they are:

- Right-of-Way (ROW): Selected technologies must not require a new dedicated ROW or grade separation because urban Honolulu has insufficient space for a new dedicated ROW, and a grade-separated system was previously proposed but did not obtain the required City Council support due to the need for a tax increase. Suitable technologies must be able to operate at-grade on existing streets and highways. While vehicles may operate in exclusive lanes, the technology must permit at-grade cross traffic and pedestrian crossings.
- Line Capacity: Selected technologies must have the capacity to move more than 3,000 passengers per hour per direction because travel demand forecasting indicates that this is the approximate line haul requirement in 2025.
- Emissions and Noise: Air pollution emissions from selected technologies must be substantially lower than the 2004 EPA regulations provided in Table 2.2-9. Once adopted, the EPA's 2004 regulations will apply to all transit vehicles, including those powered by diesel engines. Noise emissions must not exceed those of a conventional light rail vehicle or trolley bus with electric propulsion.
- Service Proven: Selected technologies must either show sufficient maturity, or the technology must be in an advanced stage of development. If the technology is not yet "proven in revenue service", the risk associated with implementing a developmental technology must be carefully weighed.
- Affordability: Selected technologies must have system costs per unit length not exceeding that of an at-grade light-rail line of $60 million per mile.
- Safety: Selected technologies must meet local and national life/safety requirements.
- Accessibility: Selected technologies must comply with Americans with Disabilities Act (ADA) requirements.
- Visual Impact: Selected technologies must not require an overhead guideway or overhead contact system (overhead wires, or catenaries) for wayside propulsion that disrupts mauka-makai views.
- Flexibility: Selected technologies must have the capability to be re-routed around blockages, and not preempt parades and other activities along the alignment.
- Sense of Permanence: Selected technologies must represent a substantial government commitment to a specific alignment in order to evoke the desired land use response from land developers.

1) Overview of Technologies

These criteria were applied to the following conventional and emerging technologies, which are described in more detail in Product 1-6 Technical Paper Assessing the Capabilities of Selected Transit Technologies (July 1999), Product 1-9 In-Town BRT: Choosing the Final Technology (April 2000), and Product 4-3 Quarterly Report Summarizing Current Development Status and Operating Data for Candidate BRT Technologies, (June 2001).

- Rail Rapid Transit;
- Commuter Rail;
- Light Rail Transit (LRT);

- Monorail;
- Automated Guideway Transit (AGT), including Automated People Movers;
- MAGLEV (magnetically levitated vehicles);
- Light-Duty Bus;
- Standard Bus;
- Conventional Trolley Bus (with overhead wires—“catenary”);
- Tram-on-Tires (large multi-articulated bus-type vehicle, some with catenaries);
- Articulated Diesel-Powered Bus;
- Articulated Hybrid-Powered Electric Bus; and
- Articulated Electric Bus Powered from Embedded Power Plates

Based on the screening criteria, the following technologies were eliminated as candidates for the In-Town transit segment:

- Light-Duty Bus: does not provide adequate capacity for the line haul requirement of the In-Town segment.
- Tram-on-Tires operated in driverless mode: not considered safe for operation at-grade in mixed traffic, hence requires dedicated ROW.
- Conventional Trolley Bus: requires overhead catenary wires with negative visual impact.
- Rail Rapid Transit: too expensive, and requires grade separation and exclusive ROW.
- Commuter Rail: too expensive, and requires exclusive ROW.
- Light Rail Transit: A detailed comparison of LRT technology with modern electric bus technology is provided later in this Section. While this technology was included in the initial alternatives, it was later rejected because of the relatively high costs associated with track work and utility relocation. LRT performance could be achieved with electric bus technology at a substantially reduced cost.
- AGT: requires grade separation and/or exclusive ROW.
- Monorail: requires grade separation and/or exclusive ROW.
- MAGLEV: too expensive, technology not sufficiently mature, and requires grade separation and exclusive ROW.
- Standard and/or Articulated Low-Floor Diesel-Powered Buses: would not meet project emission and noise goals for the In-Town transit system.

Propulsion systems using Compressed Natural Gas (CNG) were also eliminated due to the unavailability of and lack of infrastructure for natural gas on Oahu.

The technologies currently under consideration are: (1) rubber-tired, (2) low floor, (3) driver operated, (4) located at-grade, typically in a street lane, (5) able to be crossed by pedestrians and other traffic, (6) single articulated, (7) capable of operating under their own power for at least short distances to avoid disruptions in the transit lanes, and (8) electrically powered.

The requirement for electric power is driven by concerns about air and noise emissions. Electric power would be provided either from a touchable power strip embedded in the street (embedded plate technology), or on-board hybrid electric propulsion in which a diesel engine powers an alternator which produces electricity. The electricity is stored in a battery, and the power is distributed by cable to electric “hub motors”, located on each wheel. In this manner, it is possible to eliminate the drive train, facilitating a “low floor” vehicle configuration.

The resulting candidate technology options for the In-Town BRT vehicle are:

- Articulated low-floor hybrid-powered electric bus; and
- Articulated low-floor electric bus powered by an embedded plate power collection system.

Since both of these are emerging technologies the impact analyses in the FEIS are designed to permit either option to be selected at a later date. The degree to which each technology would produce different impacts is discussed in the FEIS where there would be a difference.

Fuel cell technologies are also a possible technology for the In-Town System, but fuel cell buses will not be commercially available soon enough for application during the early stages of the Primary Corridor Transportation Project.

2) Detailed Comparison of Light Rail and Electric Bus Technologies

At the time the EISPN and NOI for the MIS/DEIS were issued, both LRT and BRT were under consideration for the Urban Core. Subsequent to the issuance of the EISPN and NOI, and the scoping process, technical analysis led to a decision to drop the LRT option. Analysis showed that BRT technology could provide the service characteristics required in the Urban Core at a much lower cost than LRT. Moreover, considering the specific conditions and goals of this project, BRT was determined to be superior to LRT in critical ways – so much so that further study of LRT was deemed to be unjustified. The following discussion amplifies the comparison between LRT and BRT technologies.

Similarities

<u>a) Performance: Speed, Capacity and Noise</u>

Both LRT and BRT technologies would have similar performance characteristics, especially when applied to the central, highly urbanized section of the Urban Core. At in-town speeds, both would have similar acceleration rates; and nominal emergency braking rates would also be similar.

While LRT technology could be configured to provide far greater peak line capacity through the use of multi-vehicle trains, ridership estimates for the corridor indicate that both LRT and BRT technologies would meet the capacity needs for the foreseeable future.

From the perspective of noise and vibration impacts, especially at the proposed operating speed in the range of 35 mph or less, no significant differences would exist between the two technologies. Speeds in the range of 35 to 40 mph represent a "break point," above which steel wheels on steel rails would be somewhat quieter than comparable electric-powered rubber-tired vehicles, and below which slower speeds would slightly favor rubber tires over steel wheels.

The noise differences are not large, however, and vehicles of both technologies would run more quietly than diesel buses. In sharp curves, rubber tires have an advantage because wheel squeal could occur with steel-wheeled vehicles.

<u>b) Sense of "Permanence"</u>

The major transit investment should not only be compatible with, but also reinforce, the City's growth shaping goals. To achieve this, the transit system should be seen as a permanent, form-giving component of the mobility system that serves the Urban Core.

For the transit system to achieve a sense of permanence, it should have formal transit stops, be fixed in a permanent alignment, and be designed to be compatible with the varied communities through which it passes. If designed properly, a transit system that would use either steel-wheeled or electric-powered rubber-tired vehicles could achieve this objective.

c) Alignment Flexibility

Both technologies would have the ability to traverse relatively sharp curves and steep grades. BRT vehicles could make tighter turns than LRT vehicles, however based upon the proposed alignment in the Urban Core, no apparent constraints exist which would strongly favor one technology over the other.

d) Exclusive Street-Level Alignment

The most important performance features both technologies could achieve would be higher average speeds, higher frequency service, greater ultimate capacity, and far more reliable service than buses or streetcars in mixed traffic. This would be accomplished by providing, as much as possible, an exclusive lane, or where this is not possible semi-exclusive lane, for the transit vehicles in both directions of travel.

e) Power Source

Both the LRT and BRT technologies recommended for the In-Town system would be powered by electric motors. LRT technologies require wayside power delivery systems. While the traditional form of wayside power supply for an LRT system is overhead wires, the recommended wayside power distribution system would be a relatively new in-street buried electric power distribution and collection technology referred to as “embedded plate”. Embedded plate technology (EPT) could also be used for the BRT vehicles. Hybrid diesel/electric buses, which are also under consideration, do not require a wayside power delivery system, since the power is generated on-board.

f) Achieving Positive Separation From Traffic

Both vehicle technologies could operate in mixed traffic or could be configured to operate in exclusive and semi-exclusive lanes so that automobiles, trucks, bikes and buses only cross the lanes at traffic signal-controlled intersections.

If mixed traffic were to be allowed with through and turning automobiles in the transit lane, the operation would become very slow and unpredictable – analogous to a streetcar or conventional bus. The travel time, ridership, and urban design advantages would be reduced. Therefore, to the maximum extent possible, both technologies should be separated from adjacent lanes by positive delineation, consisting of raised markers and colored pavement.

g) Level Boarding

Both technologies would use either partial or 100 percent low-floor vehicle designs, which speeds ingress and egress for all passengers, and facilitates accessibility for physically disabled individuals. With floor heights of approximately 13 inches, these vehicles would allow the system to use stations with relatively low, unobtrusive platforms, and still provide level passenger loading without steps.

Differences

In ways just described, both LRT and BRT technologies could meet the requirements for the In-Town system, and could do so attractively and efficiently. Important differences, however, exist which are described next.

a) Station Interface and Accessibility

An advantage at stations would exist if vehicles operating in the exclusive section of the system were guided.

Through positive guidance, it is possible to control the interface between a LRT vehicle and the station platform such that the platform-to-vehicle floor gap (both horizontal and vertical) would be within the limits specified by the Americans with Disabilities Act (ADA) for wheelchair accessibility.

For LRT vehicles, level boarding would be achieved from the guidance provided by steel rails embedded in the street and vehicle suspension characteristics designed to meet the gap requirements.

Conceptually, a similar capability could be obtained for BRT vehicles using a guided technology.

With non-guided vehicles, it is possible to have the vehicle operator steer the bus to a berthing position and equip the vehicle with a relatively simple on-board ramp which would deploy to bridge the remaining gap. This is successfully done on a number of existing transit systems.

b) Operating Labor/Training of Vehicle Operators

Higher-capacity vehicles and the ability to form trains would give LRT systems a potential operating labor advantage over BRT systems because one vehicle operator could be responsible for far more passengers.

Travel demand forecasts for this project, however, showed that entraining LRT vehicles would not be necessary, even during peak periods.

c) Operating Flexibility

A major advantage of the BRT technologies under consideration is their ability to leave the designated BRT lanes to go around blockages in the lane (e.g., underground utility work, accidents, etc.) and to be re-routed during parades or other special events. The steel-wheeled LRT vehicles do not have this operational flexibility.

d) Ridership Difference

Because the standard LRT vehicles can carry 30 to 40 percent more passengers per vehicle than articulated electric buses, even when operating as single units, fewer vehicles are needed to serve the same level of ridership.

While positive from an operating cost standpoint, it results in less frequent service being needed with LRT vs. BRT systems. The service frequency difference resulted in approximately 20 percent fewer riders projected to use the LRT than the BRT system.

e) Capital Costs

The most significant cost differentiators are the trackwork for the LRT system, and the transit vehicles.

Embedded trackwork for an LRT system is estimated to add substantial cost compared to a BRT system which does not require tracks (in the range of $9-13 million more per mile). Over approximately 12.8 miles, the cost differential would be $115-166 million.

Vehicle cost differences while not straightforward to estimate could be as much as $2 million per vehicle. Electric buses are much less expensive than LRT vehicles. Even considering that fewer LRT vehicles would be required than electric buses (due to the per vehicle capacity differential) there would still be a substantial total cost savings in rolling stock with electric buses.

Potential BRT vehicles generally require replacement at the standard replacement interval for buses of 12 to 15 years. In contrast, LRT vehicles would require replacement at the standard LRT interval of 25 to 30 years. The longer useful life of the LRT vehicles would over time help to offset the greater initial cost for LRT vehicles.

The total BRT system construction cost savings assuming the embedded plate technology would be on the order of 35 percent, compared to a comparable LRT system. The differences are due to trackwork, life cycle vehicle costs and other fixed facility savings. The cost difference would be even greater if the comparison was between LRT and a BRT system using hybrid diesel/electric vehicles rather than EPT.

Evaluation of BRT and LRT Technologies

In the following comparison of LRT versus BRT, the physical alignment and station locations were assumed to be the same for both technologies. The only differences between them would be the technology used and the associated operating and performance characteristics (i.e. vehicle capacities, frequency of service, etc.).

<u>a) Criterion One: Improve Mobility</u>

Ridership would be lower on the LRT than on the BRT system because of the difference in the frequency of service. Because of the larger size of standard LRT vehicles, the headways on an LRT system would be longer to serve the same number of passengers. Because of the less frequent service on an LRT system, some passengers would find an LRT system less attractive than a BRT system with shorter headways. Therefore, ridership projections for the BRT option were forecast to be almost 20 percent greater than on the LRT alternative because of the more frequent service.

<u>b) Criterion Two: Growth-Shaping</u>

Both LRT and BRT systems in a transitway with similar transit stops would impart a sense of “permanence” to help catalyze transit-oriented development along the alignment. The perception of “permanence” (a permanent government commitment to a particular alignment) is likely to be greater with an LRT system because of the increased level of fixed investment in the alignment (e.g., investment in trackwork). Therefore, the land use investments may be somewhat greater from an LRT system than a BRT system.

<u>c) Criterion Three: Quality of Life and Livability</u>

Quality of life was evaluated from the perspective of the amount of noise and air pollution, which would be experienced by people along the In-Town transit alignment. Livability was assessed from the standpoint of visual orientation, streetscape, and scale; in other words, a sense of place.

Noise Levels

The passby noise of an LRT vehicle operating at 30 mph at a distance of 50 feet is 78 dBA in comparison to a BRT vehicle, which has a passby level of 75 dBA. This is a difference of 3 dBA, which is a “perceptible” to “noticeable” change in noise level. Therefore, the passby noise from an electric bus would be somewhat quieter than the passby noise from an LRT vehicle. Wheel squeal noise for LRT due to steel wheels running on steel rails in areas with tight turning radii could generate noise. Vibration impacts could also occur with the LRT technology, although these impacts would be mitigated. Electric bus technology would have lower noise levels than LRT technology due to the use of rubber tires. Vibration impacts would also be less.

Air Quality

LRT vehicles and electric buses powered by embedded plate technology would emit no air pollutants at street level. Hybrid diesel/electric buses would emit minimal levels of air pollutants because the diesel generator would be operating at peak efficiency from an environmental perspective.

d) Criterion Four: Capital and Operating Costs

Capital costs for the In-Town BRT system would be 35 percent less than with an LRT system on the same alignment. This cost difference even reflects the need to replace BRT vehicles on a 12-15 year replacement cycle while LRT vehicles have a 30-year useful life. The added cost for the LRT option reflects the high costs of trackwork, yards and shops. Vehicle costs would actually be somewhat less for the LRT option when the less frequent replacement cycle and smaller fleet requirements are taken into account.

Annual systemwide transit operating and maintenance costs were also estimated for each alternative for the forecast year 2025. Operating and maintenance costs would be roughly the same for the LRT and BRT options, even though the LRT would require specially trained and dedicated mechanics and operators.

e) Criterion Five: Cost-Effectiveness Analysis

Cost-effectiveness analysis compares the ridership gains with the costs for each alternative. This analysis has become an important part of the federal procedures for analyzing major transit projects. A project's cost-effectiveness index (CEI) is determined by a formula that measures the project's net cost per new passenger that would be attracted to a build alternative relative to the TSM Alternative. Therefore, when two project alternatives are compared in terms of their CEIs, the one with the lower index represents the more cost-effective of the two.

The CEI for the BRT option is very competitive compared to other national projects competing for funding. The cost per new rider gained with the LRT would be 2.8 times as costly as with the BRT. As a result, the CEI for the LRT option would be substantially less competitive in competing for FTA New Starts funds than the BRT Alternative.

f) Summary of Evaluation Findings

The BRT option would be more advantageous than LRT in meeting the islandwide and in-town mobility needs while supporting all of the livability goals. It has the highest ridership. The cost-effectiveness of the BRT option would be competitive with projects currently recommended for funding by FTA. The LRT option would be less competitive. Advanced bus technologies (embedded plate and hybrid diesel/electric) offer the quality of life benefits (e.g., reduced or no air and noise emission levels) previously associated only with LRT technology. The BRT also offers operating flexibility around blockages and special events that is not possible with LRT. The BRT system provides the features needed for Honolulu at substantially lower cost than an LRT system. Therefore, the LRT option was eliminated because most of the performance of an LRT system could be achieved at a substantial cost savings with low-floor, electric-powered, articulated bus technology.

CHAPTER 3 AFFECTED ENVIRONMENT

CHAPTER OVERVIEW AND ORGANIZATION

This chapter describes the existing social and natural environmental conditions in the primary transportation corridor. The existing conditions and the affected environment are the same for both the Refined Locally Preferred Alternative (LPA) and the Initial Operating Segment (IOS). The IOS is a subset of the Refined LPA, covering only the length from Iwilei to Waikiki. Therefore, this chapter does not have a separate section specifically for the IOS.

It is a requirement of the State Environmental Impact Statement (EIS) Law that current conditions in the area potentially affected by a project be described in order to benchmark them. Only after the existing conditions are understood may an assessment be made of the impacts that the No-Build, Transportation System Management (TSM) and Refined Locally Preferred Alternatives could create. Chapter 4 discusses the impacts of these alternatives on the transportation system; Chapter 5 discusses the impacts of these alternatives on other aspects of the environment.

The existing conditions information has been revised to reflect the most current data available since the Major Investment Study/Draft EIS (MIS/DEIS) and Supplemental Draft EIS (SDEIS) were published and circulated for public and agency review and comment. It should be noted that not all 2000 Census data was available at the time this Final EIS was compiled.

Because of the size and diversity of the primary transportation corridor, this section focuses on parameters that:

- are most pertinent to consider for a transportation project;
- were identified for particular attention through the scoping process, comments received on the MIS/DEIS and SDEIS, and other public involvement activities;
- represent particularly sensitive resources;
- would be affected differently by the alternatives (and therefore would reconfirm selecting the Refined BRT Alternative as the Refined Locally Preferred Alternative (Refined LPA)
- are required by law to be assessed.

Disciplines addressed in this Chapter include:

- Land Use and Economic Activity
- Transportation
- Neighborhoods
- Visual and Aesthetic Conditions
- Air Quality
- Noise and Vibration
- Ecosystems
- Water Resources
- Hazardous Materials
- Historic and Archaeological Resources
- Parklands

3.1 LAND USE AND ECONOMIC ACTIVITY

3.1.1 Regional Summary

Oahu is 44 miles long and 30 miles wide, containing almost 380,000 acres of land surrounded by a coastline of 112 miles. Because much of the land is mountainous, only about 54 percent of the total area is potentially developable (see Figure 3.1-1). The island is the most populous in the Hawaiian Archipelago, and comprises the City and County of Honolulu. Based on State land use classifications, 26 percent of Oahu is classified as Urban, 34 percent is classified as Agriculture, and the remaining 40 percent is classified as Conservation.

3.1.2 General Study Area

The primary transportation corridor is by far the most urban region on Oahu and in the State, supporting over 57 percent of the island's population and over 80 percent of all employment. The City and County of Honolulu divides Oahu into eight planning areas, each with specific land use objectives and development requirements as discussed below. Figure 3.1-2 illustrates the planning areas.

1) Primary Urban Center (PUC) Planning Area

The PUC extends from Pearl City at the Ewa end to Waialae-Kahala at the Koko Head end, and is bounded on the north by the Koolau Mountain Range and on the south by the coastline (see Figure 3.1-2). The 2000 Annual Report on the Status of Land Use on Oahu (May 2001) states that approximately 16 percent of the 65,000 acres within the PUC is designated for residential use; four percent is designated for commercial/industrial use; 12 percent is designated for public facilities, including parks; 53 percent is designated for preservation; and 13 percent is used by the military.

The PUC is by far the most populated planning area. In 2000, its resident population was 426,000, or close to 49 percent of the island total. Throughout the 1980s and 90s, population in other parts of the island increased at a faster rate than in the PUC. This is due to a substantial increase of relatively affordable housing in the Ewa and Central Oahu planning areas during this period, shifting population growth from the PUC to these outlying regions.

The housing stock of this area is diverse, varying from single-family dwellings to high-rise apartment buildings. The density of units in the PUC is higher than in any of the other planning areas.

2) Ewa and Central Oahu Planning Areas

The southern portion of the Central Oahu planning area is within the primary transportation corridor, including Waipahu Town and the surrounding Kunia, Waikele and Waipio communities. The Central Oahu planning area contains the wide fertile plateau between the Waianae and Koolau Ranges previously in extensive agricultural use.

Much of the Ewa planning area is within the primary transportation corridor. Much of this planning area is a low elevation plain that extends from sea level at the coastline to an elevation of only about 100 feet three to five miles inland. Like Central Oahu, the Ewa region was once one of Oahu's prime sugarcane cultivation areas, but is now experiencing urban growth as the State, and City and County of Honolulu support development of the region as the "secondary urban center" of Oahu. Diversified agricultural activities, as well as park construction have also begun on certain abandoned cane fields.

FIGURE 3.1-1
PRIMARY TRANSPORTATION CORRIDOR STUDY AREA

FIGURE 3.1-2
DEVELOPMENT PLAN AREAS

3.1.3 Corridor Land Uses

1) PUC Planning Area

The PUC features the most diverse land uses on the island (see Figures 3.1-3A through 3.1-3C). Developable areas in the valleys and on the Koolau ridges support primarily single-family residential uses, such as the neighborhoods of Manoa, Pacific Heights, Nuuanu, Kalihi Valley, Halawa Heights, Newtown, Pearl City Uplands, and Pacific Palisades. Multi-family residential areas are predominantly in Waikiki, McCully-Moiliili, Kaheka, Makiki- Punchbowl, upper Downtown, Kalihi-Palama, Salt Lake, and Pearlridge.

Industrial uses are mainly located in Kakaako, Iwilei, Kalihi-Kalihi Kai, Sand Island, Mapunapuna, the Airport area, Pearl Harbor, and Halawa and Waiawa Valleys.

The PUC remains the center of government, business, economic, and cultural activities in the State. The PUC contains most of the major employment centers on the island, such as the Honolulu International Airport, and Sand Island and Mapunapuna industrial districts; Downtown Honolulu including the adjacent Capitol District; and Waikiki. In 2000, the PUC contained about 380,000 jobs, or 78 percent of the total civilian employment on the island.

The PUC also contains a substantial military presence, mostly in the western portion. Pearl Harbor Naval Complex, Hickam Air Force Base, Tripler Army Medical Center, and Fort Shafter are the main military installations. Combined employment at these installations is 22,944 (State Databook, 2001).

Office, retail, service, and government centers are located primarily between Kalihi-Palama and Kaimuki, an area constituting the urban core of Honolulu ("Urban Core"). The Urban Core is extremely diverse in terms of land uses: low to high-density residential; small to large-scale commercial and industrial establishments; and recreational facilities ranging from small neighborhood parks to large regional parks, such as Ala Moana and Kapiolani Parks. This area contains Chinatown, the island's central business district (Downtown Honolulu), the State Capitol, City Hall (Honolulu Hale), and the State's largest visitor accommodation and activities center, Waikiki. A sizable commercial area is located on the western side of the PUC, between Aiea and Pearl City.

2) Central Oahu Planning Area

Central Oahu planning area land uses include prime agricultural lands, military installations, and major residential communities. Over the last two decades, the land use focus of Central Oahu has been residential development, although there is a small high technology park near Mililani. Most of the new housing has been developed in the master planned communities of Mililani, Waipio, Waikele and Kunia.

Waipio, Waikele and Kunia are relatively new suburban communities of single-family residences and low-density townhouses. All three contain large commercial shopping centers: Waipio Shopping Center, Royal Kunia Shopping Center, Costco and Waikele Center/Waikele Premium Outlets. The latter three draw shoppers from other parts of the island and tourists.

Waipahu is one of Central Oahu's oldest communities, generally bounded by Waiawa Interchange to the east, Pearl Harbor West Loch to the south, the H-1 Freeway to the north and Fort Weaver Road to the west. While originally a set of plantation villages built around the Waipahu Sugar Mill and segregated by ethnicity, since the end of the Second World War, Waipahu has transformed into suburban and commercial land uses. Today, the northern part of Waipahu is predominantly single-family residential, and the southern portion along Farrington Highway is mixed-use commercial, light industrial and low- to medium-density apartments. The commercial uses consist of strip malls and car dealerships along the highway.

FIGURE 3.1-3A
DEVELOPMENT PLAN LAND USES: WAIPAHU – PEARL CITY

FIGURE 3.1-3B
DEVELOPMENT PLAN LAND USES: AIEA – FORT SHAFTER

FIGURE 3.1-3C
DEVELOPMENT PLAN LAND USES: KALIHI - UNIVERSITY

Mililani has a population of approximately 90,000 residents as well as a regional shopping center and several community shopping centers. It is immediately outside the primary transportation corridor. However, most of the workers who live there are commuters who use the corridor on a daily basis.

3) Ewa Planning Area

Ewa has experienced rapid residential growth within new master planned developments. The oldest community in the region is Ewa Villages, which was built in the 1890s and consisted of eight villages housing immigrant plantation workers, segregated by national origin. Ewa Villages is currently undergoing redevelopment to provide newer housing and commercial uses. Ewa Beach, Honokai Hale, and Makakilo were developed from the 1950s through the 1970s, and all are still expanding. Newer communities include West Loch, Ewa Gentry, Ocean Pointe, and the Villages of Kapolei. Newer communities consist mostly of single-family residences or low-density townhouses.

The City of Kapolei, located in the western portion of the Ewa Planning Area, is being developed as the “second city” of Oahu. Existing land uses include a community shopping center, a 16-screen movie theater complex, a 73-acre regional park, an office complex, a bank office building, and a State office building. A State Public Library, a City and County Civic Center, and a police station were recently opened. Other employment areas in Ewa include Kalaeloa (formerly Barbers Point Naval Air Station), Campbell Industrial Park, Kapolei Business Park and Ko Olina resort. Campbell Industrial Park, located just west of the primary transportation corridor, contains approximately 300 businesses on 1,367 acres, including the State’s two petroleum refineries, large warehouses and distribution facilities. Ko Olina, also west of the corridor, is a 1,000-acre resort that includes a premier hotel, townhouses, four sandy lagoons, a golf course and clubhouse, and a marina. Additional housing is under construction or being planned, and substantial further growth for Ko Olina is planned.

Agriculture in the Ewa planning area continues despite urban encroachment. Since the end of sugarcane cultivation in the early-1990s, small-scale leased farms cultivating diversified agricultural crops have begun to operate in old sugarcane fields between Waipahu and the Villages of Kapolei.

3.1.4 Proposed Development Projects

The City of Kapolei, the area from Pearl City to Aloha Stadium, and the area from Middle Street to Kapahulu and Waialae Avenues (the “Urban Core”) contain many development projects in the planning or construction phases. Table 3.1-1 shows proposed development projects in the primary transportation corridor. As they are implemented, these projects will influence adjacent land uses.

3.1.5 Plans and Policies

1) State Plans, Policies and Controls

Land Use Plans and Controls

Hawaii State Plan

The Hawaii State Plan (June 1991) consists of comprehensive goals, objectives, policies and priorities in all areas of government functions. These functions include the protection of the physical environment, the provision of public facilities, and the promotion and assistance of socio-cultural advancement.

State Land Use Commission

Chapter 205, Hawaii Revised Statutes (HRS), involving the State Land Use Commission (SLUC), regulates land use by establishing four categories: Urban, Agriculture, Conservation, and Rural. The intent of the land classification is to accommodate growth while retaining important natural resources. Each district has specific land use objectives and development constraints.

TABLE 3.1-1
PROPOSED DEVELOPMENT PROJECTS WITHIN THE PRIMARY TRANSPORTATION CORRIDOR

Ewa

- Kalaeloa/Barbers Point Harbor expansion (ongoing)
- Kapolei Business Park (ongoing)
- City of Kapolei expansion (office buildings, civic center, commercial, etc.) (ongoing)
- Redevelopment of Barbers Point Naval Air Station (general aviation airport, regional park, etc.)
- Build out of the Villages of Kapolei (ongoing)
- East Kapolei
- Ocean Pointe (formerly Ewa Marina) (ongoing)
- Build-out of Ewa Gentry (ongoing)
- Build-out of Ewa Villages (ongoing)

Central Oahu

- Redevelopment of Waipahu Sugar Mill site (ongoing)
- Build-out of Royal Kunia (ongoing)
- Build-out of Waikele (ongoing)
- Waiawa by Gentry

Pearl Harbor

- Manana redevelopment, including Pearl City Junction (ongoing)
- Retail expansion of Pearl Highlands Center
- Ford Island redevelopment
- Aiea Sugar Mill site redevelopment
- Kamehameha Drive-In Theater site reuse
- Redevelopment makai of Kamehameha Highway between Waimalu and Kalauao Streams

Honolulu (Urban Core)

- Various high-rise housing projects in Waikiki
- King Kalakaua Plaza, Phase II (commercial, Waikiki)
- Various senior housing projects in McCully/Moiliili
- Entertainment complex at Ala Moana Center
- Victoria Ward shopping, entertainment, and housing (ongoing)
- Various high-rise housing projects in Kakaako
- Kakaako Makai redevelopment
- Various housing projects in the Punchbowl area
- Bank of Hawaii office tower
- Aloha Tower complex expansion

Source: City and County of Honolulu Department of Planning and Permitting, 2000.

Most of the lands within the primary transportation corridor are Urban. However, part of the Ewa planning area within the corridor has an Agriculture designation. On Oahu, the City and County of Honolulu administers land uses within Urban districts, with the following exceptions:

- State lands, such as lands controlled by the State of Hawaii Department of Transportation (HDOT) (e.g., portions of Honolulu Harbor, Honolulu International Airport and State roadway facilities) or the Hawaii Department of Land and Natural Resources (HDLNR) (e.g., submerged lands and state parks);
- Areas controlled by the military;

- The Kakaako Community Development District, which is administered by the Hawaii Community Development Authority (HCDA), a State authority; and
- The Aloha Tower area controlled by the Aloha Tower Development Corporation (ATDC), a State entity.

Coastal Zone Management

The objectives and policies of the Hawaii Coastal Zone Management (CZM) Program are intended to protect and manage Hawaii's valuable coastal areas and resources. Pursuant to 15 CFR 930.32, federally permitted, licensed or assisted activities undertaken in or affecting Hawaii's coastal zone must be consistent with the objectives and policies of the CZM program. The primary transportation corridor is in the CZM area.

Kakaako Community Development District Plans

Kakaako, the area east of Downtown Honolulu bounded by South Street to the west (Ewa), Kapiolani Boulevard to the north (mauka), Piikoi Street to the east (Koko Head) and the coastline to the south (makai), is a special development district under the management of the Hawaii Community Development Authority (HCDA)**,** a State agency established for long-range community planning and development. HCDA has developed major redevelopment plans for this district, which are in various stages of implementation. These redevelopment plans are intended to make Kakaako a major activity node for residential, industrial, office, maritime and other land uses. The Kakaako Community Development District Plan, adopted in 1982, serves as the basis for guiding public and private development activities in Kakaako.

For planning purposes, the district has been divided into Mauka and Makai areas, demarcated by Ala Moana Boulevard.

The Makai Area Plan, originally prepared and adopted in 1983, was revised in 1998. The basic land use premise of the plan is that substantial portions of the 221-acre Makai Area should be set aside for public enjoyment and access to the waterfront. According to the plan, the overall vision is "to create an active area through a variety of new developments, including an expansive waterfront park, maritime uses along the harbor, restaurants, seafood markets and entertainment along Kewalo Basin, a children's museum and a theater for performing arts, a world-class aquarium, and commercial development of the interior areas" (Makai Area Plan, August 1998). Plans for the area also include a new UH medical school and a private biomedical research facility.

HCDA's development strategy incorporates commercial activities, parks, restoration of the former Ala Moana Pump Station for a restaurant and Hawaiian music venue, and the inclusion of other public facilities in Kakaako Makai. As part of this strategy, current projects include infrastructure improvements to Ilalo Street and relocation of the City corporation yards out of Kakaako.

The Mauka Area Plan addresses 300 acres north of Ala Moana Boulevard, and was revised in 1997. The overall goal of the Mauka Area Plan echoes that of the Kakaako Community Development District Plan, which is to guide private and public development in the revitalization of Kakaako. Recent improvements to Kamakee Street from Kapiolani Boulevard to Queen Street improved circulation in the Mauka Area. Higher density development, including additional medium-to-high density residential uses, are envisioned for the Mauka Area.

Aloha Tower Development Plan

The State's Aloha Tower Development Corporation (ATDC) is responsible for the redevelopment of 22 acres of pier area fronting Downtown Honolulu. The ATDC developed a four-phased master plan in the late 1980s for Piers 5 to 14. The proposed plan includes maritime facilities, restaurants, retail shops, offices, a hotel, and residential condominiums. Thus far, only the first phase, redevelopment of Piers 8 to 10, has been completed. Phase One consists mainly of the Aloha Tower Marketplace development, which includes restaurants and retail stores. ATDC is updating the current master plan for Piers 5/6, 10/11 and 12 – 14, and is expected to lay the groundwork for additional development opportunities.

Honolulu Waterfront Master Plan

The Honolulu Waterfront planning area encompasses approximately 1,550 acres adjoining Honolulu Harbor. The 1989 Honolulu Waterfront Master Plan Final Report (HWMP) (1989), prepared for the Office of State Planning (now the Office of Planning in the State Department of Business, Economic Development and Tourism), included a variety of mixed-use developments in the harbor vicinity, and a Sand Island Parkway, including a tunnel between Sand Island and Kakaako. The Oahu Commercial Harbors 2020 Master Plan has updated portions of this Plan.

State Transportation Plans

Oahu Commercial Harbors 2020 Master Plan

The HDOT Harbors Division prepared the Oahu Commercial Harbors 2020 Master Plan (OCHMP) (May 1997), a long-range plan for all of the commercial harbors on the island: Honolulu Harbor, Kalaeloa Barbers Point Harbor, and Kewalo Basin. The OCHMP updated separate 2010 plans prepared for Honolulu and Kalaeloa Barbers Point Harbors. The OCHMP addressed issues and needs relating to the maritime industry exclusively (e.g., cargo and passenger movements and fishing), unlike the HWMP, which addressed additional waterfront issues, such as commercial development and landside recreation.

Major port facility improvements recommended for Honolulu Harbor include a new container terminal at the former Kapalama Military Reservation, improving Kalihi Channel to establish a second harbor entrance, a cruise ship terminal at Pier 2, expansion of the Young Brothers interisland terminal at Piers 39 and 40, a roll-on, roll-off (RORO) automobile terminal at Piers 31 to 33, an excursion vessel passenger terminal at Piers 26 and 27, and berths at Piers 19 and 20 for cruise ships. Recommended roadway improvements include a perimeter roadway around Honolulu Harbor, and a roadway tunnel under Kalihi Channel (in association with deep-draft improvements to Kalihi Channel) to replace the Sand Island Bridge.

Statewide Cruise Facilities Study (Needs Assessment)

This HDOT (Harbors Division) study assessed existing and projected levels of passenger cruise ship activity in Hawaii, in part to help the State determine cruise ship infrastructure and facility requirements for each county. Recommendations included construction of a cruise ship terminal at Pier 2 in Honolulu Harbor, and development of interim cruise ship facilities at Piers 19 and 20. Physical improvements on the neighbor islands were also recommended.

Honolulu International Airport Master Plan -- 2010

The Honolulu International Airport Master Plan -- 2010 (State of Hawaii, Department of Transportation, Airports Division, August 1994) largely focuses on facility development within the boundaries of the airport. While there is some discussion of roadway improvements, including roads in the vicinity of the airport, such improvements are limited to street level changes, and will not directly impact the grade-separated H-1 traffic.

Bike Plan Hawaii

Bike Plan Hawaii (April 1994) recommended improvements to the State's bikeway systems. This Plan serves as guidance to the HDOT and county transportation agencies when roadways are built or modified. The Honolulu Bicycle Master Plan (April 1999), prepared by the City and County of Honolulu, recently supplemented this plan (the County plan is discussed more fully below). Figures 3.1-4A through 3.1-4C show existing and future bikeways, according to Bike Plan Hawaii and the Honolulu Bicycle Master Plan.

Recreational Plans

State Comprehensive Outdoor Recreation Plan (SCORP)

First prepared in 1966, the SCORP is updated every five years by the State Parks Division of HDLNR. The December 1996 statewide plan provides the planning assumptions and technical basis for developing and operating recreational facilities. This document identifies existing federal and state outdoor recreational facilities, and an assessment of future demand for recreation resources and programs. Surveys and interviews conducted in conjunction with this plan in 1996 indicated that there is increasing demand for

FIGURE 3.1-4A
BIKEWAYS: WAIPAHU – PEARL CITY

FIGURE 3.1-4B
BIKEWAYS: AIEA – FORT SHAFTER

FIGURE 3.1-4C
BIKEWAYS: KALIHI – UNIVERSITY

additional and safe bicycling and pedestrian corridors statewide. While demand for ocean recreational facilities will continue, future development of marinas and recreational harbors will most likely have to be carried out by private developers (p. 4-13, SCORP 1996).

Educational Institution Plans

UH Manoa Master Plan

The Long Range Development Plan, University of Hawaii, Master Plan 1994 Update (Prepared by Group 70 International for University of Hawaii -- Community Colleges Physical Facilities Planning and Construction Office, April 1994) is a facility plan for the University of Hawaii's Manoa campus. The Master Plan is reviewed and approved by the UH Board of Regents, and serves as a basis for infrastructure improvements and capital program funding requests. The 1994 Update of the UH Manoa Campus long range development plan proposes to enhance the "sense of place" on the campus by locating both pedestrian and vehicular gateways at key access points to campus. The UH plans to construct a pedestrian gateway at the intersection of Campus Road and University Avenue, and a landscaped mall continuing to a "town center" at Varney Circle.

Leeward Community College and West Oahu Campus Master Plan

The purpose of the Leeward Community College Long Range Development Plan, Final Environmental Assessment (LRDP) (Prepared by Group 70 International, for University of Hawaii -- Community Colleges Physical Facilities Planning and Construction Office, March 1999) is to develop a plan for the physical site and facilities uses within the West Oahu campus and improve the transportation linkage to the surrounding community, among other goals. Most plans specified in the LRDP are aimed at improving on-site facilities. There is some discussion of ways to improve the access to and from the campus that is currently limited to Waiawa Road and Ala Ike Road on the makai side of H-1, near the Farrington Highway interchange.

UH West Oahu

A University of Hawaii (UH) West Oahu campus is planned for the Ewa region. A site on the mauka side of the H-1 Freeway in the vicinity of the future North-South Road Interchange was previously considered, but this plan was abandoned. Following extensive discussions with the community, UH officials are likely to move ahead on a 500-acre site on the Ewa plain located between Kapolei Golf Course and the future North-South Road.

UH Health and Wellness Center

The UH Health and Wellness Center will be a new campus for the U.H. John A. Burns School of Medicine (JABSOM) in Kakaako Makai. It is located between Ilalo Street and the Kakaako Waterfront Park. The first phase of the project includes construction of two buildings that will house the JABSOM, biomedical research facilities and the Cancer Research Center of Hawaii. Phase II of the project includes a parking structure and a future research center.

2) Military Installation Planning

Pearl Harbor

The Department of the Navy prepared the Pearl Harbor Naval Complex Master Plan (October 1991), a comprehensive planning document, to guide the development of the Pearl Harbor Naval Station and surrounding auxiliary facilities. Also noteworthy is the development of a master plan for Ford Island, known as the Ford Island Concept Plan (1998). This master plan envisions approximately $600 million of investment in residential, tourist, military and other land uses on Ford Island through public/private partnerships.

Ford Island Development

The U.S. Department of the Navy (Navy) is embarking on a program to sell or lease certain land holdings, and to improve the infrastructure, reconstruct facilities and locate or relocate Navy functional elements, family housing and supporting activities on Ford Island. Although this program involves properties other than Ford

Island, which is located within Pearl Harbor and is accessed via the recently completed Admiral Clarey Bridge off of Kamehameha Highway, it is nevertheless named the "Ford Island Development Program" because it implements specific authorizing legislation (10 USC 2814). The other affected properties are at Halawa Landing, Iroquois Point/Puuloa Housing, Waikele Branch Naval Magazine, and the former Barbers Point Naval Air Station. On Ford Island, the Navy is planning to provide up to 420 new family housing units, up to 190 thousand square feet of administrative space, bachelor enlisted quarters for up to a thousand personnel, a consolidated training complex, and infrastructure to support the development. Up to 75 acres on Ford Island are allowed to be developed by the private sector.

Fort Shafter Complex

The U.S. Army's Fort Shafter is another military facility within the study corridor and the Fort Shafter Installation Master Plan (1985) describes the planning framework for this facility. Currently, there are 4,080 bachelor and family housing units within the Fort Shafter complex, which consists of Fort Shafter, Tripler Army Medical Center (TAMC) and Aliamanu Military Reservation (AMR). Most military housing at Fort Shafter is located on the mauka side. There are no new units programmed between now and the year 2005.

Armed Forces Recreation Center – Fort DeRussy

A Master Plan, prepared by the University of Southern Mississippi (1988) for the U.S. Army and approved by the Secretary of the Army (1988), recommended improvements to Fort DeRussy placing greater emphasis on its recreational mission. An EIS for the Master Plan was prepared and received approval in 1991. The facility has subsequently been redeveloped to fulfill its primary mission of recreation and most Army reserve functions have been moved to Fort Shafter. The improvements included extensive landscaping of the Army post, construction of the second hotel tower, construction of a 1,300-stall hotel parking structure, and realignment and widening of Kalia Road.

Hickam Air Force Base

The Comprehensive Plan - Future Land Use Plan, Hickam Air Force Base, Oahu, Hawaii (October 1988) guides land use planning and future development of the base. New facilities are not planned near Nimitz Highway.

Kalaeloa (former Barbers Point Naval Air Station) Reuse

The naval air station was closed in 1999. A master plan designates various mixed uses to be developed over time. The redeveloped area would support about 3,390 jobs including the general aviation airport, the National Guard and lands for Hawaiian Home Lands use.

Fort Armstrong

Fort Armstrong is a former military facility located at Piers 1 and 2 in the Kakaako Makai area. This area was once the primary container cargo facility on Oahu. Now it is used for maritime break-bulk and limited container cargo operation, ship maintenance operation, and Foreign Trade Zone warehouse and offices. In the future, Pier 2 could be needed as an additional cruise boat terminal.

3) City and County of Honolulu Plans and Policies

General Plan of the City and County of Honolulu

The General Plan (revised 1992) includes broad statements on the objectives and policies of the City and County of Honolulu with regard to overall physical and economic development of the island, as well as the health and safety of the island's residents. The General Plan directs population growth and new residential development primarily to the PUC and Ewa, while limiting growth in other areas.

Development and Sustainable Community Plans

The City and County of Honolulu prepared a Development or Sustainable Community Plan for each of the eight planning areas. A general overview of the planning areas within the primary corridor can be found in Section 3.1.2. Past development plans consisted of detailed (by parcel) land use and public facilities maps. In 1992, the Revised Charter of the City and County of Honolulu was amended to require development plans to "consist of conceptual schemes for implementing and accomplishing the development objectives and policies of the General Plan and serve as a policy guide for more detailed zoning maps and regulations and public and private sector investment decisions."

The PUC Development Plan (PUC DP) is currently being revised. Until the revision is adopted, the previously approved PUC DP remains in force. According to the PUC DP (Revised Ordinances of Honolulu, 1990, Chapter 24, Article 2), the PUC shall accommodate relatively intensive commercial, governmental, residential, and recreational functions while safeguarding and adding to the existing amenities of the City's urban environment.

The Ewa Development Plan (Ewa DP) (adopted in August 1997) was the first to be updated consistent with the 1992 Charter Amendments. The Ewa DP consists of vision statements, community design principles and guidelines; and conceptual mapping of open space networks, public facility networks, and urban land uses. The vision for Ewa is the development of a "Secondary Urban Center" on Oahu to provide opportunities for urban development and residential growth. The Ewa DP projects over 38,000 housing units located primarily in master planned communities in the Ewa area by 2020. Substantial job growth is also estimated, with over 52,000 jobs in the Ewa DP Area by 2020. The City of Kapolei would have over 25,000 jobs in office, retail and government; Campbell Industrial Park and parcels adjacent to Kalaeloa Barbers Point Harbor would support more than 7,000 jobs; and the redeveloped Kalaeloa area would support approximately 3,390 jobs. Kapolei has already become the headquarters for some State agencies, which have relocated from Downtown, and a further shift in government jobs to Kapolei is expected. The City and County Civic Center and a new police station have opened in Kapolei.

The Central Oahu Sustainable Community Plan (Central Oahu SCP) has been completed, and has passed first reading at the City Council. It was referred to the Council's Planning Committee for further public discussion. Until the Central Oahu SCP is adopted by the City Council, the previous Central Oahu Development Plan remains in force.

Under the Revised Charter (1992), the Department of Planning and Permitting (DPP) administers zoning. The City and County of Honolulu Land Use Ordinance (LUO) is the local zoning code, and zoning is required to be in conformance with the Development Plans, which are policy guidelines. Zoning designations within the study area are shown in Figures 3.1-5A through 3.1-5F.

The LUO includes Special Districts and zoning designations (see Figures 3.1-5A through 3.1-5F). The study area contains the Chinatown, Hawaii Capital, Punchbowl, Thomas Square, Waikiki and Diamond Head Special Districts. The Special District ordinance outlines specific objectives and design controls for each special district, such as guidelines for architectural controls, building heights, landscaping, and preservation of visual resources and historic structures.

Special Management Area

The 1975 Shoreline Protection Act designated a shoreline Special Management Area (SMA), and Hawaii Revised Statutes (HRS) Chapter 205A outlines special controls, policies, and guidelines for development

FIGURE 3.1-5A
ZONING MAP: KAPOLEI – EWA

FIGURE 3.1-5B
ZONING MAP: WAIPAHU – PEARL CITY

FIGURE 3.1-5C
ZONING MAP: AIEA – FORT SHAFTER

FIGURE 3.1-5D
ZONING MAP: KALIHI – UNIVERSITY

FIGURE 3.1-5E
ZONING MAP: DOWNTOWN - KALIHI - SAND ISLAND

FIGURE 3.1-5F
ZONING MAP: LEGEND

within the SMA. This Act gave the counties authority to issue permits for development proposed within the SMA. For the City and County of Honolulu, DPP is the agency that administers the SMA use permit program.

The City Council acts on major SMA permits (those with capital costs over $125,000 within the SMA). The DPP director acts on minor SMA permits. Figures 3.1-6A through 3.1-6D show the SMAs within the study area.

Honolulu Bicycle Master Plan

The City and County has developed a bicycle facility master plan for the PUC. The Honolulu Bicycle Master Plan was completed in April 1999, and includes the following concepts to improve bicycling in the PUC:

- Bike-Friendly Route from Pearl City to Kahala: a bicycle-friendly route providing connections between Pearl City and Kahala (across urban Honolulu), tailored to the more experienced cyclist;
- College Access Network: bikeway improvements on roadways leading and adjacent to colleges and universities; and
- Lei of Parks: A system of bikeways linking regional and local parks from Aloha Tower to Diamond Head.

Hub-and-Spoke Bus Route Revision Program

This program involves converting the existing City and County bus routes from a predominately radial network to a hub-and-spoke configuration. Hub-and-spoke networks provide an integrated system of convenient and accessible circulator, local and express routes, organized around transit centers. The bus routes are the "spokes" and the transit centers are the "hubs" in the hub-and-spoke network. So far, 18 routes in Leeward Oahu have been converted to hub-and-spoke, and plans are underway in Central Oahu for conversion of the routes there in 2003.

4) Oahu Metropolitan Planning Organization

The Oahu Metropolitan Planning Organization (OMPO) is a joint State of Hawaii and City and County of Honolulu organization. It prepares the Oahu regional transportation plan (ORTP). The ORTP has many functions, including the identification of facilities and programs to meet increased travel demands on Oahu. The Transportation for Oahu Plan 2025 (TOP 2025), adopted in April 2001, updates the 2020 ORTP in response to the changing transportation needs of Oahu and extends the planning horizon to the year 2025. The In-Town and Regional BRT elements of the Refined Locally Preferred Alternative are included in the TOP 2025 Plan.

5) Private-Sector Plans

Waikikian Development Plan

The Hilton Hotels Corporation is planning to replace the former Waikikian Hotel, a parcel located along Ala Moana Boulevard between Hilton Hawaiian Village and the Renaissance Ilikai Hotel, with a new 350-foot hotel building containing up to 350 vacation ownership units, that includes parking, a restaurant, retail shops, a wedding chapel, and a swimming pool. The project also includes widening Dewey Lane, the road between the Waikikian Hotel site and the Ilikai, as well as appurtenant facilities and infrastructure.

Waikiki Beach Walk

Outrigger Enterprises, Inc. will be redeveloping its landholdings makai of Kalakaua Avenue, in Waikiki, along Lewers Street, Kalia Road, Beach Walk and Saratoga Road. The project, spanning two phases, will upgrade

FIGURE 3.1-6A
SPECIAL MANAGEMENT AREA: KAPOLEI – EWA

FIGURE 3.1-6B
SPECIAL MANAGEMENT AREA: WAIPAHU – PEARL CITY

FIGURE 3.1-6C
SPECIAL MANAGEMENT AREA: AIEA – FORT SHAFTER

FIGURE 3.1-6D
SPECIAL MANAGEMENT AREA: KALIHI – UNIVERSITY

five existing hotels, demolish six older hotels, and provide a new entertainment retail complex, a new hotel, and enhanced public areas.

3.1.6 Population and Employment Trends

The State Department of Business, Economic Development, and Tourism (DBEDT) develops population and employment forecasts for the entire island; the City and County's Department of Planning and Permitting then steps down the islandwide "control total" to subareas of the island.

1) Population Trends and Projections

Table 3.1-2 contains 2025 population projections from OMPO's latest Transportation for Oahu Plan 2025, and summarized distribution of the island totals by subareas as of 2000. The plan was developed based on socioeconomic and land use forecasts provided by the City and County of Honolulu Department of Planning & Permitting for the year 2025, which were based on State DBEDT projections. These more recent forecasts have been used to update travel demand analysis in the FEIS.

TABLE 3.1-2
PROJECTED OAHU POPULATION SUMMARY

		Forecast	
	2000	**2025**	**Change From 2000**
PUC DP			
Waikiki	21,900	24,120	2,220
Other PUC	404,413	470,311	65,898
Ewa	68,092	114,205	46,113
Other	378,510	421,171	42,661
Total	**872,915**	**1,029,807**	**156,892**

Source: OMPO, April 2001, based on C&C of Honolulu Department of Planning and Permitting forecasts.

The State and City have a development policy that encourages growth in the PUC and Kapolei, in part to minimize suburban sprawl and the associated costs of extending public infrastructure and services into presently undeveloped areas. The goal of preserving open space ("keep the country country"), given the limited land area of Oahu, is not only a governmental policy, it is a widespread public sentiment frequently repeated during the public outreach activities that have been conducted during project planning.

Therefore, consistent with the goal of concentrating new growth in the PUC and Kapolei/Ewa, the majority of the population growth between now and 2025 is forecasted to occur in the primary transportation corridor. As shown in Table 3.1-2, the fastest growing area will be Ewa. Approximately 114,000 people are projected to be living in the Ewa area in 2025, a growth of up to 67 percent in 25 years. The PUC also will experience significant growth, increasing by 66,000 people. The Central Oahu population is projected to increase from 148,380 in 2000 to 172, 977 in 2025, a gain of 17 percent (OMPO, April 2001).

2) Employment

Accompanying the growth in population will be an increase in employment. Employment increased at an average annual rate of 4.13 percent from 1970 to 1990. As shown in Table 3.1-3, according to the April 2001 OMPO forecast the number of jobs on Oahu is projected to increase by approximately 152,000 jobs between the years 2000 and 2025. About 51 percent of these new jobs will be located in the PUC. A second area for employment growth is expected to occur in Ewa/Kapolei and Waipahu (Department of Planning and Permitting, City and County of Honolulu, January 1999).

Major employment centers in the primary transportation corridor are:

- Pearl Harbor;
- Pearlridge Center;
- Honolulu International Airport;
- Industrial districts in Pearl City, Halawa Valley, Airport area, Mapunapuna, Kalihi, Iwilei and Kakaako;
- Downtown Honolulu and the Capitol District;
- Ala Moana Center and surrounding area;
- Waikiki; and
- University of Hawaii at Manoa.

Major employment centers outside or near the primary transportation corridor are Ko Olina Resort, Campbell Industrial Park and Kalaeloa (former Barbers Point Naval Air Station).

TABLE 3.1-3
PROJECTED EMPLOYMENT SUMMARY [1]

		Forecast	
	2000	**2025**	**Change From 2000**
PUC DP			
Waikiki	41,997	49,175	8,178
Other PUC	338,805	408,670	69,865
Ewa	14,895	56,634	41,736
Other	90,792	122,998	32,206
Total	**485,992**	**637,477**	**151,985**

Source: OMPO, April 2001, based on C&C of Honolulu Department of Planning and Permitting Forecasts.
Notes: [1]Excludes construction employment, which totaled 24,800 in 1997 and is projected at 26,200 in 2025.

The trade, service and government (military, federal, State and County) sectors are the major employment categories, representing 76 percent of all jobs on the island. This distribution of employment among sectors is not anticipated to change in the near future.

Despite the growing popularity of telecommuting and other trends in the nature of the workplace, future employment is forecast to be substantial and centralized in the PUC and Ewa (Kapolei).

3.2 EXISTING TRANSPORTATION CONDITIONS

This section presents a summary of the characteristics of the existing transportation system in the study area.

3.2.1 Highway Network

Oahu's road network is heavily constrained by topography (major roadway facilities in the study area are shown in Figure 3.2-1). Roadways are primarily located in the coastal areas between the mountains and ocean. The dominant highways, with the exception of H-2 and H-3 Freeways and Likelike and Pali Highways, generally parallel the coastline and carry Ewa-Koko Head traffic. Oahu has three state freeways:

- H-1 Freeway, extending from Ewa to Waialae/Kahala;
- H-2 Freeway, servicing traffic between Mililani/Wahiawa and Pearl City; and
- H-3 Freeway, carrying traffic between Windward Oahu and Pearl Harbor.

FIGURE 3.2-1
EXISTING HIGHWAY SYSTEM

Average daily traffic (ADT) indicates the level of roadway usage at representative points on the roadway. The H-1 Freeway is the most traveled freeway on Oahu, with ADT of 216,966, measured between the Waiau and Halawa Interchanges (traffic in both directions). ADT on H-2, south of Kipapa Bridge, is 78,858. The lowest ADT is 39,605, recorded on H-3, north of Halawa Interchange. (Traffic Survey Data, Island of Oahu, 2000).

Route 78 (Moanalua Road) serves as an H-1 Freeway bypass from the Kahauiki Interchange in Kalihi to the Halawa Interchange. It then continues as an arterial roadway, nearly parallel to Kamehameha Highway, winding through Aiea and ending in Pearl City at Waimano Home Road. Motorists traveling between Kahala and Hawaii Kai use Kalanianaole Highway. Pali and Likelike Highways traverse the Koolau Mountains, connecting the downtown area with Windward Oahu (Kailua and Kaneohe). Additional roads carry regional and local traffic.

This road network serves many travel markets, including home to work trips from residential areas in Central and Leeward Oahu to Downtown, Honolulu International Airport to Waikiki, and goods distribution from Honolulu Harbor.

Level of Service F (congested conditions) with characteristic stop-and-go traffic, is common during the morning and afternoon peak hours on the major roadways, particularly on the H-1 Freeway from the Waiawa Interchange (near the junction of H-1 and H-2) to the University of Hawaii area. Signalized routes, like Nimitz Highway, also are congested, typically requiring more than one traffic signal cycle to clear intersections and with long vehicle queues during peak periods.

Based on existing peak hour traffic volumes, the transportation corridors Ewa of Downtown Honolulu are the most constrained, with corridor deficiencies ranging from 2,500 to 4,000 vehicles per hour (vph). Other corridors, such as the Trans-Koolau and East Honolulu corridors, experience peak period congestion but not to the same degree as the primary transportation corridor.

To avoid peak-hour congestion, many motorists have shifted their time of travel, resulting in extended peak traffic hours. Weekday morning and afternoon peak traffic conditions typically last two to three hours each. Mid-day weekend traffic conditions also can resemble the weekday peak period conditions.

Recent improvements have provided better mobility for buses and vehicles with two or more passengers. The zipper lane, a contra-flow freeway lane created by using movable concrete barriers, has created a relatively high-speed morning peak period lane on the H-1 Freeway between Waiawa Interchange and Pearl Harbor Interchange. This lane has helped reduce travel time between these interchanges, but vehicles in the zipper lane must still rejoin vehicles in the general purpose lanes at Keehi Interchange and face the same delays as other vehicles traveling Koko Head from there.

Physical constraints make the addition of highway capacity within the primary transportation corridor very difficult, particularly in the segment between Middle Street and Downtown. Given the difficulty of adding roadway capacity within this corridor, more innovative approaches to accommodating future growth in travel are needed.

3.2.2 Transit Network

The City and County of Honolulu has an extensive fixed-route bus system (TheBus) that provides islandwide service and is described in the following sections.

1) Bus Routes and Operations

TheBus system began service in March 1971 with a fleet of 67 buses. The active bus fleet for FY 2001 includes 525 vehicles, with 450 buses operating on over 88 routes during peak periods. All buses are equipped with bicycle racks and encourage multi-modal travel.

During the weekdays, morning service begins at 3:16 a.m. and night service ends at 1:54 a.m. On Saturdays and Sundays, TheBus system operates from 3:51 a.m. to 2:03 a.m.

The current bus network consists of five route types:

- Urban Trunk – routes serving the downtown area;
- Urban Collector – routes connecting downtown neighborhoods to urban trunk routes and downtown destinations;
- Suburban Trunk – routes providing direct service between suburban neighborhoods and the downtown area;
- Suburban Feeder – routes connecting smaller suburban neighborhoods to suburban trunk routes; and
- Express – routes providing limited stop service from suburban areas to the downtown area.

Besides serving different parts of the island, each route type provides different levels of service, with the urban trunk routes providing the highest levels of service and the express routes providing a limited number of trips during peak periods only. With the exception of suburban feeders, nearly all routes provide direct access to the downtown area. This high level of service benefits passengers with limited wait times and provides multiple options for passengers traveling in the downtown area.

Figures 3.2-2A through 3.2-2D show the major existing bus routes. Routes 1 through 32, exclusive of Route 11, serve the central urban area of Honolulu. Route 11 and Routes 47 through 65 provide bus service between Central Honolulu and the outlying suburban and rural areas of Oahu. Routes 70 through 77 provide feeder and shuttle bus service within selected communities of suburban and rural Oahu. Routes numbered 80 and higher provide peak-period express service between suburban residential communities and major employment and activity centers (i.e., Downtown, University of Hawaii at Manoa, Waikiki, and Pearl Harbor). Routes A, B, and C are new limited stop routes.

Service frequency varies with route. In general, during peak periods, five routes operate at 10-minute or shorter headways, and 18 other routes operate at headways of 30 minutes or less. Actual service to patrons along major portions of trunk routes is more frequent, since several routes operate on the same street. Routes with peak period headways of 60 minutes or longer are Routes 70 and 72.

During the peak period, TheBus system is approaching capacity and, in recent years, average operating speeds have declined. Reduced speeds diminish the attractiveness of transit as an alternative to the private automobile, and congestion reduces transit schedule reliability. In Downtown, particularly on King and Beretania Streets, peak-hour bus volumes exceed 75 buses per hour. If bus volumes increase into the 80 to 100 buses per hour range, additional declines in bus speeds can be expected. Closely spaced bus stops are also contributing to the decline in bus speeds. The declines in average operating speeds have been most pronounced for all route types except express.

With the exception of Leeward Oahu, which is the first area to be converted to a hub-and-spoke pattern, the existing bus system operates largely as a "radial" system, with most routes directed Downtown. Most bus routes are oriented to get people into and out of the PUC. A radial system is appropriate for trips to and from Downtown, but is not ideal for other combinations of origin and destination, such as from one suburban area to another. In addition, as a result of the radial bus network configuration, the major Ewa-Koko Head streets in Downtown carry not only the urban trunk routes but also urban collector routes. Duplication of service

FIGURE 3.2-2A
EXISTING EXPRESS BUS ROUTES: DOWNTOWN/ PEARL HARBOR

FIGURE 3.2-2B
EXISTING EXPRESS BUS ROUTES: UH, DOWNTOWN AND WAIKIKI

FIGURE 3.2-2C

EXISTING LOCAL BUS AND TRUNK ROUTES: SUBURBAN TRUNK AND URBAN TRUNKS

FIGURE 3.2-2D
EXISTING LOCAL BUS AND TRUNK ROUTES:
SUBURBAN FEEDERS AND URBAN COLLECTORS

along these corridors provides greater convenience for passengers with buses passing through more frequently. However, this duplication is operationally not efficient and results in slower travel through the corridor.

To improve operating efficiency, special lanes have been constructed and/or designated for use only by buses and other high occupancy vehicles (HOV). Priority-lane operations include the Kalakaua Avenue bus lane, the H-1 Freeway HOV/bus lane, the Hawaii Kai Drive/Kawaihae Street bus lane, the Kalanianaole Highway HOV/bus lane and the Moanalua Freeway HOV/bus lane. Within Downtown, the half-mile-long Hotel Street Transit Mall also facilitates bus operations.

The Hub-and-Spoke Bus Route Revision Program is a further means to improve operating efficiency through the corridor. Currently underway, this program is a major overhaul of the existing bus service operations. Starting with Leeward Oahu, the program goal is to convert the existing, primarily radial bus route architecture into a hub-and-spoke system that connects the different networks throughout the island. Such a system includes limited bus stop service all day long and enhanced local and neighborhood circulator services. All 18 Leeward Oahu routes were converted in 2000. All 20 Central Oahu routes are scheduled to be converted in 2003. The PUC routes will start the changeover process during fiscal year 2003.

Table 3.2-1 shows the number of daily trips, the revenue hours and estimated daily boardings by route type. Approximately 50 percent of the total estimated daily ridership uses an urban trunk service along the Ewa-Koko Head arterials of the central portion of the PUC. However, all suburban trunk routes have ridership levels ranked in the top 25 for the system.

TABLE 3.2-1
SUMMARY OF BUS ROUTE TRIPS, REVENUE HOURS AND ESTIMATED DAILY BOARDINGS

Route Type	Daily Trips		Revenue Hours		Estimated Daily Boardings	
	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
Urban Trunk	1,449	35%	1,392.50	39%	102,676	50%
Urban Collector	541	13%	266.05	7%	11,568	6%
Suburban Trunk	902	22%	1,041.95	29%	50,893	25%
Suburban Feeder	629	15%	238.30	7%	7,419	4%
Express	246	6%	285.25	8%	10,267	5%
City/CountyExpress!	350	9%	373.85	10%	24,251	12%

Source: Oahu Transit Services, Inc. (OTS) March 2002.

2) Transit Travel Times

On TheBus system, there is a large difference in travel times for peak hours and off-peak hours. Table 3.2-2 provides examples of the travel time differences between peak and off-peak trips.

According to the Technical Paper on Current Transit Quality of Service in the Primary Corridor (March 1999), the existing bus system traveling through Downtown Honolulu is convenient, having many bus choices and frequent service. However, such a high level of service is limited to travel within Downtown during peak periods. For example, limited stop express buses from outlying areas are not available during off-peak hours, requiring passengers to catch local buses with longer travel times. Passengers must also transfer more often at central downtown stops to catch the buses to their final destinations. In general, the furthest distances take the most time to travel not only because of the distance itself, but also because there are more bus stops during the trip.

TABLE 3.2-2
ESTIMATED TRAVEL TIMES (MINUTES)

Origin	Destination	Express Routes – Peak	Non-Express Routes – Off-Peak	City/County Express! Avg. All Day
Ewa	Downtown Honolulu	58	81	
Waipahu	Downtown Honolulu	58	80	58
Makaha	Downtown Honolulu	81	107	81
Pearl City	Downtown Honolulu	40	46	46
Kaneohe	Downtown Honolulu	40	55	

Source: Technical Paper on Current Transit Quality of Service in the Primary Corridor, Parsons Brinckerhoff Inc., March 1999. City/CountryExpress! travel times taken from OTS March 2002 sign-up data.

Moreover, current bus scheduling does not coordinate the timing of transfers. As a result, trips requiring transfers often take longer than if they were continuous trips, making bus service less attractive for such trips. Part of the hub-and-spoke conversion is to schedule the bus arrival times at transit centers to reduce transferring times.

3.2.3 Travel Patterns

Resident households, port operations, the airport, other commercial activities, and visitors are the generators of travel on Oahu. Of these travel components, travel by members of resident households represents well over 90 percent of traffic volumes and transit ridership. This section documents current travel patterns of resident households in terms of their geographic orientation, travel purpose, and travel mode.

The information for all travel forecasts has been derived from the travel forecasting procedures maintained by OMPO, the regional transportation planning agency for the island. These procedures simulate the choices made by residents, businesses, and visitors regarding the nature, number, mode, time-of-day, and geographic orientation of trips that are made on a typical weekday. The procedures have been developed based on data obtained in extensive surveys of Oahu households, transit riders, and air passengers.

Estimates using these procedures indicate the amount of travel between different parts of the island, the share of this travel that occurs on different modes (autos, carpools, buses, and walking), and the traffic volumes and transit ridership that result on individual streets and transit lines. The following sections summarize the 2000 estimates using these procedures. The analysis is based on February 28, 1999 land use information the DPP prepared and provides a baseline for comparison with all future-year forecasts.

The summaries are based on 23 planning districts that consist of the 762 small subareas of the island, called "transportation analysis zones" (TAZs), used by computerized travel demand modeling programs. The planning districts for Oahu are the following:

- Downtown
- Kakaako
- Ala Moana
- Beretania
- Makiki
- Waikiki
- McCully
- UH Manoa
- Kaimuki
- Iwilei
- Kalihi
- Airport
- Salt Lake
- Aiea
- Waipahu
- Mililani
- Ewa
- Waianae
- North Shore
- Koolauloa
- Kaneohe
- Kailua
- East Honolulu

Modeling programs estimate the number of trips between each pair of zones and then allocate these zone-to-zone trips to the available travel modes, highway facilities, and transit services. Trips and transit share are analyzed in the “production-attraction” format. Productions are defined to be at the residence while attractions are at the workplace or other non-home location. A worker, who travels from home to work and then returns home makes two trips, both produced at the residence and attracted to the workplace. This format therefore yields summary tables in which predominantly residential areas have many more productions than attractions, while employment areas have many more attractions than productions.

1) Travel by Resident Households

The 2000 travel patterns of permanent Oahu residents were estimated for a typical weekday for travel to/from work and for all other travel purposes, respectively. “Home-based-work” trips are summed across all travel modes. These trips include travel made directly between home and work (and between work and home) but exclude the six to seven percent of work travel that involves an intermediate stop (for shopping or day-care pick-ups, for example). The estimate indicates that Oahu residents on a typical weekday make about 552,500 direct work trips, equivalent to about 276,000 workers making one trip to work and a second to return home. Not all workers travel to work on a typical weekday because of part-time employment, vacations, sick leave, business travel, and shifted work schedules (with two weekdays off rather than the weekend off). Further, some workers make intermediate stops during their work trips and are therefore counted in other types of trips.

Of the 552,500 daily work trips, approximately 106,700 work trips (19 percent) are attracted to jobs in Downtown, by far the largest single employment concentration on Oahu. Large numbers of work trips are also attracted to the Airport/Pearl Harbor area, Kakaako, and Waikiki. Large volumes of work trips are produced in the residential areas within Aiea, Mililani, Kalihi, and Kaneohe.

The estimated distribution of work travel indicates that Downtown tends to be the most common workplace location for residents of the urban core of Oahu. The largest single travel market to jobs in Downtown is from the Kalihi district, which is both close to Downtown and heavily, populated. Residents of areas that are more distant from Downtown tend to find employment more frequently in their own district (as with Ewa, the North Shore and Koolauloa) or in a significant employment center – often a military base – as with Salt Lake, Mililani, Kaneohe, and Kailua.

Oahu residents make slightly over 2,000,000 trips for all other purposes – such as school, shopping, and recreation –for all travel modes on a typical weekday. Because these trips are generally much shorter than for work travel, the most likely location of these activities is within the same district as the residence. This effect is particularly true for the larger, outlying districts where more than 60 percent of non-work travel remains within the district (as in Mililani, Waianae, Kaneohe, and Kailua).

2) Travel on Transit Services by Resident Households

This section discusses the 2000 estimated trips using transit services on a typical weekday for work and for all other purposes. The transit trips are “linked” through any transfers made along the way. Thus, the total number of boardings (or “unlinked” trips) on transit buses associated with travel by Oahu residents is approximately 15 percent higher than the number of linked trips. Travel by visitors increases the number of boardings by another 15 percent, almost entirely on bus services within Waikiki and to Ala Moana Center.

Some 95,700 daily work trips use the bus system, approximately 17 percent of all home-based-work trips. As expected, the largest concentration of trips involving transit is to workplaces in Downtown Honolulu. The high share of downtown workers who use transit – 35 percent – presumably results from high parking costs, excellent bus service, and the relatively large number of downtown workers who live in nearby residential areas that also enjoy excellent bus service. Large transit volumes also occur to jobs in Kakaako and Waikiki, while transit carries a much smaller share of workers traveling to areas outside the urban core. The transit share of travel produced from various residential areas is relatively constant, ranging primarily between 13 and 18 percent. These moderate shares are the products of very high transit shares from every residential area to Downtown and the urban core, combined with much lower shares to other areas. Variations in transit shares are tied to the average income and auto-ownership levels of various residential areas (Waikiki, Waipahu, and Iwilei), as well as the presence of nearby military facilities to which transit travel is not competitive (Airport and Mililani).

Oahu residents on a typical weekday make approximately 93,100 non-work transit trips. While Downtown is again the most common single destination for these transit trips, the concentration of non-work transit travel to Downtown is much less pronounced than it is for work trips. This pattern is the result of the nature of non-work travel (generally shorter and to areas closer to home than Downtown) and the households who choose transit for non-work travel (high concentrations of elderly, students, and lower-income persons).

3) Automobile Travel by Resident Households

The estimates for 2000 also show the number of trips that would be made using automobiles, based on auto person travel on a typical weekday for work and for all other purposes. There were approximately 942,500 daily work-related auto person trips in 2000. As expected, the largest number of these trips are attracted to Downtown. Other significant areas attracting work-related auto person trips are McCully, Iwilei, Pearl City/Aiea, and Mililani. Areas producing large shares of work-related trips are Pearl City/Aiea, Waipahu, Mililani, Ewa, Kaneohe, and Kailua. A key pattern to note is that there are significant suburban areas (Pearl City/Aiea, Mililani) attracting work trips as well as the more urban areas (Downtown, McCully, Iwilei).

There were approximately 1,339,000 daily non-work auto person trips in 2000. The larger non-work trip attractors are oriented more toward the suburban areas such as Pearl City/Aiea, Waipahu, Mililani, Kaneohe, and Kailua. Significant non-work attraction areas are Downtown, McCully, and Iwilei. Areas producing non-work auto person trips are Salt Lake, Pearl City/Aiea, Waipahu, Mililani, Kaneohe, Kailua, and East Honolulu.

3.2.4 Bicycle Travel and Pedestrian Facilities

The Honolulu Bicycle Master Plan (April 1999), sponsored by the City and County of Honolulu, and Bike Plan Hawaii (April 1994), a Statewide bike plan, inventoried existing facilities and provided recommendations to enhance bicycle travel (refer to Figure 3.1-4A through 3.1-4C).

About 100,000 bicycles are registered in Honolulu, and 1.3 percent of employees (10,500 persons) bike to work (1990 Census). There are 24.8 miles of bikeways within the PUC, the longest being the Pearl Harbor Bike Path extending from near Aloha Stadium to Waipio Peninsula (Waipahu). The DTS installed bicycle racks on downtown sidewalks to make it easier to bike to work, and placed bicycle racks on all of its buses. Hookups to the bus bicycle racks now exceed 1,100 per day (Oahu Transit Services, Inc., November 2001).

Oahu has a developed pedestrian trail system, several components of which exist entirely or in part within the project area. The study area also contains other areas of concentrated pedestrian activity, including pedestrian malls and public beach accesses. For example, there is heavy pedestrian traffic daily in and around areas such as Downtown, Waikiki, Ala Moana, and University. On Kalakaua Avenue, the City and County of Honolulu widened the sidewalk to enhance the pedestrian experience along Kuhio Beach (Kuhio Beach Park Expansion/ Kalakaua Promenade, Signing and Striping Plan, City and County of Honolulu,. August 18, 1999). The City and County also developed the Historic Waikiki Trail that winds through Waikiki, taking pedestrians to various sites of historic importance (Office of Waikiki Development, Mayor's Office, March 2000).

3.2.5 Parking

The high cost of land and development densities in Downtown Honolulu and Waikiki make it important to preserve or improve existing parking conditions, either by increasing supply or reducing the demand for spaces. Parking prices indicate that the existing parking spaces are in high demand. Parking costs published by the Downtown Planet in November 2001 showed that short-term weekday parking rates in the Downtown/Chinatown area range from 50 cents per half hour to $3.00 for every 20 minutes. Monthly rates can be as much as $250, especially in the center of Downtown, although more outlying parking garages such as those on the edge of Chinatown cost as little as $75.

Public parking can be categorized as either off-street or on-street. Off-street parking is those spaces available in parking structures or designated parking lots. These parking facilities may be privately or publicly operated. On-street parking refers to curbside spaces that may or may not be marked with meters or painted spaces. Metered parking fees accrue to the City and County of Honolulu.

The availability of parking varies by neighborhood and by street. Most travel destinations tend to have associated off-street parking facilities. Metered and unmetered on-street parking is also available throughout the entire study area, particularly at major destinations such as Chinatown, Downtown, Ala Moana, and Waikiki. In general, parking at major destinations tends to be metered and in higher demand than those at less trafficked areas. On-street parking also tends to be restricted to certain non-peak hours of the day, especially where those spaces are in the curbside lanes of roads with rush hour traffic. In areas of high parking demand, many parking vendors offer off-street parking opportunities to the public, including municipally operated parking garages.

3.2.6 Loading Zones

Vehicle loading zones are curbside areas set aside for passenger or cargo loading and unloading. They can also include some bus and shuttle stops. Some loading zones are restricted to use only during certain hours of the day, while others are unrestricted.

Loading zones are located throughout the city, but their frequency and sizes vary. Locations with highly used loading zones tend to be in key areas like Downtown and Waikiki. Due to the limited parking opportunities and the frequency of passenger loading and unloading in these areas, loading zones serve an important public function in the congested metropolitan setting. In contrast, most of the project corridor Ewa of Middle Street tends to be less populated and centered around major highways such as H-1, which contain no significant loading zones.

Waikiki has a significant number of loading zones. The existing parking and loading restrictions in Waikiki are shown on the signing and striping plans for Kalakaua, Kapahulu and Kuhio Avenues, contained in DTS Bulletin Number 4 entitled the Kalakaua Avenue Safety and Beautification Project (circa 1988). This bulletin states that the restrictions were initiated on May 26, 1987. In general, private vehicles are restricted from stopping, standing, or parking along Kalakaua Avenue and Kuhio Avenue. Commercial passenger and baggage loading and unloading along curbs are allowed on both sides of Kuhio Avenue and on the makai side of Kalakaua Avenue, except between the hours of 3:30 p.m. and 5:30 p.m. and where prohibited. There is no restriction on loading and unloading in loading bays at any time. Freight loading and unloading is allowed from 10:00 p.m. to 9:30 a.m. on both sides of Kuhio Avenue and from 10:00 p.m. to 9:00 a.m. on the makai side of Kalakaua Avenue. No stopping, standing, loading, or unloading is permitted on the mauka side of Kalakaua Avenue except freight vehicles with permits between the hours of 10:00 p.m. and 9:00 a.m. Kapahulu Avenue has a roughly 200-foot segment on the Ewa side that is restricted to loading and unloading only on Mondays through Saturdays between 7:00 a.m. and 11:00 p.m.

On Alakea Street between King and Hotel Streets, passenger and freight loading takes place on the Ewa curb at all hours of the day. This block is marked as “No Parking, Tow Away Zone” which allows commercial vehicles with permits to make brief stops for loading and unloading operations. On Kaaahi Street, freight loading occurs along both sides of this dead end street in the Iwilei area.

3.3 NEIGHBORHOODS

The primary transportation corridor spans 18 identifiable neighborhoods (see Figure 3.3-1 and Table 3.3-1). Their demographics, community resources, and location relative to the alternatives characterize these neighborhoods below.

3.3.1 Demographic Description

1) Population Trends

Population growth by neighborhood from 1990 to 2000 is shown in Table 3.3-1. The total 2000 Oahu population was 876,156, which was about five percent greater than the 1990 population. In the 1990s, the average annual growth rate was about one-half percent, based on an estimated 1997 islandwide population of approximately 870,000. Nevertheless, during the 1990s, certain neighborhoods experienced substantial population growth.

For example, Waipahu/Waikele/Kunia/Waipio and Ewa/Kapolei grew 22 and 97 percent, respectively, during the 1990s. These neighborhoods are in the western part of the corridor where former agricultural land is being converted to urban uses. Housing in Ewa and Central Oahu tends to be more affordable than in the PUC, resulting in a much higher growth rate in these outlying areas compared to the rest of the island. This trend is not changing in the 2000s, as most new housing is being built in Ewa and Central Oahu.

Growth areas in the PUC were clustered in Ala Moana/Kakaako and Downtown (see Table 3.3-1). Population growth in these neighborhoods resulted mostly from development of high-rise apartment buildings. Little to moderate growth occurred in the Pearl City, Makiki/Tantalus/Lower Punchbowl, Nuuanu/Punchbowl/Pacific Heights, and Kalihi Valley neighborhoods. Neighborhoods that experienced no growth or decreases in population from 1990 to 2000 were mostly in the eastern part of the PUC, such as Manoa, McCully/Moiliili, Waikiki and Diamond Head/Kapahulu/St. Louis Heights, and in the Aiea, Aliamanu/Salt Lake, Liliha/Kapalama Kalihi/Palama, Moanalua, and Airport/Hickam/Pearl Harbor Naval Station neighborhoods. Some of these neighborhoods are older communities, contain mostly single-family residences and are in transition from residential to commercial or industrial uses. Also, an aging population characterizes some of the neighborhoods.

2) Ethnicity

In 1990, Whites made up 32 percent of the islandwide population. They were followed by Japanese (24 percent), Filipino (14 percent), Hawaiian/part Hawaiian (11 percent), and Chinese (8 percent). The 2000 Census allowed people to choose their ethnicity among two or more races, which makes it difficult to compare this information with the 1990 census. Table 3.3-2 presents the 2000 ethnicity by neighborhood. It presents only the ethnicity data for those indicating one race on the Census form because the majority of people completing the Census indicated only one race. For example, on Oahu 80.1% indicated one race and 19.9% indicated two or more races. It should be noted that because people could indicate more than one race, the percentages will not total 100.

Ethnic mix varies by neighborhood. Neighborhoods with proportionately higher populations of White residents are Waikiki and Airport/Hickam/Pearl Harbor Naval Station. Waikiki has a high transient population. The Airport neighborhood encompasses mostly Air Force and Navy military housing. Asians are the largest ethnic group islandwide. Fifteen of the neighborhoods have Asian populations of 50% or greater. The exceptions are Waikiki, Airport, and Moanalua. Native Hawaiians and other Pacific Islanders are less numerous in the

FIGURE 3.3-1
NEIGHBORHOODS

corridor than the groups previously described. The neighborhoods with the highest proportion of Hawaiian and other Pacific Islanders, exceeding the nine percent islandwide proportion, are Kalihi Valley, Kalihi/Palama, and Nuuanu/Punchbowl. The Papakolea homestead area, a Department of Hawaiian Home Lands (DHHL) property, is located in the Nuuanu/Punchbowl neighborhood.

TABLE 3.3-1
POPULATION GROWTH BY NEIGHBORHOOD
(1990 TO 2000)

Neighborhood	Population 1990	Population 2000	Percent Change
Diamond Head/Kapahulu/St. Louis Hts.	20,945	19,137	-8.6%
Manoa	21,496	21,184	-1.5%
McCully/Moiliili	28,466	26,122	-8.2%
Waikiki	19,768	19,720	-0.2%
Makiki/Tantalus/Lower Punchbowl	29,416	30,145	2.5%
Ala Moana/Kakaako	10,978	14,186	29.2%
Nuuanu/Punchbowl/Pacific Heights	16,254	16,494	1.5%
Downtown/Iwilei	11,601	14,575	25.6%
Liliha/Kapalama	21,221	19,905	-6.2%
Kalihi/Palama	40,147	37,987	-5.4%
Kalihi Valley	17,798	17,937	0.8%
Moanalua	12,256	11,748	-4.1%
Aliamanu/Salt Lake/Foster Village	37,498	36,572	-2.5%
Airport/Hickam/Pearl Harbor Naval Station	26,762	18,163	-32.1%
Aiea	32,553	31,221	-4.1%
Pearl City/Pearl Harbor Complex	46,928	47,794	1.8%
Waipahu/Waikele/Kunia/Waipio	51,174	62,402	21.9%
Ewa/Kapolei/Makakilo	26,898	53,099	97.4%
Total Oahu	**836,231**	**876,156**	**4.8%**

Source: 2000 Census SF1 File; Planning Davison, Honolulu Department of Planning and Permitting, January 2002.

3) Families and Households

Household and family characteristics by neighborhood are shown in Table 3.3-3. Seventy-five percent of the households on Oahu in 1990 were families, which are defined as two or more persons related by blood, marriage, or law living together. This percentage dropped to 72 percent in 2000. Neighborhoods with the highest percentage of families are mainly in the western half of the corridor, Ewa of Moanalua, and include Pearl City, Waipahu and Ewa as well as Moanalua and Airport/Hickam/Pearl Harbor areas. The 2000 census indicates that these community characteristics have not changed. These neighborhoods have higher percentages of low-density housing (see Section 3.1.3), have generally younger inhabitants based on median age, and have larger household sizes.

Neighborhoods with lower percentages of families and smaller household sizes are generally located in the older parts of the central Urban Core, such as McCully/Moiliili, Makiki/Tantalus, Downtown, and Ala Moana/Kakaako. These neighborhoods have higher percentages of multifamily housing.

Educational attainment among adults in the corridor is similar to the overall Oahu population. However, certain neighborhoods, such as Manoa, Waikiki, and Makiki/Tantalus, substantially exceed the islandwide profile for high school and college graduates. Neighborhoods with a substantially lower distribution of educational attainment compared to the islandwide distribution are Kalihi/Palama and Kalihi Valley.

TABLE 3.3-2
ETHNICITY BY NEIGHBORHOOD – 2000[1]

Neighborhood	White	Black	American Indian	Asian	Native Hawaiian	Other	Two or More Races
Diamond Head/Kapahulu/St. Louis Heights	21%	0.5%	0.1%	55%	7%	0.7%	16%
Manoa	21%	0.7%	0.2%	59%	4%	0.7%	15%
McCully/Moiliili	15%	1%	0.2%	60%	7%	0.9%	16%
Waikiki	44%	2%	0.3%	39%	5%	1%	10%
Makiki/Tantalus	22%	1%	0.2%	54%	6 %	1%	16%
Ala Moana/Kakaako	19%	1%	0.2%	62%	4%	0.7%	12%
Nuuanu/Punchbowl	16%	0.5%	0.1%	53%	12%	0.8%	19%
Downtown	22%	1%	0.2%	58%	6%	0.7%	12%
Liliha/Kapalama	8%	0.3%	0.1%	67%	8%	0.3%	16%
Kalihi/Palama	4%	0.6%	0.1%	66%	14%	0.7%	14%
Kalihi Valley	6%	0.4%	0.1%	66%	12%	0.7%	16%
Moanalua	22%	5%	0.2%	46%	7%	2%	18%
Aliamanu/Salt Lake	19%	6%	0.3%	52%	6%	2%	14%
Airport/Hickam/Pearl Harbor Naval Station	62%	12%	0.6%	11%	1%	4%	9%
Aiea	18%	2%	0.3%	50%	8%	1%	20%
Pearl City	16%	2%	0.2%	56%	6%	1%	18%
Waipahu/Waikele/Kunia/Waipio	8%	2%	0.2%	62%	9%	1%	18%
Ewa/Kapolei/Makakilo	17%	2%	0.2%	50%	7%	1%	23%
Oahu	21%	2%	0.2%	46%	9%	1.3%	20%

Source: 2000 Census SF1 File; Planning Division, Honolulu Department of Planning and Permitting, January 2002.
Note: [1]Does not sum to 100 percent because people could chose more than one ethnicity.

TABLE 3.3-3
HOUSEHOLD AND FAMILY CHARACTERISTICS BY NEIGHBORHOOD – 2000

Neighborhood	Median Age	Households (HH)	Families (Percent of HH)	Average HH Size
Diamond Head/Kapahulu/St. Louis Heights	42.7	7,698	59%	2.44
Manoa	39.3	7,051	68%	2.59
McCully/Moiliili	38.9	12,670	48%	2.04
Waikiki	42.2	11,397	36%	1.72
Makiki/Tantalus	41.0	14,998	46%	1.97
Ala Moana/Kakaako	42.9	7,797	41%	1.78
Nuuanu/Punchbowl	43.5	6,180	66%	2.63
Downtown	40.9	6,818	41%	1.87
Liliha/Kapalama	44.4	6,495	72%	2.93
Kalihi/Palama	36.3	10,258	75%	3.57
Kalihi Valley	36.5	3,941	85%	4.42
Moanalua	36.0	3,219	87%	3.08
Aliamanu/Salt Lake	33.4	11,732	75%	3.09
Airport/Hickam/Pearl Harbor Naval Station	25.7	5,001	98%	3.32
Aiea	37.6	10,580	71%	2.89
Pearl City	37.7	14,369	82%	3.13
Waipahu/Waikele/Kunia/Waipio	34.1	16,937	81%	3.60
Ewa/Kapolei/Makakilo	30.8	14,324	85%	3.68
Oahu	35.7	286,450	72%	2.95

Source: 2000 Census SF1 File; Planning Division, Honolulu Department of Planning and Permitting, January 2002.

4) Housing Stock

Housing characteristics by neighborhood are shown in Table 3.3-4. Housing of all types on Oahu increased from about 174,000 units in 1970 to over 280,000 units in 1990 to 316,000 in 2000. A majority of the new homes were developed in Ewa and Central Oahu. Most of the housing units are low-density, single-family and townhouse dwellings. In the corridor, low-density neighborhoods are generally clustered in the eastern and western portions. Housing units in central Urban Core neighborhoods are higher densities, and many are in medium to high-rise apartment buildings. These neighborhoods include McCully/Moiliili, Waikiki, Makiki/Tantalus, Ala Moana/Kakaako, Downtown, Kalihi/Palama and Aliamanu/Salt Lake.

Vacancy rates of most neighborhoods ranged from one to three percent in 1990, compared to the two percent islandwide rate. The islandwide vacancy rate rose to five percent in 2000. McCully/Moiliili had a 7 percent vacancy rate followed by Manoa (3 percent) and Waikiki (23 percent).

5) Home Ownership and Stability

Home ownership characteristics are also shown in Table 3.3-4. Oahu has a lower home ownership rate (55 percent) as a result of the high cost of housing in Hawaii. In 2000, home ownership rates across the corridor neighborhoods vary from 71 and 69 percent in Pearl City and Ewa/Kapolei/Makakilo, respectively, to 2, 23, 28 and 29 percent in the Airport area, Downtown, McCully/Moiliili and Kalihi/Palama, respectively. Neighborhoods with high ownership rates tend to be more stable than neighborhoods with higher proportions of renters because resident turnover tends to be less. Also, suburban outlying areas tend to have higher home ownership rates than in central Honolulu. In 2000, the Ewa area had a 70 percent home ownership rate compared to 46 percent for the PUC and 60 percent for Central Oahu.

TABLE 3.3-4
HOUSING CHARACTERISTICS BY NEIGHBORHOOD – 2000

Neighborhood	Housing Units	Vacancy Rate	Home Ownership Rate
Diamond Head/Kapahulu/St. Louis Hts.	8,649	6%	53%
Manoa	7,420	3%	60%
McCully/Moiliili	14,098	7%	28%
Waikiki	18,370	23%	34%
Makiki/Tantalus	16,368	6%	39%
Ala Moana/Kakaako	9,440	8%	32%
Nuuanu/Punchbowl	6,584	3%	59%
Downtown	7,342	6%	23%
Liliha/Kapalama	6,852	3%	57%
Kalihi/Palama	11,108	6%	29%
Kalihi Valley	4,169	3%	60%
Moanalua	3,4,62	2%	50%
Aliamanu/Salt Lake	12,927	6%	46%
Airport/Hickam/Pearl Harbor Naval Sta.	5,627	1%	2%
Aiea	11,044	3%	59%
Pearl City	14,182	2%	71%
Waipahu/Waikele/Kunia/Waipio	17,897	4%	64%
Ewa/Kapolei/Makakilo	15,845	4%	69%
Oahu	315,988	5%	55%

Source: 2000 Census SF1 File; Planning Division, Honolulu Department of Planning and Permitting, January 2002.

6) Income

Income by neighborhood is shown in Table 3.3-5. The 2000 Census income data was not available as of May 2002. Median household income in 1990 for Oahu was $40,581. Certain neighborhoods in the corridor, such as Manoa and Pearl City, had median incomes substantially higher than this islandwide median. Neighborhoods with moderately high median incomes were Nuuanu/Punchbowl, Liliha/Kapalama, Moanalua, Aiea and Waipahu/Waikele/Kunia/Waipio.

Neighborhoods with median incomes substantially lower than the islandwide median were Waikiki, Makiki/Tantalus, Ala Moana/Kakaako, Downtown, Kalihi/Palama, and Airport/Hickam/Pearl Harbor Naval Station. However, the first four of these neighborhoods have smaller average household sizes than the Oahu average, partially explaining the lower median household incomes. Although the Airport neighborhood has a low median income level, it consists mostly of military housing, which is a form of in-kind income. The poverty rate of this neighborhood is only two percent, much lower than the Oahu overall rate. Neighborhoods with high poverty rates are Downtown, Kalihi/ Palama, Kalihi Valley and Waipahu/Waikele/Kunia/Waipio. These areas contain low-income and/or public housing units, have a disproportionate number of elderly residents, and are areas where new immigrants have settled. Low-income means a household income at or below the Department of Health and Human Services guidelines.

Neighborhoods with the highest percentages of households receiving social security and retirement incomes tend to be located in the center of the PUC, such as Liliha/Kapalama, Kalihi/Palama, and Kalihi Valley. These neighborhoods contain a large amount of older housing and long-time residents. Neighborhoods in the western portion of the corridor have lower rates of households with social security and retirement incomes. Neighborhoods with higher rates of households receiving public assistance are Downtown, Kalihi/Palama, Kalihi Valley and Waipahu/Waikele/Kunia/Waipio, the same neighborhoods that have higher than average poverty rates.

TABLE 3.3-5

INCOME AND HOME OWNERSHIP CHARACTERISTICS BY NEIGHBORHOOD – 1990

Neighborhood	Median Household (HH) Income	Families in Poverty (Percent)	Selected Sources of Income (Percent of HH)		
			Social Security	Retirement	Public Assistance
Diamond Head/Kapahulu/St. Louis Hts.	$39,357	4%	11%	8%	2%
Manoa	$51,866	2%	10%	8%	1%
McCully/Moiliili	$31,974	7%	8%	5%	2%
Waikiki	$26,980	6%	11%	8%	2%
Makiki/Tantalus	$33,623	6%	8%	5%	1%
Ala Moana/Kakaako	$25,162	7%	11%	7%	2%
Nuuanu/Punchbowl	$44,199	4%	11%	8%	2%
Downtown	$25,436	10%	7%	4%	4%
Liliha/Kapalama	$43,164	2%	14%	9%	2%
Kalihi/Palama	$25,647	16%	13%	7%	6%
Kalihi Valley	$39,794	13%	12%	8%	5%
Moanalua	$43,706	2%	8%	7%	1%
Aliamanu/Salt Lake	$38,078	4%	4%	6%	2%
Airport/Hickam/Pearl Harbor Naval Sta.	$29,989	2%	1%	0.5%	0.4%
Aiea	$45,585	4%	8%	8%	2%
Pearl City	$55,053	2%	6%	7%	1%
Waipahu/Waikele/Kunia/Waipio	$46,501	8%	7%	6%	4%
Ewa/Kapolei/Makakilo	$40,679	4%	5%	6%	2%
Oahu	$40,581	5%	8%	7%	2%

Source: Neighborhood Profiles, City and County of Honolulu Planning Department (now Department of Planning and Permitting), 1996.

Note: Does not sum to 100 percent because vacant units are included in the calculation.

3.3.2 Community Facilities and Services

Community facilities and services include libraries, shopping centers, churches, police stations, fire stations, schools (public and private), hospitals, and clinics. Parks are discussed in Section 3.11.

Activity centers and growth areas that attract and generate travel exist throughout the study area. Table 3.3-6 lists some of the major activity centers in the corridor by DP AREA.

3.3.3 Cultural Activities

To identify the cultural activities and resources in the study area, a panel of experts was formed and convened on May 24, 2001. Its purpose was to develop a working definition of "cultural practice" in an urban setting and to develop a working definition of the geographic boundary of the study area. The panel included individuals with expertise including cultural anthropology, urban planning, social impact assessment and planning, and ethnography. The definition of "cultural practices" was expanded to include the many traditions and ethnicities of Hawaii. The study corridor was identified, as the area between the H-1 Freeway and the ocean, from Middle Street to Kapiolani Park. Several methods were employed to identify cultural practices and resources, such as using the panel members' and key informants' knowledge, driving and walking through the study area neighborhoods, and obtaining schedules and other publications that provide cultural event information.

The panel was able to identify over 400 cultural practices, which were categorized in the following manner:

- Culturally Significant Districts. Often referred to as Traditional Cultural Properties (see Section 3.10), the only culturally significant districts identified in the study area are Chinatown and the Iolani Palace/King Kamehameha Statue area. Both areas are also listed on the National Register of Historic Places in part or whole. Further details on these two areas are provided in Section 3.10.2.

- Flora Gathered for Lei-Making, Sharing, Ceremonies and Cultural Activities. Flowers, foliage, seeds and other flora materials are gathered from private and public properties throughout the study area.

- Lion Dances and Fireworks Associated with Lunar New Year Celebrations. The streets and sidewalks of Chinatown are the venue for cultural practices during the Lunar New Year.

- Kupuna Iwi. Kupuna Iwi (ancestral bones) in the study area is discussed in Section 3.10.2.

- Parades and Street Festivals. Some of the streets in the study area from Downtown Honolulu to Waikiki are used for parades and street festivals, many of which are annual events. The corridor used most often for parades includes South King Street from Downtown to Punchbowl Street, to Ala Moana Boulevard to Kalakaua Avenue up to Kapiolani Park.

3.4 VISUAL AND AESTHETIC CONDITIONS

An important part of the alternatives development and analysis was the consideration given to the possible visual and aesthetic impacts a future system might have on existing visual resources. The visual impact analysis was based on the Federal Highway Administration's (FHWA's) methodology for visual impact assessment as described in their Publication No. FHWA-HI-88-054 guidelines, Visual Impact Assessment for Highway Projects. Three types of visual resources are discussed in this section: sectors/landscape units, coastal views, and other special view opportunities.

TABLE 3.3-6
MAJOR ACTIVITY SITES IN THE
PRIMARY TRANSPORTATION CORRIDOR

Ewa Area	
City of Kapolei	Kalaeloa(former Barbers Point Naval Air Station)
Central Oahu Area	
Royal Kunia Shopping Center	Waikele Center/Waikele Premium Outlets
Waipahu Town	Waipio
Waikele	Kunia
Primary Urban Center Area	
Leeward Community College	West Oahu College
Pearl Highlands Center	Pearl City Shopping Center
Westridge Shopping Center	Pearlridge Center
Pearl Kai Center	Aloha Stadium
Stadium Marketplace and Mall	Bougainville Center
Salt Lake	Pearl Harbor Naval Base
Arizona Memorial	Hickam Air Force Base
Mapunapuna Industrial Area	Honolulu International Airport
Honolulu Community College	Middle Street Industrial Area
Kalihi Kai Industrial District	Kalihi/Palama
Iwilei Industrial District	Sand Island
Honolulu Harbor	Chinatown
Downtown Financial District	Government centers (Federal/State/City)
Queen's Medical Center	Kakaako
Pali Momi Medical Center	Kaiser Medical Center
Victoria Ward Centers	Neal Blaisdell Center
Kapiolani Business District	Ala Moana Park
Ala Moana Center	Fort DeRussy
Waikiki	Honolulu Zoo
Ala Wai Park	Tokai University Pacific Center
Kapiolani Park	University of Hawaii at Manoa
McCully/Moiliili	Chaminade College
Hawaii Convention Center	

Source: Parsons Brinckerhoff, Inc., September 2002.

3.4.1 Sectors and Landscape Units

For ease of analysis, the project area was divided into sectors and landscape units. A "sector" is defined as a large but recognizable geographic entity having generally consistent land use and visual character. Sectors are comprised of smaller components called "landscape units." Thirteen sectors and 70 landscape units along potential alignments were identified in the primary transportation corridor. These sectors and landscape units are described in more detail in the Environmental Baseline Report (Parsons Brinckerhoff, Inc., June 1999).

Visual impacts were identified based on the visual character and visual quality of the landscape units, and how the alternatives are visually compatible with these units. Visual character refers to certain aesthetic attributes such as form, line, color, or texture. Visual quality is the level at which the landscape unit is vivid (memorable), is intact (free from visual encroachment), or has unity (forms a coherent harmonious visual pattern). For more detail on the methodology for analysis, refer to the Environmental Baseline Report.

Landscape units were ranked by visual field assessments on a 10-point scale with 10 being very high and 0 being very low. Of the 70 landscape units identified in the study area, the units with the highest visual character and quality include the following:

- Hawaii Capital Special District
- Chinatown Special District
- Nimitz Highway portion fronting Downtown Honolulu
- portions of Kapiolani Boulevard between the Hawaii Convention Center and Ala Moana Center
- Ala Moana Boulevard fronting Ala Moana Park
- Kalia Road in Waikiki
- portions of Kalakaua Avenue along Waikiki Beach
- portions of Ala Wai Boulevard parallel to the Ala Wai Canal
- Kapahulu Avenue between Kalakaua and Kuhio Avenues
- University Avenue between H-1 and Bachman Hall
- portions of North and South King Streets from Liliha Street through Chinatown and Downtown
- Thomas Square/Academy of Arts Special District

3.4.2 Coastal View Sections

In addition to landscape units, the primary transportation corridor contains several major coastal viewsheds. The Hawaii Coastal Zone Management Program and the City's Special Management Area Use Program both require the consideration of important coastal views.

The Coastal View Study (City and County of Honolulu, Department of Land Utilization, 1987) identifies significant makai and lateral views along Oahu's coastline. The following are those significant makai and lateral views along Oahu's shoreline that also relate to the primary transportation corridor, as listed in the Coastal View Study:

- Ewa Beach Road/Ewa Beach Park (makai views from park)
- Pearl Harbor (makai views of harbor from Kamehameha Highway, at Richardson Park)
- Keehi Lagoon (makai views of lagoon from Lagoon Drive and from Kamehameha Highway)
- Honolulu Harbor (makai views of harbor from Nimitz Highway)
- Kewalo Basin
- Ala Moana Park/Magic Island
- Ala Wai Yacht Harbor
- Kalia Road/Fort DeRussy
- Kalakaua Avenue/Waikiki Beach

3.4.3 Other Special View Opportunities

Special view opportunities were considered by identifying the character and quality of the visual environment. The importance of coastal views and views within special districts was further reinforced. The following view opportunities were considered relative to these viewsheds:

- Residential, Commercial, Institutional, and Industrial Areas: Views of and from various types of buildings and built environments within the viewsheds;
- Koolau and Waianae Mountain Ranges: Views of and from the distant mountains.

- Special Districts: Views of and from special districts designated by the City and County of Honolulu, or non-designated areas of distinctly unique character due to cultural and historical context. Special Districts include Chinatown, Hawaii Capital, Thomas Square, and Waikiki;
- Non-designated Districts: Views of and from neighborhoods that have not been officially designated by the City and County of Honolulu, but nonetheless possess unique identifiable character and fabric. These non-designated districts include the Kalihi-Palama District on North King Street, University of Hawaii-Manoa Campus mauka of Dole Street, Downtown, and Kapiolani Boulevard.
- Pacific Ocean, Pearl Harbor, and Honolulu Harbor: Limited makai views of and from the water adjacent to the study areas.

Specific view opportunities along potential project alignments include:

- Keehi Lagoon
- Kalihi-Palama District
- Kakaako Waterfront Park
- Downtown
- Hawaii Capital Special District
- Chinatown Special District
- Thomas Square/Academy of Arts Special District
- Waikiki Special District
- Hawaii Convention Center
- University of Hawaii - Manoa
- Pacific Ocean, Pearl Harbor, and Honolulu Harbor
- Koolau and Waianae Mountain Ranges

3.5 AIR QUALITY

3.5.1 Relevant Pollutants

Ambient concentrations of air pollution are regulated by both national and State ambient air quality standards (AAQS) (see Table 3.5-1). As indicated in the table, national and State AAQS have been established for particulate matter (PM), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone and lead. The State has also set a standard for hydrogen sulfide.

Particulate matter includes dust, soot, smoke, and liquid droplets. Sulfur oxides, which include SO_2, are colorless gases emitted primarily by burning fossil fuels and volcanic activity. Nitrogen dioxide is a brownish, highly corrosive gas with a pungent odor that is formed from nitrogen oxides emitted by electric utilities, industrial boilers and combustion of fossil fuels. Carbon monoxide is a colorless, odorless and tasteless gas produced by the incomplete combustion of fossil fuels. Ozone is formed in the atmosphere by a chemical reaction of nitrogen oxides and volatile organic compounds in the presence of sunlight. Although an ozone layer in the upper atmosphere shields the earth from harmful ultraviolet radiation, high ozone levels at ground level can cause harmful effects to humans and plants. Lead is a naturally occurring substance that has been used extensively in paint and gasoline. Historically, lead particulates enter the air mainly from vehicle exhaust. The elimination of lead in gasoline sold in the United States has greatly reduced the amount of lead in the air. Hydrogen sulfide is a colorless malodorous gas with the smell of rotten eggs. It is normally generated when sewage is allowed to stand for a long period.

TABLE 3.5-1
AMBIENT AIR QUALITY STANDARDS

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	$\mu g/m^3$	Annual 24 Hours	50[1] 150[2]	50[1] 150[2]	50 150[3]
Particulate Matter (<2.5 microns)	$\mu g/m^3$	Annual 24 hours	15[1] 65[4]	15[1] 65[4]	- -
Sulfur Dioxide	$\mu g/m^3$	Annual 24 Hours 3 Hours	80 365[3] -	- - 1,300[3]	80 365[3] 1,300[3]
Nitrogen Dioxide	$\mu g/m^3$	Annual	100	100	70
Carbon Monoxide	$\mu g/m^3$	8 Hours 1 Hour	10,000 40,000	10,000 40,000-	5,000 10,000
Ozone	$\mu g/m^3$	8 Hours 1 Hour	157[5,6] 235[7]	157[5,6] 235[7]	- 100[3]
Lead	$\mu g/m^3$	Calendar Quarter	1.5	1.5	1.5
Hydrogen Sulfide	$\mu g/m^3$	1 Hour	-	-	35[3]

Source: Section 40, Part 50, Code of Federal Regulations.
Chapter 11-59, Hawaii Administrative Rules.

Notes:
1 Three-year average of annual arithmetic mean.
2 99th percentile value averaged over three years.
3 Not to be exceeded more than once per year.
4 98th percentile value averaged over three years.
5 Three-year average of fourth-highest daily 8-hour maximum.
6 Implementation of standard currently stayed pending federal court decision.
7 Standard is attained when the expected number of exceedances is less than or equal to 1.

The national AAQS are stated in terms of primary and secondary standards for most of the regulated air pollutants. National primary standards are designed to protect public health with an "adequate margin of safety". On the other hand, national secondary standards define levels of air quality necessary to protect public welfare from "any known or anticipated adverse effects of a pollutant". In contrast to the national AAQS, the State AAQS are designed "to protect public health and welfare and to prevent the significant deterioration of air quality". The AAQS specify a maximum allowable concentration for a given air pollutant for one or more averaging times to prevent harmful effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the case of the short-term (i.e., 1-hour to 24-hour) AAQS, national and State standards allow a specified number of exceedances per year. The State AAQS are in some cases considerably more stringent than comparable national AAQS. In particular, the Hawaii 1-hour AAQS for CO is four times more stringent than the comparable national limit, and the State 1-hour limit for ozone is more than twice as stringent as the national 1-hour standard. Pending court review, the national 1-hour ozone standard will be phased out during the next few years in favor of a new (and more stringent) 8-hour standard.

The pollutants relevant to the project are those related in large measure to motor vehicles, which have historically constituted a major source of ambient air pollution. These pollutants are CO, hydrocarbons, nitrogen oxides and ozone. Lead was a major motor vehicle pollutant until its elimination from gasoline. Carbon monoxide impacts are localized. Even under the worst meteorological conditions, high concentrations of CO under the most congested traffic conditions are limited to a relatively short distance from heavily traveled roadways. Therefore, CO impacts are analyzed on a localized or “microscale” level. Hydrocarbon and nitrogen oxide automotive emissions play a large role in the formation of ozone. Since the chemical reactions are slow and occur as the pollutants diffuse downwind, elevated ozone levels are often found many miles from pollutant sources. Therefore, the impacts from hydrocarbon and nitrogen oxide emissions are generally analyzed on a regional or “mesoscale” level.

3.5.2 Regional Compliance with the Standards

Air pollutants from vehicular, industrial, natural and/or agricultural sources affect the present air quality in the project area. Much of the PM emissions on Oahu originate from area sources, such as agriculture. Sulfur oxides are emitted almost exclusively by point sources, such as power plants and refineries. Nitrogen oxide and hydrocarbon emissions emanate predominantly from industrial point sources, although area sources (mostly motor vehicle traffic) also contribute a substantial share of total nitrogen oxide emissions. The majority of CO emissions are generated by motor vehicles.

The Hawaii State Department of Health (DOH) operates a network of nine air quality monitoring stations at various locations on Oahu. However, each station typically monitors only certain air quality parameters. Seven of the DOH air monitoring stations on Oahu are located within or near the project study area. These include stations at Kapolei, Makaiwa, Pearl City, Liliha, Sand Island, Downtown Honolulu and Waikiki. Table 3.5-2 summarizes annual statistics from these stations based on the most recent data currently available. A brief summary of the air quality monitoring data at these stations is provided below.

Particulate matter of less than 10 microns in diameter (PM-10) is monitored at Kapolei, Pearl City, Liliha and Downtown Honolulu. The maximum 24-hour PM-10 concentrations 1999 and 2000 ranged from 43 ug/m^3 at the Downtown Honolulu station in 1999 to 164 ug/m^3 at the Pearl City station in 2000. There were no recorded exceedances of the State or national AAQS.

Carbon monoxide is monitored at Kapolei, Downtown Honolulu and Waikiki. In 1999 and 2000, maximum 1-hour CO concentrations at these locations ranged from 5.2 to 4,788 ug/m^3, and no exceedances of the State or national 1-hour AAQS were recorded. The 8-hour CO concentrations for 1999 and 2000 reached a maximum level of 1,853 ug/m^3, which is 37 percent of the allowable State limit and 19 percent of the allowable national limit. Although the highest CO concentrations typically occur on sidewalks near traffic-congested intersections, DOH measurements are not made at these locations because of practical constraints. Therefore, the DOH monitoring data may not be entirely representative of the maximum concentrations that occur within public areas.

Ozone is measured only at the Sand Island station. The maximum 1-hour concentration for 1999 was 110 ug/m^3 and for 2000 was 98 ug/m^3. There were no exceedances of the State or national AAQS.

Sulfur dioxide (SO_2) is monitored at Kapolei, Makaiwa and Downtown Honolulu. No exceedances of the State or national 3-hour standard were recorded at these stations in 1999 and 2000. The maximum 3-hour SO_2 concentration recorded was 50 ug/m^3 at the Makaiwa station in 1999. This is about four percent of the State and national standards. There were also no exceedances of the State or national 24-hour AAQS for SO_2 during 1999 and 2000. The maximum 24-hour concentration at any of the three locations during 1999 and 2000 monitoring period was 20 ug/m^3, which is about five percent of the State and national standards.

Ambient lead monitoring was discontinued in October 1997 with the EPA's approval.

Nitrogen dioxide is only monitored at the Kapolei station. The highest measurements of NO_2 concentrations ranged between 7 and 9 ug/m^3, well within the State and national AAQS. Therefore, no exceedances were recorded.

Based on the discussion above, the State and national AAQS for SO_2, NO_2, ozone and PM-10 currently are met in the project area. In fact, the project area, as well as the entire State, is presently an attainment area for all national AAQS. In addition, while CO measurements taken at the monitoring stations suggest that concentrations are in compliance with the State standards, CO concentrations near congested intersections could exceed the State AAQS at times. As indicated in Section 3.5.1, the State standards for ozone and CO are more stringent than the national standards.

TABLE 3.5-2
AIR QUALITY DATA FOR STUDY AREA MONITORING STATIONS (1999-2000)

Air Pollutant	Kapolei		Makaiwa		Pearl City		Liliha		Sand Island		Downtown Honolulu		Waikiki	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
24-Hour Particulate Matter <10 microns in diameter (PM-10)														
Possible Periods (Day)	365	366	NM	NM	365	366	365	366	NM	NM	365	366	NM	NM
Valid Periods (Day)	362	356	NM	NM	252	358	350	361	NM	NM	357	361	NM	NM
Highest Value (ug/m^3)	129	148	NM	NM	94	164	133	65	NM	NM	43	83	NM	NM
Annual Mean (ug/m^3)	15	17	NM	NM	14	16	15	15	NM	NM	14	14	NM	NM
Number times SAAQS exceeded	0	0	NM	NM	0	0	0	0	NM	NM	0	0	NM	NM
Number times NAAQS exceeded	0	0	NM	NM	0	0	0	0	NM	NM	0	0	NM	NM
1-Hour Carbon Monoxide (CO)														
Possible Periods (Hour)	8760	8784	NM	NM	NM	NM	NM	NM	NM	NM	8760	8784	8760	8784
Valid Periods (Hour)	8395	8595	NM	NM	NM	NM	NM	NM	NM	NM	8610	8726	7959	8728
Highest Value (ug/m^3)	1482	2508	NM	NM	NM	NM	NM	NM	NM	NM	4788	3990	3990	4332
Annual Mean (ug/m^3)	215	336	NM	NM	NM	NM	NM	NM	NM	NM	706	774	1048	905
Number times SAAQS exceeded	0	0	NM	NM	NM	NM	NM	NM	NM	NM	0	0	0	0
Number times NAAQS exceeded	0	0	NM	NM	NM	NM	NM	NM	NM	NM	0	0	0	0
8-Hour Carbon Monoxide (CO)														
Possible Periods (8-Hour)	1095	1098	NM	NM	NM	NM	NM	NM	NM	NM	1095	1098	1095	1098
Valid Periods (8-Hour)	1048	1076	NM	NM	NM	NM	NM	NM	NM	NM	1076	1091	994	1094
Highest Value (ug/m^3)	613	1055	NM	NM	NM	NM	NM	NM	NM	NM	1853	1753	2337	2166
Annual Mean (ug/m^3)	215	336	NM	NM	NM	NM	NM	NM	NM	NM	706	774	1048	905
Number times SAAQS exceeded	0	0	NM	NM	NM	NM	NM	NM	NM	NM	0	0	0	0
Number times NAAQS exceeded	0	0	NM	NM	NM	NM	NM	NM	NM	NM	0	0	0	0

TABLE 3.5-2 (CONTINUED)
AIR QUALITY DATA FOR STUDY AREA MONITORING STATIONS (1999-2000)

Air Pollutant	Kapolei		Makaiwa		Pearl City		Liliha		Sand Island		Downtown Honolulu		Waikiki	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
1-Hour Ozone (O_3)														
Possible Periods (Hour)	NM	NM	NM	NM	NM	NM	NM	NM	8760	8784	NM	NM	NM	NM
Valid Periods (Hour)	NM	NM	NM	NM	NM	NM	NM	NM	8566	8482	NM	NM	NM	NM
Highest Value (ug/m^3)	NM	NM	NM	NM	NM	NM	NM	NM	110	98	NM	NM	NM	NM
Annual Mean (ug/m^3)	NM	NM	NM	NM	NM	NM	NM	NM	40	32	NM	NM	NM	NM
Number times SAAQS exceeded	NM	NM	NM	NM	NM	NM	NM	NM	0	0	NM	NM	NM	NM
Number times NAAQS exceeded	NM	NM	NM	NM	NM	NM	NM	NM	0	0	NM	NM	NM	NM
3-Hour Sulfur Dioxide (SO_2)														
Possible Periods (3-Hour)	2920	2928	2920	2928	NM	NM	NM	NM	NM	NM	2757	2928	NM	NM
Valid Periods (3-Hour)	2710	2505	2899	2862	NM	NM	NM	NM	NM	NM	2757	2832	NM	NM
Highest Value (ug/m^3)	30	23	50	72	NM	NM	NM	NM	NM	NM	46	45	NM	NM
Annual Mean (ug/m^3)	2	1	2	3	NM	NM	NM	NM	NM	NM	2	1	NM	NM
Number times SAAQS exceeded	0	0	0	0	NM	NM	NM	NM	NM	NM	0	0	NM	NM
Number times NAAQS exceeded	0	0	0	0	NM	NM	NM	NM	NM	NM	0	0	NM	NM
24-Hour Sulfur Dioxide (SO_2)														
Possible Periods (Day)	365	366	365	366	NM	NM	NM	NM	NM	NM	365	366	NM	NM
Valid Periods (Day)	360	362	364	361	NM	NM	NM	NM	NM	NM	350	357	NM	NM
Highest Value (ug/m^3)	6	6	11	20	NM	NM	NM	NM	NM	NM	8	9	NM	NM
Annual Mean (ug/m^3)	2	1	2	3	NM	NM	NM	NM	NM	NM	2	1	NM	NM
Number times SAAQS exceeded	0	0	0	0	NM	NM	NM	NM	NM	NM	0	0	NM	NM
Number times NAAQS exceeded	0	0	0	0	NM	NM	NM	NM	NM	NM	0	0	NM	NM

Source: Annual Summary Hawaii Air Quality Data, 1999 and 2000, State Department of Health, Clean Air Branch.
Notes: NM = Not Measured.
Possible Periods = the total number of possible sampling periods in the year.
Valid Periods = the total number of valid sampling periods.

3.5.3 Identification of Sensitive Sites

Since areas near congested intersections may have CO concentrations exceeding the State AAQS, representative receptor areas within the project boundaries were identified for analysis. Because of the large scale of this project and the many intersections that could be affected by it, the CO microscale air quality analysis was limited to 23 intersections dispersed across the project area. They were selected based on a qualitative assessment that these could be areas of maximal CO concentrations from existing and future traffic congestion. They are meant to be representative of the locations in the project area expected to experience peak CO concentrations. The selected intersections are listed below, and the locations of these intersections are shown by number on Figures 3.5-1A and 3.5-1B.

1. Kahuapaani Street / Salt Lake Boulevard
2. Luapele Drive / Salt Lake Boulevard
3. N. King Street / Kalihi Street
4. Dillingham Boulevard / Kalihi Street
5. S. King Street / Bishop Street
6. Hotel Street / Bishop Street
7. S. King Street / Punchbowl Street
8. S. King Street / Ward Avenue
9. S. King Street / Pensacola Street
10. Kapiolani Boulevard / Pensacola Street
11. Kapiolani Boulevard / Kalakaua Avenue
12. S. King Street / Beretania Street / University Avenue
13. Dole Street / University Avenue
14. Nimitz Highway / Sand Island Access Road
15. Nimitz Highway / Waiakamilo Road
16. Ala Moana Boulevard / Richards Street
17. Ala Moana Boulevard / South St.
18. Ala Moana Boulevard / Atkinson Drive
19. Ala Moana Boulevard / Kalia Road
20. Kalakaua Avenue / Kaiulani Avenue
21. Kalakaua Avenue / Kapahulu Avenue
22. Kuhio Avenue / Kapahulu Avenue
23. Kuhio Avenue / Seaside Avenue

3.6 NOISE AND VIBRATION

3.6.1 Noise and Vibration Metrics and Standards

1) Transit Noise

The Federal Transit Administration (FTA) has developed criteria for assessing noise impacts related to transit projects. The standards outlined in Transit Noise and Vibration Impact Assessment (FTA, 1995) are based on community reaction to noise. The standards evaluate changes in existing noise conditions using a sliding scale. The higher the level of existing noise, the less transit projects are allowed to contribute additional noise.

The basic unit of measurement for noise is the decibel. To better account for human sensitivity to noise, decibels are measured on the "A-scale," abbreviated dBA. In accordance with FTA guidelines, the EIS focuses on average noise conditions over a 24-hour period, in order to account for human sensitivity to noise during the nighttime hours. Noise that occurs at night (between 10:00 p.m. and 7:00 a.m.) is given a ten dBA penalty. This adjusted noise measurement unit is known as a Day Night Equivalent Level (Ldn). A rural area with no major roads nearby would average around 50 dBA (Ldn); a noisy residential area close to a major

FIGURE 3.5-1A
INTERSECTIONS THAT UNDERWENT MICROSCALE ANALYSIS

FIGURE 3.5-1B
INTERSECTIONS THAT UNDERWENT MICROSCALE ANALYSIS

arterial would average around 70 dBA. Most of the residential areas in the study corridor fall within this range. Figure 3.6-1 provides other typical Ldn values for rural and urban areas.

Some land use activities are more sensitive to noise than others (parks, churches, and residences are more noise sensitive than industrial and commercial areas). The FTA Noise Impact Criteria group sensitive land uses into the following three categories:

- Category 1: Buildings or parks where quiet is an essential element of their purpose.
- Category 2: Residences and buildings where people normally sleep. This includes residences, hospitals and hotels where nighttime sensitivity is assumed to be of utmost importance.
- Category 3: Institutional land uses with primarily daytime uses that depend on quiet as an important part of operations, including schools, libraries and churches.

Representative noise sensitive receptors are selected where existing 24-hour noise levels are measured for Category 2 land uses and peak one-hour noise levels are measured for Category 1 and 3 land uses. At these locations, the noise level including that from the proposed transit alternatives is calculated and compared to the measured existing noise level.

2) Transit Vibration

In addition to transit noise, there is also the concern for potential impacts of vibration from transit operations. Ground-borne vibration is a small but rapidly fluctuating motion transmitted through the ground. Ground-borne vibration diminishes (or "attenuates") over distance. Some soil types transmit vibration quite efficiently; others do not. The response of humans, buildings, and sensitive equipment to vibration is described in this section in terms of the root-mean square (RMS) velocity level in decibel units (VdB). As a point of reference, the average person can just barely perceive vibration velocity levels below 70 VdB. Comparisons of typical ground-borne vibration levels are presented in Figure 3.6-2.

3.6.2 Existing Noise and Vibration Environment

Existing noise levels vary widely along the BRT alignment, which reflects the variety of current land uses and noise sources within the study area. Noise levels were measured in April and December of 1999 and October 2001 to characterize the existing noise environment in the vicinity of the Refined BRT alignment (Figures 3.6-3A and 3.6-3B). To assess the potential noise effects of the proposed Aloha Stadium Transit Center, additional noise measurements were conducted in June 2002 at sensitive receptor locations (Sites AS-1 through AS-10) in the Puuwai Momi and Halawa Valley residential communities. The existing noise levels for a total of 41 sites are summarized in Table 3.6-1.

Twenty-eight sites required long-term (24-hour) measurements to characterize noise levels at land uses with nighttime sleep activity such as residences and hotel/motels. The 13 short-term measurement sites represent daytime land uses such as schools and parks. Each measurement location is representative of surrounding noise sensitive land uses. Ambient vibration levels were not measured as part of this study. The FTA Vibration Impact Criteria were used to identify locations where potential impacts may occur based on existing land use activities.

3.7 ECOSYSTEMS

This section reviews the existing vegetation, wildlife, and marine ecosystems in the study area.

FIGURE 3.6-1
TYPICAL LDN VALUES FOR RURAL AND URBAN AREAS

FIGURE 3.6-2
TYPICAL LEVELS OF GROUND-BORNE VIBRATION

FIGURE 3.6-3A
NOISE MONITORING SITES: KALIHI – UNIVERSITY

FIGURE 3.6-3B
NOISE MONITORING SITES: ALOHA STADIUM TRANSIT CENTER AND LUAPELE RAMP

TABLE 3.6-1
MEASURED EXISTING NOISE LEVELS

Receiver Location	Land Use Category[1]	Address LONG-TERM 24-HOUR SITES	Ldn/Leq[2]
1	FTA 2	Bishop Garden Apartments at 1470 Dillingham Boulevard	66/64
2	FTA 2	2386 Kapiolani Boulevard	74/72
3	FTA 2	845 University Avenue	69/71
4	FTA 2	Apartment Building, 1720 Ala Moana	77/75
5	FTA 2	Saratoga Road at Post Office	66/63
6	FTA 2	Apartments on Kuhio Avenue between Launiu & Kaiolu Streets	76/78
7	FTA 2	Outrigger Waikiki Islander Hotel	70/76
8	FTA 2	Waikiki Banyan Hotel	72/72
9	FTA 2	Queen Kapiolani Hotel on Kapahulu at Cartwright Road	70/68
10	FTA 2	Apartment Building, 1350 Ala Moana Boulevard	73/71
11	FTA 2	Executive Center at Hotel and Bishop Streets	77/77
12	FTA 2	Residences on King Street	66/66
13	FTA 2	1122 Elm Street Apartment on Pensacola Street	74/74
14	FTA 2	Harbor Square Condominiums – Ala Moana Boulevard side	76/74
15	FTA 2	Harbor Square Condominiums – Alakea Street side	73/71
16	FTA 2	Nakama Residence (near Blood Bank)	77/77
17	FTA 2	Chinatown Gateway Apartments	73/72
18	FTA 2	Straub Hospital	75/72
AS-1[3]	FTA 2	Puuwai Momi Apartments – Building 1	67/68
AS-2	FTA 2	Puuwai Momi Apartments – Building 3	67/68
AS-3[3]	FTA 2	Puuwai Momi Apartments – Buildings 4 and 5	62/63
AS-4[3]	FTA 2	Single-family residence on Ohenana Loop, Halawa Valley Estates	55/54
AS-5	FTA 2	Single-family residence on Ohenana Loop, Halawa Valley Estates	60/59
AS-6[3]	FTA 2	Single-family residence on Ohenana Loop, Halawa Valley Estates	60/59
AS-7[3]	FTA 2	Single-family residence on Ohenana Loop, Halawa Valley Estates	69/70
AS-8	FTA 2	Single-family residence on Ohenana Loop, Halawa Valley Estates	69/70
AS-9[3]	FTA 2	Single-family residence on Ohialomi Place, Halawa Valley Estates	72/73
AS-10	FTA 2	Single-family residence on Luaole Street	69/68
		SHORT-TERM 15-MINUTE SITES	**Leq**
A	FTA 3	Kalihi Kai Elementary School	69
B	FTA 3	Honolulu Community College	72
C	FTA 3	Aala Park on King Street	68
D	FTA 3	Chinatown Gateway Park at Hotel and Bethel Streets	73
E	FTA 3	YWCA on Richards Street	68
F	FTA 3	Iolani Palace, on Richards	68
G	FTA 3	Iolani Palace, on King	75
H	FTA 3	Ala Wai Community Park	67
I	FTA 3	Buddhist Study Center on University Avenue	70
J	FTA 3	Fort DeRussy, on mauka side of Kalia Road	66
K	FTA 3	Thomas Square on King Street	62
L	FTA 3	McKinley High School classroom building on Pensacola Street	61
M	FTA 3	McKinley High School building on King Street	62

Source: Parsons Brinckerhoff, Inc. September 2002.

Notes: [1] Land use category descriptors:

FTA Category 1 = Buildings or parks where quiet is an essential element of their purpose.

FTA Category 2 = Residences and other buildings where people sleep, such as hotels, apartments and hospitals.

FTA Category 3 = Institutional land uses with primarily daytime and evening use, including schools, libraries and churches.

[2] Ldn is used for land uses with nighttime noise sensitivity and for residential areas where FTA rather than FHWA noise procedures are applicable. Peak-hour Leq is used for commercial, industrial, and other land uses that do not have nighttime noise sensitivity.

[3] 24-hour noise levels at these locations were estimated based upon short-term noise samples, which were compared to the closest 24-hour noise measurement locations.

3.7.1 Terrestrial Vegetation

Vegetation within the study area consists of:

- Maintained plantings, such as roadway medians, shoulders, landscaping of adjacent properties, golf courses, and botanical gardens
- Ruderal (weedy) patches, such as undeveloped properties
- Abandoned agricultural areas, such as the area makai of H-1 near Kapolei
- Cultivated agricultural areas, such as the Pearlridge watercress farm and the diverse agricultural areas in Ewa

According to the U.S. Fish and Wildlife Service (FWS), three federally endangered plant species have been observed within the Ewa area of the study corridor:

- kooloaula *(Abutilon menziesii)*,
- awiwi *(Centaurium sebaeoides)*, and
- ihiihi *(Marsillea villosa*)

In addition, the plant pu'uka'a (*Torulinium odoratum* ssp. *auriculatum)*, a Species of Concern, has been reported within the Ewa portion of the study area.

Many impressive trees and plants are found within the study area. Some of these trees meet the criteria for "Exceptional Trees," which are defined as "a tree or grove of trees with historic or cultural value, or which by reason of its age, rarity, location, size, aesthetic quality, or endemic status has been designated by the city council as worthy of preservation." (Revised Ordinance of Honolulu Section 41-13.2, 1990)

In addition, several streets within the study area contain mature vegetation within medians and streetscapes. These include Dillingham Boulevard, Richards Street, Halekauwila Street, Kapiolani Boulevard, South King Street, and Kalakaua Avenue. Many examples of banyan trees, monkeypods, mahogany trees, palm trees, and other impressive species lie along the corridors.

The community and elected officials had concerns regarding the potential impacts to existing trees as a result of the proposed project. A tree inventory was conducted where street widening was anticipated. In compiling the baseline tree inventory, a certified arborist recorded trees on the In-Town BRT alignment. Other streets and specific areas were added to the inventory as necessary. More than 900 trees were inventoried. The survey entailed noting the tree species, size (in diameter at breast height), distance from the curb, maturity (including transplantability), and health condition. The arborist determined the maturity, transplantability, and health of each tree by conducting a visual check.

Notable trees were also identified as part of the study. A "notable" tree is defined as those trees that the arborist deemed to be important to the urban landscape character. This category includes individual trees or tree types, as well as groups of trees that together comprise a recognized and important element of the visual landscape. Examples of notable trees along the alignment are large banyan trees (*Ficus spp.*) on Kalia Road, the Kamani trees (*Callophylum inophyllum*) lining Dillingham Boulevard, monkeypod trees (*Samanea saman*) on Kapiolani Boulevard, and clusters of various palms on Saratoga Road in Waikiki.

Tree health was also considered in determining whether or not trees are "notable". If the arborist identified a tree to be "overmature" (close to its life expectancy for successful replanting) or otherwise unhealthy, the tree was typically not deemed to be "notable". Only in a few instances were unhealthy or overmature individual trees identified as "notable" because of their contribution to the overall landscape. Examples of such trees are the Kamani trees on Dillingham Boulevard and the monkeypods on Kapiolani Boulevard.

Preliminary designs prepared after the MIS/DEIS was published (August 2000) and initial plans indicated that there would be impacts on urban street trees. Because of concerns about the magnitude of tree impacts initially identified, the City undertook concerted efforts to redesign portions of the In-Town BRT to minimize tree impacts. Redesign efforts in various locations included shifting or eliminating bus stops, reducing the number or size of traffic and BRT lanes, converting some exclusive BRT lanes to semi-exclusive or mixed-traffic lanes, and designing bus stops around existing trees, among others.

3.7.2 Freshwater Fish and Terrestrial Wildlife

The study area encompasses mostly urbanized land. Any remaining terrestrial wildlife habitats are generally highly modified and populated with introduced wildlife species. Numerous streams within the corridors provide habitat for species of introduced and indigenous fish, and migrating shorebirds. All streams have been modified in the lower reaches and are of relatively poor ecological quality.

The FWS notes that the Hawaiian hoary bat (*Lasiurus cinereus semotus*), federally listed as endangered, has been sporadically sighted within the Honolulu metropolitan area. The following waterbird species, federally listed as endangered, have been observed in wetland areas within the project area:

- Hawaiian coot (Fulica americana alai),
- Hawaiian duck (*Anas wyvilliana*),
- Hawaiian common moorhen (*Gallinula chloropus sandvicensis*), and
- Hawaiian stilt (*Himantopus mexicanus knudseni*).

The Oahu elepaio (*Chaoiempis sandwichensis ibidis*) has also recently been listed as an endangered species and its critical habitat designated. Their critical habitat is associated with the Koolau and Waianae mountains on Oahu.

The State of Hawaii lists the Oahu population of the white tern (*Gygis alba*) as endangered. White terns are a relatively recent bird to the avifauna of Oahu. Prior to the 1960s, they could only be seen with regularity in the Northwestern Hawaiian Islands. Their establishment on Oahu may be a result of crowded conditions elsewhere which have forced the birds to search for other roosting and nesting localities. At present the major site used by white terns on Oahu is Kapiolani Park, with some activity scattered elsewhere in urban Honolulu (Bruner, May 1992).

3.8 WATER

This section discusses surface waters (such as lagoons, streams, navigable waters, or harbors), groundwater, floodplains, coastal areas, wetlands, and water-dependent recreation.

3.8.1 Surface Water

The State's general policy is to maintain or improve existing water quality in all State waters. All waters of the State of Hawaii are classified as inland waters or marine waters. Inland waters are fresh waters, brackish waters, or saline waters, including streams, springs, wetlands, estuaries, anchialine pools, and saline lakes. Types of marine waters are embayments, open coastal waters, or oceanic waters. The State has defined water use classifications for inland and marine waters and set water quality criteria for each water use classification.

According to the Hawaii Department of Health (HDOH) administrative rules, inland waters can be either water use Class 1 or Class 2. The water quality in Class 1 waters is to be maintained in their natural states; no waste discharge is allowable. Class 2 waters are those to be protected for recreational use, propagation of aquatic life, agricultural and industrial water supplies, shipping, and navigation. Marine waters are categorized as Class AA and Class A. Class AA waters are to "remain in the natural pristine state as nearly as possible with an absolute minimum of pollution or alteration of water quality from any human-caused source or actions." Class A waters can be used for "recreational use and aesthetic enjoyment," among other allowable uses compatible with protecting the natural resources in these waters (Hawaii Administrative Rules (HAR), Chapter 11-54, Water Quality Standards).

1) Coastal Surface Waterbodies

The following large coastal surface water bodies are located within or adjacent to the project study area:

- Pearl Harbor
- Keehi Lagoon
- Honolulu Harbor
- Kewalo Basin
- Ala Wai Canal and Boat Harbor

These five water bodies are all highly urbanized and/or altered from their natural state. All have been listed by HDOH as "Water Quality-Limited Segments," as required by the Clean Water Act Section 305(b) and defined by 40 CFR 130.8. Water Quality-Limited Segments are water bodies having pollutants in excess of the established water quality standards, such that they cannot reasonably be expected to attain or maintain state water quality standards without additional action to control sources of pollution.

a) Pearl Harbor

Pearl Harbor is an estuary designated as Class 2 inland water, with a special set of water quality criteria because of its polluted condition. Pearl Harbor receives flows from a drainage basin of approximately 100 square miles. Freshwater inflows create a stratified estuary where a surface layer of brackish water flows out of the main channel with little tidal influence. The abundant rainfall at the heads of the streams that drain into Pearl Harbor results in runoff that transports pollutants from upland forest, agricultural, commercial, industrial, military, and residential lands. Water quality parameters for nitrogen, phosphorus, turbidity, fecal coliform, temperature, and chlorophyll are frequently violated in Pearl Harbor. The narrow entrance channel and the configuration of the lochs retard flushing of the harbor (Hawaii Coastal Zone Management Program, Office of State Planning, June 1996). Siltation is also a major problem, which is addressed by frequent maintenance dredging. Sediments are continuously resuspended by ship traffic.

b) Keehi Lagoon

Keehi Lagoon is a highly modified water body, designated Class A by HDOH. After World War II, seaplane runways were dredged, greatly increasing the volume of the lagoon and retarding flushing. When the Honolulu International Airport (HIA) was built, an additional circulation channel was constructed, which improved water quality, but a gradient of increasing turbidity and plant nutrients exists toward the discharges of Kalihi and Moanalua Streams. Other point source discharges to the lagoon include a drainage canal from HIA and adjacent industrial areas, and several additional drainage outlets along Lagoon Drive on the more southwesterly shoreline of the lagoon. The currents in Oahu's southern coastal waters move from Honolulu Harbor into Keehi Lagoon. These currents may transport pollutants into Keehi Lagoon and recirculate suspended matter. Various causes, effects and symptoms of water pollution in the lagoon have been documented, including petrochemical contamination of sediments and water, fish kills, and the presence of human enteric viruses. Although circulation in Keehi Lagoon is good, the lagoon regularly experiences violations of water quality parameters for phosphorus and turbidity. Nearly the entire lagoon includes fill material deposited from nearby dredging and from other sources.

In 1943, Kalihi Channel was dredged to the depth of 35–40 feet as part of military project to connect Kapalama Basin in Honolulu Harbor with the open ocean. Currently, there are two bridges over the Kalihi Channel effectively blocking ship access to Honolulu Harbor from Keehi Lagoon.

Over 300 vessels (e.g. boats and floating structures) are anchored throughout Keehi Lagoon and are often used as residences. Many of the vessels are not seaworthy and cannot propel themselves under their own power.

c) Honolulu Harbor

Honolulu Harbor is a Class A marine embayment. Honolulu Harbor has had recognized water pollution problems as far back as the 1920s. Two streams, Kapalama and Nuuanu, and numerous ditches and storm drains, contribute runoff to the harbor, along with associated pollutants. Water quality in the Kapalama Basin portion of the harbor is particularly poor because of discharges from Kapalama Stream. The parameters of greatest concern are nutrients, metals, suspended solids, pathogens, and turbidity (HDOH, March 1998). Coliform bacteria, nitrogen, phosphorus, and turbidity levels in the water regularly exceed State water quality standards. In 1978 and subsequent HDOH sampling, heavy metals, chlorinated pesticides, polychlorinated biphenyls (PCBs), chlordane, and dieldrin (a toxic chlorinated organic compound used in insecticides) have been identified in harbor waters.

d) Kewalo Basin

Two major storm drains discharge into Kewalo Basin, a Class A marine embayment. One drain serves Ala Moana Park and Center and the mauka residential and commercial areas. The other drain serves the Ward Avenue-Kakaako District, which consists of mostly light industrial and commercial businesses. All areas support heavy vehicular traffic. Kewalo Basin's design hinders circulation of water in the basin. As a result, the urban pollutants that collect in the basin remain concentrated for extended periods. Street debris, oil, chemicals, nutrients, and heavy metals are transported by urban runoff into Kewalo Basin (Hawaii Coastal Zone Management Program, Office of State Planning, June 1996). Water quality standards have been exceeded for nitrogen, phosphorus, and turbidity (HDOH, March 1998).

e) Ala Wai Canal and Boat Harbor

The Ala Wai Canal is a Class 2 inland water or estuary; the Ala Wai Boat Harbor at the mouth of the Ala Wai Canal is a Class A marine water body. As the connecting point for the Makiki, Manoa, Palolo, and Kapahulu watersheds, the Ala Wai Canal accumulates sediments, nutrients, some heavy metal contaminants, solid waste, and trash (Hawaii Coastal Zone Management Program, Office of State Planning, June 1996). Phytoplankton growth, suspended sediments, and visually objectionable trash discolor water in the canal. In addition, some incidences of bacterial infection have been reported. Water circulation from the point where the Manoa Stream meets the canal to near Kapahulu Avenue is poor. Floating debris collects under the makai side of the McCully Street Bridge, creating an unsightly mess. There is a fish advisory against the consumption of fish from the Ala Wai Canal, as well as other urban streams in Honolulu. Though the Ala Wai Canal flows into the boat harbor, the fish advisory does not mention the boat harbor specifically or other water bodies associated with urban streams.

2) Streams

In addition to the large water bodies discussed above, several streams are located within the study area. Most of these stream channels have been altered in the lower reaches and are not of high ecological quality. These streams include the following:

- Makakilo Gulch
- Makalapa Gulch
- Hunehune Gulch
- Kaloi Gulch
- Honouliuli Gulch
- Waikele Stream

- Kapakahi Stream
- Panakauahi Gulch
- Waiawa Stream
- Punanani Gulch
- Waimalu Stream
- Kalauao Stream
- Drainage canal next to Kalauao Stream
- Aiea Stream
- Halawa Stream
- Moanalua Stream
- Kahauiki Stream
- Kalihi Stream
- Kapalama Stream/Drainage Canal
- Waolani Stream
- Nuuanu Stream
- Pauoa Stream
- Makiki Stream
- Manoa-Palolo Drainage Canal

The water quality in these urban streams is poor. HDOH in May 1998 placed a health advisory against the consumption of fish from the Ala Wai Canal and other urban streams in Honolulu, due to the detection of organochlorine pesticides and lead in the fish. This advisory is still in effect (HDOH Fish Advisory, "DOH advises public to not eat fish from Honolulu streams," May 21, 1998).

3.8.2 Groundwater

1) Soil and Geology

Within the study area, coral reefs and eroded volcanic material have formed a wedge of sedimentary rock and sediments, referred to as caprock, which rests on the underlying volcanic rock. Caprock is composed predominantly of coral-algal limestone, interlaid with terrigenous clays and muds. Volcanic ash from the Honolulu volcanic series is often found in the caprock. The caprock is approximately zero to 1,000 feet thick in the study area (Wentworth, 1951).

Underneath the caprock lies the volcanic rock of the Koolau Range in most of the study area. Occasionally, these rocks are exposed towards the Koko Head end and they dominate the central portion. The rocks are mostly volcanic lava flows and pyroclastic deposits. The volcanic rocks exposed towards the Ewa end of the study area near Kapolei are part of the Waianae volcanic series.

There is recent alluvium in the study area, consisting mainly of clayey organic silt with variable amounts of sand, some pockets of gravel and cobbles, and localized thin layers of marine sediments. Low-lying areas were filled during urbanization and are usually underlain by recent alluvium. Often, these areas were originally marshlands. The Downtown Honolulu area consists mainly of silty sand and coral gravel dredged from Honolulu Harbor. It is unconsolidated, with high porosity and permeability.

The central and Ewa portions of the study area are mostly on alluvium and volcanic rock. The volcanic rocks are typical a'a and pahoehoe flows. They vary greatly in strength, thickness, hardness, and other engineering properties. There are also pyroclastic deposits that are generally permeable, low in strength, and may be highly weathered. Soil coverage on top of these rocks is generally thin to nonexistent.

2) Aquifers

The Southern Oahu Basal Aquifer (SOBA) is the principal aquifer underlying all of southern Oahu. The portions of the SOBA in the study area are the Pearl Harbor Aquifer Sector and the Ewa Aquifer System. In accordance with the 1984 Sole Source Aquifer Memorandum of Understanding between the FHWA and the Environmental Protection Agency (EPA), a Ground Water Impact Assessment (GWIA) was prepared to meet the coordination requirements of Section 1424(e) of the Safe Drinking Water Act.

The SOBA occurs as a basal freshwater lens floating on saline groundwater. It is recharged by rainfall that falls on the mauka area of Honolulu and the Leeward Coast. The caprock overlies the SOBA and impedes the escape of groundwater from this basaltic aquifer. Water in the caprock is brackish and not potable. The caprock is less permeable than water-bearing lava flows near the Koolau Range and constitutes a barrier that retards the seaward flow of groundwater. The caprock layer thins with distance from the shoreline and ends at varying distances inland, and the basalt layer is exposed or underlies surficial materials. As a consequence, inland areas of central Honolulu have the highest water tables in southern Oahu.

Beneath the caprock and underlying all of southern Oahu, the SOBA is heavily utilized, containing large supplies of fresh water. The basal groundwater is under artesian pressure; water levels range from ten to thirty feet above sea level. Although the capacity of the caprock to store and transmit water is small compared to that of the basalt aquifer, the caprock contains large quantities of water accumulating from rainfall, irrigation return, and leakage upward from the artesian portion of the basalt aquifer. Caprock water is generally of poor quality because of its relatively high chloride content, but it has been developed for agricultural and industrial purposes. Groundwater levels in the caprock in the study area vary with ocean tides and may also be influenced locally by streams. Depths may be as little as five feet below ground surface in the Koko Head portion of the study area.

There are numerous injection wells for waste discharge into the caprock in central Honolulu, including those for thermal effluent, car-wash return, and rainwater. Pollutants in these discharges do not reach the SOBA, however, due to upward artesian pressure.

The U.S. Environmental Protection Agency (EPA) has designated the SOBA as the sole or principal source of drinking water for the Pearl Harbor area. Based on Hawaii status codes related to the protection of drinking water, the SOBA is designated as a currently used source of fresh drinking water that is both irreplaceable and highly vulnerable to contamination (Mink and Lau, 1990).

3.8.3 Floodplains

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) indicate several areas within the study area falling within the 100- or 500-year base floodplains. These floodplains are associated with streams, estuaries, canals and tsunami inundation areas. The largest of these floodplain areas occurs Koko Head of Ward Avenue, makai of South King Street, and Ewa of Paoakalani Avenue. This area includes Ala Moana Beach Park, the Ala Moana Center, and Waikiki. The area includes the 100-year base floodplains associated with the Manoa-Palolo Stream and the Ala Wai Canal. It includes areas that would be inundated by worst-case hurricane conditions.

Other flood zones within the study area are associated with streams entering Pearl Harbor. Wailani, Kapakahi, and Waikele Streams form a floodplain where they enter the West and Middle Lochs. Waiawa, Honouliuli, Aiea, and Kalauao Streams all have floodplains associated with them as they enter Pearl Harbor. Additional floodplains occur at the mouth of Pearl Harbor, along much of the Leeward Coast, and along Halawa Stream near Moanalua Highway. Another isolated floodplain occurs at the confluence of Nuuanu and Waolani Streams near the intersection of the Pali Highway and the H-1 Freeway. Floodplains are also associated with Kaloi Gulch, near Kapolei Parkway.

3.8.4 Wetlands

As defined by 40 CFR 230.41(a)(1), wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. There are no wetlands suspected to be present within the proposed construction areas as many of the streams in the study area are concrete-lined, eliminating the potential for wetlands to exist.

3.8.5 Navigable Waters

Waters subject to tidal influence are generally defined as navigable. Further, navigability is defined by usage such that non-tidal streams carrying commercial traffic are deemed navigable. Table 3.8-1 lists the streams in the majority of the study area that have been deemed navigable. Navigation of all streams in the study area is extremely limited or non-existent. Most navigation is limited to small recreational boating such as canoes and kayaks (Communication with the U.S. DOT and the United States Coast Guard on March 23, 2000). Coordination with the U.S. Coast Guard will continue. For the purposes of the Department of the Army permitting requirements, the Division Engineer for the U.S. Army Corps of Engineers (ACOE) determines navigability under the authority of 33 Code of Federal Regulations (CFR) Part II, Section 329.14(b). The Coast Guard determination does not necessarily affect the ACOE permitting jurisdiction.

TABLE 3.8-1
NAVIGABLE WATERWAYS IN THE STUDY AREA

Waterway	Navigable Length	
	Kilometers	Miles
Waiawa Stream	0.16	0.1
Waimalu Stream	0.16	0.1
Waikele Stream	1.67	1.0
Kahauiki Stream	0.74	0.5
Panakauahi Gulch	2.04	1.3
Kapakahi Gulch	0.37	0.2
Kalauao Creek	0.16	0.1
Aiea Creek	0.32	0.2
Halawa Creek	0.32	0.2
Moanalua Stream	1.60	1.0
Kalihi Stream	0.80	0.5
Kapalama Stream	0.80	0.5
Nuuanu Stream	0.80	0.5
Pauoa Stream	Entire length	
Manoa-Palolo Drainage Canal	Entire length	
Ala Wai Canal	Entire length	

Sources: U.S. DOT, United States Coast Guard, letter, June 13, 1989.

3.8.6 Coastal Zone Management (CZM) Areas

The U.S. Department of Commerce in September 1978 approved the Hawaii Coastal Zone Management (CZM) Program with the following goals:

- Protect valuable resources;
- Preserve management options;
- Ensure public access to beaches, recreation areas, and natural reserves; and
- Provide for solid and liquid waste treatment within the Special Management Area (SMA).

In Hawaii, the Department of Business, Economic Development, and Tourism (DBEDT) administers the program. Federally funded activities must receive a consistency determination from the CZM program to assure that they meet the guidelines in the State policy. Hawaii Revised Statutes (HRS) Chapter 205A outlines special controls, policies, and guidelines for development within the area along the shoreline referred to as the Special Management Area (SMA) designated by the 1975 Shoreline Protection Act. This act gave the counties authority to issue permits for development activities proposed within the SMA. For the City and County of Honolulu, the Department of Planning and Permitting (formerly the Department of Land Utilization) is the agency that administers most of the SMA Use Permit program. The City Council has the authority to approve these SMA permits. In addition, the Kakaako area is a Hawaii Community Development District. This district stretches from Honolulu Harbor to Piikoi Street. In this district, the Hawaii Community Development Authority (HCDA) has the authority to approve SMA permits.

3.8.7 Water Recreation

Recreational uses of surface waters within or adjacent to the study area are limited primarily to the ocean and the Ala Wai Canal. The Department of Land and Natural Resources (DLNR), Division of Boating and Ocean Recreation, manages the recreational uses of shore waters and shore areas in accordance with Chapter 13-250-256, Part III, entitled "Ocean Waters, Navigable Streams and Beaches." It divides the coastal areas into segments and specifies what water-based uses are allowed within specific zones. Most of the study area falls within the South Shore Oahu Ocean Recreation Management segment, which includes all ocean waters and navigable streams from Makapuu Point to the west boundary of the Reef Runway of HIA. In addition to swimming and sunbathing, people surf, snorkel, paddle, canoe, sail, cruise, ride jet skis, whale watch, water ski, and fish in this area. The remaining Ewa portion of the study areas falls within a Non-designated Ocean Recreation segment, from Pearl Harbor to Kalaeloa (formerly Barbers Point).

Makai of Ala Moana Regional Park is the Ala Moana Commercial Thrill Craft Zone, which is restricted to commercial operators. Ewa of this zone and makai of HIA is the Keehi Lagoon/Kahakaaulana Islet Commercial Zone, which is the site of commercial thrill craft and other commercial ocean activities. Recreational thrill craft are accommodated in the Reef Runway Zone that parallels the airport's Reef Runway.

Recreational use of the navigable streams in the corridor is minimal. Recreational use of the Ala Wai Canal consists primarily of paddling and fishing. However, as mentioned earlier in this section, the water quality is poor and HDOH has issued a health advisory regarding the consumption of fish from the Ala Wai Canal. (HDOH Fish Advisory, "DOH advises public to not eat fish from Honolulu streams," May 21, 1998).

3.9 HAZARDOUS MATERIALS

Present and historic land uses in the corridor could have produced site contamination. Most contaminated sites are or were associated with the use, transportation, or storage of hazardous materials. Heavy industrial activities and commercial uses such as vehicle service stations and dry cleaning operations are among the types of land uses with the potential to produce site contamination. Site contamination could result from on-site land uses, or contaminants may have migrated from a nearby site to an area involved in one or more of the project alternatives. This section provides preliminary information on documented sources of hazardous materials or contamination in the primary transportation corridor that could affect property acquisition or construction associated with the project.

Regulatory information indicates the presence of Leaking Underground Storage Tanks (LUSTs), other sources of petroleum contamination, PCBs, potential solid waste, and/or hazardous waste materials throughout the Regional and In-Town BRT corridors. The Refined LPA is designed to operate primarily on existing streets, where no hazardous materials are expected to be encountered. No hazardous material sites have been identified at proposed transit stops. However, off street facilities associated with the BRT, such as transit centers and traction power supply stations (TPSS) for the In-Town BRT may encounter site contamination issues.

The approximately 15 TPSS sites to be located intermittently along the In-Town BRT alignment would each have a roughly 500 square-foot footprint. In most cases, they would be located inside existing or proposed buildings. Potential TPSS locations are designated on the preliminary engineering drawings provided in Appendix B (see Volume 4). However, since it would be 8 to 14 years before the EPT is installed depending on the segment, the locations shown on the design drawings are not site specific; each notation is intended only to indicate the general vicinity in which a TPSS would be placed. Site specific environmental assessments of each TPSS would be prepared prior to proceeding with implementation of EPT. Locations and design treatments would be established with community input.

Methane is likely to be present in the subsurface areas where petroleum contamination occurs. Methane is produced during the degradation of organic matter, including petroleum hydrocarbons. Methane could be a concern in the case of confined subsurface structures (such as utility vaults) where methane gases can build up and potentially ignite. Such incidents have been reported in areas of Iwilei and downtown Honolulu, and the presence of methane may need to be considered in project planning.

3.10 HISTORIC AND ARCHAEOLOGICAL RESOURCES

3.10.1 Applicable Legal and Regulatory Requirements

Section 106 of the National Historic Preservation Act (NHPA) requires that actions that are federally funded, authorized or carried out take into account the effect of such actions on any district, site, building, structure or object that is included in or eligible for inclusion in the National Register of Historic Places (NRHP). Such resources are called "historic properties." Section 106 requires coordination and consultation the State Historic Preservation Officer (SHPO), and other agencies and organizations that may have an interest in or is mandated to protect historic properties. In addition, the Advisory Council on Historic Preservation is afforded the opportunity to comment on actions that may potentially affect historic properties.

Chapter 6E of the Hawaii Revised Statutes (HRS) places similar responsibilities on State agencies to evaluate their projects. Since the project involves both federal and State agencies, both HRS Chapter 6E and Section 106 apply to the project.

The Section 106 and Chapter 6E process consists of: (1) identification of historic properties in the Area of Potential Effect (APE); (2) assess potential project effects on the historic properties in the APE, and, (3) if necessary, mitigate adverse impacts. This section of the FEIS documents activities to identify historic properties in accordance with the requirements of the Code of Federal Regulations (CFR) pertaining to the Protection of Historic Properties (36 CFR 800) (known as Section 106) and HRS Chapter 6E.

For a district, site, building, structure or object to be considered eligible for the NRHP, it has "integrity of location, design, setting, materials, workmanship, feeling, and association", and meet any one of the following criteria:

(A) associated with events that have made a significant contribution to the broad patterns of history;
(B) associated with the lives of persons significant in the past;
(C) embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction; or
(D) yielded, or may likely yield, information important in prehistory or history.

The Hawaii Register of Historic Places (HR) provides an additional criterion:

(E) site that has cultural significance, such as religious structures (shrines, *heiau*), or human burial locations.

For descriptive purposes, the historic properties identified in this section are categorized in the following manner:

- Archaeological Remains, Sites or Resources. Most of these historic or potentially historic properties would be related to the Native Hawaiian population, especially those originating prior to western contact.
- Historic-Period Resources. These are historic or potentially historic buildings, structures or objects constructed or erected after western contact. This category includes historic districts.

- Traditional Cultural Properties (TCP). An area or place associated with the cultural practices or beliefs of a living community because it is rooted in that community's history, or it is important in continuing that community's cultural identity.

3.10.2 Description of the Resources

The study area with regards to historic properties is called the Area of Potential Effect (APE). It is defined in 36 CFR 800.16 as the "geographic area or areas within which an undertaking (project, activity or program) may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. [It] is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking." Since many elements of the Refined LPA, such as the In-Town BRT transitway, would not rise above or extend beyond existing streets, the APE was limited to the street itself. However, where elements of the Refined LPA uses new right-of-way, such as transit centers, and/or involve structures, such as transit stops, the APE would be extended to the new right-of-way or those properties immediately adjacent to the structure. However, what is meant by adjacent could vary depending on the property. In a letter dated March 8, 2000, the SHPO concurred with the APE definition (see Appendix A).

1) Archaeological Resources

It is unlikely that archaeological remains exist near the soil surface in the project area because most of the project area is fill and/or the soil surface has been highly disturbed in association with large-scale agriculture and urban development. Also, the APE along most of the project area would be within the H-1 Freeway and existing streets. However, archaeological deposits, including burials, have been discovered in the project area, such as in Chinatown, Downtown/Aloha Tower, the Capitol District, Kakaako, the University of Hawaii Historic District, the Fort DeRussy area, and along Kalakaua Avenue in Waikiki. Some of these discoveries were unexpected. For example, one human burial was discovered in 1997 during construction activities at Pier 40 in an area of reclaimed land, and three burials were found on a site adjacent to the Middle Street Bus Maintenance Facility in 1992. The sandy soil conditions of Fort DeRussy and Kalakaua Avenue make the discovery of burials in these locations not unexpected. Further study or monitoring would be conducted if required on a site-specific basis, depending on the construction activity (i.e. excavation).

Some of the Refined LPA's off-street elements are proposed to be in the Ewa plain, an area that has undergone substantial ground disturbance from past and present agricultural activities that would have removed or destroyed surface or near surface archaeological remains. However, natural archaeological/cultural features remain, such as Puu Kapolei. Other off-street elements of the Refined LPA are in urban areas where it is highly unlikely that there would be surface or near-surface archaeological resources or sites, but subsurface remains may be encountered if deep excavation is required.

2) Historic-Period Resources

The following program was used to identify historic-period resources in the APE. This program relied on consultation with the State Historic Preservation Division (SHPD).

1. Research of secondary data sources, such as previous survey reports and current NRHP and HR lists to identify known historic properties;
2. Conduct windshield surveys to identify buildings or structures that may be 50 years or older;
3. Obtain information on the age of buildings and structures identified in the windshield survey;
4. Consult with SHPD to eliminate buildings or structures that clearly would not meet NRHP Criteria;
5. Conduct inventory survey of the remaining buildings or structures after Step Four to assess eligibility for the NRHP; and
6. Obtain SHPD concurrence on NRHP eligibility assessment.

As described above, the APE for historic-period resources would not extend beyond the roadway for many of the elements of the TSM Alternative and Refined LPA because they would be at-grade and within roadway rights-of-way. There are no historic-period resources in the APE of the TSM Alternative. Similarly, there are no historic-period resources in the APE of the Regional BRT element of the Refined LPA, including project elements in Ewa and Aloha Stadium. However, the APE of the In-Town BRT element of the Refined LPA includes several historic-period resources, among them are the Chinatown Historic District, Hawaii Capital Historic District, and the University of Hawaii Historic District (see Table 3.10-1 and Figures 3.10-1A and 3.10-1B) because transit stops are planned to be located within each of these districts. Other historic-period resources listed on Table 3.10-1 and shown on Figures 3.10-1A and 3.10-1B were determined to be within the APE of the In-Town BRT because they are adjacent to proposed transit stops or would be affected by right-of-way acquisition. Many of the historic-period resources in the APE are located in an historic district. Descriptions of the three affected historic districts are provided below.

A. Chinatown Historic District

Chinatown (State Site 80-14-1380) is the oldest section of Downtown Honolulu. Constructed in the first decades of the 20th century, after the fire of 1900, Chinatown still retains a concentration of original and historically significant buildings, and its distinctive cultural activities and environment even of its earliest ethnic community. These historically significant buildings are primarily simple, two- and three-story structures of common materials, but with interesting details and harmonious designs. Typically the buildings abut the front and side property lines, with awnings over the sidewalks. Together, the buildings form a historical environment more significant than the individual structures.

The Chinatown BRT Stop is planned to be in proximity to two potentially historic properties, the Lung Doo Benevolent Society and Yew Char Buildings.

B. Hawaii Capital Historic District

The Hawaii Capital Historic District (State Site 80-14-1307) includes most of the important civic buildings in the core of Honolulu (see Figure 3.10-1B). The historic centralization of government services in Honolulu resulted in an unusual concentration of public and private architecture, spanning the years from 1820 (the Mission Frame House) through 1969 (the State Capitol Building).

The government buildings have inspired commercial firms, churches, the YMCA and YWCA, among others, to erect buildings complementing the civic structures. Most of the civic buildings are government-owned, but several are commercial or other institutional buildings. Some of the buildings in the district were specifically listed in the overall NRHP nomination, such as Iolani Palace and Grounds, Kawaiahao Church and Grounds, Saint Andrew's Cathedral, and the Mission Houses because they had already been placed individually on the NRHP. The U.S. Post Office, Custom House and Court House (State Site 80-14-9952), one of the two historic-period resources of the district in the APE of the In-Town BRT, was individually listed on the NRHP in 1975. Additional buildings were placed on the NRHP along with the district in 1978, including the other historic-period resources in the district in the APE, the Hawaii State Library (State Site 80-14-1307), There is a wide range of architectural styles in the district, with distinguished examples of Classical Revival, Romanesque, Spanish Mission, Italian Mediterranean, New England Colonial, French Baroque, and Georgian buildings.

The significance of this district resides in its architectural and visual character, its large amount of open space, and its central role in the history of Oahu and the Hawaiian Islands.

C. University of Hawaii Historic District

The University of Hawaii (UH) Historic District (State Site 80-14-1325) is a non-contiguous district that includes the historically significant structures on the Manoa campus (see Figure 3.10-1A). Structures (e.g., transit stops) associated with the In-Town BRT are not planned to be near the two areas of the campus that contribute heavily to the historical significance of the district: the original quadrangle and a circular drive off Dole Street.

TABLE 3.10-1
KNOWN AND POSSIBLE HISTORIC-PERIOD RESOURCES IN THE APE

Loc. No.	Historic Resource	Street	State Site Number	Register Status[1]	Tax Map Key	Year Built
1	Chinatown Historic District	N. King St. and Hotel St.	80-14-9986	NRHP	All of plats 1-7-2,3,4, et al.	1900-1920
2	Lung Doo Benevolent Society	N. Hotel St.	None	*	1-7-3:33	
3	Yew Char Building	N. Hotel St.	None	*	1-7-3:42	
4	Portland Building	Hotel St.	None	DE (1/11/80)	2-1-10:13	1903
5	Hawaii Capital Historic District	Various	80-14-1307	NRHP	Various	--
6	U.S. Post Office, Custom House, & Court House (HCHD)	S. King St.	80-14-9952	NRHP	2-1-25:4	1871
7	Hawaii State Library	S. King St.	80-14-1307	NRHP	2-1-25:1	1913
8	Thomas Square	S. King St.	80-14-9990	NRHP	2-4-1:1	--
9	Kapiolani Boulevard historic landscape	Kapiolani Blvd.	None	*	Various	--
10	Blue Cross Animal Hospital	Kapiolani Blvd.	None	*	2-3-15:1	1938
11	Varsity Theater	University Ave.	None	TBD	2-8-006:032	1939
12	University of Hawaii Historic District	University Ave.	80-14-1325	HR	2-8-015:001	1931
13	Bachman Hall	UH Campus – University Ave.	None	*	2-8-023:003	1949
14	Dillingham Transportation Building	735 Bishop St.	80-14-9900	NRHP	2-1-14:03	1929
15	Ala Moana Park	Ala Moana Blvd.	80-14-1388	HR	2-3-37:01	--
16	Kapiolani Park (i/c Honolulu Zoo)	Kapahulu Ave.	80-14-9758	HR	Various	--

Source: Mason Architects, Inc. and State Historic Preservation Division, 2002
Notes: [1] Register Status:
NRHP Listed on National Register of Historic Places.
HR Listed on Hawaii Register of Historic Places (very likely to be eligible for the National Register).
DE Determined Eligible for the National Register by the Keeper of the NRHP.
* Determined eligible from consultation with SHPD on June 24, 2002.

In addition, In-Town BRT structures are not planned to be adjacent to other historic properties of the district, such as Founders Gate. However, the UH-Manoa BRT stop will be placed at Sinclair Circle and would be in proximity to Bachman Hall across a grassy lawn. The historic status of Bachman Hall has not been determined.

D. Other Historic-Period Resources

Other notable historic-period resources listed on Table 3.10-1 include Thomas Square (State Site 80-14-9990), Kapiolani Boulevard historic landscape, Dillingham Transportation Building (State Site 80-14-9900), Ala Moana Park, and Kapiolani Park, which includes Honolulu Zoo. The SHPD has designated the monkeypod trees along Kapiolani Boulevard as an historic landscape. These trees are considered "notable" because they are important to the urban landscape character.

Historic Sidewalk Features, which are typically curbs made of lava rocks and sidewalks made of Chinese granite, are located at various places throughout Honolulu, from Kalihi to University and Waikiki. They were used during earlier periods of Honolulu's development. The light-colored Chinese granite sidewalks tend to be limited to the Chinatown/Downtown area. Table 3.10-2 provides the locations along the proposed In-Town BRT alignment where lava curbs have been identified and may be affected.

FIGURE 3.10-1A

HISTORIC-PERIOD RESOURCES IN THE AREA OF POTENTIAL EFFECT: KALIHI TO THE UNIVERSITY OF HAWAII

FIGURE 3.10-1B

HISTORIC-PERIOD RESOURCES IN THE AREA OF POTENTIAL EFFECT: HAWAII CAPITAL HISTORIC DISTRICT

TABLE 3.10-2
HISTORIC SIDEWALK AND CURB ELEMENTS
IN THE AREA OF POTENTIAL EFFECT OF THE IN-TOWN BRT

Location	Comments
CHINATOWN/DOWNTOWN	
Hotel Street at Kekaulike Mall	Makai side - all lava; Mauka side - mostly lava
Alakea Street between Queen Street and Nimitz Highway	KKHD Side - about 2.5 pieces of lava at existing bus stop
Bishop Street between Queen Street and Nimitz Highway	Ewa Side – lava curbs
South King Street at Punchbowl Street in front of State Library	Mauka side curb and edge of sidewalk all lava
KAKAAKO/MAKIKI	
South King Street at Alapai Street to Cooke Street	Mauka side - all lava to Cooke Street; Makai side – mostly lava
South King Street at Ward Avenue, in front of Thomas Square and Neal Blaisdell Center	Mauka side - all lava from Ward to Victoria St., except storm drain; Makai side - all lava at existing bus pull-out
South King Street at Pensacola Street, in front of Kaiser Honolulu Clinic	Mauka side - mostly lava; Makai side - all lava
WAIKIKI AREA	
Saratoga Road	Mostly lava rock

Source: Parsons Brinckerhoff, Inc., December 2001.
Note: Curbs locations surveyed approximately as shown in design drawings (SSFM, November 26, 2001). No granite sidewalks were noted during field surveys.

3) Traditional Cultural Properties or Practices (TCPs)

A traditional cultural property (TCP) may also be eligible for the NRHP. According to the National Register Bulletin 38, Guidelines for Evaluating and Documenting Traditional Cultural Properties (1994), a TCP is defined generally as a resource that is eligible for the NRHP because of its association with the cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community. Consultation was held with the Office of Environmental Quality Control (OEQC) and the Office of Hawaiian Affairs (OHA) to identify potential TCPs in the study area.

Following the initial consultation, a panel of experts was formed and convened. Its purpose was to develop a working definition of "cultural practice" in an urban setting and to develop a working definition of the geographic boundary of the study area. The panel included a mix of individuals with expertise including cultural anthropology, urban planning, social impact assessment and planning, and ethnography.

The panel work session was held on May 24, 2001. It was agreed to define "cultural practices" to include the many traditions and ethnicities of Hawaii. The study corridor was identified, as the area between the H-1 Freeway and the ocean, and from Middle Street to Kapiolani Park. Several methods were employed to identify cultural areas and practices, such as using the knowledge of the panel members and key informants, driving and walking through the neighborhoods of the study area, and obtaining schedules and other publications that provide information about cultural events.

The panel was able to identify over 400 cultural practices, which were categorized in the following manner: From this list, two culturally significant districts were identified: Chinatown and Iolani Palace/Kamehameha Statue area. As stated above, both areas are already considered historic properties in part or whole.

Chinatown is the location of more than 70 cultural practices, the largest critical mass of practices identified in the study area. The "cultural character" of Chinatown is reinforced by the design of buildings, streets, and landscaping, as well as practices, such as the constant presence of sidewalk retail activities.

The Iolani Palace/Kamehameha Statue area, which is part of the Hawaii Capital Historic District, is culturally significant because of its historical and cultural symbolism. The "look" and the ability to carry out certain ceremonies in and through this area are important attributes, such as the starting point of the King Kamehameha Day Parade.

3.11 PARKLANDS

Parks and recreational facilities in the study area have been identified through a review of available mapping, coordination with City, State, and federal agencies, and field surveys. This section describes the findings of this work.

Hawaii's mild tropical climate encourages a variety of outdoor recreational activities. Consequently, numerous areas have been designated as parks and recreational areas on the island of Oahu. They are heavily utilized by the public for various activities, making Oahu's parks and recreational facilities valuable and important.

Through literature review, agency coordination and field review, parklands in the project area were identified. In addition to interviewing agencies, several documents were reviewed, including the Index of Oahu Parks and Facilities (City and County of Honolulu, April 1997); Existing State Parks and Other Areas Fiscal Year 1997-98 (State of Hawaii, 1998); aerial photos; and TMK Oahu Street and Condo Map Book, 12th Edition (Hawaii TMK Service, 1998).

This list was evaluated to identify those park and recreation resources located immediately adjacent to elements of the alternatives, including those located adjacent to proposed ramps, park-and-ride lots, and transit centers and transit stops. These parks and recreational facilities are listed on Table 3.11-1, and their locations are shown on Figures 3.11-1A through 3.11-1C.

TABLE 3.11-1
PARKLAND RESOURCES IMMEDIATELY ADJACENT TO PROJECT ELEMENTS

Map Key[1]	Park	Street	(Acres)	Classification [2]	Jurisdiction
1	Aloha Stadium	Kamehameha Hwy and Salt Lake Boulevard	97.44	Sports Arena	State of Hawaii
2	Aala Park	North King Street	6.69	Urban Park	City and County
3	Fort Street Mall	Fort Street	0.87	Mall	City and County
4	Chinatown Gateway Park	Bethel Street	0.40	Urban Park	City and County
5	Union Street Mall	Between Hotel and Bishop Streets	0.36	Mall	City and County
6	Iolani Palace State Monument	Hotel Street	10.60	Urban Park	State of Hawaii
7	Unnamed open space adjacent to federal building	Ala Moana Boulevard and Halekauwila Street	N/A	Urban Park	United States
8	Thomas Square	South Beretania Street, Ward Avenue and King Street	6.42	Urban Park	City and County
9	Mother Waldron Neighborhood Park	Pohukaina Street	1.76	Neighborhood Park	City and County
10	Ala Moana Regional Park, including Aina Moana Recreation Area (Magic Island)	Ala Moana Boulevard	119.18	Regional Park	City and County
11	Frank C. Judd Mini Park	Kapiolani Boulevard	0.37	Mini Park	City and County
12	Ala Wai Promenade	Kalakaua Avenue	4.43[3]	Urban Park	City and County
13	Ala Wai Community Park and Clubhouse	Kapiolani Boulevard	13.98	Community Park	City and County
14	Ala Wai Neighborhood Park	University Avenue	15.70	Neighborhood Park	City and County
15	Duke Paoa Kahanamoku Beach Park	Paoa Place	0.43	Beach Park	City and County
16	King Kalakaua Park (formerly Waikiki Gateway)	Kalakaua Avenue	0.57	Urban Park	City and County
17	Beachwalk Triangle	Beachwalk and Kalakaua Ave.	0.15	Urban Park	City and County
18	Princess Kaiulani Triangle	Kaiulani and Kuhio Avenues	0.12	Urban Park	City and County
19	Kuhio Avenue Mini Park	Kuhio Avenue	0.12[4]	Mini Park	City and County
20	Kuhio Beach Park	Kalakaua Avenue	3.40	Beach Park	City and County
21	Kapiolani Regional Park[5] (includes Honolulu Zoo)	Kapahulu and Kalakaua Avenues	154.73	Regional Park	City and County
22	Kapiolani Beach Park	Kalakaua Avenue	12.09	Beach Park	City and County
23	Waikiki Beach[6]	Kalakaua Avenue	unknown	Various	Various (City, State, and Private)
24	Irwin Memorial Park	Aloha Tower Drive	0.7	Urban Park	State of Hawaii
25	Makai Gateway Park	Ilalo Street	6	Community Park	State of Hawaii
26	Kakaako Waterfront Park	Kelikoi Street	30	State Park	State of Hawaii
27	Tamarind Park	Bishop/King Streets	N/A	Urban Park	Private

Sources: Parsons Brinckerhoff Inc., Initial Field Survey 1989, Update January 1992; City and County of Honolulu Department of Parks and Recreation, Index of Oahu Parks and Facilities, 1997; DLNR, State Parks Division, Existing State Parks and Other Areas, 1998, Agency Interviews, December 1999.

TABLE 3.11-1 (CONT.)
PARKLAND RESOURCES IMMEDIATELY ADJACENT TO PROJECT ELEMENTS

Notes:

[1]Map Key refers to numbers on Figures 3.11-1A through 3.11-1C.

[2]Classifications:

District Park - park approximately 20 acres in size servicing approximately 25,000 people, with playfields, recreation complex and passive areas.
Community Park - park approximately 10 acres in size servicing approximately 5,000 people with playfields, passive areas and a recreation building.
Neighborhood Park - park approximately 6 acres in size, servicing approximately 5,000 people, with playfields, courts, and a comfort station.
Mall - long, narrow, pedestrian walkway in commercial areas, with benches, water fountains, arbors, landscaping.
Mini Parks - small landscaped areas, servicing high-density areas with benches, picnic tables, and children's play areas.
Regional Park - Large area that may serve the entire island or region of the island with a variety of recreation park types and facilities, natural and cultural sites.
Urban Parks - Passive landscaped areas, usually located in residential or business areas.
Beach/Shoreline Park- Area along shoreline, with facilities to support water activities, picnicking, and other passive activities.
Classifications not included: Right-of-Ways, Traffic Related Areas, Military Parks and Unencumbered State Land

[3]Ala Wai Promenade has two portions, the Waikiki side and the Ewa side. The Ewa side is larger and measures roughly 4.43 acres. The size of the Waikiki side could not be determined, but it is a smaller, thin strip of land along the Ala Wai Canal, between Ala Moana Boulevard and McCully Street.

[4]The Kuhio Mini Park consists of three small areas along Kuhio Avenue. The area of only the largest of the three is known; the other two mini parks are landscaped bus stops.

[5]The acreage for Kapiolani Regional Park includes the Honolulu Zoo, the tennis courts, Paki Community Park, Waikiki Playground, and the community gardens.

[6]The name "Waikiki Beach" refers to a stretch of beach from the State-owned Duke Kahanamoku Beach to the edge of Sans Souci Beach, and does not refer to an official beach park area. Note that beach ownership in this area is both public and private.

FIGURE 3.11-1A
PARKLAND RESOURCES: AIEA - FORT SHAFTER

FIGURE 3.11-1B
PARKLAND RESOURCES: FORT SHAFTER - DOWNTOWN

FIGURE 3.11-1C
PARKLAND RESOURCES: DOWNTOWN – WAIKIKI

CHAPTER 4 TRANSPORTATION IMPACTS

CHAPTER OVERVIEW AND ORGANIZATION

This Chapter discusses transportation related impacts and performance, and is divided into two major parts. Section I covers the IOS and Section II covers the three alternatives for the Primary Corridor Transportation Project. The purpose of this presentation is to disclose fully the beneficial and adverse transportation related impacts of the project and to present proposed mitigation measures.

The first section of this Chapter is specific to the impacts of the IOS from Iwilei to Waikiki, the first segment of the Refined LPA to be built. The transportation impact analyses of the IOS reflect conditions in 2006, shortly after the opening of the IOS in 2005. The transportation impact analyses presented in Section II reflect conditions in 2025 for each of the entire primary transportation corridor alternatives- the No-Build Alternative, TSM Alternative, and Refined LPA.

I. IWILEI TO WAIKIKI (IOS) TRANSPORTATION IMPACTS AND MITIGATION

This section presents a summary of the potential transportation impacts associated with the IOS and No-Build conditions, as anticipated for the year 2006. Because 2006 is only three years from the time of the preparation of this document, traffic and transit volumes were factored by recent historical growth rates to produce a 2006 No-Build condition. The IOS was developed by maintaining the projected 2006 traffic volumes and modifying transit volumes to reflect proposed changes in transit service. The 2006 No-Build condition is different from the 2025 No-Build Alternative described and analyzed elsewhere in this FEIS. A more detailed presentation of the transportation impact assessment for the IOS is contained in Section IOS.4 (pages IOS-22 to IOS-31) in the IOS Chapter, which follows Chapter 5.

1) Transit Impacts

The IOS will operate in a combination of exclusive, semi-exclusive and mixed flow transit lanes. There will also be traffic signal priority at selected intersections to speed up BRT service.

The proposed average transit headways for the IOS is six minutes during peak periods and ten minutes during off-peak periods. Ten BRT vehicles will be needed to provide peak period service.

Most existing local and express bus service will be maintained, including Routes 19, 20, and 42 that travel on Ala Moana Boulevard as local service and Routes 201 and 202 that travel on Ala Moana Boulevard as express routes. Because the IOS will serve the same function as the existing Route 8, Route 8 will be replaced by the IOS. Likewise, Routes 55, 56, and 57 that provide suburban bus service from the windward side of Oahu to Downtown and then Ala Moana Center will terminate in Downtown, with the BRT providing service between Downtown and Ala Moana Center.

With these proposed changes, the forecasted Year 2006 linked transit trips and the daily transit boardings for the IOS are as summarized in Table 4-1.

The proposed enhancements included in the IOS are projected to result in approximately 4,500 new transit riders per day more than the No-Build condition in 2006 or about a fourth of the boardings on the IOS buses.

TABLE 4-1
PROJECTED YEAR 2006 TRANSIT RIDERSHIP

	Estimated Daily Trips/Boardings
Systemwide No-Build Daily Linked Transit Trips	199,680
Systemwide IOS Daily Linked Transit Trips	204,190
Projected New Transit Riders to System	4,510
Daily IOS Boardings	16,370

Source: Parsons Brinckerhoff, April 2003.

2) Urban Intersection Impacts

Because auto capacity along streets within the urban core of Honolulu is governed by intersection operations, intersection analyses were performed to assess the impacts of the IOS in relation to the No-Build condition. Key intersections along the IOS route were evaluated. These intersections were grouped into four areas for ease of discussion, and because traffic issues within these groupings tend to be similar. These areas are Downtown, Kakaako, Ala Moana-Fort DeRussy, and Waikiki.

Downtown Traffic Operations

The IOS will result in little difference from the No-Build condition in terms of traffic LOS at Downtown intersections. The maximum projected increase in intersection delay is 0.9 seconds, and this would occur at the Nimitz Highway/ Bishop Street intersection.

Kakaako Traffic Operations

There is very little difference in intersection operations forecast between the No-Build and IOS conditions. The lane geometry and signal operation of the intersections in Kakaako will be the same for the No-Build and IOS conditions. This includes Ala Moana Boulevard through Kakaako.

The IOS is proposed to operate in mixed traffic along Ala Moana Boulevard in the section between Queen Street and the Ala Wai Bridge. The lane conversions proposed in the future with the Refined LPA will take place when more of the Refined LPA is in place and the diversion of motorists to transit is sufficient to offset the traffic impacts of the lane conversions.

Ala Moana-Fort DeRussy Traffic Operations

The Ala Moana-Fort DeRussy area is located between the Ala Wai Canal (at Ala Moana Boulevard) on the Ewa end and Fort DeRussy on the Koko Head end. Ala Moana Boulevard, between Atkinson Drive and Kalakaua Avenue, experiences periods of congestion today. To help lessen the congestion, the IOS proposes to add a semi-exclusive transit lane in each direction on Ala Moana Boulevard between Holomoana Street and Kalia Road by reducing the width of the existing raised median and narrowing existing traffic lanes.

In the Koko Head-bound direction, the semi-exclusive lane is proposed to be added to the existing three general-purpose lanes. BRT vehicles, local buses, tour buses and trolleys, and vehicles making right-turns will be allowed into this semi-exclusive lane. The lane will begin just Ewa of Holomoana Street and continue to Kalia Road. The net effect in the Koko Head-bound direction will be to create a double right-turn movement, helping to accommodate the substantial existing and projected future right-turning traffic at Kalia Road.

In the Ewa-bound direction, the semi-exclusive lane will begin at the Kalia Road intersection. It will continue to Hobron Lane, where it will become a right-turn only lane except for City buses. City buses in the semi-exclusive lane will be given an advance green signal to allow BRT and other City buses to transition into the general purpose lanes without conflicting with other Ewa-bound through traffic on Ala Moana Boulevard. Ewa of Hobron Lane, the lane configurations will be the same for the No-Build and IOS conditions.

The analyses show that there will be an improvement in the LOS at the Hobron Lane intersection during the P.M. peak period with the IOS, otherwise there is no difference forecast between the No-Build and IOS conditions in terms of LOS for the other intersections along Ala Moana Boulevard.

The IOS includes widening of the two-lane segment of Kalia Road by one lane in each direction, with these lanes being designated as semi-exclusive lanes. BRT, local buses, private buses, and autos turning right into driveways on Kalia Road will be able to use these lanes. Removing these vehicles from the existing general-purpose lanes will provide room for other local traffic along this segment.

The Kalia Road/Ala Moana Boulevard intersection is expected to operate similarly between the No-Build and IOS conditions.

Kalia Road currently transitions from a two-way street to an Ewa-bound one-way street at Saratoga Road. The existing Saratoga/Kalia Road intersection is STOP-sign controlled. In the projected 2006 scenario, the IOS project will modify this intersection to make traffic movements between the Ewa Kalia leg and the Saratoga leg the through movement. The Koko Head Kalia leg would form a T-intersection with this through movement and will be signalized. This will not affect the LOS.

Waikiki Traffic Operations

The Waikiki area includes key intersections along Kalakaua and Kuhio Avenues between Saratoga Road and Kapahulu Avenue.

Lane configurations for intersections within this segment of the IOS alignment are the same for the No-Build and IOS conditions with the following exceptions: the makai curb lane on Kalakaua Avenue between Saratoga Road and Uluniu Avenue will be converted to a semi-exclusive lane in the IOS. This lane will be available for right turning vehicles and buses, both public and private. Another exception will occur at Kalaimoku Street. This street will be modified to accommodate an additional lane in the makai-bound direction between Kuhio Avenue and Kalakaua Avenue. The additional lane will be provided by eliminating on-street parking and narrowing the existing lanes on Kalaimoku Street. This configuration will allow BRT vehicles to return to Saratoga Road, which is a two-way street. The mauka-bound capacity for traffic on Kalaimoku Street will remain the same as with existing conditions. Also, on Saratoga Road at Kalakaua Avenue, a new lane will be added in the mauka-bound direction to allow an additional right turn movement onto Kalakaua Avenue.

The IOS in 2006 will operate in mixed traffic along Kuhio Avenue. The Refined LPA calls for the conversion of one of the Ewa bound lanes to a semi-exclusive transit lane in the future when the diversion of motorists to transit offsets the loss of the lane.

Minimal impacts are projected for the Waikiki segment when comparing the IOS to the No-Build condition. The BRT vehicles will run in mixed flow on Kuhio Avenue and Kapahulu Avenue and in semi-exclusive lanes on Kalakaua Avenue. On Kalakaua Avenue, the semi-exclusive lanes will be shared by BRT vehicles, tour buses, and vehicles making right turns onto cross streets. Analyses indicate that with this configuration, traffic LOS is not expected to be significantly different compared to the No-Build condition.

The Kalakaua Avenue/Saratoga Road intersection will have the most difference in peak hour operation with the IOS operating with slightly more delay per vehicle during the A.M. peak hour.

3) Parking Impacts

The only potential parking impacts with the IOS would be to on-street parking. Curbside parking spaces were counted as being affected if their expected use in Year 2006 will be affected in any way, either all day long or by limiting their use to off-peak hours.

The IOS will affect a total of 22 existing unrestricted spaces. Unrestricted spaces will be affected on Queen Street (5 marked spaces), Saratoga Road (5 marked spaces), and Kapahulu Avenue (12 marked spaces). The parking for the Kakaako Makai area will be coordinated with the Hawaii Community Development Authority (HCDA).

The IOS will not affect weekend, holiday, or overnight parking on the makai side of Ala Moana Boulevard adjacent to Ala Moana Park. The IOS will travel to Waikiki using the center lane during the off-peak times when vehicles are legally allowed to park along the curb.

Parking Impact Mitigation

Near each of the locations where on-street parking will need to be removed there are large existing off-street parking facilities with reserve capacity during most times to absorb the on-street parkers. Replacement of the removed parking is therefore not deemed necessary.

4) Loading Zone Impacts

Most loading zones are restricted to use by commercial vehicles, which are primarily tour buses and freight vehicles with permits. Other vehicles that may stand briefly in such loading zones include taxicabs, armored cars, and special transit service vehicles. Existing municipal bus stops are not considered loading zones.

Preliminary engineering for the IOS has taken into consideration the need to avoid impacts to passenger and freight loading zones. The IOS will therefore not result in any loading zone impacts.

5) Bicycling Impacts

The IOS is consistent with both the Honolulu Bicycle Master Plan (April 1999) and the State's Bike Plan Hawaii (1994). All buses will have bike racks to accommodate intermodal transit. New bike parking racks will continue to be installed around the city.

Impacts to Existing Bikeways and Cycling

Although most of the IOS alignment is not designated as a "bikeway", roadways along the segment are used by cyclists to varying degrees because of the paucity of bikeway facilities. Semi-exclusive/exclusive BRT curbside lanes will be provided on Hotel Street (existing bus lanes), Auahi Street, portions of Ala Moana Boulevard, Kalia Road, Saratoga Road in the vicinity of Fort DeRussy, and a segment of Kalakaua Avenue between Saratoga Road to Uluniu Street. Cyclists will be allowed to use these semi-exclusive/exclusive BRT curbside lanes, which will be an improvement in bicycle transportation over existing conditions where curbside lanes along these street segments are used by mixed or general traffic. The level of bicycle access and transportation service along the rest of the IOS will remain the same as today.

6) Pedestrian and Special Event Impacts

The IOS will be constructed along existing roadways and existing pedestrian street crossings will be preserved. Pedestrian access will be provided at transit stops in conformance with the Americans with Disabilities Act (ADA).

Moreover, the IOS will provide benefits for all pedestrians in a number of ways. Transit uses less space to carry more people than automobiles. The environmentally friendly transit vehicles that will be used with the IOS will produce less noise and air pollution. These factors will contribute to an improved urban walking experience.

The IOS will not affect parades and large events, such as the Hoolaulea, that are held on Ala Moana Boulevard and/or Kalakaua Avenue. When required, portions of the IOS can be rerouted during parades, just as the bus routes along these streets are rerouted during parades today, as stipulated by existing event detour plans.

The Waikiki Livable Communities Study has undertaken a comprehensive review of Waikiki with the intent of providing a more walkable environment for visitors and residents. One such improvement, the widening of sidewalks along Kuhio Avenue will be implemented concurrent with the IOS.

II. 2025 ALTERNATIVES

This part of Chapter 4 describes the transportation related impacts and performance of the Refined LPA and compares it to the No-Build and TSM Alternatives. The focus is on impacts and performance in 2025, the planning horizon for the Primary Corridor Transportation Project.

Several years have elapsed since publication of the MIS/DEIS. During this period some refinements have been made to the Locally Preferred Alternative based on community input and public comments. To maintain a fair comparison, comparable refinements have also been made to the No-Build and TSM Alternatives. These refinements are described in Chapter 2. Other differences from the MIS/DEIS that are reflected in this chapter of the FEIS are the following:

- The background highway network for all of the Alternatives in the FEIS has been updated to be consistent with the recently updated Oahu Metropolitan Planning Organization (OMPO) regional transportation plan contained in the report Transportation for Oahu Plan-TOP 2025. The MIS/DEIS included the committed to near-term projects that were in the then current Transportation Improvement Program (TIP) in the background highway network. The background highway network used in the FEIS is shown in Figure 2.2-1A in Chapter 2.
- The information presented in this chapter, as well as all of the evaluation information based on travel forecasts for 2025 presented in other chapters, has been developed using the most current travel demand forecasting models and procedures established by OMPO. These models simulate the choices made by residents and visitors regarding the nature, number, mode, time-of-day, and geographic orientation of trips that they make on an average weekday. The models have been developed with data obtained in extensive surveys of Oahu households, transit riders, and air passengers. The OMPO forecasting models used in the FEIS analyses reflect refinements to the OMPO models used in the MIS/DEIS, as OMPO continues to refine and improve their models. An explanation of the travel demand models is provided in section 4.1, and a full documentation of the OMPO forecasting models and procedures is available in OMPO Model Development Project, Final Documentation, 2002.
- Year 2025 forecasts reflect the population and employment projections that were prepared by the Department of Business, Economic Development and Tourism (DBEDT) in February 2000 and the zonal allocations that were prepared from these projections by the City's Department of Planning & Permitting. These revised forecasts are not significantly different from the forecasts used in the MIS/DEIS with the year 2025 population now forecast to be 5 percent lower and employment 4 percent higher than reflected in the MIS/DEIS.
- The BRT operations plan has been refined so that Regional BRT vehicles that serve the Middle Street Transit Center continue into town using the In-Town bus priority lanes rather than terminating at Middle Street. This will result in less transferring being required, faster travel times for riders, and more effective use of the In-Town BRT improvements.

Transportation performance is assessed in five principal areas: Island-wide and Corridor travel demand and indices, transit impacts, highway impacts, parking impacts, and bicycle and pedestrian impacts.

Implementation of the Refined LPA will be phased over 14 years, the first phase consisting of construction of the Initial Operating Segment (IOS), which is scheduled to begin in Calendar Year 2003. The IOS Chapter following Chapter 5 presents a detailed assessment of potential impacts resulting from implementation of this phase, as well as proposed mitigation measures.

4.1 OMPO TRAVEL DEMAND MODELS

Analyses of future transportation conditions conducted for the Primary Corridor Transportation Project were based on results obtained from the OMPO travel demand models. This section provides an overview of the elements of the travel demand model.

The OMPO travel demand models are analytic techniques that predict future travel demand based on land use, socioeconomic, and transportation system characteristics. Underlying the models is an assumption that demand for transportation is created by the separation of urban activities – the need to participate in these urban activities leads to a need for travel. The goal of analysis is to infer from the spatial distribution of activities the amount, type, and location of travel that a population will undertake. Regional travel forecasting requires: 1) gathering data at the lowest practical level of aggregation; 2) using official forecasts of population, employment, and income; 3) developing models to accurately represent travel behavior; and 4) applying the models to the forecast data inputs to produce forecasts of future travel patterns.

The travel demand model relies on the data of where individuals, businesses, and other places of activity are located (or will be located). In the case of forecasts, this is typically done in several steps: economic growth (basic employment) is estimated, then population growth stimulated by those jobs is estimated, then population-serving employment and attendant population increases are estimated. The resulting jobs and population (or households) are then allocated to small areas, or zones, of the region (typically, based on aggregations of census blocks, or in some cases, tracts.)

The State of Hawaii, Department of Business, Economic Development and Tourism (DBEDT) prepares forecasts for each county of total population, employment, personal income, and visitors. The City and County of Honolulu, DPP, allocates the population, dwelling units, and employment to the 726 TAZs.

The travel demand model incorporates numerous household and individual characteristics to make its forecast. Chief among these characteristics are household auto ownership and household or worker income.

The model also uses the performance of the transportation infrastructure available to each traveler. This infrastructure is described as networks of facilities through which transportation service is provided. The highway network in travel demand modeling is an abstraction of real or proposed facilities for serving the general driving public, commercial vehicles providing public transportation and goods movement services, bicyclists, and pedestrians. The abstraction emphasizes connectivity and spatial separation of the activity centers from which demand for travel emerges rather than representing physical details such as curvature, grade, and surface type, although these features are accounted for implicitly in the representation of vehicle throughput (capacity) for the roadway.

The transit network represents the spatial and temporal connectivity of the public transportation system on Oahu by relating transit routes and service levels to the highway network and thus to travel activity centers. The transit network abstraction allows generalized measures of separation to be determined between areas of the island which reflects weighted average in-vehicle travel time, access/egress time, out-of-vehicle waiting and transfer times, and cost.

The transportation networks provide a means for measuring the spatial separation between the groups of travelers and the opportunities they are attempting to realize. This separation, or as often called, impedance measure, affects the decisions travelers make in their destination, departure time, mode and route choices. The transportation networks are thus used to determine the demand for travel on routes between centers of activities. This demand for travel on routes of the networks may ultimately be related back to the transportation facilities being represented in the model to evaluate the transportation impacts of land use, facility, and service level changes, among other transportation policy concerns.

The population and employment forecasts, allocated to zones, and transportation networks become the inputs in the demand modeling process. They are used in conjunction with a set of models of travel behavior which, together with the abstracted demographic, economic, and infrastructure data, produce predictions of travel demand. The OMPO models of travel behavior include two sets of procedures, models of resident travel that forecast travel patterns of Oahu residents on an average weekday, and a set of ancillary models that forecast airport access trips, trips by visitors and trips by commercial vehicles. Following the estimation of travel demand (defined as numbers of trips between specified origins and destinations, by mode and by time of day) a final set of models are used to assign these trips to highway and transit networks.

The OMPO models of resident travel include five components:

- The Vehicle Ownership model estimates the distribution of vehicle-ownership levels by each type of household. It takes as input a distribution of households in each zone by their demographic characteristics, as produced by the land use model.
- The Trip Generation model predicts the trip-productions and trip attractions, stratified by 11 trip purposes, based on calibrated trip-rates applied to the numbers and characteristics of households and jobs in each zone on the island. The Vehicle-Ownership and Trip Generation models are applied together in a single computer program.

The 11 trip purposes used in the models of resident travel are:

1. Journey-to-Work – Home-Based Work
2. Journey-to-Work – Home-Based Non-Work
3. Journey-to-Work – Work-Based Non-Work
4. Journey-to-Work – Non-Home-Based, Non-Work-Based
5. Journey-at-Work – Work-Based
6. Journey-at-Work – Non-Work-Based
7. Non-Work-Related – Home-Based College
8. Non-Work-Related – Home-Based K-12 School
9. Non-Work-Related – Home-Based Shopping
10. Non-Work-Related – Home-Based Other
11. Non-Work-Related – Non-Home-Based

Examples of these trip purposes are described as follows:

a. A person leaves his home and goes to work (Journey-to-Work – Home-Based Work).

b. A person leaves his home heading toward work and stops at the dry cleaner (Journey-to-Work – Home-Based Non-Work). He continues on and then stops for a coffee (Journey-to-Work – Non-Home-Based, Non-Work-Based). He continues on and reaches work (Journey-to-Work – Work-Based Non-Work).

c. A person leaves work and goes to lunch (Journey-at-Work – Work-Based). He continues on to shop (Journey-at-Work – Non-Work-Based), and then returns to work (Journey-at-Work – Work-Based).

d. A person leaves his home and goes to college (Non-Work-Related – Home-Based College).

e. A person leaves his home and goes to high school (Non-Work-Related – Home-Based K-12 School).

f. A person leaves his home and goes shopping (Non-Work-Related – Home-Based Shopping). He continues on to a restaurant (Non-Work-Related – Non-Home-Based), and then returns home (Non-Work-Related – Home-Based Other).

- The Trip Distribution model applies a logit formulation to develop a zone-to-zone trip table for each trip purpose using the predicted trip productions and trip attractions in each zone together with zone-to-zone highway travel times derived from the highway network. The distribution model for several purposes uses segmentation by vehicle-ownership level. The model considers all travel over the average weekday for each trip purpose, using peak-period highway times for travel to/from work and school and off-peak highway times for all other trip purposes.
- The Mode Choice model applies a nested-logit formulation to estimate the shares of each zone-to-zone travel market that will use each of 10 competing travel options. The options include alternative modes (auto, transit, and non-motorized travel), occupancies (1, 2, and 3+ per vehicle), transit access-modes (walk, park/ride, and kiss/ride), transit paths (local, premium, and guideway), walking, and bicycling. The model considers a large number of characteristics of the trip, the traveler, and the competing travel options to estimate the shares attracted to each option. Like the Trip Distribution model, the Mode Choice model considers travel for an entire average weekday for each trip purpose, using peak travel conditions for commuter travel and off-peak conditions for all other trip purposes.
- The Time-of-Day / Direction model accomplishes several steps necessary to prepare trip tables for assignment to the highway and transit networks. First, it allocates the daily trip tables developed by the Trip Distribution model for each trip purpose across the individual time-periods of the day. Second, for the person-trips choosing one of the automobile options, it converts trip tables from production-attraction format to origin-destination format and computes vehicle trips based on the three occupancy levels. Finally, the model aggregates the resulting trips across trip purposes to produce time-period specific tables for assignment to the highway and transit networks.

The ancillary models include:

- The Airport Access trip procedures estimate vehicle trips generated by air travelers, to and from the airport. The estimation procedures consist of a trip generation step, a distribution step, and a mode choice / time of day step.
- The Visitor model utilizes a nested logit structure to simultaneously estimate the frequency/destination and mode choice of visitors traveling from hotels or resort condos to 25 key destinations on Oahu.
- The Truck trip estimation procedures estimate trips by 2-, 3-, and 4-axle trucks. The estimation procedures consist of a trip generation step, a distribution step, and a time of day step.

In the final travel demand modeling step, trips in the mode- and time-specific trip tables are assigned to paths in their respective infrastructure networks ("trip assignment.") The implied network performance (i.e., interzonal time characteristics) is calculated based on the volume expected on each link. The assignment algorithm typically assumes that each traveling party will attempt to minimize its individual cost ("generalized cost") for each trip.

The highway assignment procedures perform equilibrium capacity constraint assignments for the morning peak period (from 5 to 9 AM), the evening peak period (from 2 to 6 PM), and the off-peak period.

Transit trips are assigned by peak and off-peak time period to five different path types (walk-to-local-bus, walk-to-premium-bus, walk-to-guideway, kiss-n-ride, and park-n-ride). These results are then combined into one file for each time period, reporting volumes on each bus line in the network.

4.2 REGIONAL TRAVEL DEMAND AND SYSTEMWIDE PERFORMANCE

Chapter 1 of this FEIS, the Purpose and Need Chapter, summarizes existing and projected future travel demand for the Island of Oahu. The summaries show that travel to and from and within the urban core of Honolulu constitutes the majority of the travel that takes place on the island for both current and projected time frames. Because of the geographical constraints of the primary corridor (mountains on one side and ocean on the other), travel is concentrated along a linear corridor and focused onto a limited number of parallel highway and arterial streets. Even with the planned widenings and other improvements to the highway system, because of projected growth, congestion is forecast to get even worse than today. Community feedback from outreach activities such as the Trans 2K workshops have indicated that grade-separated structures and extensive roadway widening as means to reduce traffic congestion are unacceptable. Instead people indicated that they are in favor of solutions that increase the people carrying capacity of the existing transportation infrastructure. The BRT Alternative builds upon the already successful bus system in Honolulu and takes it to the next level with a bus rapid transit system.

The following sections summarize the regional transportation implications of implementing the Regional and In-Town BRT system as part of Oahu's multi-modal long-range regional transportation plan.

4.2.1 Person Trips By Mode

Table 4.2-1 summarizes the number of daily person trips projected for the year 2025 by mode. As shown, the Refined LPA is projected to result in the greatest number of transit person trips, about 52,000 more than the No-Build Alternative. Correspondingly, the Refined LPA would have the lowest number of auto person trips compared to the other Alternatives.

TABLE 4.2-1
PROJECTED YEAR 2025 DAILY SYSTEMWIDE
PERSON TRIPS BY MODE

Type of Trip	No-Build	TSM	Refined LPA
Auto Person Trips	3,367,860	3,368,250	3,302,070
Transit Person Trips	261,130	279,400	312,570

Source: Parsons Brinckerhoff Inc., June 2002.

4.2.2 Systemwide Highway Performance

Vehicular travel demand within the primary corridor is projected to exceed available capacity for all the Alternatives even with widening of the H-1 Freeway and other programmed roadway improvements as described in the TOP 2025 plan. Faced with this situation the goal has been to make the most efficient use of the roadway space available so that the greatest number of people can be served.

Table 4.2-2, Projected Year 2025 Daily Vehicle Miles of Travel (VMT) and Vehicle Hours of Delay (VHD), shows that in 2025 the Refined LPA (which has the highest level of transit service provided), would have the lowest VMT by autos and other vehicles compared to the TSM and No-Build Alternatives. This results from increased use of travel modes other than single-occupant-vehicles (SOVs); i.e. fewer vehicles, less VMT.

This is confirmed by the lower number of vehicle trips (and, therefore, more transit usage) projected to occur with the Refined LPA than with the TSM or No-Build Alternatives.

Lower VMT is also indicative of less traffic congestion. When there is a high level of traffic congestion, drivers often take longer and more circuitous paths as they "hunt" for less congested routes. This, in turn, affects neighborhoods as streets meant to accommodate local traffic become through traffic routes.

TABLE 4.2-2
PROJECTED YEAR 2025 TRAVEL DEMAND INDICATORS
DAILY VEHICLE MILES TRAVELED (VMT) AND VEHICLE HOURS OF DELAY (VHD)

Alternative	Time Period	VMT	VHD	Daily Vehicle Trips
No-Build	A.M.	5,145,570	177,750	555,140
	Off-Peak	6,846,540	81,065	877,875
	P.M.	5,596,345	192,890	660,150
	Total Daily	17,588,455	451,705	2,093,165
TSM	A.M.	5,133,800	173,015	554,970
	Off-Peak	6,840,120	81,255	878,365
	P.M.	5,587,195	184,155	660,250
	Total Daily	17,561,115	438,420	2,093,585
Refined LPA	A.M.	4,893,630	145,470	535,040
	Off-Peak	6,614,640	72,135	856,560
	P.M.	5,361,660	156,020	641,125
	Total Daily	16,869,930	373,625	2,032,725

Source: Parsons Brinckerhoff, Inc., June 2002.
Notes: VMT = vehicle miles traveled
VHD = vehicle hours of delay

Another indicator of regional travel is Vehicle Hours of Delay (VHD), which is the difference between free-flow and congested vehicle travel time. In 2025 the Refined LPA is projected to have substantially lower daily VHD than the No-Build or TSM Alternatives. This reduced VHD is indicative of less congestion on roadways islandwide.

4.2.3 Systemwide Transit Performance

To the extent that an alternative attracts more riders than another, it is providing better mobility by reducing travel time or cost. Increases in transit ridership also can be viewed as a proxy for many other transit benefits – reduced highway congestion, energy consumption, and emissions.

As shown in Table 4.2-3, the Refined LPA is forecast to attract more riders than either the TSM or No-Build Alternatives. Similarly, the Refined LPA would result in an increased percentage of transit trips (mode share) compared to the other alternatives. This indicates that the reductions in VMT, VHT, and Daily Vehicle Trips forecast for the Refined LPA are a result of a shift in mode from auto to transit.

TABLE 4.2-3
PROJECTED ISLAND-WIDE TRANSIT RIDERSHIP
(FORECAST YEAR 2025)

	No-Build	TSM	Refined LPA
Total Transit Trips (Daily Linked-Trips)	261,130	279,400	312,570
New Transit Trips compared with No-Build	Not Applicable	18,270	51,440
New Transit Trips compared with TSM	Not Applicable	Not Applicable	33,170
Transit Mode Share:			
All Trip Purposes	6.6%	6.9%	7.9%
Work Trips	14.7%	15.7%	18.4%

Source: Parsons Brinckerhoff, Inc., June 2002.

The current level of transit ridership on Oahu is about the same as it was 20 years ago (73.5 million annual riders in 2002 compared to 73.8 million in 1982). During that period, however, transit ridership has seen periods of growth, and period of decline. From 1982 to 1994, transit ridership grew with generally a slow but steady growth rate at an average of about 0.4% per year. Over this same approximate time period, economic activity on Oahu, as measured by the civilian wage and salary job count, was also growing, though at a much more rapid rate of about 2.5% per year.

Following these period of growth were periods of decline in employment and in transit ridership. Since its low point in 1998, Oahu employment has increased by a little less than 1% per year (to 2001). Transit ridership in the three years since its low point in 1999 has also grown, at a rate of over 3.5% per year.

Therefore, in general, changes in transit ridership on Oahu have generally paralleled changes in employment levels, though the changes in direction of growth for transit have lagged those of employment by a year or two.

While the directions of growth and decline have been in parallel, the magnitude of changes have not. Differences during the 1980s and early 1990s are particularly notable. Even though Oahu employment was enjoying significant growth during this period, transit ridership grew only slightly. Several conditions led to this circumstance. Because of various policy and financial issues, bus service grew very little during this period. Bus revenue miles grew at a rate of only about 0.75% per year over this period, while the number of buses in the fleet remained nearly constant for half the period. Much of the route structure also remained static. However, while the bus system changed little during the period, other characteristics relating to travel on Oahu changed considerably. The 1980s and early 1990s saw considerable residential growth in areas outside the Primary Urban Center, areas not well served by the bus route structure in place. This expansion of urban development was helped by considerable investment in highway infrastructure up until the mid-1980s.

The relatively static nature of the bus system started to change in the early 1990s. A restructuring of the route system began, with the provision of new express routes and the provision of direct service for employees entering Waikiki from some locations that had previously required a transfer. Service improvements continued through the 1990s. Major changes have occurred in the early 2000s with introduction of limited-stop services and a hub-and-spoke system. While the system changes through most of the 1990s were occurring during a period of declining employment, the most recent changes have occurred as the economy has picked up. This period of economic growth and service improvements have seen significant transit growth – at a rate of over 3.5% per year.

Over the next 20+ years, to 2025, employment on Oahu is projected to increase by over 30% (2000-2025) at a rate of over 1% per year, about the same rate of growth as has occurred since 1998. The past 20 years have seen a period where transit ridership grew at a much slower rate than employment growth; and a period, over the last three years, where transit ridership has grown at a much more rapid rate than employment growth. The next 20+ years are not anticipated to see the same sort of land use changes that worked against transit in the 1980s, as the majority of development growth is projected to occur in the Primary Urban Center and Kapolei/Ewa. Nor are significant improvements to the highway system expected. Thus, a replay of the 1980s and early 1990s, when transit growth lagged far behind employment growth is not anticipated.

On the other hand, the 2025 No-Build Alternative does not assume the level of improvements in transit service that have occurred during the past couple of years, so a continuation of the current trend where transit ridership growth is occurring at 3.5 times the rate of employment growth also is not anticipated. Rather, the 2025 No-Build Alternative estimates that transit growth to 2025 will occur at a slightly faster rate than employment growth (1.4% per year versus 1.1% per year). Transit growth, due to the significant improvements in transit service, is forecast to be 2.35 % per year with the Refined LPA.

4.2.4 Highway Screenlines

Another indicator used in evaluating roadway mobility is the comparison of projected traffic volume versus roadway capacity at selected screenlines. A screenline is an imaginary line that cuts across roadways in a transportation corridor. In a screenline analysis the traffic volumes and capacities of all major roadways passing through the imaginary line are summed and compared as a volume over capacity (v/c) ratio. A v/c ratio greater than one indicates that demand exceeds capacity, which, in turn, indicates that traffic congestion would occur at that screenline. Figure 1.2-3 in Chapter 1 illustrates the location of the screenlines used in the analysis.

Tables 4.2-4 and 4.2-5 summarize the projected Year 2025 peak hour, peak direction traffic volumes, the associated roadway capacities, and the resulting volume over capacity ratio (v/c ratio) for the A.M. and P.M. peak hours, respectively at those screenlines. A useful index to categorize v/c is Level of Service (LOS). LOS is a qualitative index based on the v/c quantitative analysis that involves traffic volumes, number of roadway lanes and their configurations, and traffic signal timing and phasing. LOS ranges from A, (free-flow conditions) to F, (congested conditions).

As shown in Tables 4.2-4 and 4.2-5, even with the significant highway improvements recommended in the OMPO long-range regional transportation plan, year 2025 travel demand on roadways is projected to exceed capacity at many of the screenlines within the primary corridor. At almost all of the screenlines the level of congestion would be equal or less with the Refined LPA compared to the No-Build and TSM Alternatives.

The most congested location is forecast to be at the Kalauao screenline in the Pearl City-Aiea sub-region. This screenline has only three major roadways: H-1 Freeway, Moanalua Road, and Kamehameha Highway. The OMPO long-range regional transportation plan recommends that H-1 in this area be widened by one lane in each direction. Even with such widening, the v/c ratio is still projected to be well above 1.0 with all of the Alternatives. However, as shown in Table 4.1-5 the congestion in this area would be substantially less during the afternoon peak period with the Refined LPA that has the addition of the P.M. zipper lane.

4.2.5 Summary

Forecasted year 2025 travel demand is projected to result in continued congestion on regional roadways within the primary corridor. This level of congestion is projected to be worse than today and, in conjunction with other factors such as cost of parking, will result in commuters seeking alternative modes of transportation. The Refined LPA, with its enhanced zipper lanes, and in-town priority treatments will provide a way to avoid this congestion, thereby attracting more new riders than the No-Build and TSM Alternatives.

4.3 TRANSIT IMPACTS

In the previous section (4.2), the Refined LPA was identified as having the highest level of transit ridership. This section discusses and compares the transit characteristics of the No-Build, TSM, and Refined LPA Alternatives in further detail.

4.3.1 Transit Service Supplied

Transit service levels that would result from each alternative and their relative differences in the levels of service provided between the alternatives are highlighted in this section. Table 4.3-1 offers several indicators of how much transit service would be supplied to transit riders under each alternative. Revenue miles are the number of miles a transit vehicle is open to the paying public to ride. Revenue hours are the number of hours people can ride transit, excluding times when the vehicles are operating but not open to the public (e.g., when a bus leaves its route to return to the garage). All the future alternatives would increase the fleet size, service revenue miles, and revenue hours over the system today.

TABLE 4.2-4
PRIMARY CORRIDOR
ESTIMATED LEVEL OF SERVICE AT SCREENLINES, 2025 A.M. PEAK HOUR INBOUND

Screenline Name	No-Build				TSM				Refined LPA			
	Vehicle Volume	Capacity	V/C Ratio	LOS	Vehicle Volume	Capacity	V/C Ratio	LOS	Vehicle Volume	Capacity	V/C Ratio	LOS
Kahe Point	4,596	4,050	1.13	F	4,597	4,050	1.14	F	4,328	4,050	1.07	F
Ewa	8,617	11,700	0.74	C	8,484	11,700	0.73	C	7,850	11,700	0.67	B
Waikele	12,973	11,500	1.13	F	12,892	11,500	1.12	F	12,244	11,500	1.06	F
Kalauao	25,089	17,650	1.42	F	24,904	17,650	1.41	F	23,669	17,650	1.34	F
Moanalua	22,072	22,100	1.00	F	22,028	22,100	1.00	F	20,392	22,100	0.92	E
Kapalama	23,595	22,700	1.04	F	23,326	22,700	1.03	F	21,224	21,800	0.97	E
Nuuanu	23,422	20,300	1.15	F	22,541	20,300	1.11	F	20,700	20,300	1.02	F
Ward	21,132	20,200	1.05	F	20,434	18,300	1.12	F	19,358	19,300	1.00	F

Source: Parsons Brinckerhoff, Inc., June 2002.
Note: * LOS F caused by downstream congestion.

TABLE 4.2-5
PRIMARY CORRIDOR
ESTIMATED LEVEL OF SERVICE AT SCREENLINES, 2025 P.M. PEAK HOUR OUTBOUND

Screenline Name	No-Build				TSM				Refined LPA			
	Vehicle Volume	Capacity	V/C Ratio	LOS	Vehicle Volume	Capacity	V/C Ratio	LOS	Volume	Capacity	V/C Ratio	LOS
Kahe Point.	4,365	4,050	1.08	F	4,233	4,050	1.05	F	4,001	4,050	0.99	E
Ewa	9,497	11,700	0.81	D	9,350	11,700	0.80	D	8,737	11,700	0.75	C
Waikele	11,710	12,500	0.94	E	11,567	12,500	0.93	E	11,154	12,500	0.89	D
Kalauao	21,936	15,900	1.38	F	21,822	15,900	1.37	F	20,944	17,650	1.19	F
Moanalua	20,599	19,900	1.04	F	20,524	19,900	1.03	F	19,557	21,600	0.91	E
Kapalama	22,541	22,700	0.99	E	22,106	22,700	0.97	E	20,683	21,800	0.95	E
Nuuanu	22,358	20,500	1.09	F	22,084	20,500	1.08	F	21,184	20,500	1.03	F
Ward	21,592	24,400	0.88	D	21,813	22,500	0.97	E	20,689	20,600	1.00	F

Source: Parsons Brinckerhoff, Inc., June 2002.
Note: * LOS F caused by downstream congestion.

TABLE 4.3-1
PROPOSED TRANSIT SERVICE INDICATORS
(FORECAST YEAR 2025)

	2000 System	No-Build	TSM	Refined LPA
Annual Revenue Miles (million)	17.10	19.27	23.96	26.01
Annual Revenue Hours (million)	1.25	1.29	1.44	1.63
Fleet Size	530	626	700	794

Source: Parsons Brinckerhoff, Inc., June 2002 and Federal Transit Administration, 2000 National Transit Database.

Each build alternative (TSM and Refined LPA) would provide more revenue miles and revenue hours than the No-Build Alternative, indicating increased capacity and more frequent service. The increase of the No-Build Alternative of 2025 over 2000 would be about a 13 percent increase in annual revenue miles. The TSM Alternative would have approximately a 40 percent increase over 2000. The Refined LPA would have approximately a 52 percent increase over 2000. The higher amount of revenue hours and revenue miles with the Refined LPA is a reflection of the objective to provide added person carrying capacity in the corridor without building new roadways.

4.3.2 Ridership Impacts of the Alternatives

This section presents the impacts of the alternatives on the use of transit. This is important since an increase in transit ridership demonstrates the improved access and operating efficiency of the system. It begins with a comparison in terms of islandwide ridership, then proceeds to look at ridership in key travel markets.

1) Impact on Ridership Within the Primary Transportation Corridor

Table 4.2-3 showed the island-wide forecast of transit ridership for Oahu. Island-wide, the Refined LPA is projected to attract 51,440 more riders per day than the No-Build and 33,170 more than the TSM Alternative. A more complete understanding of the differences among the alternatives can be discerned by examining ridership within the primary transportation corridor, which is the focus of this FEIS. The Refined LPA would attract additional transit riders by both improving in-town mobility and strengthening the connections throughout the corridor. The increases in ridership and mode split shown in Table 4.3-2 reflect the service benefits – particularly reduced travel time – which such a system would provide within the primary transportation corridor.

TABLE 4.3-2
PROJECTED TRANSIT RIDERSHIP WITHIN THE PRIMARY TRANSPORTATION CORRIDOR
(DAILY LINKED-TRIPS IN 2025)

	No-Build	TSM	Refined LPA
Total Transit Ridership within the Primary Transportation Corridor	202,000	216,130	234,390
Transit Mode Share:			
All Trip Purposes	8.5%	8.7%	10.0%
Work Trips	19.2%	19.5%	22.6%

Source: Parsons Brinckerhoff, Inc., June 2002.

While the TSM Alternative would provide greater service benefits than the No-Build Alternative, the added benefits of a high capacity BRT system are shown to attract substantially more riders within the primary transportation corridor.

With regard to the Refined LPA, its projected 312,570 average daily linked-transit trips, island-wide, are forecast to account for 432,430 transit boardings on an average weekday in 2025. This compares to current average daily linked-transit trips of 185,660. The increase in daily ridership would represent a 68 percent increase. As shown in Table 4.3-3 approximately 19 percent of the daily transit boardings island-wide would involve use of the In-Town BRT.

TABLE 4.3-3
TRANSIT RIDERSHIP BY SUB-MODE
(FORECAST YEAR 2025)

Transit Sub-Mode	Refined LPA Daily Transit Boardings
Boardings on Regional BRT and Local Buses	348,350
Boardings on In-Town BRT	84,080
Total Boardings	432,430

Source: Parsons Brinckerhoff, Inc., June 2002.

2) Other Measures of Service

The ridership forecasting results can be used to compute several other indicators of the level of service provided by each alternative. These measures are presented in Tables 4.3-4 and 4.3-5 and discussed below.

TABLE 4.3-4
OTHER MEASURES OF SERVICE
(FORECAST YEAR 2025)

Measure	No-Build	TSM	Refined LPA
Boardings per Linked Trip (Transfer Rates)	1.29	1.33	1.38
Passenger per Seat at Peak Load Point (Comfort)	1.31	1.01	0.90

Source: Parsons Brinckerhoff, Inc., June 2002.

TABLE 4.3-5
PROJECTED 2025 PM PEAK HOUR TRANSIT TRAVEL TIMES
WITHIN THE PRIMARY CORRIDOR

	No-Build	TSM	Refined LPA
	Transit Travel Time (minutes)	Transit Travel Time (minutes)	Transit Travel Time (minutes)
Downtown–Kapolei	83.1	78.0	58.2
Downtown-Mililani	66.5	61.5	42.1
Downtown-Waikiki	25.0	25.0	23.1
Downtown-U.H.-Manoa	24.4	23.3	22.6
Downtown-Middle St. TC	17.6	16.3	13.3

Source: Parsons Brinckerhoff, Inc., June 2002.

<u>Transfer Rates</u>

One indicator of the level of service is the number of transfers a typical rider must make to complete a trip. Riders prefer not to transfer, unless transferring results in other benefits such as a shorter total travel time. In Table 4.3-4, the amount of transferring is expressed in terms of the number of boardings per linked transit trip. The Refined LPA would involve the greatest amount of transferring. With the No-Build and TSM Alternatives more riders would have a one-mode ride from origin to destination. The additional transferring in the Refined LPA is to a high degree offset by the more frequent, more comfortable, and more reliable service provided, and in many cases by the shorter total travel time provided by the Refined LPA.

Comfort

Level of comfort can be measured in terms of the probability of getting a seat on the transit vehicle during the peak hour. As shown in Table 4.3-4, the seated capacity of the TSM Alternative would be about equal to the demand. On an average weekday, there would be at least one seat for every rider even at the heaviest used part of the system. The seated capacity of the Refined LPA would be slightly greater than the demand. With the No-Build Alternative, however, the ridership demand would exceed the seated capacity by over 30 percent. Almost a third of all riders would not find a seat and would be required to stand. In some instances with the No-Build Alternative, buses would be full and would pass by riders waiting at stops.

Reliability of Service

Another component of transit level of service is the reliability of the service, or the likelihood the service will remain on schedule. In most cases, the reliability of service is correlated to the amount of the service that utilizes exclusive and semi-exclusive lanes. Transit service in local mixed traffic is most subject to delays caused by traffic congestion, as discussed in Section 4.3. Transit service in an exclusive or semi-exclusive lane is less subject to delays caused by other vehicles or outside events. The Refined LPA can thus be expected to be less affected by traffic delays and offer more reliable service, which will play a role in attracting transit riders.

Transit Travel Time in the Primary Transportation Corridor

The Refined LPA is the only alternative to provide a P.M. zipper lane and major ramp improvements for buses along the H-1 Freeway. It also, because of the transit priority lanes in-town, is projected to result in better transit LOS at the analyzed intersections within the urban core. This means that, because of the congestion on the roadways and the provision of exclusive and semi-exclusive lanes, the Refined LPA would provide faster transit travel times and more reliable service within the Primary Corridor than either the TSM or No-Build Alternatives.

Travel time differences by 2025 are shown in Table 4.3-5, Transit Travel Time Within the Primary Corridor, for selected origins and destinations. Table 4.3-5 shows that the P.M. zipper lane and priority transit lanes in-town provided in the Refined LPA will allow the BRT to operate significantly faster than buses in the No-Build Alternative, where no new priority is given to transit vehicles. The travel times shown include time spent walking to-and-from transit stops and time spent waiting for the bus, as well as the in-vehicle travel time.

4.3.3 Ridership on the In-Town BRT

This section provides detailed information on the projected ridership for the In-Town BRT , including the number of boardings and alightings projected for each stop and the link volumes between stops.

1) Boardings and Alightings

Table 4.3-6 shows how the 84,080 daily boardings on the In-Town BRT would be distributed by stop. The heaviest utilized stops would be the Middle Street Transit Center, which is the Ewa terminus of the In-Town BRT, and the Union Mall stop in Downtown Honolulu before the UH and Waikiki lines branch. Of the 84,080 daily In-Town boardings, 22,570 would occur on the two lines between Middle Street and Downtown Honolulu, 45,240 would occur on the Kakaako/Waikiki Branches and 16,270 would occur on the University

TABLE 4.3-6
REFINED LPA
PROJECTED IN-TOWN BRT STATION BOARDINGS AND ALIGHTINGS
(TOTAL DAILY IN YEAR 2025)

Eastbound			**Westbound**		
Station	**On**	**Off**	**Station**	**On**	**Off**
From Regional BRT	14,210				
Middle Street to Downtown Honolulu			**University Branch**		
Middle Street Transit Center	7,720	2,150	UH Manoa	2,055	
Kalihi	1,395	650	University/King	1,100	140
Honolulu Community College	2,600	725	Isenberg	940	260
Iwilei Transit Center	1,720	270	Convention Center	1,010	270
Chinatown	1,650	860	Keeaumoku/Ala Moana Center	1,450	565
Union Mall		2,830	Pensacola	570	290
UH Manoa Branch			McKinley High School	1,355	435
Union Mall	1,040		Thomas Square	285	130
Iolani Palace	220	1,120	Alapai Transit Center	2,755	280
Alapai Transit Center	280	2,755	Iolani Palace	1,120	220
Thomas Square	130	285	Union Mall		1,040
McKinley High School	435	1,355	**Waikiki Branch – Ward to Waikiki**		
Pensacola	290	570	Kapahulu	3,320	
Keeaumoku/Ala Moana Center	565	1,450	Kalakaua/Uluniu	3,930	80
Convention Center	270	1,010	Kalakaua/Seaside	5,245	500
Isenberg	260	940	Saratoga	4,180	290
University/King	140	1,100	Fort DeRussy	2,710	2,720
UH Manoa		2,055	Hobron	1,965	810
Kakaako Mauka Branch			Ala Moana Park	1,600	3,780
Union Mall	2,785		Kamakee		585
Bishop/Queen	2,510	1,805	**Kakaako Mauka Branch**		
Federal Building	380	660	Kamakee	1,280	
Cooke Street	1,045	1,860	Cooke Street	1,860	1,045
Kamakee		1,280	Federal Building	660	380
Kakaako Makai Branch			Bishop/Queen	1,805	2,510
Union Mall	75		Union Mall		2,785
Aloha Tower	130	25	**Kakaako Makai Branch**		
Channel Street	395	70	Kamakee	25	
Cooke Street	65	155	Ahui Street	190	70
Ahui Street	70	190	Cooke Street	155	65
Kamakee		25	Channel Street	70	395
Waikiki Branch – Ward to Waikiki			Aloha Tower	25	130
Kamakee	585		Union Mall		75
Ala Moana Park	3,780	1,600	**Downtown Honolulu to Middle Street**		
Hobron	810	1,965	Union Mall	2,830	
Fort DeRussy	2,720	2,710	Chinatown	860	1,650
Saratoga	290	4,180	Iwilei Transit Center	270	1,720
Kalakaua/Seaside	500	5,245	Honolulu Community College	725	2,600
Kalakaua/Uluniu	80	3,930	Kalihi	650	1,395
Kapahulu		3,320	Middle Street Transit Center	2,150	7,720
			To Regional BRT		14,210
Total	**49,145**	**49,145**	***Total***	**49,145**	**49,145**

Source: Parsons Brinckerhoff, Inc., June 2002.

Branch. An additional 14,210 boardings would occur on buses that started along the Regional BRT segment and continued into town along the In-Town BRT alignment.

Transit riders arrive at their boarding station by walking, by bus, and by driving or being dropped off. Table 4.3-7 shows how many people are expected to arrive at each stop on the In-Town BRT by each mode. Almost 66 percent, or 64,700, of all In-Town BRT riders are expected to arrive by walking, and another 32 percent, or 31,910, would arrive by bus. Transfers from other buses are expected at 20 of the stops, with almost 72 percent of the transfers occurring at Middle Street Transit Center.

TABLE 4.3-7
REFINED LPA
PROJECTED IN-TOWN BRT MODE OF ARRIVAL
(FORECAST YEAR 2025)

Station	Walk	Bus	Drive
Middle Street Transit Center	120	23,020	950
Kalihi	1,420	630	0
Honolulu Community College	3,030	40	250
Iwilei Transit Center	1,720	10	260
Chinatown	2,510	0	0
Union Mall	10,140	910	0
Iolani Palace	1,330	10	0
Alapai Transit Center	2,680	350	0
Thomas Square	390	430	0
McKinley High School	1,310	480	
Pensacola	830	30	0
Keeaumoku/Ala Moana Center	1,950	70	0
Convention Center	1,280	0	0
Isenberg	710	490	0
University/King	560	680	0
UH Manoa	1,320	730	0
Aloha Tower/Federal Bldg.	1,380	280	0
Cooke Street	2,910	480	0
Kamakee	1,830	60	0
Ala Moana Park	5,320	60	0
Hobron	2,780	0	0
Fort DeRussy	5,430	0	0
Saratoga	3,200	1,020	250
Kalakaua/Seaside	500	0	0
Kuhio/Seaside	5,240	0	0
Kalakaua/Uluniu	80	0	0
Kuhio/Liliuokalani	3,930	0	0
Kapahulu	790	2,530	0
Total	**64,700**	**31,910**	**1,710**

Source: Parsons Brinckerhoff, Inc., June 2002.

Kapahulu, University/King, Kalihi, and Isenberg are the next most frequent bus transfer stops. Less than 5 percent of all In-Town BRT riders are expected to arrive by auto.

2) Link Volumes

Table 4.3-8 displays the forecast of In-Town BRT link volumes between stops for the Refined LPA. As shown, the Ewa end of the In-Town BRT will be more heavily utilized than the Koko Head termini. On the Ewa end, the In-Town BRT would carry a relatively uniform load from Middle Street to Downtown Honolulu, reaching a maximum of approximately 24,640 one-way daily riders on the Chinatown to Union Mall segment. Heading Koko Head from Downtown, the link volumes are projected to decrease as the ends of the UH and Waikiki branches are reached.

TABLE 4.3-8
REFINED LPA
PROJECTED IN-TOWN BRT LINK VOLUMES
(TOTAL DAILY IN YEAR 2025)

Eastbound		Westbound	
Segment	**Volume**	**Segment**	**Volume**
From Regional,	14,210		
Middle Street to Downtown Honolulu		**University Branch**	
Middle Street Transit Center to Kalihi	19,780	UH Manoa to University/King	2,055
Kalihi to Honolulu Community College	20,525	University/King to Isenberg	3,015
Honolulu Community College to Iwilei Transit Center	22,400	Isenberg to Convention Center	3,695
Iwilei Transit Center to Chinatown	23,850	Convention Center to Keeaumoku/Ala Moana Center	4,435
Chinatown to Union Mall	24,640	Keeaumoku/Ala Moana Center to Pensacola	5,320
University Branch		Pensacola to Thomas Square	6,520
Union Mall to Iolani Palace	9,150	Thomas Square to Alapai Transit Center	6,675
Iolani Palace to Alapai Transit Center	6,675	Alapai Transit Center to Iolani Palace	9,150
Alapai Transit Center to Thomas Square	6,520	Iolani Palace to Union Mall	10,050
Thomas Square to Pensacola	5,600	**Kakaako/ Waikiki Branch**	
Pensacola to Keeaumoku/Ala Moana Center	5,320	Kapahulu to Kuhio/Liliuokalani	3,320
Keeaumoku/Ala Moana Center to Convention Center	4,435	Kuhio/Liliuokalani to Kuhio/Seaside	7,170
Convention Center to Isenberg	3,695	Kuhio/Seaside to Saratoga	11,915
Isenberg to University/King	3,015	Saratoga to Fort DeRussy	15,805
University/King to UH Manoa	2,055	Fort DeRussy to Hobron	15,795
Kakaako/ Waikiki Branch		Hobron to Ala Moana Park	16,950
Union Mall to Aloha Tower/Fed. Bldg.	16,190	Ala Moana Park to Kamakee	14,770
Aloha Tower/Federal Building to Cooke Street	15,610	Kamakee to Cooke Street	15,610
Cooke Street to Kamakee	14,185	Cooke Street to Aloha Tower/Federal Building	16,190
Kamakee to Ala Moana Park	14,770	Aloha Tower/Federal Building to Union Mall	15,660
Ala Moana Park to Hobron	16,950	**Downtown Honolulu to Middle Street**	
Hobron to Fort DeRussy	15,795	Union Mall to Chinatown	24,640
Fort DeRussy to Saratoga	15,805	Chinatown to Iwilei Transit Center	23,850
Saratoga to Kalakaua/Seaside	11,915	Iwilei Transit Center to Honolulu Community College	22,400
Kalakaua/Seaside to Kalakaua/Uluniu	7,170	Honolulu Community College to Kalihi	20,525
Kalakaua/Uluniu to Kapahulu	3,320	Kalihi to Middle Street Transit Center	19,780
		To Regional	14,210

Source: Parsons Brinckerhoff, Inc., June 2002.

4.4 HIGHWAY IMPACTS

The Islandwide Mobility Concept Plan (1999), one of the principal frameworks of the Primary Corridor Transportation Project, and a direct outcome of the Oahu Trans 2K workshops, acknowledges the difficulty and relatively temporary benefit of widening roadways. Physical and aesthetic constraints make roadway widening within the Primary Corridor very difficult and expensive, particularly within the urban core of Honolulu from Middle Street to Waialae-Kahala. Given the difficulty of adding lanes, future transportation improvements within the urban core are principally focused on transporting more people within the same roadway space as provided at present.

The Year 2025 No-Build, TSM, and Refined LPA Alternative traffic volumes all utilize the same land use and background highway network assumptions, which are based on the OMPO TOP 2025 regional transportation plan. The primary difference between the Alternatives is the configuration and operation of the transit network. The Primary Corridor has two sub-corridors: the regional sub-corridor along H-1 Freeway between Kapolei and Middle Street, and the In-Town sub-corridor, located between Middle Street and University Avenue/Kapahulu Avenue. The primary impact of the Refined LPA assessed for regional highways is the consequence of implementing the contra-flow zipper lane during the P.M. peak period in addition to the existing A.M. peak period operation.

Improvements within the urban core with the TSM and Refined LPA Alternatives focus on converting general-purpose traffic lanes to semi-exclusive and exclusive transit lanes. Doing so improves person carrying capacity, thereby providing an alternative to the automobile for enhanced mobility within the urban core. At the same time, the semi-exclusive and exclusive transit lanes reduce the roadway capacity on streets where they are implemented. The In-Town sub-corridor analysis evaluates the impacts of implementing these transit priority measures on the street system within the urban core of Honolulu.

4.4.1 Regional Roadway Impacts

Limited access freeways and high-capacity arterial roadways provide much of the regional roadway mobility. The No-Build and TSM Alternatives would utilize only the A.M. zipper system that exists today. The Refined LPA would provide higher capacity levels for transit and high-occupancy autos through the use of the existing A.M. and proposed P.M. zipper lane. The P.M. zipper lane would provide the same type of benefit for Ewa-bound peak period traffic that the A.M. zipper lane provides for Koko Head-bound peak period traffic today. The BRT will also provide regional transit priority through the use of an express ramp at Luapele Drive directly into and out of the zipper lane. Priority treatments at other ramps for BRT buses are also included.

1) Freeway Operations with Zipper Lane Deployed

The OMPO long-range regional transportation plan assumes that the H-1 Freeway is widened by one lane in each direction between Halawa Interchange and Waiawa Interchange. This will permit displacement of two Koko Head-bound lanes to implement the Ewa-bound zipper lane during the P.M. peak period. This is comparable to the way the zipper lane is currently implemented during the A.M. peak period. The zipper lane is currently designated as a high-occupancy vehicle lane, requiring at least two or three persons per vehicle depending on the time of morning. Expanding the zipper lane operation to the P.M. peak period will benefit not only transit riders, but high-occupancy vehicle occupants as well. Today, the A.M. zipper lane carries at least 2,000 more people per hour than the highest utilized general-purpose lane.

The zipper lane system is an integral part of the Regional BRT component of the Refined LPA. It will allow buses to bypass much of the congestion that is forecasted for the general-purpose lanes on H-1 Freeway for the P.M. as well the A.M. peak periods.

Analyses were conducted to determine the impacts of the proposed zipper lane improvements. One of the issues considered is the impacts to freeway operations on H-1 Freeway just Koko Head of the Kaonohi Street grade separation. This area, known as the Kalauao Screenline, is representative of freeway operations influenced by existing and proposed deployment of the zipper lane. It also provides a consistent segment of roadway on which vehicular operations can be evaluated and person carrying ability can be measured and compared between the Alternatives.

If an Ewa-bound zipper lane were implemented during the P.M. peak period traffic conditions, seven lanes would be provided for traffic in the Ewa-bound direction. The zipper lane would displace two Koko Head-bound lanes, leaving four lanes in the Koko Head-bound direction. The projected maximum A.M. peak period hourly volume in the Koko Head-bound direction would be 15,650 vph, while the maximum hourly volume in the Ewa-bound direction would be 8,360 vph. Table 4.4-1 summarizes the results that indicate that the general-purpose lanes of Koko Head-bound H-1 would be heavily loaded but acceptable (LOS E), and the Ewa-bound H-1 would also operate at LOS E during the future A.M. peak period. The zipper lane would provide a means for buses and HOVs to bypass the LOS F congestion in the Koko Head-bound direction.

TABLE 4.4-1
PROJECTED YEAR 2025 H-1 FREEWAY OPERATIONS AT KALAUAO SCREENLINE WITH REFINED LPA

	A.M. Peak Hour			P.M. Peak Hour		
	Lanes	**Volume (vph)**	**LOS**	**Lanes**	**Volume (vph)**	**LOS**
Koko Head-Bound	7	15,650	E		8,940	E
Ewa-Bound		8,360	E	7	14,700	E

Source: Parsons Brinckerhoff, Inc., June 2002.
Note: vph = vehicles per hour, LOS = level of service.

The projected maximum P.M. peak period hourly volume in the Ewa-bound direction would be 14,700 vph, while the maximum hourly volume in the Koko Head-bound direction would be 8,940 vph. Analysis results summarized in Table 4.4-1 show that both directions of H-1 Freeway would operate at an acceptable LOS E during the P.M. peak period. The zipper lane would still allow buses and HOVs to travel at a better LOS than the Ewa-bound general-purpose lanes on H-1. The Koko Head-bound direction would operate at LOS E with four general-purpose lanes.

2) Person Throughput on H-1 Freeway

More frequent service combined with proposed zipper lane and ramp enhancements will result in greater use of the A.M. zipper lane by buses in the Refined LPA. As a result, the Refined LPA is projected to carry more people through the Kalauao Screenline in the Koko Head-bound direction than the other Alternatives.

During the P.M. peak period, the added zipper lane operation in the Ewa-bound direction coupled with more frequent service and ramp enhancements for the Refined LPA will result in significant increases in person throughput (i.e. number of people passing across the screenline). Direct benefits would accrue not only to buses, but all vehicles with multiple occupants. Additionally, provision of the P.M. zipper lane would draw multiple occupant traffic out of the HOV and general-purpose lanes, providing indirect benefits to other motorists as well.

Table 4.4-2 compares the person throughput in the peak direction between the No-Build, TSM, and Refined LPA Alternatives. As shown, the Refined LPA will provide more person throughput capability on H-1 Freeway, especially during the P.M. peak period due to the proposed P.M. zipper lane. Transit passenger carrying capacity will also be increased because of more frequent service and the ability for buses to exit and enter the zipper lane at key locations along the corridor.

TABLE 4.4-2
PROJECTED YEAR 2025 COMPARISON OF H-1 FREEWAY PERSON THROUGHPUT AT THE KALAUAO SCREENLINE

Type of Lane(s)	A.M. Peak Hour			P.M. Peak Hour		
	No-Build	TSM	Refined LPA	No-Build	TSM	Refined LPA
Zipper	6,755	7,710	9,675	N.A.	N.A.	6,725
HOV	4,405	4,300	3,800	5,060	5,295	3,800
General Purpose	12,710	12,650	12,650	10,140	10,120	10,120
Total	23,870	24,660	26,125	15,180	15,415	20,645

Source: Parsons Brinckerhoff, Inc., June 2002.
Note: Numbers are persons per hour.

3) Summary

The Refined LPA will not only benefit transit riders by giving them an uncongested route to-and-from the urban core, but will benefit peak period traffic operations on the regional roadway system by reducing the number of autos using it. The benefits would accrue to all traffic on the freeway by shortening the length of time the freeway is congested.

Additionally, expanding zipper lane operation to the P.M. peak period will benefit transit riders and carpool occupants with 2 or more riders by providing a less congested path through the heavily traveled H-1 Freeway corridor. Analysis determined that the contra-flow zipper lane could be implemented during the P.M. peak period, while maintaining acceptable traffic flow in the off-peak direction lanes on H-1.

4.4.2 In-Town Traffic Operations

The Oahu Trans 2K meetings identified community sentiment for an alternative approach to addressing traffic congestion on roadways within the urban core of Honolulu. Meeting attendees acknowledged that while there is an important role for roadways, building new or widening existing highways couldn’t solve current traffic congestion because there is inadequate space for new for wider streets. This is especially true within the urban core of Honolulu. Even if space existed for widening within the urban core, this widening would be ineffective without the ability to widen regional facilities and improve the interfaces between the regional facilities and urban core roadways. The goal therefore is to identify a way to carry more people within the urban core without rebuilding the entire roadway system. Additionally, the Oahu Trans 2K process identified a desire that communities, particularly in the urban core, become more pedestrian friendly and less auto dependent.

Still, regionally accepted projections of future population and employment growth imply a need to improve the capacity to move people to and from and within the urban core of Honolulu. Within the urban core, roadway improvements have a role in improving this capacity, but roadway improvements alone fall short. Without major roadway widening or grade-separation of intersections, roadway capacities can only be marginally enhanced through efficiency programs such as intersection channelization and traffic signal coordination. Contra-flow operation (borrowing a lane of traffic from the opposing direction of travel) during peak periods is helpful in increasing capacities, but is expensive to maintain and can only be implemented under the right conditions.

Most of the roadways within the urban core of Honolulu have already been optimized as much as possible using these techniques. Any future capacity enhancements without roadway widening or grade-separations will have to come from a shift away from single occupant vehicles, to transit and other modes. This has already begun with the initiation of limited-stop transit service such as CityExpress! A and B and CountryExpress! C. These limited-stop transit services provide faster travel times due to the reduced number of stops along their routes and are, therefore, able to carry more people per hour. Even so, when roadways become congested, the transit vehicles become trapped within the congestion along with other vehicles. The roadway capacity again becomes the constraint.

The In-Town BRT will take transit to the next level in terms of person carrying capacity. The CityExpress! limited-stop concept is expanded by expediting limited-stop transit vehicles through the traffic congestion via a combination of semi-exclusive and exclusive transit lanes. To do this without widening roadways, lanes within roadways will be converted from general-purpose traffic use to semi-exclusive or exclusive transit lanes. Because buses carry more people per vehicle than general-purpose autos, providing buses an expedited path along a roadway increases the person carrying capacity of a roadway.

While increasing the people-carrying capacity, the traffic impact of converting lanes is that it reduces the auto-carrying capacity of the roadways where semi-exclusive or exclusive lanes have replaced general-purpose lanes. Screenline analysis, using volume/capacity (v/c) ratios, is used to address the corridor impacts of this capacity reduction. A V/C ratio of 1.00 indicates that the corridor volume demand equals the summed capacity of the roadway links along the screenline. A screenline is an imaginary line through which all roadways within a corridor pass. A corridor V/C ratio greater than 1.00 indicates that the corridor demand is greater than the screenline capacity. These V/C ratios are often linked to an index called level of service (LOS). LOS ranges from LOS A to LOS F, with LOS A indicating free-flow traffic conditions and LOS F indicating congested traffic conditions. Because auto capacity within streets within the urban core of Honolulu is governed by intersection operations, intersection analyses were also performed to assess the impacts of the Refined LPA in relation to the No-Build and TSM Alternatives. The intersection analyses also use an LOS index to identify operational levels. Unlike the screenline analyses, the intersection LOS is based on average vehicle delay expressed as seconds per vehicle. Measures to mitigate these impacts are identified where feasible. The In-Town traffic operations are divided into four general areas for the purposes of this discussion: 1) Dillingham Boulevard Corridor, 2) Downtown Area, 3) Mid-Town Corridor, and 4) Waikiki Corridor.

1) Dillingham Boulevard Corridor

a. Overview

Figure 4.4-1 illustrates the location of the Dillingham Boulevard corridor, which is from Middle Street to North King Street in an Ewa-Koko Head orientation. It is located parallel to and between North King Street and Nimitz Highway. The Ewa end of this corridor is actually named Kamehameha Highway between Middle Street and Puuhale Road, becoming Dillingham Boulevard Koko Head of Puuhale Road. For most of its length, Dillingham Boulevard currently has a 5-lane cross-section made up of 2 lanes in each direction and a painted median that accommodates exclusive left-turn lanes. On its Ewa end, it is connected to the H-1 Freeway Viaduct, Middle Street, and Nimitz Highway (under the viaduct) via ramping at the Keehi interchange. The Ewa end of Dillingham has a 7-lane cross-section (3 lanes Koko Head-bound, 3 lanes Ewa-bound and a median for exclusive left-turn lanes) with a transition to the 5-lane cross-section at Puuhale Road. The Koko Head-end of Dillingham Boulevard ends at North King Street, opposite Liliha Street. Major intersections are signalized and on-street parking is not allowed. The posted speed limit is 35 mph (25 mph near schools). Existing transit service on Dillingham Boulevard is provided by bus routes C (Country Express!), Route 3-Ruger/Navy, Route 52-Ala Moana Center/Wahiawa Circle Island, and Route 62-Ala Moana Center/Wahiawa Heights. The combined service on Dillingham Boulevard is approximately 10 to 11 buses per hour during the peak periods and 9 buses per hour during the midday time period.

In its current configuration it is able to accommodate existing A.M. and P.M. peak hour volumes although queuing may occur during the A.M. peak period on the Koko Head-bound ramps from H-1 and Nimitz Highway to Dillingham Boulevard.

During peak periods, it is projected that as many as 60 BRT buses per hour, per direction, will utilize Dillingham Boulevard. Along Dillingham Boulevard the BRT will carry 3,500 passengers during the A.M. peak hour.

FIGURE 4.4-1 DILLINGHAM CORRIDOR

Because Dillingham Boulevard is such a key link, transit will be given priority through the use of exclusive BRT lanes located in the middle of Dillingham Boulevard. Only BRT buses will use these lanes. To achieve this, two traffic lanes (one in each direction) out of the existing four traffic lanes on Dillingham Boulevard will be converted from auto to exclusive transit use. Median exclusive left-turn lanes will be maintained at most intersections.

In response to comments to the MIS/DEIS, a series of working group meetings comprised of business owners, property owners, community representatives, government agencies, and other stakeholders were held. This working group reviewed concerns expressed with the BRT Alternative contained in the MIS/DEIS and made suggestions to improve it.

Two key modifications to the BRT Alternative that came out of this process related to accessibility to properties along Dillingham Boulevard and traffic operation with a single traffic lane in each direction.

<u>Accessibility to Properties Along Dillingham Boulevard</u>

The BRT will be located in the middle of Dillingham Boulevard in exclusive lanes. Vehicles will be able to turn left at selected intersections and driveway locations. U-turns will also be allowed at most intersections. Most driveways will be limited to right-in/right-out traffic movements, a change from the current condition that allows left-turns to be made into the painted two-way left-turn median.

Large commercial vehicles would have difficulty using the U-turns at signalized intersections because of their turning radii. Solutions for large commercial vehicles to access properties from all directions and better traffic circulation parallel to Dillingham Boulevard were identified.

The following modifications to the BRT Alternative were made to address these issues:

- U-turns will be allowed at most signalized intersections, allowing vehicles the ability to access driveways regardless of their direction of travel.
- Parallel roadways, such as Colburn Street, Kaumualii Street, and Kaluaopalena Street, will be modified, where appropriate, to improve access and traffic circulation within the Dillingham Corridor. These roadways will enable larger commercial trucks to circulate when they are too large to execute a U-turn at a signalized intersection. To enable these parallel roadways to effectively serve this circulator function, it is also proposed to signalize intersections with major cross streets such as Waiakamilo Road, McNeill Street, and Mokauea Street. Parallel roadways within primarily residential areas will not be used for circulation purposes.
- In rare special cases where essential low volume access to driveways could not be accommodated through other means, access across the exclusive BRT lanes will be allowed.

Figure 4.4-2 illustrates alternate property access on Dillingham Boulevard.

<u>Single Traffic Lane Operation on Dillingham Boulevard</u>

A single lane for traffic has the potential to be blocked by local buses while loading or unloading passengers (some local bus service will remain on Dillingham Boulevard with these buses running in the curb lane, not in the exclusive transit lane), commercial vehicles stopped for loading and unloading, and vehicles slowing to make right turns. These obstructions could limit the ability for Dillingham Boulevard to effectively carry traffic. The following modifications to the BRT Alternative in the MIS/DEIS are reflected in the Refined LPA:

FIGURE 4.4-2 ALTERNATIVE PROPERTY ACCESS ON DILLINGHAM BOULEVARD

- Selective widening of Dillingham Boulevard . One of the key changes to the BRT Alternative is the addition of an approximate 7-foot widening on the makai side of Dillingham Boulevard between Waiakamilo Road and Puuhale Road to provide two 18-foot traffic lanes. These wider lanes (one in each direction) would allow through traffic on Dillingham Boulevard to bypass vehicles turning right into driveways or streets and local buses stopping for passengers.

- Bus Turnouts. Between Waiakamilo Road and Kaaahi Street, it was the consensus of the working group not to widen Dillingham Boulevard in this section, but to provide bus turnouts (bus bays), so that local buses stopping to load and unload passengers will not block through traffic. Turnouts rather than widening will allow the existing Kamani trees that line Dillingham Boulevard to remain.

b. Year 2025 Traffic Volumes on Dillingham Boulevard

While the No-Build and TSM Alternatives do not propose any changes to the lane configurations on Dillingham Boulevard, the Refined LPA proposes the conversion of one traffic lane in each direction to exclusive transit lanes in each direction. This will leave one traffic lane in each direction, capable of carrying general-purpose traffic. This reallocation of lanes has raised concerns about the impacts to motorists on Dillingham Boulevard and other parallel streets and highways.

To better understand the intersection analyses of traffic impacts that follow, background with regard to the future traffic projected for Dillingham Boulevard is presented.

Existing traffic on Dillingham Boulevard during peak periods totals around 1,500 vehicles per hour (vph) in the peak direction. This traffic demand currently requires two traffic lanes in each direction on Dillingham Boulevard.

To analyze what is likely to happen when two lanes on Dillingham Boulevard are converted to exclusive BRT use requires looking at a screenline through the affected area. As discussed in the regional highway portion of this chapter, a screenline is an imaginary line along which traffic volumes on parallel roadways that cross it are summed. This provides an understanding of the total traffic demand through an area and identifies the distribution of that demand to the roadways that cross the screenline. Table 4.4-3 summarizes A.M. peak hour traffic volumes at the Kapalama screenline for existing conditions, projected Year 2025 conditions for the three Alternatives. The Kapalama screenline is located along the Kapalama Canal and is crossed by School Street, H-1 Freeway, Olomea/Halona Streets (H-1 frontage roads), North King Street, Dillingham Boulevard, and Nimitz Highway.

As shown in Table 4.4-3, the current Kapalama screenline is near capacity in the peak direction during the A.M. peak hour. Further, all future Alternatives result in peak direction A.M. peak hour travel demand that exceeds the capacity of the Kapalama screenline. This occurs even when including the capacity enhancements within the Nimitz Highway corridor assumed in the OMPO long-range regional transportation plan.

Table 4.4-3 also shows that the Refined LPA is projected to have a beneficial effect on the Kapalama screenline through a reduction in auto traffic by attracting more trips to transit. The Refined LPA will result in almost 3,000 fewer vehicle trips in the peak direction during the A.M. peak hour than the No-Build Alternative and almost 2,000 fewer vehicle trips than the TSM Alternative during the same period.

c. Person Throughput on Dillingham Boulevard

The previous analysis demonstrated that a single lane on Dillingham Boulevard is forecast to result in v/c ratios at or below those on adjacent roadways.

TABLE 4.4-3
COMPARISON OF PROJECTED SCREENLINE TRAFFIC VOLUMES
KAPALAMA SCREENLINE-A.M. PEAK HOUR-KOKO HEAD-BOUND

	2000 Existing		2025 No-Build		2025 TSM		2025 Refined LPA	
Roadway	**Volume**	**V/C**	**Volume**	**V/C**	**Volume**	**V/C**	**Volume**	**V/C**
School Street	1,285	0.92	1,400	1.00	1,400	1.00	1,400	1.00
H-1 Freeway	7,065	1.01	9,740	1.39	9,700	1.31	8,640	1.23
Olomea Street	965	0.96	1,000	1.00	1,000	1.00	1,000	1.00
North King St.	1,260	0.90	1,780	1.11	1,600	1.00	1,600	1.00
Dillingham Blvd.	1,335	0.96	1,780	1.11	1,600	1.00	900	1.00
Nimitz Highway	3,850	0.99	8,170	1.26	7,590	1.17	7,510	1.16
Screenline Total	**15,758**	**0.98**	**23,870**	**1.25**	**22,890**	**1.20**	**21,050**	**1.14**

Source: Parsons Brinckerhoff, June 2002.
Note: Volume is expressed as vehicles per hour (vph), V/C=volume/capacity ratio. It is anticipated that for all Alternatives, all roadways that make-up the Kapalama screenline will be at or above capacity. However, because of the reduction in auto travel with the Refined LPA, Dillingham Boulevard will be able to maintain a volume over capacity (V/C) ratio of 1.00 with one less lane than in the No-Build and TSM Alternatives, and still result in lower V/C ratios on Nimitz Highway and the H-1 Freeway.

Although the analysis also concluded that all roadways along the Kapalama screenline would be at or above capacity, the Dillingham Boulevard corridor is the only corridor that provides a protected facility for the transit mode via the exclusive BRT lanes.

This will enable Dillingham Boulevard to carry more people per hour with the Refined LPA than with the TSM or No-Build Alternatives. Table 4.4-4 summarizes the capacity in number of person trips per hour that could be accommodated within Dillingham Boulevard. This table is based on the Kapalama screenline volumes shown in Table 4.4-3 and the bus and BRT volumes based on the proposed headways for each Alternative.

As shown, the Refined LPA will be able to accommodate half the auto person trips per hour compared to the No-Build and TSM Alternatives. On the other hand, the Refined LPA will be able to serve 10 times the number of transit trips per hour than would the No-Build Alternative. Overall, the Refined LPA will have about three to four times the total person trip capacity in the Dillingham Boulevard corridor than the No-Build or TSM Alternatives.

The ability of the Refined LPA to achieve the amount of transit person capacity shown in Table 4.4-4 is dependent on the exclusive lanes located in the middle of Dillingham Boulevard. These lanes help the BRT vehicles to bypass congestion on Dillingham Boulevard, thereby enabling them to achieve higher transit frequencies.

d. Intersection Analyses

Selected intersections along Dillingham Boulevard were evaluated using methods documented in the 2000 Highway Capacity Manual, published by the Transportation Research Board, and the results are summarized in Table 4.3-5. The results of these analyses show that in the year 2025 most intersections along Dillingham Boulevard will be congested with demand exceeding capacity. In the No-Build, TSM, and Refined LPA Alternatives, most intersections are projected to operate at Level Of Service (LOS) F. Note that No-Build, TSM, and Refined LPA Alternative delays are similar, even if the Refined LPA has only half as many traffic lanes on Dillingham Boulevard than the No-Build or TSM Alternatives. This results from the reduction in traffic volume caused by a significant shift in mode of travel from auto to transit as discussed previously.

TABLE 4.4-4
ESTIMATED PERSON TRIP THROUGHPUT CAPACITY ON DILLINGHAM BOULEVARD
KAPALAMA SCREENLINE – A.M. PEAK HOUR – KOKO HEAD-BOUND

Mode	2025 No-Build	2025 TSM	2025 Refined LPA
Transit Persons/Hour	770	210	7,080
Auto Persons/Hour	2,120	1,920	1,060
Total Persons/Hour	2,890	2,130	8,140

Source: Parsons Brinckerhoff Inc., June 2002.
Note: All table entries in persons/hour. TSM Alternative uses other corridors more heavily for bus routing.
Average Auto Occupancy = 1.2 persons/auto, Average Bus Occupancy = 70 persons/bus.
Average BRT Occupancy = 100 persons/BRT.

The benefit of the exclusive transit lane is clearly shown by the transit LOS. This LOS focuses on the amount of delay projected for transit vehicles on Dillingham Boulevard. In the case of the No-Build and TSM Alternatives, this reflects the average delay projected for all through vehicles on Dillingham Boulevard. In the Refined LPA, transit priority is provided via exclusive BRT lanes, and this LOS refers to the average delay projected for BRT buses in the exclusive lanes. As shown in Table 4.4-5, the exclusive lane provides dramatic improvements in transit LOS over the No-Build and TSM Alternatives.

e. Summary

The configuration of the BRT Alternative originally proposed in the MIS/DEIS has been refined to be responsive to comments received on the MIS/DEIS and the SDEIS.

The BRT Alternative concept of converting two lanes of Dillingham Boulevard from general traffic use to exclusive transit use remains. The refinement is comprised of a 7-foot widening on the makai side (less than a lane width) for Dillingham Boulevard between Puuhale and Waiakamilo Roads to provide 18-foot wide traffic lanes instead of the originally proposed 14-foot lanes. This will allow through traffic on Dillingham Boulevard to bypass local buses, commercial vehicles, or right-turning vehicles as they load/unload or slow executing a right-turn. Between Waiakamilo Road and Kaaahi Street, bus turnouts will be provided for local buses instead of the 18-foot wide lanes. This will preserve the existing Kamani trees located in that segment of Dillingham Boulevard, while keeping local buses when loading and unloading passengers out of the through traffic flow.

A more formalized system of U-turns and parallel streets are also proposed to provide property access for landowners and businesses located adjacent to Dillingham Boulevard.

The Refined LPA is projected to result in a lower (less congested) screenline V/C ratio than the No-Build or TSM Alternative.

Even with one lane in each direction converted to exclusive transit use, intersection LOS for the Refined LPA will be equal to or better than for the No-Build and TSM Alternatives. This is possible primarily because the Refined LPA is projected to achieve sufficiently higher transit usage to decrease the A.M. peak hour, peak direction traffic at the Kapalama screenline by almost 3,000 vph. A similar decrease is forecast to occur during the P.M. peak period.

2) Downtown Area

The Regional and Dillingham Corridors work to conduct BRT vehicles to the Iwilei Transit Station on the edge of Downtown. From there, the In-Town BRT utilizes a short segment of N. King Street and then uses the existing Hotel Street Transit Mall.

TABLE 4.4-5
PROJECTED YEAR 2025 PEAK HOUR INTERSECTION LOS
DILLINGHAM BOULEVARD (DELAY IN SECONDS)

Intersection	Peak Time Period	No-Build				TSM				BRT			
		Auto LOS	Delay	Transit LOS	Delay	Auto LOS	Delay	Transit LOS	Delay	Auto LOS	Delay	Transit LOS	Delay
Laumaka St. and	A.M.	E	77.0	E	78.5	E	77.0	E	78.5	B	14.4	B	12.3
Dillingham Blvd	P.M.	F	121.8	F	125.8	F	121.8	F	125.8	F	94.0	A	7.7
Puuhale Rd. and	A.M.	D	52.3	D	51.0	D	52.3	D	51.0	C	31.6	B	11.3
Dillingham Blvd	P.M.	F	87.9	E	56.2	F	87.9	E	56.2	E	78.0	B	15.8
Mokauea St. and	A.M.	F	104.4	E	78.4	F	104.4	E	78.4	F	145.2	A	8.8
Dillingham Blvd	P.M.	F	123.9	F	137.5	F	123.9	F	137.5	F	172.1	C	25.5
Kalihi St. and	A.M.	F	359.0	F	288.9	F	359.0	F	288.9	F	338.5	C	34.4
Dillingham Blvd	P.M.	F	218.7	F	198.2	F	218.7	F	198.2	F	220.9	C	31.5
McNeill St. and	A.M.	F	98.4	F	102.8	F	98.4	F	102.8	F	85.6	B	18.2
Dillingham Blvd	P.M.	F	171.3	F	188.0	F	171.3	F	188.0	F	103.3	C	27
Waiakamilo Rd. and	A.M.	F	159.8	F	107.7	F	159.8	F	107.7	F	132.2	C	32
Dillingham Blvd	P.M.	F	174.7	F	188.1	F	174.7	F	188.1	F	116.7	C	29.5
Kohou St. and	A.M.	F	98.3	F	105.9	F	98.3	F	105.9	F	96.1	C	25
Dillingham Blvd	P.M.	F	108.5	F	117.6	F	108.5	F	117.6	F	91.9	C	24.5
Kokea St. and	A.M.	F	132.8	F	149.0	F	132.8	F	149.0	F	132.8	C	28.0
Dillingham Blvd	P.M.	F	143.7	F	153.6	F	143.7	F	153.6	F	138.1	C	25.0
Ala Kawa St. and	A.M.	F	114.5	F	125.5	F	114.5	F	125.5	F	100.0	B	19.2
Dillingham Blvd	P.M.	F	133.5	E	69.5	F	133.5	E	69.5	F	136.4	C	23.5
Kaaahi St and	A.M.	F*	-	F*	-	F*	-	F*	-	F*	-	C	20.0
Dillingham Blvd	P.M.	F*	-	F*	-	F*	-	F*	-	F*	-	C	25.0

Source: Parsons Brinckerhoff Inc., June 2002.
Note: *LOS F caused by downstream condition. Providing exclusive transit lanes along Dillingham Boulevard in the Refined LPA will result in much higher person trip throughput on Dillingham Boulevard.

Use of the Hotel Street Transit Mall by BRT vehicles will shift local transit vehicles from Hotel Street to parallel streets such as King Street and Beretania Street. Consolidation and reorganization of local and express bus routes would enable the parallel streets to accommodate the other transit vehicles.

The three In-Town BRT alignments then separate to serve their respective corridors. The Kakaako Mauka and Kakaako Makai BRT branches use the Bishop/Alakea couplet in mixed-flow mode between Hotel Street Transit Mall and Ala Moana Boulevard. The UH-Manoa Branch uses Richards Street between Hotel Street Transit Mall and South King Street.

3) Mid-Town Corridor

a. Overview

The Mid-Town Corridor covers the area from Downtown through Ala Moana. The In-Town BRT has three branches in this corridor, which are characterized by a combination of exclusive transit lanes, semi-exclusive transit lanes, and mixed-flow operation. Figure 4.4-3 shows the In-Town BRT alignments in the Mid-Town Corridor.

The Mid-Town Corridor, starts where the UH-Manoa Branch connects to South King Street at Richards Street, and the Kakaako Mauka and Kakaako Makai Branches intersect Nimitz Highway (Ala Moana Boulevard) at Bishop/Alakea Streets.

Along sections of Richards, South King, and Pensacola Streets, where the BRT will be operating in a curbside contra-flow lane, flashing warning signs with audible devices will be installed to alert pedestrians at crosswalks, and motorists at driveways that a BRT bus is approaching. In between driveways and crosswalks, edge treatments such as shrub plantings and bollards with chains will be installed to warn and discourage pedestrians from crossing at places other than crosswalks.

Traffic impacts within the Kakaako Mauka and Kakaako Makai areas are expected to be minimal. The BRT vehicles will be traveling on secondary streets such as Halekauwila, Pohukaina, and Auahi within Kakaako Mauka, and on Aloha Tower Drive and Ilalo Street within Kakaako Makai. The Kakaako Makai branch will also travel on a short segment of Ala Moana Boulevard, between Aloha Tower Drive and Forrest Avenue, but does so in mixed-traffic. BRT buses will have little effect on the overall traffic flow on these roadways.

If transit priority is implemented within the traffic signal timing schemes, there could be additional delays to cross-street traffic. The primary transit priority technique would be to extend the green phase on the BRT route to allow a BRT vehicle to pass through the intersection without stopping. Signal priority is not the same as signal preemption used by emergency vehicles. Signal preemption changes the traffic signal as soon as it is safe to do so to accommodate an emergency vehicle. All other phases are preempted. Signal priority only modifies the signal timing within a narrow range to expedite transit vehicle flow along a corridor.

The following sections discuss the projected year 2025 traffic impacts of the three Alternatives where implementation of semi-exclusive and exclusive lanes would occur on major arterial segments within the Mid-Town Corridor. These intersections occur along South King Street and Kapiolani Boulevard between Punchbowl Street and Kalakaua Avenue and on Ala Moana Boulevard between Piikoi Street and Atkinson Drive.

b. Year 2025 Peak Hour Traffic Volumes Within Mid-Town Corridor

Table 4.4-6 summarizes the projected year 2025 outbound (Koko Head-bound) P.M. peak hour traffic volumes at the Ward Avenue screenline. The P.M. peak hour outbound volumes are the most constrained and are, therefore, the focus of this analysis.

The projected Ward Avenue screenline volumes are similar for all three Alternatives, with the Refined LPA being about 1,000 vehicles per hour (vph) less than the No-Build and about 600 vph less the TSM Alternative. Although the Refined LPA results in the lowest screenline traffic volume, it results in the highest volume over capacity (v/c) ratio. The ratio is higher for the Refined LPA, because the roadway capacity for traffic decreases due to the conversion of general-purpose traffic lanes to semi-exclusive and exclusive transit lanes. In this case, the decrease in traffic volume due to the mode shift to transit is not quite enough to offset the decrease in roadway capacity.

FIGURE 4.4-3 MID-TOWN CORRIDOR

TABLE 4.4-6
COMPARISON OF SCREENLINE TRAFFIC VOLUMES AT WARD SCREENLINE-PM PEAK HOUR-KOKO HEAD-BOUND

Roadway	2000 Existing		2025 No-Build		2025 TSM		2025 Refined LPA	
	Volume	V/C	Volume	V/C	Volume	V/C	Volume	V/C
H-1 Freeway	7,545	1.00	7,750	1.03	7,950	1.05	7,950	1.05
Kinau Street	1,490	0.75	1,850	0.93	1,900	0.95	1,950	0.98
South King St.	3,335	0.69	4,690	0.98	4,215	0.96	3,500	0.97
Kapiolani Blvd.	1,825	0.67	2,630	0.97	2,600	0.96	2,605	0.96
Queen Street	300	0.60	900	0.90	900	0.90	950	0.95
Ala Moana Blvd.	2,740	0.91	2,940	0.98	2,920	0.97	2,895	0.97
Screenline Total	**17,235**	**0.84**	**20,760**	**0.99**	**20,485**	**0.99**	**19,850**	**1.00**

Source: Parsons Brinckerhoff Inc., June 2002.
Note: Volume is expressed as vehicles per hour (vph), V/C=volume/capacity ratio.

c. Person Throughput on South King Street and Kapiolani Boulevard

A goal of the Primary Corridor Transportation Project is to increase mobility by improving the flow of people not just vehicles. The Midtown Corridor roadways will be able to carry substantially more people than they would otherwise through the use of semi-exclusive and exclusive transit lanes.

South King Street is a one-way Koko Head-bound arterial with six traffic lanes available during peak periods. A semi-exclusive transit lane is proposed in the Koko Head-bound direction for BRTs, local buses, and vehicles making right turns into driveways and cross streets. An exclusive BRT lane traveling contra-flow to the prevailing Koko Head-bound traffic will serve the Ewa-bound BRT buses. Implementing these two transit priority lanes without widening South King Street will require converting two South King Street general-purpose lanes to transit use.

Similarly, once the alignment transitions from South King Street to Kapiolani Boulevard at Pensacola Street, two lanes will be converted from general-purpose to exclusive transit use on Kapiolani Boulevard, between Pensacola Street and Atkinson Drive. These lanes will be located in the middle of Kapiolani Boulevard and will be used by BRT buses exclusively. Because the two exclusive lanes on Kapiolani Boulevard will have the greatest impact, it is the focus of this analysis. Table 4.4-7 summarizes the results of the person throughput analysis for Kapiolani Boulevard.

TABLE 4.4-7
PERSON TRIP THROUGHPUT CAPACITY ON KAPIOLANI BOULEVARD BETWEEN PENSACOLA STREET AND ATKINSON DRIVE
P.M. PEAK HOUR – KOKO HEAD-BOUND

Mode	2025 No-Build	2025 TSM	2025 Refined LPA
Transit Persons/Hour	1,120	1,290	2,690
Auto Persons/Hour	3,220	3,220	2,150
Total Persons/Hour	4,340	4,480	4,840

Source: Parsons Brinckerhoff Inc., June 2002.
Note: All table entries in persons/hour. TSM Alternative uses other corridors more heavily for bus routing.
Average Auto Occupancy = 1.2 persons/auto, Average Bus Occupancy = 70 persons/bus
Average BRT Occupancy = 100 persons/BRT

As shown in Table 4.4-7, the Refined LPA has the potential to carry 8-12 percent more persons per hour than possible with the TSM and No-Build Alternatives, respectively, in the peak direction during the P.M. peak hour. For all Alternatives, the general-purpose lanes will be at capacity. The exclusive transit lanes, however, will be well below their capacity. Within this segment, the exclusive BRT lanes are projected to carry 22 BRT buses per hour in the peak direction. The Refined LPA, therefore, will significantly increase the potential person carrying capacity of Kapiolani Boulevard without having to widen it.

d. South King Street

South King Street is the one-way Koko Head-bound half of the South King Street/South Beretania Street high-capacity couplet. The Refined LPA proposes to operate BRT buses in both Koko Head and Ewa-bound directions on South King Street. The Koko Head-bound direction will be in a semi-exclusive lane shared by BRT buses, local transit, and right-turning vehicles. The Ewa-bound exclusive contra-flow lane will be for BRTs only. Local buses will continue to utilize South Beretania Street in the Ewa-bound direction along with general-purpose traffic.

Table 4.4-8 summarizes the intersection and transit LOS along South King Street.

TABLE 4.4-8
PROJECTED YEAR 2025 INTERSECTION LOS –MID-TOWN CORRIDOR ON SOUTH KING STREET

Intersection	Peak Time Period	No-Build				TSM				Refined LPA			
		Auto LOS	Delay	Transit LOS	Delay	Auto LOS	Delay	Transit LOS	Delay	Auto LOS	Delay	Transit LOS	Delay
Punchbowl St.	A.M.	E	75.5	D	35.5	E	90.0	C	22.6	E	57.2	C	34.5
and South King St.	P.M.	D	46.1	C	34.0	D	57.9	B	18.3	D	44.8	C	31.0
Alapai St.	A.M.	B	16.3	B	15.8	B	17.3	B	11.7	D	40.8	C	24.4
and South King St.	P.M.	C	30.7	C	20.2	D	36.9	C	20.6	E	78.2	B	18.8
Ward Ave.	A.M.	B	17.9	B	18.4	B	18.3	B	13.2	C	23.2	B	13.1
and South King St.	P.M.	D	47.7	C	28.7	D	49.7	C	20.5	D	49.7	B	14.1
Pensacola St.	A.M.	C	24.4	C	27.0	C	24.4	C	23.5	C	33.2	B	19.4
and South King St.	P.M.	C	26.3	C	33.5	C	26.3	C	33.5	C	34.5	B	19.7

Source: Parsons Brinckerhoff Inc., June 2002.

Peak traffic orientation during the A.M. peak period will continue to be in the Ewa-bound (into Downtown) direction for this corridor. Since South King Street operates as a couplet with South Beretania Street, the peak direction traffic will be on South Beretania Street, leaving South King Street with relatively unconstrained intersection operations even in 2025, with the exception of Punchbowl Street. The South King Street/Punchbowl Street intersection is projected to be congested in 2025 due to the high traffic demand on Punchbowl Street. For the Alapai Street, Ward Avenue, and Pensacola Street intersections, the TSM and Refined LPA Alternatives are projected to be operating at slightly lower, but still unconstrained LOS compared to the No-Build Alternative due to the reduction in general-purpose lanes (one for the TSM and two for the Refined LPA). Providing a semi-exclusive (Koko Head-bound) and an exclusive (Ewa-bound) transit lane for the BRT will allow the BRT to operate better than general purpose lanes along South King Street. The transit LOS is based on the delay experienced by the transit vehicles at the intersections summarized in Table 4.4-8.

Peak traffic during the P.M. peak period in 2025 will continue to be Koko Head-bound along South King Street. Similar to the Dillingham Corridor, there is projected to be a reduction of traffic volume at the Ward Avenue screenline due to the diversion of some auto drivers to transit. This diversion will enable the Refined

LPA to perform at comparable intersection LOS to the No-Build and TSM Alternatives, even with the conversion of two general-purpose lanes; one to semi-exclusive transit use and one to exclusive transit use.

e. Kapiolani Boulevard

A key feature of Kapiolani Boulevard today is the contra-flow lane operated in the peak direction during peak traffic periods. The contra-flow lane coning operation provides four traffic lanes in the peak direction and two traffic lanes in the off-peak direction. The No-Build and TSM Alternatives would maintain this configuration, although the TSM Alternative would allocate one peak direction lane for semi-exclusive transit operation (buses and right-turning vehicles). During contra-flow operation, left turns from the off-peak direction of Kapiolani Boulevard are prohibited, forcing off-peak direction left turns to make circuitous jug handle movements using streets parallel to Kapiolani Boulevard.

The Refined LPA will convert two general-purpose traffic lanes to exclusive transit lanes in the middle of Kapiolani Boulevard generally between Pensacola Street and Atkinson Drive, leaving two traffic lanes in each direction regardless of the time period. Contra-flow coning will continue Koko Head of Atkinson Drive, but will be discontinued between Atkinson Drive and South Street. Exclusive left-turn traffic lanes on Kapiolani Boulevard are proposed in the Refined LPA at the Pensacola Street, Piikoi Street, and Kaheka/ Mahukona Street intersections. These will operate throughout the day.

Table 4.4-9 summarizes the projected intersection level of service along Kapiolani Boulevard.

TABLE 4.4-9
PROJECTED YEAR 2025 INTERSECTION LOS – MID-TOWN CORRIDOR ON KAPIOLANI BOULEVARD

Intersection	Peak Time Period	No-Build				TSM				Refined LPA			
		Auto LOS	Delay	Transit LOS	Delay	Auto LOS	Delay	Transit LOS	Delay	Auto LOS	Delay	Transit LOS	Delay
Pensacola St.	A.M.	C	24.7	B	12.4	D	36.6	A	9.7	E	56.0	B	15.5
Kapiolani Blvd.	P.M.	C	25.8	B	13.4	C	27.3	A	9.8	D	47.6	B	16.4
Piikoi St. and	A.M.	C	29.7	B	11.4	D	46.5	A	7.8	E	56.7	B	11.7
Kapiolani Blvd.	P.M.	C	30.5	C	35.0	C	34.5	B	11.8	E	57.4	C	27.0
Keeaumoku St. and	A.M.	C	23.8	B	16.5	D	37.5	B	13.3	E	77.5	A	5.3
Kapiolani Blvd.	P.M.	C	33.6	C	30.9	C	40.0	B	20.3	D	44.4	B	19.5
Atkinson Dr. and	A.M.	C	26.4	C	25.1	D	35.2	C	20.4	D	42.4	B	17.3
Kapiolani Blvd.	P.M.	F*	-	F*	-	F*	-	B	14.7	F*	-	B	13.0

Source: Parsons Brinckerhoff Inc., June 2002.
Note: *LOS F caused by downstream condition

Both the No-Build and TSM Alternatives are proposed to retain the current contra-flow coning operation on Kapiolani Boulevard. Although this operation inconveniences drivers by restricting left turns from Kapiolani Boulevard in the off-peak direction, it does have the advantage of providing four lanes of travel in the peak direction. It also has the advantage of providing at least two through lanes unhindered by the friction of turning movements (the curb lane and the coned lane handle the turning traffic). Under the projected Year 2025 peak hour traffic volumes, Kapiolani Boulevard intersections are projected to operate acceptably with the exception of the Kapiolani Boulevard/Atkinson Drive intersection during the P.M. peak hour. This intersection is expected to be impacted by congestion at the downstream Kapiolani Boulevard/Kalakaua Avenue intersection. Because this delay is caused by the downstream intersection, delay is difficult to predict and no value is provided.

The Refined LPA is projected to have lower intersection LOS in 2025 compared to the No-Build and TSM Alternatives, mainly due to the two fewer lanes available to carry traffic in the peak direction. It is projected that Kapiolani Boulevard will operate about two LOS levels lower than the No-Build or TSM Alternative, but will still be operating acceptably for urban peak period conditions. As in the No-Build and TSM Alternatives, the Kapiolani Boulevard/Atkinson Drive intersection is projected to be affected by the congestion at the downstream Kapiolani Boulevard/Kalakaua Avenue intersection.

Providing exclusive transit lanes on Kapiolani Boulevard will allow the BRT to operate with less constraints through this corridor. This is especially helpful where traffic congestion is projected. The exclusive lanes allow the BRT to bypass the traffic queues caused by the congestion.

f. Ala Moana Boulevard

During both A.M. and P.M. peak periods in 2025, the Ala Moana Boulevard/Atkinson Drive intersection is projected to be congested for all Alternatives. Especially during the P.M. peak period, congestion at the Atkinson Drive intersection is expected to affect the upstream Ala Moana Boulevard/Piikoi Street intersection. Given the physical constraints of Ala Moana Center on the mauka side and Ala Moana Park on the makai side of Ala Moana Boulevard, roadway widening is not an option for this roadway segment. As a result, this segment is projected to be a traffic bottleneck in the long-range future regardless of the alternative implemented (See Table 4.4-10).

TABLE 4.4-10
PROJECTED YEAR 2025 INTERSECTION LOS –MID-TOWN CORRIDOR ON ALA MOANA BOULEVARD

Intersection	Peak Time Period	No-Build				TSM				Refined LPA			
		Auto LOS	Delay	Transit LOS	Delay	Auto LOS	Delay	Transit LOS	Delay	Auto LOS	Delay	Transit LOS	Delay
Piikoi St. and	A.M.	D	58.9	D	48.9	D	58.9	D	48.9	E	79.8	C	28.4
Ala Moana Blvd	P.M.	F*	-	F*	-	F*	-	F*	-	F*	-	C	29.6
Atkinson Dr. and	A.M.	F	91.7	E	63.5	F	91.7	E	63.5	F	130.5	C	27.2
Ala Moana Blvd	P.M.	F	82.5	E	66.7	F	82.5	E	66.7	F	239.5	C	31.5

Source: Parsons Brinckerhoff Inc., 2002.
Note: * LOS F caused by downstream congestion

Given this finding, the Refined LPA will clearly provide greater mobility for more people through this area. While traffic will be significantly delayed in all Alternatives, only the Refined LPA with its semi-exclusive lane Koko Head-bound and exclusive lane Ewa-bound will allow BRT vehicles, local buses, and tour buses to bypass the congestion and continue to provide service for their patrons. The No-Build and TSM Alternatives will provide no real advantage to the public or private buses, subjecting both to the same delays as other traffic in this bottleneck location.

3) Waikiki Corridor

a. Overview

The Waikiki Corridor is located between the Ala Wai Canal (at Ala Moana Boulevard) on the Ewa end to Kapahulu Avenue on the Koko Head end. Figure 4.4-4 shows the Waikiki Corridor.

FIGURE 4.4-4 WAIKIKI CORRIDOR

b. Ala Moana Boulevard

Ala Moana Boulevard, between Atkinson Drive and Kalakaua Avenue, experiences periods of congestion even today. To remedy this condition, the Refined LPA proposes to widen a section of Ala Moana Boulevard between the Ala Wai Canal and Kalia Road by 5-10 feet by reducing the width of the raised median, along with narrowing the existing traffic lanes to provide an additional lane in both Ewa-bound and Koko Head-bound directions.

In the Koko Head-bound direction, a semi-exclusive lane is proposed to be added to the existing three general-purpose lanes. BRT vehicles, local buses, tour buses and trolleys, and vehicles making right-turns will be allowed into this lane. It will begin just Ewa of Holomoana Street and continue along the curb to Kalia Road. Transit vehicles will be given an advanced green at the Ala Moana Boulevard /Atkinson Drive signal to allow them to reach this lane without competing with traffic in the general-purpose lanes between Atkinson Drive and Holomoana Street. This configuration will provide three lanes dedicated to through traffic movement at Hobron Lane plus a left-turn lane, and a semi-exclusive lane serving transit vehicles and right-turning traffic. The semi-exclusive lane will continue to Kalia Road, where it becomes a right-turn-only lane into Kalia Road. The three general-purpose lanes on Koko Head-bound Ala Moana Boulevard will extend to Kalia Road intersection where the outside lane will also become a right-turn only lane. The net effect in the Koko Head-bound direction will be to create a double right-turn lane from Ala Moana Boulevard to Koko Head-bound Kalia Road.

In the Ewa-bound direction, the semi-exclusive lane will begin at the Kalia Road intersection. It will continue to Hobron Lane, where it will transition from a curbside lane to a median lane. An advanced green signal will allow the BRT and other transit vehicles to transition to an exclusive median lane without conflict from other through traffic on Ala Moana Boulevard. This lane will continue to Atkinson Drive, where it will continue as an exclusive transit lane, available only to BRT vehicles and private buses. Also, to reduce conflicts at Atkinson Drive, left turns into Ala Moana Park will be prohibited. Motorists will be able to use the Ewa entrance to Ala Moana Park. The three general-purpose lanes will be configured as two through Ewa-bound lanes and one exclusive right-turn lane.

Table 4.4-11 summarizes projected 2025 traffic conditions for this segment of roadway.

TABLE 4.4-11
PROJECTED YEAR 2025 INTERSECTION LOS – WAIKIKI CORRIDOR ON ALA MOANA BOULEVARD

Intersection	Peak Time Period	No-Build				TSM				Refined LPA			
		Auto LOS	Delay	Transit LOS	Delay	Auto LOS	Delay	Transit LOS	Delay	Auto LOS	Delay	Transit LOS	Delay
Atkinson Drive	A.M.	F	91.7	E	63.5	F	91.7	E	63.5	F	130.5	C	27.2
And Ala Moana Blvd.	P.M.	F	82.5	E	66.7	F	82.5	E	66.7	F	239.5	C	31.5
Hobron Lane	A.M.	F	228.4	F	278.4	F	228.4	F	278.4	E	31.2	C	10.9
And Ala Moana Blvd.	P.M.	F	101.7	F	63.8	F	101.7	F	63.8	E	41.7	C	19.9
Kalia Road	A.M.	F	116.9	F	95.3	F	116.9	F	95.3	F	93.2	D	60.9
And Ala Moana Blvd.	P.M.	F	314.9	F	196.2	F	314.9	F	196.2	F	141.7	D	69.9

Source: Parsons Brinckerhoff Inc., June 2002.

The most constrained conditions are projected to occur at the Ala Moana Boulevard/Hobron Lane intersection. This intersection currently accommodates the through traffic on Ala Moana Boulevard and a significant level of turning traffic to-and-from Hobron Lane. Hobron Lane serves the Renaissance Ilikai Hotel, the Hawaii Waikiki Prince Hotel, and the Ala Wai Boat Harbor on the makai side and numerous condominiums and hotels on the mauka side. This intersection currently experiences and is projected to experience periods of traffic congestion. Because of the added lanes for BRTs, other transit, and right-turning vehicles, the Refined LPA is projected to provide the best LOS. Its LOS E is still considered congested, but is much better than the LOS F projected in the No-Build and TSM Alternatives. More importantly, the Refined LPA will provide a less congested path for both public and private transit buses through this historically congested corridor.

Recent plans for a new hotel tower within the Hilton Hawaiian Village propose a new signalized intersection along Ala Moana Boulevard located at the existing Dewey Lane. Dewey Lane is located between the Renaissance Ilikai Hotel and the Hilton Hawaiian Village and is currently restricted to right-in/right-out traffic movements. The Draft Environmental Impact Statement (DEIS) Waikikian Development Plan, July 2001, documents proposals to modify this intersection as a full-movement, signalized intersection. The DEIS indicates that the Dewey Lane intersection would operate acceptably during the peak hour time periods.

c. Kalia Road

Kalia Road is currently configured with 5 traffic lanes (2 Koko Head-bound, 2 Ewa-bound, 1 median left-turn lane) between Ala Moana Boulevard and Maluhia Road (Hale Koa Hotel and Fort DeRussy Entrances). Koko Head of Maluhia Road, Kalia Road is a two-lane roadway with one lane in each direction and left-turn lanes provided at key intersections. The Refined LPA proposes to widen Kalia Road by one lane in each direction, with these lanes being designated as semi-exclusive lanes. BRT, local buses, private buses, and autos turning right into driveways on Kalia Road will be able to use these lanes.

To provide an exclusive lane for Ewa-bound BRT buses at Ala Moana Boulevard, the existing three general-purpose Ewa-bound lanes on Kalia Road (1 exclusive left, 1 left/through, and 1 exclusive right) would be reallocated as 2 general-purpose lanes (1 exclusive left, 1 left/through/right) and the exclusive transit lane.

Because of the new lanes proposed for Kalia Road, traffic operations are projected to be better in 2025 with the Refined LPA compared to the No-Build or TSM Alternatives that would only have two lanes on Kalia Road, Koko Head of Maluhia Road. Because the future bus operations plan proposes to turn-back some of the local bus routes in the Fort DeRussy area, the proposed semi-exclusive transit lanes will be very helpful. The transit routes will be turned-back to decrease the number of local buses circulating on Kuhio Avenue.

d. Saratoga Road

Kalia Road currently transitions from a two-way street to an Ewa-bound one-way street at Saratoga Road. The existing Saratoga/Kalia intersection is STOP-sign controlled. The future configuration of this intersection depends on final plans for Outrigger Hotel's redevelopment. Outrigger plans to redevelop an area between Kalakaua Avenue and Kalia Road and along Lewers Street and Beachwalk. As part of those plans, a new hotel tower is proposed between Beachwalk and Saratoga Road with its lobby entrance on Saratoga Road. Preliminary plans show two driveways for the lobby entrance located on Saratoga Road, close to the Kalia Road/Saratoga Road intersection. The BRT will turn from Kalia Road to Saratoga Road, maintaining a through and semi-exclusive lane in both directions. How Outrigger proposes to configure this intersection as part of the redevelopment could have an effect on the operation of the BRT and other traffic. The Outrigger's project is still in the planning phase at this time, and Outrigger continues to work with the City to arrive at a configuration that would be appropriate for the hotel and BRT operations.

Projected BRT and local bus volumes combined are estimated to total 60 transit vehicles/hour. This is a small fraction of the traffic volume that currently uses this intersection. It is believed that this volume can be accommodated by any reasonable intersection developed in conjunction with the Outrigger's redevelopment plan.

At Kalakaua Avenue, a new lane will be added in the mauka direction to allow an additional right turn movement onto Kalakaua Ave.

e. Kalakaua Avenue

Kalakaua Avenue will be used as the Koko Head-bound segment of the counter-clockwise BRT Loop within Waikiki. The No-Build and TSM Alternatives would not have buses operating on Kalakaua Avenue between Kuhio Avenue and Kapahulu Avenue.

On Kalakaua Avenue in the Refined LPA, three through lanes and a semi-exclusive lane are proposed heading in the Koko Head direction until Kaiulani Street where the mauka lane will be terminated. At Uluniu Avenue, the BRT will switch to a mixed-flow operation to provide 3-through lanes, and the BRT will transition from the makai lane to the mauka lane to make a left turn onto Kapahulu Avenue. On Kapahulu Avenue, the BRT will operate in mixed traffic.

Traffic within Waikiki along Kalakaua Avenue is extremely variable, depending on special events such as festivals, conventions, wedding receptions and others. Since these special events do not generally occur during peak commuting time periods, the analysis in this FEIS focuses on recurring conditions during the peak commuting time periods. That is when the BRT will be running at maximum frequency. During periods of back-up in the right lane, BRT vehicles will be able to go around the congestion by using the adjacent lane. Additionally, during special events such as parades, the BRT will be re-routed off of Kalakaua Avenue to alternate streets.

As shown in Table 4.4-12, there is little impact projected in 2025 from the BRT on Kalakaua Avenue.

TABLE 4.4-12
PROJECTED YEAR 2025 INTERSECTION LOS – WAIKIKI CORRIDOR ON KALAKAUA AVENUE

Intersection	Peak Time Period	No-Build				TSM				Refined LPA			
		Auto LOS	Delay	Transit LOS	Delay	Auto LOS	Delay	Transit LOS	Delay	Auto LOS	Delay	Transit LOS	Delay
Saratoga Road	A.M.	D	62.7	**	**	D	62.7	**	**	D	65.5	C	27.2
and Kalakaua Ave.	P.M.	E	78.5	**	**	E	78.5	**	**	E	79.5	C	31.5
Seaside Avenue	A.M.	B	25.4	**	**	B	25.4	**	**	B	25.9	B	25.9
and Kalakaua Ave.	P.M.	C	35.8	**	**	C	35.8	**	**	C	41.7	C	39.9
Uluniu Street	A.M.	B	25.9	**	**	B	25.9	**	**	B	30.2	B	25.9
and Kalakaua Ave.	P.M.	C	35.9	**	**	C	35.9	**	**	C	35.7	C	29.9

Source: Parsons Brinckerhoff Inc., June 2002.
Note: ** transit on Kuhio Avenue only.

f. Kuhio Avenue

Kuhio Avenue is currently a four-lane collector roadway with two lanes in each direction. In addition, left-turn lanes are located within a painted median.

The Waikiki Livable Communities project is an effort currently underway aimed at identifying improvements within Waikiki that can make it an even more pleasant environment in which to live, work, and visit. One of the concepts that has emerged from the Livable Waikiki effort is to create wide pedestrian promenades on both sides of Kuhio Avenue. To accomplish this, the existing sidewalks would be widened into Kuhio Avenue, the existing roadway would be narrowed, and the traffic lanes reduced. What would remain is enough roadway width to provide two traffic lanes in one direction, one traffic lane in the other direction, and space for median left-turn lanes at selected locations. Turnouts would be provided for commercial truck and tour bus loading and for local bus stops.

In the Refined LPA Alternative, two lanes would be oriented in the Ewa-bound direction with the curb lane designated as a semi-exclusive lane for BRT, municipal bus, and tour bus vehicles. There would be a single Koko Head-bound lane for general-purpose traffic.

The No-Build and TSM Alternatives would be identical along Kuhio Avenue. Local buses and tour buses would travel in mixed-flow, as they do today. Two traffic lanes would be oriented in the Koko Head-bound direction and one lane would be oriented in the Ewa-bound direction.

In the Refined LPA, the lane configuration will be the reverse of the No-Build and TSM Alternatives, with two lanes being oriented in the Ewa-bound direction and one lane being oriented in the Koko Head-bound direction. One of the Ewa-bound lanes will be designated a semi-exclusive lane for use by BRT vehicles, local buses, private buses, and autos making right turns into cross streets or driveways. Immediately after Lewers Street the BRT will swap lanes with Ewa-bound through lanes to prepare it for a left-turn onto Kalaimoku Street. To achieve this without having BRT vehicles mix with the through traffic, the BRT will be given an advance green signal before the Ewa-bound through traffic, allowing the BRT to change into the makai lane unimpeded. The BRT will then follow Kalaimoku Street back to Saratoga Road.

Table 4.4-13 summarizes the projected 2025 LOS for Kuhio Avenue intersections. As shown, the majority of the intersections are projected to operate at LOS F for all of the Alternatives. This is largely a result of the significant increase in hotel rooms forecasted, especially in the International Marketplace area.

The Refined LPA will offer substantial benefit to BRT and other bus riders since they will have a dedicated lane that avoids the traffic congestion forecasted for Kuhio Avenue. The other Alternatives would not provide any transit priority and, therefore, transit riders would experience similar delays to the overall traffic on Kuhio Avenue.

4.5 PARKING IMPACTS

Parking impacts fall into three categories. The first category of impact is that related to parking at transit centers and park-and-rides. The second is on-street parking impacts, due to the designation of exclusive or semi-exclusive lanes for transit vehicles. The third category of impact pertains to off-street parking.

4.5.1 Transit Centers and Park-and-Ride Facilities

To intercept auto users and get them on transit, park-and-ride facilities are proposed in all of the alternatives. Many of the park-and-rides will occur at transit centers and give parkers transit connections to multiple destinations. From a regional perspective these park-and-rides will reduce VMT as well as parking and traffic impacts in the urban core. While there may be some localized impacts associated with these park-and-rides, sites have been selected to minimize the potential traffic impacts and increase opportunities to enhance neighborhoods.

Table 4.5-1 shows the number of parking spaces proposed at each transit center and park-and-ride facility in the No-Build, TSM and Refined LPA Alternatives. The number of spaces shown is based on projected usage from the travel demand models combined with a preliminary assessment of site constraints and surrounding neighborhood compatibility. Project-specific community planning and environmental assessments would be performed for each of these sites prior to their implementation. It is intended that a parking pricing schedule be developed to encourage parking outside of the urban core rather than parking within the core.

TABLE 4.4-13
PROJECTED YEAR 2025 PEAK HOUR INTERSECTION LOS –WAIKIKI CORRIDOR ON KUHIO AVENUE

Intersection	Peak Time Period	No-Build				TSM				Refined LPA			
		Auto LOS	Delay	Transit LOS	Delay	Auto LOS	Delay	Transit LOS	Delay	Auto LOS	Delay	Transit LOS	Delay
Kalaimoku St.	A.M.	F	136.7	F	124.4	F	137.0	F	124.4	F	409.4	E	56.1
And Kuhio Ave.	P.M.	F	145.5	F	152.8	F	146.0	F	152.8	F	336.8	E	78.3
Lewers St.	A.M.	F	339.5	F	277.4	F	340.0	F	277.4	F	520.5	C	20.7
And Kuhio Ave.	P.M.	F	317.9	F	371.4	F	318.0	F	371.4	F	496.2	D	43.6
Royal Hawaiian Ave.	A.M.	F	158.7	F	117.8	F	159.0	F	117.8	F	195.4	D	28.3
And Kuhio Ave.	P.M.	F	143.4	F	133.3	F	143.0	F	133.3	F	201.7	D	47.4
Seaside Ave.	A.M.	F	217.0	F	241.3	F	217.0	F	241.3	F	166.5	C	29.4
And Kuhio Ave.	P.M.	F	168.8	F	121.8	F	169.0	F	121.8	F	249.2	C	31.6
Kanekapolei St.	A.M.	F	245.5	F	305.6	F	245.5	F	305.6	F	92.6	C	25.2
And Kuhio Ave.	P.M.	F	140.5	F	89.7	F	140.5	F	89.7	F	60.7	B	18.9
Liliuokalani Ave	A.M.	F	212.5	F	249.8	F	213.0	F	249.8	C	31.2	B	10.9
And Kuhio Ave.	P.M.	F	126.1	F	135.8	F	126.0	F	135.8	D	41.7	B	19.9
Kapahulu Avenue	A.M.	C	20.3	B	17.9	C	20.3	B	17.9	B	19.1	B	18.4
And Kuhio Ave.	P.M.	E	79.4	F	121.3	E	79.4	F	121.3	E	67.1	B	12.6

Source: Parsons Brinckerhoff Inc., June 2002.

TABLE 4.5-1
PROPOSED NEW PARKING STALLS AT TRANSIT CENTERS AND PARK-AND-RIDES

Proposed Transit Centers and Park-and-Ride Facilities	Number of New Parking Stalls		
	No-Build	TSM	Refined LPA
Aloha Stadium Park-and-Ride (upgrade part of existing parking)	500	500	1,000
Iwilei Transit Center	300	300	300
Kaneohe Transit Center	150	150	150
Kapolei Transit Center	0	400	470
North-South Road Park-and-Ride	300	500	600
Middle Street Transit Center	750	750	1,000
Waianae Transit Center	100	100	100
TOTAL	**2,100**	**2,700**	**3,620**

Source: Parsons Brinckerhoff, Inc., June 2002.
Note: Numbers represent total amount of parking spaces for each alternative.

Not all of the new spaces shown in Table 4.5-1 would be built as part of the PCTP, since some spaces are being planned as independent projects. These independent projects are shown as part of the No-Build Alternative. In addition to the 2,100 new park-and-ride spaces that would be constructed as part of independent projects, there would be 600 additional new spaces with the TSM Alternative and 1,520 additional new spaces with the Refined LPA.

4.5.2 On-Street Parking

Curbside parking spaces were counted as being affected if their expected use in the year 2025 will be affected in any way, either all day long or by limiting their use to off-peak hours.

Parking spaces are categorized by availability during peak and off-peak hours. “Unrestricted parking” spaces are defined as those currently available during peak and off-peak hours. There are no parking spaces that are available only during peak hours and not at off-peak hours. Therefore, unrestricted parking spaces represent those parking spaces that would be impacted during peak period transit operation.

“Restricted parking” spaces refer to all other types, namely spaces that currently have some time restriction on parking. Most such spaces are available only during off-peak hours. These spaces will therefore not be affected by peak-period transit operations, because their use is not allowed during the peak traffic hours. The definition of restricted parking also includes spaces that are available only partially during off-peak hours, such as those on Ala Moana Boulevard that are for use only on weekends, holidays, and overnight on weekdays.

The number of affected parking spaces was determined from City and County striping plans and/or independent field checks. Where curb parking spaces were not marked by parking meters and/or parking space stripings, the linear curbside distance available for parking (exclusive of driveways and other uses such as bus stops, loading zones, no parking zones, etc.) was measured and divided by 22 feet, a typical parking space length according to the current City and County’s Traffic Standards Manual (DTS, July 1976).

1) No-Build Alternative

The No-Build Alternative would not have any impacts on existing parking spaces, because it does not propose any changes to current roadway uses.

2) TSM Alternative

The TSM Alternative would affect an estimated 166 unrestricted parking spaces that are currently available during peak and off-peak hours. This alternative would not affect any restricted parking spaces that are currently limited to off-peak use only.

Potential parking reductions would occur on King Street and Beretania Street. Transit vehicles would operate in semi-exclusive lanes on these streets, requiring that curbside lanes be restricted to use by transit vehicles or vehicles making right turns. The impact would occur along King Street between Middle Street and Kalakaua Avenue (139 spaces) and Beretania Street between Aala Park and South King Street (27 spaces). The 139 parking spaces on King Street consist of the segment from Middle Street to Richards Street, which would lose 109 spaces, Richards Street to Ward Avenue 24 spaces, and Ward Avenue to Kalakaua Avenue 30 spaces. These spaces (marked and unmarked) would require the elimination of parking spaces currently available during the morning peak hours (parking in these spaces is generally prohibited during the afternoon peak), while they would still be available during off-peak hours.

3) Refined LPA

<u>IOS</u>

The IOS will affect unrestricted parking spaces on Queen Street (5 marked spaces), Saratoga Road (5 marked spaces), and Kapahulu Avenue (12 marked spaces).

<u>Middle Street to Iwilei Segment</u>

The Middle Street to Downtown branch will affect 27 unrestricted spaces on Kaaahi Street.

<u>Iwilei-Waikiki Branch</u>

Under the Refined LPA, the alignment on Ala Moana Boulevard becomes semi-exclusive versus in mixed traffic in the IOS. Therefore, the makai side of Ala Moana Boulevard will lose 124 restricted spaces (unmarked), though these impacts will be limited to weekend, holiday, and nighttime uses, when they are currently available. The same impacts as for the IOS will occur on all other streets.

<u>Kakaako Mauka Branch</u>

Along the Kakaako Mauka Branch, 69 unrestricted and 66 restricted spaces will be affected on Halekauwila and Pohukaina Streets. These spaces are all marked.

<u>UH-Manoa Branch</u>

Along the UH-Manoa Branch, 199 unrestricted spaces and 343 restricted spaces will be affected. Of this amount, 20 unrestricted spaces on Richards Street between Hotel and King Streets will be lost. Kapiolani Boulevard will lose the most curb parking, totaling roughly 214 unmarked restricted parking spaces available now only at off-peak times. Of the 214 unmarked restricted parking spaces, about 48 unmarked spaces on the makai side of Kapiolani Boulevard between McCully Street and University Avenue will be affected, and the remaining roughly 166 affected spaces on Kapiolani Boulevard occur along the stretch between Pensacola and McCully Streets. Other spaces affected by the UH-Manoa Branch will be along South King Street (43 unrestricted and roughly 98 restricted), Pensacola Street (80 unrestricted and 9 restricted), and University Avenue (56 unrestricted and 22 restricted).

4.5.3 Off-Street Parking

The discussion on displacements in Section 5.2 deals with off-street parking impacts. Table 5.2-2 identifies the properties that will loose parking spaces under the Refined LPA. These proposed parking impacts are the result of street widening.

4.5.4 Parking Mitigation

It is expected that an efficient transit system would encourage people to use transit rather than driving private vehicles. In fact, on the order of 7,000 people per day under the TSM Alternative and over 21,000 people per day under the Refined LPA are expected to be diverted out of their cars to use transit. Some of these former auto drivers would be able to give up their cars or park their cars at outlying park-and-ride facilities, thereby lessening the need for parking in the Primary Urban Center (PUC). The need for parking would decline regardless of whether the people who gave up their cars are residents and/or employees in the PUC. Thus, parking demand in the PUC is expected to decline in general under all Build alternatives, but especially along the transit spine in the Refined LPA. Moreover, the community planning process will be an integral part of the design phase to help mitigate any potential parking impacts to specific neighborhoods.

In areas where a large concentration of parking spaces will be affected, replacement parking in new off-street parking facilities will be considered, following community-based planning. For example, replacement parking could be provided in the neighborhood around University Avenue, where 78 on-street parking spaces will be lost, but this plan has not been decided with the community. At least initially, representatives of the McCully/Moiliili neighborhood who served on the Mid-Town/University working group chose not to recommend replacing this parking since it would result in the loss of land for other uses. More recently the issue of replacement parking was requested to be reconsidered in the final design phase.

Replacing the off-peak and weekend parking lost on Ala Moana Boulevard is not viable, so no replacement parking is proposed for that area. Other areas of concern will be addressed on a case by base basis during the project's final design phase.

4.6 LOADING ZONE IMPACTS

Conceptual engineering designs have taken into consideration the need to avoid impacts on as many loading zones as possible, especially in the Waikiki area. Potentially affected areas and the proposed mitigations are discussed in this Section.

As shown in Table 4.6-1, the linear distance designated as loading zones was measured along the proposed alignments. The number of zones that these distances represent is also included in the table. One continuous street segment that allows loading activity was counted as one loading zone; if the activity was allowed continuously along several blocks each block was counted as a separate zone.

The table also distinguishes the loading zones allowed during peak and off-peak hours, as opposed to those zones restricted to use only during off-peak hours.

Most loading zones are also restricted to use by commercial vehicles, which are primarily tour buses and freight vehicles with permits. Other vehicles that may stand briefly in such loading zones include taxicabs, armored cars, and special transit service vehicles.

TABLE 4.6-1
SUMMARY OF ESTIMATED LOADING ZONE IMPACTS

Alternative	Total Distance (Feet)	Peak And Off-Peak (Number Of Zones)		Off-Peak Only Loading (Number Of Zones)	
		Commercial Vehicles With Permit	Passenger Or Other Vehicles	Commercial Vehicles With Permit	Passenger Or Other Vehicles
No-Build	0	0	0	0	0
TSM	1,200	9	5	0	0
Refined LPA	725	16	8	2	0

Source: Parsons Brinckerhoff, Inc., June 2002.

4.6.1 No-Build Alternative

The No-Build Alternative would not have any impacts on existing loading zones, because that alternative does not propose any changes to existing roadway uses.

4.6.2 TSM Alternative

Under the TSM Alternative, a local street bus priority system would operate on North and South King Street and on South Beretania Street. In total, an estimated 1,200 feet of loading zones would be affected. Buses would operate on North King Street in semi-exclusive lanes, affecting both mauka and makai curbside loading zones during peak periods. On South King Street and South Beretania Street, where the bus would operate in a couplet, only the right curbside lane in the direction of travel would be affected during peak periods. The total impact of this alternative would be the equivalent of 13 loading zone spaces, of which 9 are peak and off-peak loading zones for commercial vehicles with permits.

4.6.3 Refined LPA

The loading zone impacts for the In-Town portion of the Refined LPA will be approximately 725 feet of curbside loading space. The Regional BRT will not result in any loading zone impacts. Impacts that will occur are those associated with the In-Town BRT, mostly in Downtown, plus on Kaaahi Street in Iwilei. The Refined LPA will not preclude continued use of any of the existing passenger or freight loading zones on either Kalakaua or Kuhio Avenues in Waikiki.

On Kaaahi Street, freight loading occurs along both sides of this currently dead end street. With the Refined LPA on-street loading between Dillingham Boulevard and Kaaahi Place will be prohibited, and these operations will have to be relocated either to side streets or to off-street parking/loading areas.

In the block of Alakea Street between King and Hotel Streets, passenger and freight loading takes place on the Ewa curbs at all hours of the day. This block is marked as “No Parking, Tow Away Zone” which allows commercial vehicles with permits to make brief stops for loading and unloading operations. During the P.M. peak period the BRT will operate in a semi-exclusive Ewa curb lane (BRT and left turning vehicles only) in this block, and stopping or loading will be prohibited.

The proposed BRT lane along Kalakaua Avenue has been revised since publication of the MIS/DEIS. The proposed curbside BRT lane will extend from Saratoga Road to Uluniu Avenue as a semi-exclusive lane, which will allow commercial passenger carriers and right turning vehicles to share the curbside lane with the BRT. Passenger and freight loading operations that use the existing pullouts on the makai curb will not be affected by the BRT. Koko Head of Uluniu, the BRT will operate in mixed traffic to Kapahulu Avenue where it turns left in the mauka direction.

On Kalakaua Avenue, commercial freight carriers will be allowed to use the makai-side, semi-exclusive BRT curb lane during legal delivery hours (10 P.M. to 9 A.M.). The BRT will simply pass around a stopped loading truck by using the adjacent traffic lane. In the event that a freight truck blocks the BRT curb lane during other times, the BRT vehicle can simply go around the stopped vehicle in the adjacent lane. There will not be any noticeable impact to freight loading on Kalakaua Avenue with the Refined LPA.

On Kuhio Avenue, the BRT has been modified from an exclusive center lane as shown in the MIS/DEIS to operating in a semi-exclusive lane on the mauka curb. This lane will be shared with local buses, commercial passenger buses, and right-turning vehicles. Today freight loading is generally permitted along both sides of the street from 10 P.M. to 7:30 A.M. Commercial passenger loading is permitted all-day and night except between the hours of 3:30 to 5:30 P.M. With the Refined LPA, turnout bays will be provided along both sides of Kuhio Avenue to allow commercial freight vehicles, tour buses, taxis, and trolleys to load during the designated hours and still allow moving vehicles to pass these parked vehicles safely without encroaching on the semi-exclusive lane. Stricter enforcement of the loading zone hours of availability will be needed on Kuhio Avenue with the Refined LPA so that it works effectively. The benefits will be an enhanced pedestrian environment through widened sidewalks and added landscaping, as well as improved transit circulation.

Similarly, tour buses and trolleys will be able to continue to load/unload at their current locations on either side of both Kalakaua and Kuhio Avenues with the BRT.

An existing tour bus loading zone on Saratoga Road, mauka of its intersection with Kalia Road will be relocated under a redevelopment plan for Outrigger Hotels that has already been approved by the City Council. Therefore, the BRT stop proposed at this location would not displace the tour bus loading zone, and there will be no loading zone impacts on Saratoga Road.

4.6.4 Loading Zone Impacts Mitigation

As with parking impacts, community-based planning will be an integral part of the final design phase to address mitigation measures for loading zone impacts.

Along Kuhio Avenue, turnout bays will be provided which will permit passenger and freight loading to continue to occur along the mauka and makai curbs during the designated hours.

4.7 BICYCLING IMPACTS

This section describes the project's potential impacts to existing and currently proposed bicycle systems in the study area, as described in the Honolulu Bicycle Master Plan (April 1999).

The No-Build Alternative would not affect bicycle transportation because it would not affect existing streets in a manner to interfere with the safety and convenience of cyclists. Implementation of the Bicycle Master Plan would continue under all alternatives. All buses would have bike racks to accommodate intermodal transit. New bike parking racks will continue to be installed around the city.

The TSM Alternative, which includes a network of semi-exclusive bus and in-town bus priority lanes, would not affect bicycle usage because no existing bikeway would be displaced or modified.

One of the primary purposes of the Refined LPA is to enhance in-town mobility by restoring a balanced transportation system that includes measures that encourage transit, bicycle, and pedestrian modes. Therefore, the Refined LPA has been designed to provide concurrent systems enhancing transit, bicycle and pedestrian travel within the very limited space of the existing roadway rights-of-way. Cyclists have been accommodated along the entire length of the In-Town BRT system.

The general approach to enhancing bicycle travel under the BRT Alternative includes the following elements:

- BRT vehicles would be equipped with bike racks to facilitate intermodal transit. Bike parking facilities would be installed at transit centers, transit stops, and park-and-ride facilities.
- A separate bike lane will be provided, or in many areas, 14 to 18 feet wide curbside lanes for the joint use of bicycles and vehicles will be provided.
- Where a bike lane or 14 to 18 feet wide curbside lanes cannot be accommodated, cyclists will be allowed to share the transitway in curb-running sections. Many cities, including New York City, London, Toronto, Madison Wisconsin, Seattle and Portland Oregon, allow bicycles to use at least portions of their curb-running transitways.

In most cases, these measures will improve bicycle transportation over the existing conditions.

Coordination with cyclists will be conducted to further define the details of the bicycle mitigation program.

The In-Town BRT element of the Refined LPA could assist with implementation of planned bikeway facilities through coordination of right-of-way and/or use of travel lanes. Planned bikeway facilities that could be jointly developed include proposed facilities on Dillingham Boulevard, South King Street, Ala Moana Boulevard, Kalia Road, and Saratoga Road. Methods of incorporating these proposed bicycle facilities in the design will be addressed in the final design phase.

4.7.1 Impacts to Existing Bikeways and Cycling

Although most of the In-Town BRT alignment is not designated as a "bikeway", roadways along the alignment are used by cyclists to varying degrees because of the paucity of bikeway facilities. Figures 3.1-4A through 3.1-4C show existing bikeways in the study area that support cycling as a viable transportation mode and recreational activity. Bikeways recommended in the Honolulu Bicycle Master Plan are also shown.

A bikeway can be a bike route, lane or path. A bike route is a road that is designated for the shared use of bicycles and motor vehicles. Bike routes typically have wide shoulder lanes or relatively little traffic. A bike lane is a portion of a roadway designated by striping, signage or pavement markings for the preferential or exclusive use of bicycles. A bike path is a completely separated right-of-way designated for the exclusive or semi-exclusive use of bicycles. In urban areas, bike paths are normally paved, and located in parks or scenic areas.

Most of Honolulu's existing bikeways are not linked systematically, although the Pearl Harbor Bike Path is continuous between Waipahu and Aloha Stadium, and eventually is proposed for extension to Kapolei. Bikeways on Kalanianaole Highway also form a continuous link between Kahala and Hawaii Kai.

When bikeways are not continuous, cyclists must use roadways that are not designated as bikeways. More confident cyclists often use the street. Less confident cyclists tend to ride on sidewalks or landscaped areas off of the roadway, although riding on sidewalks in business districts, such as Downtown, is illegal.

Segments that contain semi-exclusive/exclusive BRT curbside lanes include Hotel Street (lanes wide enough for shared bicycle use), South King Street between Alapai Street and Ward Avenue (existing bike lane to be retained), University Avenue by Puck's Alley (existing bike lane to be retained), Ala Moana Boulevard between Piikoi Street and Atkinson Drive (lanes wide enough for shared bicycle use), Kalakaua Avenue (existing bike lane to be retained), Kapahulu Avenue (existing bike lane to be retained) and Kuhio Avenue.

Street-by-street descriptions of how the BRT lanes will affect bicycle transportation in the study area are provided below. In general, these impact analyses are based on the principle that the following street changes would improve bicycling transportation:

- new bicycle lane or path;
- curbside BRT lane where it would replace an existing general purpose lane, but would not displace an existing bike lane (cyclists will be allowed to use curbside BRT lanes); and
- widened curbside lane where both vehicles and cyclists can share use safely.

Bicycle transportation service would remain the same if street changes retain curbside conditions of the affected roadway, such as retaining bike lanes or keeping the same curbside lane widths. Bicycle transportation would be adversely affected if curbside lanes are narrowed or the number of through lanes is reduced to a point where motor vehicles cannot pass cyclists safely without venturing onto the BRT lane.

Dillingham Boulevard is not currently designated a bikeway although it links the Keehi Interchange end of the Nimitz Highway bike path with Kalihi and Iwilei. Much of Dillingham Boulevard presently has little or no shoulder space, and the curb lanes are not wide enough for bicycles and motor vehicles to travel side-by-side safely.

The In-Town BRT exclusive BRT lanes are proposed to be generally center running on Dillingham Boulevard, reducing the number of through lanes by two. The impacts on each section of Dillingham Boulevard would be as follows:

- Existing paths/sidewalks will remain between the Nimitz Highway bike path and the first crosswalk on Dillingham Boulevard.
- Between Middle Street and Puuhale Road, the BRT will transition from shared curbside-lane (Ewa bound) and center-running lane (Koko Head bound) to exclusive center-running lanes. However, throughout this section, the width of the curb lanes (shared BRT and general) will range from 14 feet to 18 feet, which is adequate for cyclists and motor vehicles to travel side-by-side.
- Bicycle transportation will improve in the section between Puuhale Road and Waiakamilo Road because the curbside lanes will be widened to 18 feet. This is an improvement over the existing narrower lane width.
- The BRT exclusive lanes will continue on Dillingham Boulevard past Waiakamilo Road, and use Kaaahi Street and Iwilei Road, to link with North King Street. The curbside lane widths would be narrowed to generally 12 feet along this segment, the same as today. However, by reducing the number of general purpose lanes from four to two, vehicles and cyclists would have to share the 12-foot lanes, which is not enough space for vehicles to pass cyclists safely without venturing onto the BRT lane. Cyclists will have the option of using existing bike lanes on Waiakamilo Road and Nimitz Highway, Koko Head of Waiakamilo Road.
- Bicycle transportation will not be affected by the BRT use of Kaaahi Street because it presently has no outlet, and is not used for cycling. Only a very small portion of Iwilei Road would be used for BRT lanes.

The BRT on North King Street will occupy the two mauka side lanes, which will not affect cycling because cyclists could use the makai curb lane when traveling in the Koko Head-bound direction.

The BRT will occupy the existing bus lanes on Hotel Street, an existing bus mall. The Waikiki Branch (Kakaako Mauka and Makai) will use Bishop and Alakea Streets, and the UH Manoa Branch will use Richards Street to South King Street. To maintain access to properties along Bishop, Alakea and Richards Street, the BRT lanes will be shared with other vehicles, except the Koko Head bound BRT lane on Richards Street. Therefore, the existing level of bicycle access on Hotel, Bishop, Alakea and Richards Streets will remain the same.

On South King Street, the Koko Head bound In-Town BRT will occupy general-purpose lanes. Therefore, bicycle transportation along the makai side of South King Street will not be affected along this section. Although a curbside-running Koko Head-bound BRT lane is proposed from Alapai Street to Pensacola Street, bicycle transportation along this segment will improve because a bike lane will also be provided along this section (see Section 4.6.3).

The Ewa-bound BRT lane on South King Street between Richards Street and Pensacola Street will occupy a new contra-flow lane next to the mauka curb. This will prevent the use of this lane by Koko Head-bound cyclists who currently use this lane to avoid the makai-side lanes that turn onto Kapiolani Boulevard. Cyclists have the option of using an existing shared-use bike path within the Capitol District, which passes next to the State Capitol, Iolani Palace, the State Library, Honolulu Hale and the Municipal Building.

The BRT lanes will be on the Ewa side on Pensacola Street. Cyclists will be able to use both sides of this one-way street, the same as today. On Kapiolani Boulevard between Pensacola Street and Atkinson Drive, the BRT will generally be center running, but some segments will be shared-use along the center and curb lanes. Kapiolani Boulevard is limited as a cycling facility, but since four travel lanes will remain after the BRT is in place, the present level of bike access will be retained.

At Atkinson Drive and Kalakaua Avenue, the BRT will shift to curbside running in general purpose lanes to University Avenue. Since the BRT will be operating in general traffic, the existing level of bicycle transportation along this section of Kapiolani Boulevard will remain the same.

On University Avenue, the BRT will shift to center-running exclusive lanes to King Street. The existing makai-bound and mauka-bound bike lanes will be relocated to the curb, and existing street parking will be removed (see Section 4.5). Therefore, the existing level of bicycle transportation along this section of University Avenue will remain the same. After the King Street stop the mauka bound BRT will operate in mixed traffic to Sinclair Circle so that the existing bike lane can be retained. In the makai direction the BRT will be in an exclusive median lane between Sinclair Circle and King Street. The existing bike lane on this side of University Avenue will be retained also.

The Kakaako Mauka and Kakaako Makai branches of the In-Town BRT start deviating from the UH branch at the Hotel Street/Bishop Street/Alakea Street intersections. The Kakaako mauka and makai branches will then split at the Ala Moana Boulevard/Bishop Street/Alakea Street Intersections, with the mauka branch continuing on Halekauwila Street to South Street, and the makai branch continuing on Bishop Street to Aloha Tower Marketplace, to Aloha Tower Drive, and then on to Ala Moana Boulevard until Forrest Avenue. Since the BRT will be operating in mixed traffic through most of the areas described, the existing level of bicycle transportation will remain the same. One of the BRT lanes on Halekauwila Street will be shared with general-purpose vehicles and the other will be exclusive up to Punchbowl Street. Therefore, there will be a slight improvement in bicycle transportation on Halekauwila Street. Bicycle transportation will not be affected on South Street because cyclists could ride on the Koko Head side of this one-way mauka-bound street.

The Kakaako Mauka branch will operate in Semi-exclusive curbside-running lanes on Pohukaina and Auahi Streets in Kakaako, leaving two through lanes. Therefore, bicycle transportation on these streets will be improved as cyclists will be able to use the semi-exclusive lanes without conflicts from through traffic.

Along the Kakaako Makai branch, from Aloha Tower Marketplace the BRT will operate along Ala Moana Boulevard, Forrest Avenue, Ilalo Street and Ward Avenue in mixed traffic. Bicyclists will therefore be unaffected. The Kakaako Makai branch rejoins the Kakaako Mauka branch at the Ward Avenue/ Auahi Street intersection. After traveling on Auahi Street in semi-exclusive lanes, the two branches transition to Ala Moana Boulevard via Queen Street. From Queen Street to just Koko Head of Atkinson Drive, the Koko Head-bound BRT will be on Ala Moana Boulevard in a curbside-running semi-exclusive lane and the Ewa-bound BRT will be in a center-running exclusive lane. Ala Moana Boulevard attracts very little bicycle usage because of a lack of shoulder space, and motor vehicles travel at relatively high speeds. A current alternative to using Ala Moana Boulevard between Queen Street and Atkinson Drive is a shared-use pedestrian/bicycle path within Ala Moana Regional Park running along the park's mauka-boundary near, and parallel to, Ala Moana Boulevard. In the Koko Head bound direction, the BRT lane will improve bicycle transportation because of the semi-exclusive BRT curbside lane. However, the bicycle transportation service will remain the same in the Ewa bound direction.

From Atkinson Drive to Hobron Lane, the Ewa-bound BRT will be in a center-running exclusive lane on Ala Moana Boulevard. It will be in a semi-exclusive curb lane between Hobron Lane and Kalia Road. The Koko Head bound BRT on Ala Moana Boulevard will be in a curb-running semi-exclusive lane between Atkinson Drive and Kalia Road.

Continuing on in Waikiki, the BRT will follow a curbside alignment on Kalia Road, Saratoga Road, Kalakaua Avenue, Kapahulu Avenue and Kuhio Avenue. These BRT lanes will be mostly semi-exclusive lanes. None of these streets are designated bikeways. Since cyclists will be allowed to use these BRT lanes, the Refined LPA will improve bicycle transportation in Waikiki.

4.7.2 Impacts to Future Bikeway Facilities

The Honolulu Bicycle Master Plan (April 1999) calls for the development of an integrated network of bikeways that would link people with their destinations. The State Department of Transportation has recently published a draft Bike Plan Hawaii: A State of Hawaii Master Plan (May 2003), which updates the 1994 version of the plan.

The recommendations of both plans are similar. The Honolulu Bicycle Master Plan recommends the development of a regional bike corridor, which would be a grid of east-west and mauka-makai bikeways. Figures 3.1-4A through 3.1-4C show the recommended bikeways in the Honolulu Bicycle Master Plan.

The No-Build Alternative would not affect the proposed bikeways.

The TSM Alternative could affect the proposed bikeways because of the network of semi-exclusive lanes that are proposed in the PUC. Bicycles would be able to share the semi-exclusive lanes with transit vehicles.

With the Refined LPA, the following street segments, which are proposed by the Honolulu Bicycle Master Plan to be used for bikeway facilities, will also be used by the proposed In-Town BRT:

- Dillingham Boulevard between Keehi Interchange and Puuhale Road;
- North and South King Streets between Iwilei Road and Pensacola Street;
- University Avenue between Varsity Place and Maile Way; and
- Ala Moana Boulevard between Downtown and Waikiki.

Therefore, these future bikeway facilities may be jointly planned with the In-Town BRT to enhance both transit and bicycle travel. For example, the Refined LPA includes bike lanes on South King Street between Alapai Street and Pensacola Street.

4.7.3 Mitigation Measures

To improve or maintain the level of bicycle transportation in the study area, the following bicycle enhancement projects will be provided under the Refined LPA:

- Curbside semi-exclusive BRT lanes at various locations to be shared with bicyclists;
- Widen the curbside lanes on Dillingham Boulevard from 14 feet to 18 feet between Middle Street and Waiakamilo Road; and,
- Bike lane on South King Street between Alapai Street and Pensacola Street.

4.8 PEDESTRIAN IMPACTS

All of the alternatives will preserve existing pedestrian facilities, such as sidewalks and walking paths. All the elements of the Refined LPA will be constructed primarily on existing roadways and existing pedestrian street crossings will be preserved. Full pedestrian access will be provided at transit centers and curbside In-Town BRT stops in conformance with the Americans With Disabilities Act (ADA). Existing signalized cross walks will be upgraded to access center-running In-Town BRT stops.

Moreover, the Refined LPA will provide benefits for pedestrians in a number of ways. Transit will use less space to carry more people than automobiles. Environmentally friendly transit vehicles will produce less noise and air pollution. These factors will contribute to an improved urban walking experience. As transit begins to carry a heavier load of trips under this alternative, the transportation system will become more balanced and walking would play a greater role.

If the local communities so desire, redevelopment around the transit centers and transit stops will allocate resources for pedestrian improvements. This will provide the opportunity to widen and landscape sidewalks making urban Honolulu a more attractive place. Growth focused around the BRT system could be tailored to transit/pedestrian oriented uses.

4.8.1 Special Event Impacts

None of the alternatives will affect parades and large events, such as Hoolaulea, that are held on Ala Moana Boulevard and/or Kalakaua Avenue, even the Refined LPA with its In-Town BRT. When required the Kakaako/Waikiki Branches of the In-Town BRT can be rerouted during parades, just as the bus routes along these streets are rerouted during parades today. The embedded-pate technology may require the substitution of buses for the BRT vehicles along that branch or branch segment during parades and special events.

CHAPTER 5 ENVIRONMENTAL ANALYSIS AND CONSEQUENCES

CHAPTER OVERVIEW AND ORGANIZATION

This chapter consists of two major sections. Section I covers the IOS and Section II covers the three alternatives for the Primary Corridor Transportation Project. This Chapter discusses the potential impacts on the built and natural environments that the IOS may have in 2006 and that the corridor-wide alternatives may have in 2025. The purpose of this presentation is to disclose fully the beneficial and adverse impacts of the proposed project and the alternatives that were considered. Laws do not require selecting the alternative with the least adverse impacts, but the consequences of selecting each alternative must be disclosed.

The first section of this Chapter (Section I) is specific to the impacts of the IOS from Iwilei to Waikiki, the first segment of the Refined LPA to be built. The impact analyses of the IOS reflect conditions in 2006, shortly after the opening of the IOS in 2005. The impact analyses presented in Section II reflect conditions in 2025 for each of the entire primary transportation corridor alternatives - the No-Build Alternative, TSM Alternative, and Refined LPA.

Each section is organized around technical disciplines. Both the short-term (construction-phase) and long-term (operational-phase) benefits and impacts associated with the project are addressed within each discipline.

This Chapter includes discussions of the following environmental, socio-economic, and cultural parameters:

- Land Use/Employment
- Displacements/Relocations of Existing Land Uses
- Neighborhoods
- Visual and Aesthetic Resources
- Air Quality
- Noise/Vibration Levels
- Ecosystems
- Water Resources
- Energy Usage
- Historic and Archaeological Resources
- Parkland Resources

Measures to mitigate adverse impacts are identified, and these mitigation measures are included in the project definition.

I. IWILEI TO WAIKIKI (IOS)

The IOS from Iwilei to Waikiki will be the first segment of the Refined LPA to be built. The impact analyses of the IOS reflect conditions in 2006, a year after the expected implementation of the IOS in 2005. This early year analysis permits an assessment of conditions expected prior to the entire Refined LPA being in place.

Table 5-1 summarizes the transportation and environmental impacts that are anticipated in 2006 as a result of implementing the IOS. It should be noted that any potentially significant impacts resulting from implementing the IOS will be mitigated.

LONG-TERM IMPACTS

For many of the environmental factors, the IOS will have no impacts and/or require no mitigation measures. For those factors that may potentially have adverse impacts and/or require mitigation, brief descriptions are provided below. For detailed discussion of all environmental disciplines, see Section IOS.5 on pages IOS-31 to IOS-58 in the IOS Chapter, which follows Chapter 5.

1) Displacements and Relocations

In general, the IOS facilities will be constructed within existing roadways, with the exception of the widening of Kalia Road in Fort DeRussy. The IOS will not result in the displacement of any residence, business, or institution. At Fort DeRussy, there will be a partial displacement of landscaped areas next to the road, however, no buildings or structures will be affected. The removed landscaping will be replaced with similar landscaping along Kalia Road.

2) Visual and Aesthetic Resources

The IOS will provide opportunities to enhance the visual quality of a portion of urban Honolulu by developing public spaces with more landscaping and street-level amenities that will improve the visual quality of the streetscape and enhance the pedestrian experience. The physical improvements and landscape treatments of the IOS will be designed to reinforce the character of neighborhoods and provide a visual sense of place.

Some IOS transit stops will be located in areas with high visual or aesthetic value, and may cause visual impacts if transit stop structures such as canopies and kiosks visually intrude upon important surrounding viewsheds. Therefore, each transit stop will be uniquely designed to fit appropriately into each setting and, where possible, to enhance the aesthetics of the area. Sensitive areas where construction of transit stops is planned include:

- Downtown
- Aloha Tower
- Kakaako Makai Gateway and Waterfront Parks
- Fort DeRussy and along Kalakaua Avenue
- Kapiolani Park

The IOS transit stops in or near these areas will require special design treatment. Effective planning with area businesses, residents, and agencies will result in design features sensitive to each area.

3) Ecosystems

The only faunal species of potential concern within the IOS area is the white tern (*Gygis alba*). White terns are a State of Hawaii designated endangered species on Oahu, which use Kapiolani Park and Fort DeRussy as habitat, among other areas. White terns are well adapted to urban environments, and the IOS is not expected to cause adverse interactions with this species, including its eggs, which are laid on bare tree branches. Nevertheless, a survey of the IOS corridor will be conducted for white terns and their eggs prior to completing final design. If sensitive trees or areas are identified, they will be monitored immediately prior to and/or during construction. If affected trees are relocated or trimmed (see Section 5.7.2), monitoring will be coordinated with the U.S. Fish and Wildlife Service, and the City's Department of Parks and Recreation will be consulted because they have standard procedures to avoid impacts to white terns and their eggs.

TABLE 5-1
SUMMARY OF IOS IMPACT ASSESSMENTS AND MITIGATION MEASURES

	IOS IMPACTS	MITIGATION
ENVIRONMENTAL FACTORS		
Land Use, Development, and Plan Consistency	Consistent with HCDA Kakaako Makai Plan. Serves UH Medical School and related facilities currently under construction.	None necessary.
Business and Residential Displacements	Displacement of some landscaped areas at Fort DeRussy. No buildings or structures will be affected.	Landscaping removed at Fort DeRussy will be replaced with similar landscaping nearby along Kalia Road.
Neighborhoods and Environmental Justice	The IOS will not cause disproportionately high and adverse health or environmental effects on any minority and low-income population and will provide many positive transit benefits.	None necessary.
Visual Character	IOS transit stops located in areas with high visual or aesthetic value may cause adverse visual impacts. Landscaping altered by the project may cause changes to the visual environment at certain locations.	IOS transit stops located in areas with high visual or aesthetic value will be designed to be appropriate in each setting and where possible will enhance the aesthetics of the area. Any existing landscaping affected by the IOS will be mitigated through provision of new street plantings and tree replacements.
Air Quality	No impact.	None necessary.
Noise/Vibration	No impact.	None necessary.
Ecosystems – Faunal Species	No impact. White terns (State of Hawaii endangered species on Oahu) occur in the IOS corridor, but no adverse impacts are expected.	Even though no adverse impacts are expected, a survey of the IOS corridor will be conducted for white terns and their eggs prior to completing final design. If sensitive trees or areas are identified, they will be monitored immediately prior to and/or during construction. Relocation and/or trimming of trees will be coordinated with the City's Department of Parks and Recreation.
Ecosystems – Botanical Resources	Construction of the IOS will displace 47 trees, of which nine are "notable" trees on Kalia Road. Some tree trimming will be required. No designated exceptional trees will be affected.	A tree preservation plan will be prepared. Affected trees will be relocated near their original locations or replaced in accordance with the tree preservation program.
Water	No impact.	None necessary.
Energy Consumption	No adverse impact.	None necessary.

TABLE 5-1 (CONT.)
SUMMARY OF IOS IMPACT ASSESSMENTS AND MITIGATION MEASURES

	IOS IMPACTS	MITIGATION
Historic and Archaeological Resources	Development of the Alakea and Saratoga Transit Stops may "adversely affect" historic sidewalk features and lava rock curbs, which are considered historic. Development of the IOS is not expected to uncover buried archaeological resources or native-Hawaiian ancestral burial sites.	In accordance with the project's Memorandum of Agreement, DTS will work with the State Historic Preservation Division (SHPD) and other interested parties to explore using the lava rock curb material in the design of the two IOS transit stops affected. If burials or archaeological artifacts are uncovered during construction, work will stop and the SHPD will be notified immediately for appropriate action.
Parklands	The IOS will generally improve transit access to parks in the study area. Transit stops adjacent to parks could adversely affect their visual and aesthetic characteristics, even though no park property is used.	Transit stops near parks will require special design treatment.
Indirect and Cumulative	Substantial land use changes are not anticipated. The IOS may stimulate planned transit-oriented commercial and residential development. The IOS will be an important addition to the transportation infrastructure, supporting planned developments in Kakaako and Waikiki. The IOS and other planned developments will enhance short- and long-term employment.	None necessary.
Construction Impacts	Construction impacts will be temporary. Construction activities on streets will likely result in temporary traffic delays, detours, and bus stop relocation. Construction equipment and vehicles delayed by construction activities will increase emissions of fugitive dust and automotive air pollutants, such as carbon monoxide. Construction equipment also emits relatively high noise emissions, which could disturb nearby residences, schools, office buildings, and other noise-sensitive uses. Impacts to surface and groundwater resources are not expected due to best management practices. Utility services may be disrupted causing inconveniences to affected residences and businesses.	The Construction Management Program for the IOS will address all standard construction-period traffic and transportation issues. In addition, contractors will be required to comply with all applicable air quality, noise, and water quality laws. Substantial planning, including resident and business notifications, will be conducted to minimize inconveniences should interruptions in utility service be required.

Source: Parsons Brinckerhoff, Inc., April 2003.

The vegetation within the IOS corridor consists mostly of maintained plantings, such as landscaping on roadway medians and shoulders and adjacent properties. Construction of the IOS transit stops and semi-exclusive and exclusive transit lanes will displace some of the corridor's landscaping, requiring the relocation or removal of trees. A total of 47 trees will be affected by the IOS, of which nine are considered "notable", which is defined as a tree deemed to be important to the urban landscape character. The nine notable trees include a cluster of Date (*Phoenix dactylatra*) and Royal Palms (*Roystonea regia*) on Saratoga Road (healthy palms only) and banyans (*Ficus spp.*) on Kalia Road.

Mitigation for impacts on landscaping will consist of re-vegetation and landscape redesign along the alignment where possible. All 47 trees affected by the IOS will be relocated on-site or replaced as part of the tree preservation program.

4) Historic and Archaeological Resources

Pursuant to Section 106 of the National Historic Preservation Act, a Memorandum of Agreement (MOA) has been prepared to document the anticipated adverse impacts. A copy of the MOA is included in Appendix A.

The FTA has determined that the Alakea and Saratoga Transit Stops will "adversely affect" lava rock curbs, which are considered "historic" by the SHPD, because they will be temporarily removed during construction. The DTS will reuse the lava rock curb material in the design of the two IOS affected transit stops.

It is highly unlikely that the IOS corridor contains archaeological resources, artifacts or sites, and burial sites at or near the ground surface. Subsurface archaeological resources have been discovered in the Fort DeRussy area, and along Kalakaua Avenue in Waikiki, but the construction of IOS transit lanes and stops will excavate to much less depths than previous construction activities. In the unlikely event that a burial or archaeological artifact is uncovered during construction, work will stop and the State Historic Preservation Division (SHPD) will be notified immediately. Should a burial site be found during construction, specific legal procedures and cultural practices will be followed, such as involvement by the Oahu Island Burial Council. Construction would resume upon approval by appropriate authorities.

5) Parklands

In general, the IOS will enhance the value of the park and recreational resources in the study area by improving their accessibility for transit users. In addition, the IOS will not require land from or cause proximity impacts to any of these park or recreational resources. However, the transit stops adjacent to parks have the potential to adversely affect the aesthetic characteristics of these parks, even though these transit stops will not use park property. Therefore, this transit stop will require special architectural design treatment.

6) Other IOS Environmental Issues

Although the following environmental factors regarding the IOS are not anticipated to be adverse and/or require mitigation, brief descriptions are provided below because they may be of importance to the community. As noted above, detailed discussion of all environmental disciplines are provided in Section IOS.5.

Environmental Justice

Two minority and low-income populations, Kalihi-Palama and Chinatown, are within the IOS service area. These communities will not experience disproportionately high and adverse health or environmental effects due to the IOS, but both will experience improved transit service. In addition, public participation activities for the project occurred islandwide from 1998-2003. General outreach efforts included a project website, print ads, newspaper articles, legal and public notices, Progress Report newsletters, and mass mailings that included the two EJ populations identified above.

Floodplains

Although portions of the IOS alignment are within floodplains, development of the system will largely be limited to areas within or near existing roadways and do not involve the types of changes that would affect floodplains or the potential for flooding. The project is in compliance with U.S. DOT Order 5650.2 on Floodplain Management and Protection. Any required construction will comply with the rules and regulations of the National Flood Insurance Program and all applicable ordinances for flood hazard districts.

Indirect Impacts

Under certain market conditions, transit-oriented development and/or re-development, such as mixed-use high density residences and pedestrian-scale commercial districts, have the potential to flourish in areas immediately surrounding IOS transit stops. However, the Primary Urban Center is already highly urbanized, and the IOS in the year 2006 would have little time to influence development or market conditions.

SHORT-TERM IMPACTS

This section presents an assessment of the temporary impacts of construction of the IOS and mitigation measures related to those impacts. Most of the IOS will be placed within the same rights-of-way as the existing surface roadway system, which must remain operational throughout construction. The IOS is being planned, designed and scheduled to meet this challenge with minimal disruption. However, some impacts on the environment, nearby facilities, and established patterns of activity are inevitable. These impacts will be temporary, and their severity will depend largely on the type of construction methods employed, how they will be carried out, and what controls are exercised. Sections 5.12 and IOS.5.12 in the IOS Chapter address these issues in more detail.

1) Transportation and Circulation

The Construction Management Program for the IOS will include development of a "Maintenance of Traffic Plan". This plan, which will be reviewed and approved by the City Department of Planning and Permitting (DPP), will include systemwide as well as subarea consideration of the most important traffic and transportation issues and mitigation measures. The plan will address traffic rerouting, maintenance of residence and business access, parking, and other issues. See Section IOS.5.12.1 in the IOS Chapter for additional details.

2) Displacements, Relocation and Restricted Access for Existing Uses

No permanent displacements and relocations will be necessary for the IOS. The IOS will require temporary areas for construction staging. There are a number of vacant sites along the IOS alignment that could serve as construction staging areas.

3) Neighborhoods and Businesses

Adverse impacts to neighborhoods and businesses near construction sites will be related primarily to disruptions of local transportation and circulation patterns, and air and noise emissions caused by construction vehicles and equipment, and vehicles delayed by construction. These impacts are addressed in other sections.

4) Air Quality

Construction will cause emissions of fugitive dust, airborne particulate matter of relatively large size. Fugitive dust will be generated by particulate matter being kicked up by such activities as excavation, demolition, clearing, stockpiling, hauling, vehicle movement, and dirt tracking onto paved surfaces at access points. Fugitive dust also will be generated from the material processing and storage that will occur at the stockpile areas associated with recycling usable portions of excavated material.

Carbon monoxide (CO) is the principal pollutant of concern in localized areas. Since emissions of CO from motor vehicles increase with decreasing vehicle speed, disruption of traffic during construction could result in short-term elevated concentrations of CO. To minimize CO emissions, efforts will be made during construction to limit disruptions to traffic through prior planning of alternate routing, traffic control, and public notices, especially during peak travel periods.

Contractors will be required to comply with all applicable air quality laws to limit adverse effects on air quality from demolition, clearing, material processing and construction activities, as well as from construction vehicles.

5) Noise and Vibration

Noise generated from construction of the IOS could adversely affect nearby residences, schools, office buildings, and other noise-sensitive activities. To minimize the level of impact, a specification for noise and vibration limits from construction activities will be developed and enforced. The specification will be submitted to the Hawaii Department of Health (HDOH) for their review. An industrial hygienist will monitor compliance with the specification during construction through on-site noise and vibration monitoring during various stages of construction. The Construction Management Program for the IOS will explicitly address the minimization of noise levels generated during construction. See Section IOS.5.12.5 in the IOS Chapter for additional details.

Vibration levels at adjacent structures will be monitored and the structures protected from vibration impacts, as necessary.

6) Water Quality

During construction of the IOS, impacts to surface water would be associated with point and non-point source stormwater discharges and dewatering discharges. Impacts to surface and groundwater resources potentially could occur from discharges containing particulate (sediment) and chemical contaminants. Erosion and sediment discharges will be minimized through the application of Best Management Practices (BMPs) techniques designed to minimize erosion and capture sediment prior to discharge. Details of the BMPs will be developed during final design of the IOS and detailed erosion and sediment control plans will be included in the final construction plans for the IOS. Studies at specific locations to identify potential chemical contaminants in dewatering and stormwater discharges and stockpile drainage will be performed during final design of the IOS. Any dewatering discharge will require a dewatering permit that could only be obtained after designing an appropriate treatment process to ensure that the discharge meets water quality standards.

Spills associated with construction activities also pose a potential threat to water resources. Development of a Spill Containment Control and Countermeasure Plan, including maintenance of clean-up equipment on-site, along with detailed spill prevention measures, will mitigate the impact of inadvertent releases.

See Section IOS.5.12.1 in the IOS Chapter for further details and mitigation measures.

7) Ecosystems

Wildlife habitat is very limited along the IOS alignment and construction of the IOS will have no major effect on the characteristics or size of populations of the resident wildlife species in the area. Even though no adverse impacts are expected, a survey of the IOS corridor will be conducted for white terns and their eggs prior to completing final design, as discussed above.

Construction impacts on trees will consist of permanent removals and/or relocations of trees that are not compatible with the road widening of Kalia Road. Mitigation is addressed in Section IOS.5.7 in the IOS Chapter and will be described in detail in the tree preservation plan to be developed with a qualified certified arborist. A qualified certified arborist will also prepare a tree protection plan to be used during construction. A Street Tree Review will also be conducted by the DPP as part of the construction plan review by the City. The DPP's Street Tree Review applies only to those trees not located within a Special Design District.

8) Utility Service

The IOS will affect few major utilities but many minor ones. Substantial planning will occur so that interruptions in utility service to customers are minimized. Disruptions to utility service, if necessary, will be restricted to short-term localized events. Many of the utilities that are to be buried underground or moved to another underground location could be relocated simultaneously with existing utilities to minimize the need for multiple excavations. As much as possible, relocated utilities will be buried together or coordinated with infrastructure improvements already planned by the City or other agencies. Coordination of utility relocations will be scheduled, programmed, and monitored as a part of the Construction Management Plan and Public Participation Program.

9) Economic

Construction activities associated with the IOS will result in temporary construction related jobs. During construction of the IOS, local businesses could be negatively affected by increased congestion in front of their properties or by reduced access. Location-specific measures, including access, safety, noise and aesthetic requirements of adjacent businesses, will be identified during final design and incorporated into construction contracts. A public information program for commuters, tourists, local residents and the business community will be sustained. A community and government agency mitigation involvement program will be initiated to allow for the exchange of information and ideas for mitigating construction related problems if they arise.

10) Historic Resources and Archaeology

Discussion of the potential impacts on historic properties is provided in Section IOS.5.10 in the IOS Chapter. Historic-period resources will not be affected by construction of the IOS because these properties will not be in the construction area, nor will they be used to store equipment and vehicles or used as staging areas. There is a chance that construction along certain sections of the IOS, such as in Waikiki, could uncover Kupuna Iwi (ancestral bones) or other archaeological artifacts. However, the alignment is mostly urban and has been substantially altered for many years. In addition, most of the project requires little excavation. The project's MOA will provide procedures in the unlikely event that unanticipated resources are encountered during construction of the IOS. The SHPO will be notified immediately if any bones, artifacts or other signs of historic occupation are observed.

UNRESOLVED IOS ISSUES

Most issues raised during the extensive public involvement, coordination, and consultation conducted for this project have been addressed in the FEIS, although some issues remain unresolved. The unresolved issues are presented below with a brief discussion regarding resolution of the issue.

1. Transit Stop Design. The design of the the architectural elements of the transit stops along the IOS corridor will involve public and agency input. When transit stops are near visually important areas, they will be given special design consideration to ensure there is no negative visual impact.

2. Tree Relocations. The exact locations where affected trees will be replanted will be determined during final design.

II. OVERVIEW OF 2025 ALTERNATIVES

The remainder of this chapter describes the impacts and mitigation measures for the corridor-wide Alternatives, including the entire Refined LPA, as implemented in Year 2025.

As described in Section 2.2, all three of the corridor-wide Alternatives - No-Build Alternative, TSM Alternative, and Refined LPA - would utilize future transit centers and park-and-ride facilities needed to support the City's on-going conversion of its radial bus route system to a hub-and-spoke system. Many of these transit centers and park-and-rides will be built as independent projects regardless of which alternative is implemented. With the TSM Alternative and Refined LPA there would be an incremental increase in transit use of these future centers or "hubs" over what would occur under a no action or No-Build scenario. The following discussion describes the environmental impacts of these incremental differences as well as the impacts of other features of the TSM Alternative and Refined LPA that are not part of the No-Build Alternative.

The impacts of the No-Build Alternative compared to the existing conditions (Chapter 3) are discussed below. The analyses show that the No-Build Alternative poorly supports the purposes and needs of the project, as described in Chapter 1. The No-Build Alternative does not provide a transportation system that would effectively handle present or future travel demand levels. It would not maintain even current mobility levels, encourage land use development in desired patterns, support implementation of an urban growth strategy that integrates land use and infrastructure planning, or maintain the existing quality of life. The No-Build Alternative would rely on conventional diesel buses, at least for the immediate future, and continue the present focus on automobiles for transportation. Consequently, regional air pollutant emissions would worsen by between 15 to 30 percent by 2025, although increased emissions may be offset by reductions resulting from vehicle emission improvements. Localized (intersection-level) air quality (worst-case 1-hour microscale concentrations) would generally worsen, but not to a point where they would violate National Ambient Air Quality Standards. Noise levels along streets would remain similar to present levels, even with an increase in diesel buses and vehicles, because the vehicles would be moving more slowly ("pass by" noise increases with speed).

Compared to the future No-Build baseline conditions, the TSM Alternative, with its emphasis on revamping bus service and some bus priority improvements, would provide moderate support to the project's purposes and needs by enhancing people-carrying capacity within the corridor. However, this alternative would not support desired land use development patterns or the City's urban growth strategy that integrates land use and infrastructure planning.

The TSM Alternative on the average would not worsen air quality conditions. Noise levels would not increase, again because of the trade-off between more vehicles and slower speeds. Impacts to neighborhoods, historic resources, ecosystems, water resources, and parklands would be similar to those under the No-Build Alternative. The Refined LPA represents a major transportation improvement over the TSM Alternative in terms of meeting the project purposes and needs. It will substantially increase people-carrying capacity within the corridor and help focus growth along the In-Town BRT alignment. Higher density redevelopment in a transit-supportive manner, particularly at transit centers and transit stops, will be encouraged. This alternative will be more effective than the TSM and No-Build Alternatives in supporting implementation of an urban growth strategy that integrates land use and infrastructure planning. It will help facilitate desired land use development patterns consistent with the vision for the island. It will improve connections between Kapolei and the Primary Urban Center (PUC), and among communities in the PUC.

The Refined LPA could potentially require the loss of 4-acres from a farm, as well as partial displacements affecting 29 additional properties resulting from the loss of off-street parking, landscaping, and/or the reconfiguration of driveways. These partial displacements would result primarily from road widening on Dillingham Boulevard. Affected landowners would be compensated for these partial property takings, if they are required.

Consultation under Section 106 of the National Historic Preservation Act is continuing. The Refined LPA will cause an “adverse effect” on Chinatown, the Capital District, and Thomas Square because these resources have visual integrity, which may be affected by the transit stops. Therefore, the FTA and the State Historic Preservation Officer (SHPO) will be executing a Memorandum of Agreement (MOA).

In the Refined LPA, transit stops and other project elements will be designed to maintain or improve visual conditions through cohesively designed landscaping, street furniture, street trees and lighting. Transit stops in special design districts will be designed to harmonize with their unique environments. For example, the Refined LPA will have transit stops in Chinatown, Thomas Square, the Hawaii Capital Special Districts, and on Kalakaua Avenue fronting the Duke Kahanamoku statue. However, the transit stops will avoid placing canopies or other elements such that they will affect views of any important landmarks. The Luapele ramp included in this alternative would introduce a new visual element.

By using electric bus technology along the In-Town portion of the alignment, the Refined LPA will reduce emissions compared to the diesel buses in the No-Build and TSM Alternatives. Additionally, because the Refined LPA will reduce automobile travel, regional air emissions will be less. Also, the electric buses will generally be quieter than conventional diesel buses.

The Refined LPA construction impacts will be greater than those of the TSM Alternative because construction is more extensive. For example, concrete transit lanes and transit stops will be constructed along the In-Town BRT alignment. Construction impacts will be temporary and detailed mitigation plans will be developed, including a traffic maintenance plan. An archaeological contingency procedure has been developed for the unlikely event that unanticipated archaeological resources are encountered during construction.

Neighborhood and water resource impacts will be similar to the No-Build and TSM Alternatives.

The project definition for the Refined LPA includes the following project refinements and clarifications that have been made to the project in response to public and agency comments received on the SDEIS:

Changes:

- Relocation of Park-and-Ride Facility from Kunia Road to North-South Road
- SDOT proposed ramps at Wakea Street substituted for Direct BRT/HOV Ramp in Kapolei
- SDOT proposed ramps at North-South Road substituted for Direct BRT Ramp at Kunia Road
- Use of existing Middle Street off-ramp instead of a Direct BRT/Park-and-Ride Ramp
- Minor rerouting of In-Town BRT from Channel Street onto Forrest Avenue

Clarifications:

- H-1 Express Lanes from Kapolei to Managers Drive to be built by SDOT whether BRT is built or not
- In the initial years of operation the In-Town BRT will operate in semi-exclusive lanes, not exclusive lanes on Kapiolani Boulevard between Pensacola Street and Atkinson Drive
- Hybrid diesel/electric buses will be used on the In-Town BRT until more advanced technologies are service proven

Any potential impacts caused by these changes in response to comments on the SDEIS are included in this chapter. These changes did not result in any additional adverse environmental impacts, and in some cases lessened the anticipated project impacts. Implementation of the entire Refined LPA, including the Regional BRT, will be phased over 14 years. As described in Chapter 2, implementation of the In-Town BRT will begin with construction of the Initial Operating Segment (IOS) Iwilei-Waikiki Branch from 2003 through 2005. The IOS initially will use hybrid diesel/electric buses.

The potential impacts from the IOS and the remainder of the Refined LPA are included in the overall assessment of impacts described in this chapter. In addition, the IOS Chapter following Chapter 5 provides details on the potential impacts and proposed mitigation measures associated specifically with implementation of the IOS.

The remainder of the In-Town BRT will be started shortly after the IOS, with concurrent implementation of the Kalihi Segment (2004 – 2006), Downtown – University segment (2005 – 2007) and Kakaako Mauka segment (2005 – 2006). A decision will be made in 2008 if the system will be converted to use embedded plate technology. Implementation of the embedded plate system, if selected as the long-term propulsion technology, would begin with construction along the Iwilei to Waikiki segment in 2010.

5.1 LAND USE AND EMPLOYMENT

This section analyzes the potential effects the alternatives would have on existing land uses, development projects and land use plans and policies. Section 5.1.1 summarizes the land use findings. Section 5.1.2 focuses on the regional impacts, while Section 5.1.3 focuses on corridor-level impacts such as accessibility, land use and development, and consistency with plans and policies. Section 5.1.4 discusses transit center and transit stop area impacts. The concluding section summarizes the effects the alternatives would have on employment.

5.1.1 Overview

The Refined LPA's transit components will be compatible with and support current land use plans and policies that link transportation and land use through transit-oriented goals and objectives. The No-Build and TSM Alternatives would be less supportive of proposed public policies and plans.

The sense of permanence can have a major effect on land use and development. Among the alternatives that were evaluated, the sense of permanence referred to in Section 2.2.3 would best be met by the Refined LPA rather than the No-Build and TSM Alternatives because only the Refined LPA will provide a major investment in a fixed transitway. Conventional bus routes can be changed "overnight", which does not convey a sense of permanence to developers interested in investing in a community.

Related to permanence, transit system technology can also be a factor in land use and development. As described in Section 2.2.3, there are two transit technologies currently being considered for the In-Town BRT element of the Refined LPA. The embedded plate technology would require a higher public investment than the hybrid diesel/electric technology in wayside improvements, such as power modules, traction power supply stations, and utility relocation. The embedded plate-powered vehicles obtain wayside power from plates embedded in the pavement, whereas hybrid diesel/electric vehicles obtain power internal to the vehicle using diesel engines and batteries. The fixed infrastructure needed by the embedded plate technology provides the permanency that could spur transit-oriented development in certain areas. This is in addition to public investment in transit lane pavement and lane delineations, stations, streetscape furnishings, and modified traffic signals that give priority to In-Town BRT vehicles, which would also be provided if the hybrid diesel/electric technology were used.

Complementary transit services (e.g., circulator bus routes) that will connect with the In-Town BRT may also help focus development to selected areas. Therefore, the Refined LPA will provide the type of public investment that could encourage transit-oriented development in targeted areas, especially if this investment is accompanied by transit supportive land use policies relative to zoning, parking, and mixed-uses.

5.1.2 Regional Impacts

The study area is mostly urban. As described in Section 3.1, study area land uses vary widely from dense residential, business and commercial districts to industrial parks to suburban residences to agricultural fields to undeveloped conservation and open space. While the Refined LPA could facilitate transit-oriented development along the In-Town transit spine, it would be unlikely to change other land use trends along other places in the study area. The Refined LPA will convey government's willingness to invest in a fixed transit system thereby providing a sense of permanence in the primary transportation corridor, a policy action that has had strong influence in generating much needed developer interest in cities elsewhere. This same policy may help focus transit-oriented development along the In-Town BRT alignment particularly at transit stops. Examples of transit-oriented development include mixed-use high density residences and pedestrian-scale commercial districts.

5.1.3 Corridor Level Impacts

1) Land Use and Accessibility

One of the major factors affecting land development is transportation accessibility. Linkages to major destinations and activity generators, such as employment centers (e.g., central business districts), schools, shopping centers and parks or recreational resources, make real estate attractive for land development. Conversely, properties with poor linkages to activity centers are not as attractive as properties that have good access, which make them poor candidates for land development. Transportation can be a powerful tool the City can use in promoting transit-oriented development in certain areas. Transit-oriented development has improved the quality of life in the urban environment of other cities.

As shown in Table 5.1-1, Major Destinations in the Primary Urban Center (PUC), the alternatives would offer varying service levels to important economic centers in the PUC. These centers are the major travel destinations of the PUC, such as Aloha Stadium, Pearl Harbor, Ala Moana Center, and Waikiki, the State's principal visitor accommodation center. As shown on Table 5.1-1, the Refined LPA will provide better transit service to most of these destinations as compared to the No-Build and TSM Alternatives.

2) Land Use and Development

Considering a major transit investment is not only focusing on mobility but also on broader land use planning objectives to direct future growth to existing urban areas in a manner that will improve the quality of the urban lifestyle and potentially protect agricultural land and open space from urban development.

Since the Refined LPA will provide substantially better transit service than the TSM and No-Build Alternatives and will provide a permanent, fixed piece of transportation infrastructure (In-Town BRT) within the urban core of Honolulu, it will facilitate transit-oriented development, consisting of higher-density mixed residential and commercial land uses. It is doubtful that the TSM or No-Build Alternative would encourage transit-oriented development in the urban core. Investments in fixed facility-type transit, such as the In-Town BRT, have resulted in transit-oriented development in other cities, such as Portland, Oregon; San Diego, California; and Denver, Colorado.

A fixed transit corridor can serve as the backbone of a compact, sustainable city. Such a permanent facility signals to the development community a commitment to permanent access and travel markets. A fixed transit system such as the In-Town BRT coupled with transit supportive land use policies relative to zoning, parking,

TABLE 5.1-1
MAJOR DESTINATIONS IN THE PRIMARY URBAN CENTER

Site	Location	Size or Service Levels	No-Build	TSM	Refined LPA
1	Pearl City Shopping Center	250,000 sq. ft. GLA	**0**	**0**	**+**
2	Pearlridge Center	1,400,000 sq. ft. GLA	**0**	**0**	**++**
3	Pearl Highlands Center	409,847 sq. ft. GLA	**0**	**0**	**++**
4	Aloha Stadium	About 50,000 seats	**0**	**+**	**++**
5	Stadium Mall	220,287 sq. ft.	**0**	**+**	**++**
6	Salt Lake	17,121 residents in 2000	**0**	**0**	**0**
7	Pearl Harbor Naval Base	15,000 workers	**0**	**0**	**0**
8	Arizona Memorial	1.5 million attendees/year	**0**	**0**	**0**
9	Honolulu International Airport	9 million passengers/year	**0**	**0**	**0**
10	Mapunapuna	163 acres	**0**	**0**	**+**
11	Middle Street Industrial Area	NA	**0**	**+**	**++**
12	Honolulu Community College	4,000 students	**0**	**0**	**++**
13	Kalihi/Palama	37,987 residents in 2000	**0**	**0**	**++**
14	Costco Warehouse	150,000 sq. ft.	**0**	**0**	**+**
15	Home Depot	145,000 sq. ft.	**0**	**0**	**+**
16	Kalihi Kai Industrial District	585 acres	**0**	**0**	**0**
17	Sand Island	About 510 acres	**0**	**0**	**0**
18	Iwilei Industrial District	320 acres	**0**	**++**	**++**
19	Chinatown	About 30 acres	**++**	**++**	**++**
20	Downtown Financial District	60,000 daytime population	**++**	**++**	**++**
21	Government Centers (Federal/State/City)	About 150 acres, 3 million sq. ft.	**++**	**++**	**++**
22	Queen's Medical Center	About 750,000 sq. ft.	**+**	**+**	**+**
23	Kakaako	over 600 acres; 20,000 workers	**0**	**0**	**++**
24	Victoria Ward Centers	over 250,000 sq. ft.	**0**	**0**	**++**
25	Neal Blaisdell Center	22 acres; about 400,000 att./year	**0**	**0**	**++**
26	Kapiolani Business District	About 2 million sq. ft. commercial	**0**	**0**	**++**
27	Ala Moana Center	2 million sq. ft. GLA	**++**	**++**	**++**
28	Ala Moana Park	About 120 acres	**++**	**++**	**++**
29	Hawaii Convention Center	200,000 sq. ft. exhibit space; 47 meeting rooms of over 100,000 sq. ft.	**++**	**++**	**++**
30	Waikiki	3.7 million annual visitors; 19,720 residents.	**0**	**0**	**++**
31	Kapahulu/Diamond Head	19,419 residents in 2000	**0**	**0**	**+**
32	Ala Wai Golf Course	200,000 rounds/year	**0**	**0**	**+**
33	Honolulu Zoo	700,000 attendees/year	**0**	**0**	**++**
34	Kapiolani Park	155 acres	**0**	**0**	**++**
35	McCully/Moiliili	26,122 residents in 2000	**0**	**0**	**++**
36	University of Hawaii at Manoa	19,000 students	**0**	**0**	**+**
37	Tokai University Pacific Center	-----	**0**	**0**	**+**
38	Hilton Hawaiian Village	22 acs; 2,545 rooms; 1,900+ employees	**0**	**0**	**++**
39	Hale Koa Hotel, Fort DeRussy	72 acs; 817 rooms; 900+ employees	**0**	**0**	**++**
40	Royal Hawaiian Shopping Center	6.5 acs; 279,000 sq. ft. GLA; 1,500+ employees	**0**	**0**	**++**
41	Aloha Tower Marketplace / Maritime Center	22 acres	**0**	**0**	**++**
42	Kakaako Waterfront Park	30 acres	**0**	**0**	**++**
43	McKinley High School	2,000 students	**0**	**0**	**++**

Sources: City Department of Planning and Permitting and Parsons Brinckerhoff, September 2002.

Notes:
- **++** These activities are located within 1/4-mile of transit centers or BRT transit stops.
- **+** These activities are located within 1/2-mile of transit centers or BRT transit stops.
- **0** These activities are not served by transit centers or BRT transit stops. Where an activity has more than one location, at least one location is served but not necessarily all locations, treatments, and other ground level elements.

sq. ft. = square feet

GLA = gross leaseable area

and mixed-uses, has been shown to encourage the development community to invest along the transit spine in other cities. This assessment of the relationship between transit investments and development responses is consistent with the views of a panel of land use/transportation planners and developers from other parts of the United States and Honolulu that was convened for this project in July 1999.

The land use panel concluded that transit-oriented development in the urban core would not likely happen without a major investment in a permanent fixed transit system. The land use panel indicated that the urban core has available land for development or redevelopment despite a relatively high urbanization level. The panel suggested that appropriate implementation tools be established that encourage development in the PUC and discourage or prohibit development where it is not desired, such as on agricultural land and open space.

Finally, the land use panel noted that many conditions to spur transit-oriented development are in place in Honolulu and a fixed transit corridor could facilitate the City and County's land use vision of greater mixed-use densities in certain parts of the city. This conclusion was conditioned upon a comprehensive transit/land use implementation strategy developed and managed by a strong land development implementation body. For example, the land use panel pointed out that facilitating development along a transit corridor would require consolidating numerous small tracts of land to allow for higher density land uses. According to transit-oriented development experts Michael Bernick and Robert Cervero in Transit Villages in the 21st Century, 1997, "If developers face the prospect of negotiating individual land purchases among multiple land owners, any one of whom can renege and doom a project, little is likely to happen. The risks and uncertainties are just too great."

The areas along the transit corridor where transit-oriented redevelopment appear to have the greatest potential because of ownership patterns are in Kakaako and Iwilei. The Hawaii Community Development Authority (HCDA) plans and regulates Kakaako land use (see Section 3.1) and the Housing and Community Development Corporation of Hawaii (HCDCH), a State agency, is planning the redevelopment of a portion of Iwilei. Other parts of the corridor as indicated below have the potential for limited transit-oriented redevelopment with some land consolidation:

- Joint use commercial/retail with the proposed transit center at Middle Street;
- Kapalama Canal area between Dillingham Boulevard and King Street for medium density residences (see Figure 5.1-1);
- Kapiolani Boulevard at Keeaumoku Street, an area that includes the Sheridan Street Superblock (see Figure 5.1-1);
- Area surrounding the Hawaii Convention Center, which has the potential for high-rise mixed uses;
- University Avenue at King Street area, which is planned for University-oriented mixed residential and retail use; and
- Lewers Street area in Waikiki, which is being planned for hotel and commercial development.

3) Consistency with Land Use Plans and Policies

All of the alternatives would be consistent with the plans and policies of the State of Hawaii and the City and County of Honolulu. The alternatives would also be consistent with relevant plans regarding transportation, recreation, educational institutions, military installations, and major private sector developments. Table 5.1-2 provides a summary of the project alternatives' consistency with these plans and policies. Further discussion is provided below.

FIGURE 5.1-1
LAND USE DEVELOPMENT POSSIBILITIES

TABLE 5.1-2
CONSISTENCY WITH PLANS AND POLICIES

	ALTERNATIVE		
	No-Build	**TSM**	**Refined LPA**
State of Hawaii			
Land Use Plans and Controls			
Hawaii State Plan	C	C	C
State Land Use Classifications	C	C	C
State Coastal Zone Management Program	C	C	C
Kakaako Mauka and Makai Area Plans	C	C	C
Aloha Tower Development Plan	C	C	C
Honolulu Waterfront Master Plan	C	C	C
Transportation Plans			
Oahu Commercial Harbors 2020 Master Plan	C	C	C
State Cruise Ship Terminal Needs Assessment	C	C	C
Honolulu International Airport Master Plan	C	C	C
Bike Plan Hawaii	C	C	C
Highways Division Plans and Projects	C	C	C
Recreational Plans			
Statewide Comprehensive Recreational Plan	C	C	C
Educational Institution Plans			
UH-Manoa Long Range Master Plan	C	C	C
Leeward Community College Long Range Plan	C	C	C
UH-West Oahu Campus Master Plan	C	C	C
UH Health and Wellness Center	C	C	C
Military Installation Planning			
Pearl Harbor Naval Complex Master Plan	C	C	C
Ford Island Development	C	C	C
Fort Shafter Complex	C	C	C
Hickam Air Force Base	C	C	C
Armed Forces Rec Center – Fort DeRussy	C	C	C
Kalaeloa (former Barbers Point NAS) Reuse	C	C	C
Fort Armstrong	C	C	C
City and County of Honolulu			
General Plan of the City and County of Honolulu	C	C	C
Development and Sustainable Community Plans	C	C	C
Special Management Area	C	C	C
Honolulu Bicycle Master Plan	C	C	C
Hub-and-Spoke Bus Route Revision Program	C	C	C
Oahu Metropolitan Planning Organization			
Oahu Regional Transportation Plan (TOP 2025)	C	C	C
Private-Sector			
Waikikian Development Plan	C	C	C
Waikiki Beach Walk	C	C	C

Source: Parsons Brinckerhoff, Inc., September 2002.
Key: C: Consistent with Plan/Program

State Plans, Policies and Programs

Hawaii State Plan

All the alternatives would generally be consistent with the objectives and policies of the Hawaii State Plan (June 1991), in particular those relating to public welfare and economic development because of the provision of transportation infrastructure. Even the No-Build alternative, because it includes baseline projects identified in the Oahu Regional Transportation Plan (see Section 2.2.1), would support State Plan objectives and policies relating to public welfare and economic development.

State Land Use Classifications

Transportation improvements under the No-Build, TSM and Refined LPA Alternatives would be consistent with the State "Urban" classification, which predominates the primary transportation corridor. Under the Refined LPA, the proposed North-South Road park-and-ride facility in Ewa is on "Agriculture" classified land. However, much of the Ewa area is classified "Urban", even in undeveloped areas, and those areas still classified "Agriculture" would likely soon be reclassified "Urban" in the near future because they are being planned for urban uses, such the UH West Oahu site.

Coastal Zone Management Program

The following describes the project's consistency with the objectives and policies of the State's Coastal Zone Management (CZM) Program. The Department of Business, Economic Development and Tourism (DBEDT), the agency administering the State's CZM program, concurred with DTS's CZM consistency determination (see Appendix A).

Recreation Resources
None of the alternatives would adversely affect use of any park or recreational resource. See Section 5.11 for further information.

Historic Resources
Although no historic-period resource would be directly affected by any of the alternatives, the project's Memorandum of Agreement (MOA) will specify consultation with the State Historic Preservation Division and other interested parties on the design of the In-Town BRT stops that may affect the visual integrity of certain historic properties. Also, construction of the In-Town BRT along certain segments may uncover archaeological resources and possibly human burials of native Hawaiians. The MOA, therefore, provides a monitoring plan. See Section 5.10 for further information.

Scenic And Open Space Resources
Since the primary elements of the TSM and Refined LPA Alternatives involve vehicles, such as buses and In-Town BRT vehicles, adverse impacts to important visual resources are not expected. Some of the In-Town BRT stops would be located in areas with high visual or aesthetic value. Therefore, they will be designed to blend in with their environment. See Section 5.4 for further information.

Coastal Ecosystems
None of the alternatives would be located in the Shoreline Setback Area or the Special Management Area. Therefore, impacts to coastal ecosystems are not anticipated. See Section 5.7 for further information.

Economic Uses
None of the alternatives would adversely affect coastal dependent economic activities. The Refined LPA in particular, will extend the In-Town BRT system into Waikiki, the State's premier visitor resort.

Coastal Hazards
None of the alternatives would be located along the shoreline. Therefore, exposure to coastal hazards would not occur.

Managing Development
Certain elements of the alternatives will require State and County permits that include provisions for public participation and the protection of coastal resources.

Public Participation
The Primary Corridor Transportation Project has conducted wide-ranging and extensive public involvement. Appendix A contains a description of the project's public involvement activities.

Beach Protection
None of the alternatives will affect coastal erosion because no project element will be adjacent to or abut the shoreline.

Marine Resources
None of the alternatives will affect marine or coastal resources because no project element will be adjacent to or abut the shoreline.

Kakaako Mauka and Makai Area Plans

None of the alternatives will adversely affect Hawaii Community Development Authority development plans for the Kakaako Special District, which are intended to make Kakaako into a major activity node for residential, industrial, office, maritime and other land uses. The In-Town BRT will traverse both Kakaako Mauka and Makai, and therefore will support and benefit the type of mixed-used development envisioned for these areas. See Section 5.1.4 for additional discussion on the land use impacts of the In-Town BRT in Kakaako.

Aloha Tower Development Plan

None of the alternatives will adversely affect the State's Aloha Tower Development Corporation (ATDC) redevelopment plans for the Aloha Tower area, Piers 5 to 14, which will include maritime facilities, restaurants, retail shops, offices, a hotel, and residential condominiums. The In-Town BRT will serve the existing Aloha Tower Marketplace, and therefore, will support other future development. See Section 5.1.4 for additional discussion on the land use impacts of the In-Town BRT at Aloha Tower.

Honolulu Waterfront Master Plan

None of the alternatives will adversely affect the State's plans for the Honolulu Waterfront, an area encompassing approximately 1,550 acres adjoining Honolulu Harbor. These plans were detailed in the 1989 Honolulu Waterfront Master Plan Final Report. The Oahu Commercial Harbors 2020 Master Plan (OCHMP) has updated portions of this plan (see below).

Oahu Commercial Harbors 2020 Master Plan

None of the alternatives will adversely affect the Hawaii Department of Transportation (HDOT), Harbors Division long-range plan for its land holdings at Honolulu Harbor. The OCHMP addressed issues and needs relating to the maritime industry exclusively, such as cargo and passenger movements and fishing.

State Cruise Ship Terminal Needs Assessment

The HDOT Harbors Division study recommended a cruise ship terminal at Pier 2 in Honolulu Harbor, and development of interim cruise ship facilities at Piers 19 and 20. None of the alternatives will adversely affect these plans. The Kakaako Makai Branch of the In-Town BRT would be in proximity to the future Pier 2 cruise ship terminal.

Honolulu International Airport Master Plan

None of the alternatives will adversely affect the HDOT Airports Division development plans for Honolulu International Airport.

Bike Plan Hawaii

Discussion of project consistency with Bike Plan Hawaii is provided in Section 4.7.2.

HDOT Highways Division Plans and Projects

The Refined LPA will be consistent with the HDOT Highways Division improvement plan known as Ala Moana Boulevard Improvements: Atkinson Drive to Kalakaua Avenue. The project involves landscaping to improve the pedestrian environment. The proposed transit and pedestrian oriented improvements can be designed to be consistent with one another.

HDOT Highways Division has an ongoing program to restore the concrete bridge deck on the Pearl City viaduct of the H-1 Freeway. The Regional BRT improvements include replacement of the existing permanent median barrier with a movable one. The movable barrier will be lighter weight than the fixed barrier. Implementing the BRT improvements will be coordinated with the maintenance/rehabilitation program for the Pearl City viaduct to ensure consistency with the State's ongoing program for this facility.

Close coordination between the affected State agencies and the DTS will continue so that the Refined LPA maximizes compatibility with the State's plans and programs for the surrounding area.

Statewide Comprehensive Recreational Plan

None of the alternatives will adversely affect State Parks Division's plans for developing and operating recreational facilities in the State. See Section 5.11 for additional information on potential impacts to parks and recreational facilities.

UH- Manoa Master Plan

None of the alternatives will adversely affect the University of Hawaii's facility plans for its Manoa campus. An important element of the UH-Manoa plan is to enhance the "sense of place" on the campus by locating both pedestrian and vehicular gateways at key access points to campus. Although the In-Town BRT UH-Manoa Stop will be located at Sinclair Circle, it will have no adverse effect on projects designed to enhance the "sense of place".

Leeward Community College Long Range Plan

None of the alternatives will adversely affect the University of Hawaii's facilities plans for its Leeward Community College. For example, the Regional BRT will not affect plans to provide additional access to and from the campus.

UH-West Oahu

None of the alternatives will adversely affect the University of Hawaii's plans to develop a new campus in Ewa, the UH- West Oahu campus. The North-South Road park-and-ride facility under the Refined LPA will be located near the proposed campus site.

UH Health and Wellness Center

None of the alternatives will adversely affect the University of Hawaii's plans to develop a UH Health and Wellness Center, which would also be the new campus for the UH John A. Burns School of Medicine, in Kakaako Makai. The In-Town BRT will traverse Kakaako Makai, and therefore will support the transportation needs of the facility. See Section 5.1.4 for additional discussion on the land use impacts of the In-Town BRT in Kakaako Makai.

<u>Military Installation Planning</u>

Pearl Harbor Naval Complex Master Plan

None of the alternatives will adversely affect the Department of the Navy facility plans for the Pearl Harbor Naval Complex, which includes redevelopment of Ford Island (see below).

Ford Island Development

None of the alternatives will adversely affect the Department of the Navy plans to provide military personnel and family housing, administrative and training facilities, and supporting infrastructure on Ford Island. The only element of the alternatives near Ford Island is the Aloha Stadium Transit Center/Park-and-Ride, which would be located at the overflow parking lot of the stadium. This facility will not be on Navy property, and therefore, will not influence the scope and schedule of the Ford Island development program. Indirect impacts may occur since traffic relating to the transit center and traffic from higher future Ford Island resident and worker populations would use the Kamehameha Highway / Salt Lake Boulevard (Koko Head-bound) intersection. On the other hand, the transit center's proximity to Ford Island would improve transit service for the workers and residents of the island.

Fort Shafter Complex

None of the alternatives will adversely affect the U.S. Army's facility plans for Fort Shafter.

Armed Forces Recreation Center – Fort DeRussy

None of the alternatives will adversely affect the U.S. Army's master and recreational planning of Fort DeRussy in Waikiki. Recent improvements to the installation have included extensive landscaping, a second tower to the Hale Koa Hotel, a 1,300-stall hotel parking structure, and realignment and widening of Kalia Road. The In-Town BRT will traverse Fort DeRussy on Kalia Road, and will require widening of Kalia Road, which will displace some landscaping and a few parking spaces (see Section 5.2.2 for additional information). Despite these impacts, none of the installation's recreational facilities will be affected.

Hickam Air Force Base

None of the alternatives will affect the U.S. Air Force's facility plans for Hickam Air Force Base.

Kalaeloa (former Barbers Point Naval Air Station) Reuse

Despite not technically being a military installation plan, none of the alternatives will nevertheless affect redevelopment of the former Naval installation, which may include developing a general aviation airport and Department of Hawaiian Home Lands use.

Fort Armstrong

Similar to Kalaeloa, Fort Armstrong is also a former military installation located at Piers 1 and 2 in Kakaako Makai. None of the alternatives will adversely affect future facilities, which would include continuing maritime break-bulk and limited container cargo operations at Pier 1, and a cruise ship terminal at Pier 2.

City and County of Honolulu Plans, Policies and Controls

General Plan

Since the automobile was introduced in Hawaii early in the 1900s, development of Oahu evolved from that of an ahupuaa (land division extending from uplands to sea used by pre-contact Hawaiians) system to one that was based on plantation agriculture and the port of Honolulu (Honolulu Harbor). Current land use patterns are largely based on the needs of the automobile, with resultant pressure to suburbanize peripheral agricultural and open space lands. As in much of the United States, Oahu's suburbs, such as those in Central and Leeward Oahu, have an imbalance of houses compared to jobs that results in traffic congestion along major transportation corridors as large numbers of workers commute to Honolulu's central business district and other employment centers, such as Waikiki.

The City and County of Honolulu General Plan provides goals and objectives to guide future growth, addressing key issues, such as population, economic activity, housing, and utilities. These four areas are very influential in the direction and rate of future growth. As a matter of General Plan policy, future growth is directed to where residential and employment uses would occur in conjunction with transportation access and circulation. The General Plan also "address[es] the need for a balanced system for the pedestrian, bikeway, public transportation, and automobile". It also calls for a variety of attractive and convenient travel modes, including "public transportation-for travel to and from work…through a mass transit system including exclusive right-of-way rapid transit and feeder-bus components…"

The No-Build Alternative does not support General Plan policies because it does nothing to address the key issues relating to helping direct population distribution, economic activity, housing, and utilities. The TSM Alternative somewhat supports the General Plan population distribution policies, but does not support the orderly economic growth and transportation policies.

The Refined LPA supports the General Plan policies and guidelines because all the elements of this alternative provide a more balanced transportation system than either the No-Build or TSM Alternatives. It supports the transportation-related objectives of the plan. In addition, it will also use the transportation investment of this alternative to facilitate transit-oriented development in the urban core. Along with other supportive policies, the Refined LPA is consistent with the City's organizing principles relating to land use and economic growth.

Development and Sustainable Community Plans

Not only is transportation important for the efficient movement of people and goods, but it is also integral to the quality of life of residents. Spending less time traveling means more time for recreation or other enjoyable activities. Transportation should, therefore, be tightly integrated with land use management controls and policies. The corridor spans three different planning areas (Ewa, Central Oahu and PUC) as designated by the City and is, therefore, influenced by different transportation policies as stated in the development or sustainable community plan of the respective planning area. Recognizing that each planning area has a unique piece of the transportation corridor, it is necessary to review these policies as they have been outlined in their individual development plans.

The Ewa Development Plan was updated and adopted in 1997. Since the Central Oahu Sustainable Community Plan and the PUC Development Plan are currently being updated or adopted, existing and proposed policies are analyzed. Table 5.1-3 summarizes the consistency of the alternatives with policies and guidelines contained in the Ewa, Central Oahu and PUC Development/Sustainable Community Plans (present Ewa Plan and present and proposed Central Oahu and PUC Plans).

TABLE 5.1-3
RELATIONSHIP OF ALTERNATIVES TO PRESENT AND PROPOSED DEVELOPMENT OR SUSTAINABLE COMMUNITY PLAN POLICIES AND GUIDELINES

	Alternative		
Development or Sustainable Community Plan	**No-Build**	**TSM**	**Refined LPA**
Ewa	O	O	XX
Central Oahu (Present)	O	X	XX
Central Oahu (Proposed)	O	O	XX
Primary Urban Center (Present)	O	O	XX
Primary Urban Center (Proposed)	O	O	XX

Sources: Helber Hastert & Fee Planners, Inc.; Plan Pacific, Inc., April 20, 1999.
Notes: XX Highly Consistent with Policy
X Consistent with Policy
O Weak or Poorly Defined Relationship to Policy

As indicated on Table 5.1-3, the No-Build and TSM Alternatives would be inconsistent with current and proposed growth policies of the development and sustainable community plans, particularly proposed land use policies to encourage higher densities in the urban core and discourage development on agricultural and open space lands elsewhere on the island. These alternatives would not relieve pressure to urbanize outlying agricultural lands, leading to higher transportation costs and limited choices of urban lifestyles.

Implementing the Refined LPA will result in an increase in people-carrying capacity and transit service particularly in the PUC, which will provide incentives for transit-oriented development if other supportive polices are implemented. Transit-oriented development, which consists of a mix of residential and commercial uses in a pedestrian friendly environment, are envisioned in the proposed updated PUC Development Plan (May 2002) along the In-Town BRT alignment, such as in Kakaako.

In summary, the No-Build and TSM Alternatives would fail to address the proposed land use and economic development policies to encourage greater densities in the urban core because neither would provide an attractive and convenient travel mode for PUC residents. In addition, neither alternative would address the General Plan goal of limiting suburban development of agricultural and open space lands. The panel of experts assembled to review the proposed alternatives and evaluate their transit-oriented development potential echoed these findings.

Special Management Area

Segments of the In-Town BRT in Kakaako Makai, along Ala Moana Boulevard and in Waikiki will be within the Special Management Area (SMA). Normally, work on existing right-of-way is not considered “development”, the standard in which a SMA use permit is needed. It may be likely that pavement work for the In-Town BRT would not be considered “development”, but a transit stop, even if located on existing right-of-way, would be considered a “development”. Assuming that transit stops and Traction Power Supply Station (TPSS) would be the only elements of the In-Town BRT that would be a “development”, a major SMA use permit would be required if the affected transit stop or TPSS in the SMA has a capital cost of over $125,000. Major SMA use permits require approval by the City Council, but minor SMA use permits may be granted by the Director of the City Department of Planning and Permitting.

Developing the In-Town BRT will be consistent with the SMA program because it will not adversely affect access to and along the shoreline, and viewsheds to, from and along the shoreline. To the contrary, the Refined LPA will improve access to the shoreline in some areas. It will not introduce structures that would affect beach processes or present hazards along the shoreline.

Honolulu Bicycle Master Plan

Discussion of project consistency with the Honolulu Bicycle Master Plan is provided in Section 4.7.2.

Hub-and-Spoke Bus Route Revision Program

None of the alternatives will adversely affect the DTS’s program to convert existing City bus routes from a predominately radial network to a hub-and-spoke configuration. All three alternatives assume converting to hub-and-spoke routes. See Section 4.3 for the discussion on transit service impacts.

Oahu Metropolitan Planning Organization

None of the alternatives will adversely affect the Oahu Metropolitan Planning Organization’s Transportation for Oahu Plan 2025 (TOP 2025), adopted in April 2001. The No-Build Alternative includes the baseline highway network of the TOP 2025. The TSM Alternative includes the highway network plus improvements to the bus transit system. The baseline highway network as well as the In-Town and Regional BRT are included in the TOP 2025 Plan.

Private-Sector Plans

Waikikian Development Plan

None of the alternatives will adversely affect Hilton Hotels Corporation’s plan to replace the former Waikikian Hotel with a new 350-room hotel building. The In-Town BRT will be adjacent to the Hilton Hawaiian Village on Ala Moana Boulevard and Kalia Road, and therefore will serve the transit needs of the hotel and planned development. See Section 5.1.4 for additional discussion on the land use impacts of the In-Town BRT in Waikiki.

Waikiki Beach Walk

None of the alternatives will adversely affect the Outrigger Enterprises, Inc. plan to redevelop its landholdings along Lewers Street, Kalia Road, Beach Walk and Saratoga Road. The In-Town BRT will be adjacent to the development on Kalia and Saratoga Roads, and therefore will serve the transit needs of the development. See Section 5.1.4 for additional discussion on the land use impacts of the In-Town BRT in Waikiki.

5.1.4 Transit Center and Transit Stop Area Impacts

Future development of the area surrounding transit centers and transit stops would be guided and affected by existing and proposed land uses and regulations. The policies guiding growth, particularly those General Plan and Development or Sustainable Community Plan policies discussed in Section 3.1 and Section 5.1.3, support transit-oriented development. Other factors that affect transit center and transit stop area land uses include the availability of land for development, zoning, existing land uses, and market conditions. A transit stop's land use development influence, as experienced in other cities, is generally concentrated within a quarter-mile of the stop. This distance coincides with the maximum distance that most people would walk to-and-from a transit stop. It also has been found that transit stops located within commercially designated areas support higher density land development and redevelopment than those in low-density residential areas. The influences of land use policies were based on the Ewa Development Plan, and drafts of the Central Oahu Sustainable Community Plan and the PUC Development Plan.

It should be noted that, compared with existing bus stops, the transit stops associated with the In-Town BRT will have more extensive improvements, providing a greater sense of permanence. Curbside as well as median transit stops will have increased amenities including raised platforms, enhanced shelters, seating and landscaping. Well-marked, signal controlled pedestrian crosswalks will be used at all median transit stops. In addition, sheltered waiting areas, seats, lighting and safety railings will be provided so that transit patrons can wait in safety and comfort. Figure 2.2-4 shows typical median and curbside transit stops for the In-Town BRT.

Table 5.1-4 provides a comparison of the general land use impacts anticipated among the No-Build and TSM Alternatives and the Refined LPA.

1) Regional Facilities

As shown in Table 5.1-4, the Kapolei Transit Center and the North-South Road park-and-ride facility will be constructed under the No-Build and TSM Alternatives and the Refined LPA. Figure 5.1-2 shows the general location of the proposed Kapolei Transit Center and North-South Road Park-and-Ride. Also included in Table 5.1-4 are transit centers that are included in the Oahu Transportation Improvement Program (OTIP), FY 2002-2004 as part of the conversion of the network to a hub-and-spoke configuration. The OTIP transit centers include: Aloha Stadium, Middle Street, Iwilei, Pearl City/Aiea, Wahiawa Town, Mililani Town, Kailua, and Kaneohe. Figure 5.1-3 shows the general location of the Pearl City/Aiea transit center.

Kapolei Transit Center/Park-and-Ride

With the No-Build and TSM Alternatives and the Refined LPA, a new transit center and park-and-ride facility in the growing City of Kapolei could help foster development of parcels in and around this transit-related site. For example, pedestrian activity within and around the transit center could encourage retail stores and eating establishments to locate near the center. In addition, the transit center could encourage other commercial investment or services, such as childcare. The connection between Kapolei and the Honolulu urban core, as discussed in Section 1.1, is necessary to encourage coordinated growth. The City is planning to open an interim or temporary transit center with a park-and-ride lot at a vacant parcel near the new City police station. As Kapolei grows, the transit center would be relocated to a location nearer the city center.

North-South Road Park-and-Ride

The North-South Road Park-and-Ride, which will be located along the future North-South Road between Farrington Highway and the H-1 Freeway, is proposed under the No-Build and TSM Alternatives and the Refined LPA. This proposed site also allows using the future North-South Road Interchange with the H-1 Freeway for bus access. The growing Ewa residential communities need a park-and-ride facility so that current and new residents are encouraged to use transit instead of private automobiles for commuting. The park-and-ride facility will support land use plans and policies of this growth area. The site of the proposed park-and-ride facility will displace existing agricultural land. Since the surrounding land will remain agriculture, the land uses surrounding the facility will not change unless zoning is changed to urban designations. If that were to occur, the park-and-ride facility could influence the development that occurs. For example, the UH Board of Regents has recently approved the area makai of the park-and-ride as the site for UH-West Oahu.

FIGURE 5.1-2
TRANSIT CENTER/PARK-AND-RIDE LOCATIONS: KAPOLEI – EWA/WAIPAHU

TABLE 5.1-4
POTENTIAL FOR TRANSIT-ORIENTED DEVELOPMENT

	Alternatives		
Transit Facility	**No-Build**	**TSM**	**REFINED LPA**
Regional Facilities			
Kapolei Transit Center/Park-and-Ride	**XX**	**XX**	**XX**
North-South Road Park-and-Ride	**X**	**X**	**X**
Aloha Stadium Transit Center/Park-and-Ride	**X**	**X**	**X**
Middle Street Transit Center/Park-and-Ride	**X**	**X**	**X**
Pearl City/Aiea Transit Center	**X**	**X**	**X**
Wahiawa Town Transit Center	**X**	**X**	**X**
Mililani Town Transit Center	**X**	**X**	**X**
Kailua Transit Center	**X**	**X**	**X**
Kaneohe Transit Center/Park-and-Ride	**X**	**X**	**X**
In-Town Facilities			
Middle Street to Iwilei Segment			
Middle Street Transit Center/Park-and-Ride	**-**	**X**	**X**
Kalihi Stop	**-**	**-**	**X**
Honolulu Community College Stop	**-**	**-**	**X**
Waikiki Branch			
Iwilei Transit Center	**X**	**X**	**XX**
Chinatown Stop	**-**	**-**	**X**
Union Mall Stop	**-**	**-**	**X**
Aloha Tower Stop	**-**	**-**	**X**
Fort Armstrong Stop	**-**	**-**	**XX**
Coral Stop	**-**	**-**	**XX**
Kewalo Basin Stop	**-**	**-**	**XX**
Kamakee Stop	**-**	**-**	**XX**
Ala Moana Park Stop	**-**	**-**	**X**
Hobron Stop	**-**	**-**	**XX**
Ft. DeRussy Stop	**-**	**-**	**X**
Saratoga Stop	**-**	**-**	**XX**
Kalakaua/Seaside Stop	**-**	**-**	**X**
Kalakaua/Uluniu Stop	**-**	**-**	**X**
Kapahulu Stop	**-**	**-**	**X**
Kuhio/Liliuokalani Stop	**-**	**-**	**X**
Kuhio/Seaside Stop	**-**	**-**	**X**
UH-Manoa Branch			
Iolani Palace Stop	**-**	**-**	**X**
Alapai Transit Center	**X**	**X**	**X**
Thomas Square/NBC Stop	**-**	**-**	**X**
King/Pensacola Stop	**-**	**-**	**X**
Pensacola/Kapiolani Stop			**XX**
Ala Moana/Keeaumoku Stop	**-**	**-**	**XX**
Convention Center Stop	**-**	**-**	**X**
Isenberg Stop	**-**	**-**	**X**
University/King Stop	**-**	**-**	**XX**
UH-Manoa (Sinclair Circle) Stop	**-**	**-**	**X**
Kakaako Mauka Branch			
Bishop Stop	**-**	**-**	**X**
Alakea Stop	**-**	**-**	**X**
Halekauwila Stop	**-**	**-**	**XX**
Cooke Stop	**-**	**-**	**XX**

Sources: Helber Hastert & Fee Planners, Inc.; Plan Pacific, Inc.; Parsons Brinckerhoff, Inc., September 2002
Notes:
X May support transit-oriented development if other factors are present
XX Support transit-oriented development
- No Transit Center or Stop at this location

Aloha Stadium Transit Center/Park-and-Ride

A regional transit center at the Aloha Stadium overflow parking lot along Kamehameha Highway is included under the No-Build and TSM Alternatives and the Refined LPA (see Table 5.1-4). Unlike the Kapolei Transit Center, the Aloha Stadium Transit Center is not expected to induce land use changes in the area surrounding the site because much of the surrounding area is occupied by the stadium and its parking, and a U.S. military base (Pearl Harbor). The remainder of the surrounding land uses consists of residential neighborhoods of single-family and medium-density dwellings and two shopping centers about a half-mile away. Therefore, there are no developable lands adjacent to the proposed transit center, unless zoning changes are made and the community is supportive of higher-densities and/or land use changes.

2) In-Town Facilities

Three transit centers, 31 transit stops, and one park-and-ride facility are planned for urban Honolulu from Middle Street to the University of Hawaii at Manoa and Waikiki for the In-Town BRT element of the Refined LPA (see Table 5.1-4). The Alapai and Iwilei Transit Centers are included in all alternatives. The Middle Street Transit Center/Park-and-Ride is planned for the TSM Alternative and the Refined LPA.

As shown on Table 5.1-4, the Refined LPA provides an In-Town BRT system that will include dedicated transit lanes, transit centers and transit stops that will be permanent facilities. Such facilities have the potential to facilitate transit-oriented development patterns. For example, as discussed in Section 1.1, the draft update of the PUC Development Plan calls for pedestrian-scale development with convenient walking access to transit. The land uses surrounding Dillingham Boulevard, Iwilei, Kakaako, Convention Center, Kapiolani Boulevard, and some Waikiki sites would be, to varying degrees, influenced by the presence of transit-related facilities and would support a pedestrian-scale environment. Although it is unlikely other parts of the city would see dramatic land use changes because of certain constraints such as ownership patterns, their urban environment would nevertheless become more pedestrian oriented, which could support certain establishments or lifestyles. The parts of Honolulu in which substantial land use changes resulting from the project would not be expected, but would nevertheless see their pedestrian environment enhanced by the In-Town BRT are the Middle Street business area, Chinatown, Neal Blaisdell Center near Thomas Square, and certain areas within Waikiki that have been fully developed under current City land use policies.

The following discusses in more detail some of the areas around the transit centers and transit stops.

Middle Street to Iwilei Segment

There is one transit center and two transit stops planned for the area between Middle Street and Iwilei (see Table 5.1-4). See Figures 5.1-3 and 5.1-4 for general locations.

Middle Street Transit Center/Park-and-Ride Facility

The Middle Street Transit Center/Park-and-Ride site (a separate DTS project) is currently surrounded by industrial and commercial uses on three sides, and military uses on one (Ewa) side. The City is not planning to change these uses, and will probably maintain current zoning. Therefore, the transit center/park-and-ride facility is not expected to change or intensify surrounding land uses, except at the site itself, where as part of the project, joint-use transit oriented retail/commercial establishments will be developed.

Kalihi and Honolulu Community College (HCC) Transit Stops

The Kalihi Transit Stop will support Dillingham Boulevard commercial establishments and serve area residents. While many of the businesses and residences are on small lots, which limits redevelopment

FIGURE 5.1-3
TRANSIT CENTER/TRANSIT STOP/PARK-AND-RIDE LOCATIONS: PEARL CITY - AIEA - KALIHI

FIGURE 5.1-4
TRANSIT CENTER/TRANSIT STOP LOCATIONS: KALIHI - DOWNTOWN - KAKAAKO

potential if there is no consolidation of small parcels, the commercial areas would likely experience some redevelopment to be compatible with increased pedestrian activities because of the presence of a transit stop.

The HCC Transit Stop is not expected to cause substantial land use changes because the surrounding environment is already built-up. However, it will serve HCC employees and the student population plus employees in the surrounding industrial and commercial area.

<u>Waikiki Branch</u>

One transit center and 16 transit stops are planned for the In-Town BRT, Waikiki Branch (see Table 5.1-4). The facilities' general locations are shown on Figures 5.1-4 and 5.1-5.

Iwilei Transit Center

Since the Iwilei Transit Center (a separate DTS project) will be planned along with a larger HCDCH/DAGS mixed-use senior housing complex. However, due to lack of funding at this time, the mixed-use development is not a committed project.

Chinatown and Union Mall Transit Stops

The In-Town BRT stops in Chinatown and Downtown are not expected to influence major land use changes or intensification because the area is already highly developed. However, the transit stops will provide improved transit service to employees, residents, and visitors in a manner similar to how Hotel Street is currently used as a bus-only facility, with a high degree of pedestrian activity on both sides of the street.

Aloha Tower Transit Stop

The Aloha Tower Transit Stop will be located next to Aloha Tower Marketplace and the Hawaii Maritime Museum. The transit stop will make Aloha Tower Marketplace, Hawaii Maritime Museum and surrounding areas more readily accessible, and therefore, could generate greater business activity. Business conditions will need to improve however, at Aloha Tower Marketplace before additional retail, hotel, passenger cruise ship facilities and entertainment uses are added.

Fort Armstrong, Coral and Kewalo Basin Transit Stops

The Fort Armstrong Transit Stop will be located on Ala Moana Boulevard in proximity to the U.S. Immigration Office and the Kakaako Pumping Station, two properties listed on the National Register of Historic Places. Real estate for the transit stop will not be taken from these properties, nor would the stop affect the view of these properties from Ala Moana Boulevard. The transit stop will support and may encourage future commercial land uses in Kakaako Makai, which are being planned by the Hawaii Community Development Authority.

The Coral Transit Stop will be located next to the Makai Gateway and the Kakaako Waterfront Parks, which feature cultural and recreational facilities. It will also be in proximity to the proposed biotech facilities and University of Hawaii School of Medicine. The stop will not change existing and planned land uses, but it could encourage growth of commercial activities on the mauka side of Ilalo Street.

The Kewalo Basin Transit Stop will be located near a restaurant and maritime fishing operations. A complex of shops, restaurants, and entertainment facilities are planned for Kewalo Basin, with or without the In-Town

BRT. However, this transit stop will provide convenient access to these activities, as well as the Children's Discovery Center and nearby marine research facilities.

Kamakee Transit Stop and Ala Moana Park Transit Stop

The Kamakee Transit Stop is within Victoria Ward Centers, a major commercial district that includes movie theaters, restaurants, and small to large retail establishments. The new owner/developer is planning to continue enlarging this already successful commercial district. Therefore, land use intensification in the Kamakee Stop vicinity would occur with or without the In-Town BRT.

The stop at Ala Moana Regional Park is surrounded by a major recreational resource on one side and a major commercial shopping center on the other. Therefore, this stop will not lead to any changes in land uses in the general vicinity.

Hobron, Ft. DeRussy, Saratoga, Kalakaua/Seaside, Kalakaua/Uluniu, Kapahulu, Kuhio/Liliuokalani and Kuhio/Seaside Transit Stops

With few exceptions, the transit stops in Waikiki will not substantially influence land use changes. However, they will support pedestrian-oriented business activities along Ala Moana Boulevard, and Kalakaua and Kuhio Avenues.

Two areas in Waikiki are anticipated to undergo substantial redevelopment: the vacant or low-rise apartment buildings surrounding Hobron Lane and Lipeepee Street, and the blocks bound by Lewers Street, Kalakaua Avenue, Saratoga Road, and Kalia Road.

The Hobron/Lipeepee area is zoned Apartment, although the current PUC Development Plan Land Use Map designates this area for Resort Mixed Use. The proposed Hobron Transit Stop could encourage a zone change that allows hotel and commercial development and/or mixed uses, but the City Council would have to approve any zoning change and would consider many other factors, including public opinion.

The Outrigger Hotel Corporation, which owns or manages several hotels in the Lewers and Saratoga Road area, has plans for redeveloping these blocks, utilizing incentives such as the zoning regulations mentioned in Section 3.1, and local and State tax exemptions for new construction projects. The proposed Saratoga Stop would probably not induce redevelopment by itself, but would be an asset to the redevelopment.

The transit stops at Kalakaua/Seaside Avenues and at Kalakaua/Uluniu Avenues could increase business activity at the street level. The transit stops will reinforce the existing pedestrian-oriented uses. Since Kalakaua Avenue is already highly developed, land use intensification is not expected.

The stop on Kapahulu just mauka of Lemon Road would have no impact on land uses since it is adjacent to Kapiolani Park on the Koko Head side and to high-density hotels on the Ewa side.

Since most of the properties in the Kuhio/Liliuokalani Transit Stop vicinity have been developed to the maximum allowed under current zoning regulations, the present land use patterns are expected for the most part to remain unchanged, with or without the In-Town BRT stop. However, properties mauka of Kuhio Avenue have development potential as they have remained vacant since the early 1990s as a result of unfavorable market conditions for new, high-rise condominium projects. The proximity of the transit stop could make the development of these properties more attractive, but the timing of future development would more likely be influenced by market conditions.

A BRT stop could make the area of Kuhio/Seaside Avenues more attractive for high-rise residential development, especially since the In-Town BRT will help reduce noise levels from diesel buses and otherwise improve the ambience of Kuhio Avenue. However, like other areas in Waikiki, the BRT stop would not result in a sufficient increase in pedestrian activity at the street level to produce an intensification of land uses on its own.

UH-Manoa Branch

One transit center and nine transit stops are planned for the In-Town BRT, UH-Manoa Branch (see Table 5.1-4). The facilities' general locations are shown on Figures 5.1-4 and 5.1-5.

Iolani Palace Transit Stop and Alapai Transit Center

The Iolani Palace Transit Stop will be located in the Historic Precinct of the Hawaii Capital Special District. It will be designed as a low key facility so as not to detract from the historically important buildings, grounds and circulation patterns in the Precinct. Because the transit stop is located in an important historic district, land use changes would not be expected.

The Alapai Transit Center, located on the mauka side of the Cooke and South King Streets intersection, would remain operational under the No-Build and TSM Alternatives. Under the Refined LPA, the facility's basic function will remain the same. Since the land uses surrounding the transit center include the Capitol District and a relatively built-up urban environment, which includes the main police station, substantial land use changes surrounding the transit center are not expected under the Refined LPA, unless the transit center itself is redeveloped for mixed-use transit/commercial uses.

Thomas Square/NBC, King/Pensacola, Pensacola/Kapiolani, and Ala Moana/Keeaumoku Transit Stops

The areas surrounding the proposed Thomas Square/NBC and King/Pensacola Transit Stops are established with the Honolulu Academy of Arts, Thomas Square, Blaisdell Concert Hall, Hawaiian Electric Company (HECO), Straub Clinic and Hospital, Honolulu Club, Kaiser Honolulu Clinic, and McKinley High School. Since One Archer Lane was developed, parcels for redevelopment are limited. Parcels near South King and Pensacola Streets are relatively small, and without consolidation, redevelopment opportunities in this area would be limited. Therefore, a transit stop will not likely influence land use changes at these locations.

In contrast, the Pensacola/Kapiolani and Ala Moana/Keeaumoku Transit Stops will help foster the intensification of commercial and residential land uses because there are several large vacant parcels that provide excellent development opportunities. The City is also encouraging in-fill development of other vacant and underutilized parcels along Kapiolani Boulevard.

Convention Center Transit Stop

With or without a transit stop, the recently constructed Hawaii Convention Center is expected to encourage redevelopment of the adjacent areas, except the low and medium density residences in the Keheka and McCully/Moiliili neighborhoods. Commercial land uses along Kapiolani Boulevard, Atkinson Drive, and Kalakaua Avenue have the potential to intensify because of the transit stop and the convention center.

Isenberg Transit Stop

The area surrounding the proposed transit stop that will be at the corner of Isenberg Street and Kapiolani Boulevard consists primarily of single-family and multifamily residences in relatively small lots on the mauka side of Kapiolani Boulevard, and high-density apartment buildings on the makai side. Although zoning on the mauka side allows for higher density housing, without consolidating the small residential parcels, major redevelopment of the area is not expected with or without the transit stop. The makai side is already built-up, and is not likely to change as a result of the transit stop.

FIGURE 5.1-5
TRANSIT CENTER/TRANSIT STOP LOCATIONS: KALIHI - UH-MANOA - WAIKIKI

University/King and UH-Manoa Transit Stops

Small scale commercial activities surround the proposed transit stop at University Avenue and King Street. It is anticipated that the transit stop would result in increased pedestrian activity and this would in turn result in intensified commercial activity. In addition, the updated draft PUC Development Plan is encouraging higher density residences in the general vicinity of the stop through the conversion and consolidation of smaller lots.

The UH-Manoa (Sinclair Circle) Transit Stop is located within the University of Hawaii campus, adjacent to the Bachman Hall lawn and Sinclair Library. The University is planning to retain the distinct open space and the gateway/entrance to the University, and is, therefore, not planning major land use changes in the area of the stop. However, a small parking structure is planned near Sinclair Circle. Residences, primarily single-family homes on small parcels, near the University would not likely be affected by the transit stop. Although the stop will support the University through improved transit services, it is not expected to influence land use changes.

Kakaako Mauka Branch

Four transit stops are planned for the Kakaako Mauka Branch of the In-Town BRT (see Table 5.1-4). The general locations of these stops are shown in Figure 5.1-5.

Bishop and Alakea Transit Stops

The Bishop and Alakea Transit Stops will be located in the heart of Honolulu's downtown and financial district. Similar to the other stops in Chinatown and Downtown, it is not expected that these stops would influence major land use changes or intensification because the area is already highly developed. However, the transit stops will provide improved transit service to employees, residents, and visitors.

Halekauwila and Cooke Street Transit Stops

The Halekauwila Transit Stop will be adjacent to the State and Federal offices on Punchbowl Street, and along with the Cooke Street Stop, is located in the Kakaako Community Development District. The Kakaako development district provides substantial opportunities for transit-oriented land uses because HCDA is constructing the roadway and utility infrastructure and large land parcels are becoming available for development. HCDA is also encouraging a mix of residential and commercial uses, which is consistent with the transit- and pedestrian-oriented objectives of the project.

5.1.5 Construction Employment Impacts

Substantial economic impacts would result from the Refined LPA compared to the No-Build Alternative. These impacts may be measured by increases in State output/economic activity, employment, and job earnings.

Construction expenditures would occur over the period of construction, directly creating new demand for construction materials and jobs. These direct impacts would lead to indirect or secondary economic impacts, as output from other industries increases to supply the construction industry. The direct and indirect impacts of construction expenditures cause firms in all industries to employ more workers, leading to induced impacts as the additional wages and salaries paid to workers lead to higher consumer spending, creating new demand in many other economic sectors.

1) Methods and Assumptions

Terminology

To analyze the economic impacts of the alternatives, the economic consequences of an increase in the demand for construction goods and services were modeled. Economists use input-output (I-O) models to analyze how changes in a specific industry affect other industries and households.

The following terms help to characterize this process.

- **Direct Impacts** — the increase in demand within the State economy for construction materials and services from the project; usually measured as construction expenditures, but can also be expressed as the number of new construction jobs or job earnings.
- **Indirect Impacts** — the sum of all transactions that filter through the State economy because of the direct purchase of material and labor by the project's construction activity.
- **Induced Impacts** — the increase in household consumption within the State economy from workers who receive additional earnings through the direct or indirect impacts of construction.
- **Total Impacts** — the sum of the direct, indirect and induced economic impacts as measured by the overall increase in output, employment, and/or earnings within the State economy; also referred to as the total multiplied impacts, where the multiplier is the ratio of total to direct impacts.
- **Gross Impacts** —the economic effects of total project expenditures prior to assessing the proportion of economic impacts that would have still occurred in the absence of the project being constructed.
- **Net Impacts** —just the economic effects attributable to funds that are available only because of the project; these being funds that might otherwise not enter the local economy. For purposes of examining economic impacts on the State, only the federal grant funds that would be applied to project construction are assumed to be money that would not be spent within the State in the absence of the project. Economists emphasize the net impacts as more accurate measures of the true increases in output, employment, and earnings associated with a project.

Figure 5.1-6 illustrates the typical spending multipliers arising from the construction activity that would be associated with a transportation investment in the primary transportation corridor, and the associated flow of funds through the State economy.

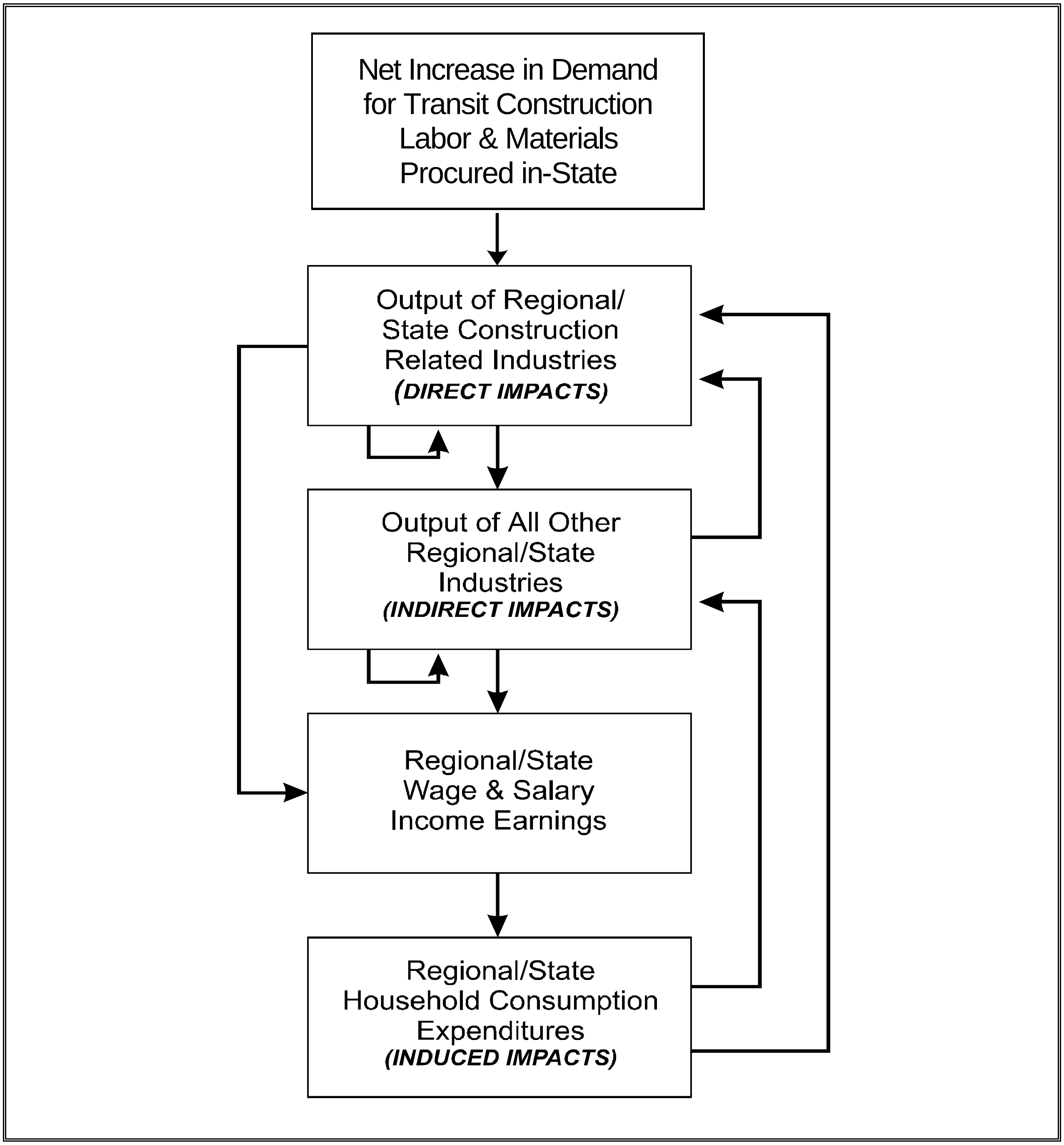
For this analysis, the Hawaii Input-Output Study 1997 Benchmark Report (March 2002) provides demand multipliers for output, earnings, and employment, by industry/economic sector, from the State Input-Output model. The Benchmark Report is the seventh in a series of input-output (I-O) studies of Hawaii's economy prepared over the past 35 years by the Department of Business, Economic Development & Tourism (DBEDT).

These multipliers apply to the State. For this project, Oahu represents the majority of the State's market for construction activities, and given the magnitude of the project, expenditures would have wider-ranging economic impacts. Therefore, given the economic dominance of Oahu to the rest of the State and the geographic isolation of the State from the rest of the U.S. economy, it is appropriate to consider statewide economic impacts.

Application of State of Hawaii Input-Output Multipliers

Three classes of State of Hawaii I-O final demand multipliers are utilized to estimate the gross and net impacts:

FIGURE 5.1-6
CONSTRUCTION SPENDING MULTIPLIER REACTIONS



Source: Parsons Brinckerhoff, Inc. July 2000.

- ***Final Demand Output Multipliers*** translate the initial project capital expenditures (demand) for construction outputs to the total multiplied effect on the demand for output of all firms/industries (in dollars) within the State economy;
- ***Final Demand Earnings Multipliers*** translate the same direct project expenditures into the total multiplied effect on wage and salary earnings within the State economy; and
- ***Final Demand Employment Multipliers*** convert project expenditures into the total multiplied effect on employment within the State economy, expressed in person-year jobs.

An estimate for the construction-related direct employment can be backed into by dividing a fourth class of multiplier, the ***Direct Effect Employment Multipliers,*** into the total employment estimates derived from the final demand employment multipliers when the capital cost estimates do not include detailed labor requirements. Similar ***Direct Effect Earnings Multipliers*** and resultant direct wage and salary earnings estimates can also be derived.

As shown in Table 5.1-5, capital costs are divided into three categories: general construction (including engineering/design services), components from outside of Hawaii (including vehicles and pre-manufactured elements), and land acquisition. The majority of the capital costs fall under the first category, general construction, which is assumed to be completely procured within the regional economy. The construction services industry I-O multipliers for the State are then applied to this portion of the total capital costs. Buses and other transit vehicles are assumed to be procured from outside the State.

TABLE 5.1-5
CAPITAL COSTS BY CATEGORIES (2002 $ × 1,000)

Alternative	Expenditure/Multiplier Categories			
	General Construction	Components from Outside of Hawaii	Land	Total
No-Build	$36,500	$367,900	--	$404,400
TSM	$93,100	$435,700	$12,000	$540,800
Refined LPA	$488,000	$543,800	$6,400	$1,038,200

Source: Parsons Brinckerhoff, Inc., October 2002.

Table 5.1-6 presents final demand multipliers and the direct effect multipliers for the State as contained in the DBEDT Input-Output Study.

Gross total economic impacts are calculated by multiplying the expenditure in millions of dollars in the General Construction category in Table 5.1-5 by the appropriate final demand multiplier in Table 5.1-6. Using the Refined LPA as an example, the expenditure of $488 million in the general construction category multiplied by the final demand employment multiplier of 19.3 yields a gross total employment impact on all industries within the regional economy of approximately 9,420 person-year jobs.

1. ($488M × 19.3) = 9,418 person-year jobs

However, some of these jobs would have occurred without the investment in the primary transportation corridor. A more realistic measure of net impacts on employment can be assessed by multiplying the gross total employment impact by the percentage of general construction expenditures representing the in-flow of federal discretionary grant money to the State. This gives approximately 2,800 person-year jobs, which represents the increase in statewide employment attributable to federal Section 5309 New Starts money used to fund the project.

TABLE 5.1-6
STATEWIDE ECONOMIC IMPACT MULTIPLIERS

		FINAL DEMAND MULTIPLIERS			DIRECT EFFECT MULTIPLIERS	
Expenditure Category	**Hawaii I-O Industry #**	**Output (dollars)**	**Earnings (dollars)**	**Employment (jobs)**	**Earnings (dollars)**	**Employment (jobs)**
Construction	#23, Road Construction	2.12	0.68	19.3	1.92	2.52

Source: Hawaii Input-Output Study 1997 Benchmark Report, Department of Business, Economic Development and Tourism (March 2002).

2. ($488M × 19.3 × 29.6% (which represents the percentage of federal New Starts funds vs. local and other federal funds expected to be contributed to the construction portions of the Refined LPA)) = 2,787 person-year jobs.

Gross direct construction employment within the State can be derived by dividing the direct effect employment multiplier from Table 5.1-6 into the gross total employment attributable to the construction expenditures from Table 5.1-7, or approximately 3,740 person-year jobs in project engineering and construction.

3. (9,418 ÷ 2.52) = 3,737 person-year jobs

Similarly, gross direct employment earnings for these 3,740 person-year jobs over the construction period would total approximately $173 million in 2002 dollars.

4. ($331.8M ÷ 1.92) = $172.8 in 2002 dollars.

2) Construction Economic Impacts Summary

The gross and net total impacts on the State economy resulting from construction activities are exhibited in Tables 5.1-7 and 5.1-8. Table 5.1-7 presents the gross total economic impacts for the entire State.

TABLE 5.1-7
TOTAL ECONOMIC IMPACTS OF PROJECT

		Total Statewide Impacts			Direct Construction Impacts	
Alternative	**(A) Gross Direct Expenditure for Construction ($2002 Million)**	**(B) Output ($ Million)**	**(C) Earnings ($ Million)**	**(D) Employment (Jobs)**	**(E) Earnings ($ Million)**	**(F) Employment (Jobs)**
		=(A) x 2.12	**=(A) x 0.68**	**=(A) x 19.3**	**=(C) ¸ 1.92**	**=(D) ¸ 2.52**
No-Build	36.5	77.4	24.8	704	12.9	279
TSM	93.1	197.4	63.3	1,797	33.0	713
Refined LPA	488.0	1,034.6	331.8	9,418	172.8	3,737

Source: Parsons Brinckerhoff, Inc., using DBEDT multipliers from I-O model, October 2002.

TABLE 5.1-8
ECONOMIC IMPACTS OF FEDERAL DISCRETIONARY FUNDS

Alternative	(A) FTA Section 5309 New Starts Funds Expected ($2002 Million)	Total Statewide Impacts			Direct Construction Impacts	
		(B) Output ($ Million)	(C) Earnings ($ Million)	(D) Employment (Jobs)	(E) Earnings ($ Millions)	(F) Employment (Jobs)
		=(A) x 2.12	=(A) x 0.68	=(A) x 19.3	=(C) ¸ 1.92	=(D) ¸ 2.52
No-Build	0.0	0.0	0.0	0.0	0.0	0.0
TSM	0.0	0.0	0.0	0.0	0.0	0.0
Refined LPA	144.4	306.1	98.2	2,787	51.1	1,106

Source: Parsons Brinckerhoff, Inc., using DBEDT multipliers from I-O model, October 2002.

Using the Refined LPA as an example, new demand for construction would generate gross direct impacts equal to the capital cost of $488 million in 2002 dollars. Adding in the indirect and induced impacts on the output of other industries in the State, the gross multiplied impact on output would be about $1 billion over the construction period. Of this amount, $331.8 million would be paid to workers as wage and salary earnings for the 9,418 person-year jobs generated.

Table 5.1-8 presents the net total economic impacts within the State attributable to FTA Section 5309 New Starts money used to help fund the project. Demand for construction expenditures would range from no New Starts construction money for the No-Build and TSM Alternatives to $144.4 million for the Refined LPA (2002 dollars), reflecting the money generated by New Starts grants used for construction of portions of the project. Adding in indirect and induced impacts on the output of other Hawaii industries, the net multiplied impact on output would range from no construction money for the No-Build and TSM Alternatives to $306.1 million for the Refined LPA over the construction period. These numbers correspond to no new jobs created for the No-Build and TSM Alternatives to 2,787 person-years of new jobs created by the Refined LPA.

While gross total economic impacts are useful for examining the overall magnitude of the project, the net economic impacts from federal discretionary (grant) funds represent more generally accepted and appropriate estimates of the true economic impacts that would arise solely from project construction. This is because local funds invested in the project and federal formula funds which would flow to the State anyway would likely be spent in some other manner within the local economy — with similar multiplied impacts — in the absence of investment in the primary transportation corridor.

Economic Impacts Resulting From The Refined LPA

The Refined LPA will create additional transit jobs. There would be approximately 1,540 jobs as compared to 1,181 jobs today. This is an increase of approximately 360 jobs or 30 percent. This reflects new bus drivers and mechanics. There will be additional administration and management jobs. These numbers were derived using the same ratio of jobs per revenue vehicle hour as with the existing fleet.

Economic Impacts to Private Bus Operators

The BRT routings, stop locations and other features are designed to serve trips by Oahu residents going to-and-from home, work, school, shopping and other purposes. It is not designed to serve the tourist market as are the private bus operations in Honolulu. Unlike private sector buses, taxis and vans, the BRT will not pick-up passengers at their hotels, transfer them to-and-from the airport, take them directly to a desired tourist destination non-stop, or accommodate luggage unless the luggage can fit on the passenger's lap.

Although it is not ideally suited for tourists, some may choose to use the BRT since it serves some activity centers that attract tourists. However, the BRT goes to these places because most of these are also major employment sites or sites where local residents go to as well. According to islandwide data compiled by the OMPO and a recent on-board survey conducted in Waikiki, visitor's account for approximately five to ten percent of total daily boardings systemwide and 20-25 percent of boardings in Waikiki. The tourists expected to use the public transit system with the BRT is forecast to be no greater proportionally than today.

When applied to the forecasted daily boardings associated with the Waikiki portion of the In-Town BRT, the total number of visitor trips is equal to approximately 7.7 percent (6,400) of all daily In-Town BRT boardings (83,200). It is not expected that tour bus and trolley operators will be adversely affected due to the relatively low number of tourists that are expected to choose BRT for their travel needs. The more important determiners of economic impact on tour bus operators will be intra-industry competition and the overall health of the tourism market as expressed in visitor arrivals.

The Kaimuki-Kapahulu-Waikiki Trolley is a result of the community visioning team's effort to increase the vitality of the area. The trolley began operation on August 1, 2000. The trolley operates seven days a week from early in the morning to 11:00 p.m. on thirty-minute headways. There are 25 stops along the trolley route, which would connect to the future BRT in Waikiki. The trolley is averaging over 120 riders per day. The City contracts with a private bus operator for this service, which has provided the private operator the opportunity for economic benefit. Other opportunities to contract with private passenger carriers will exist on the Refined LPA circulator routes.

5.2 DISPLACEMENTS AND RELOCATIONS

This section discusses potential displacements of existing land uses associated with the No-Build Alternative, TSM Alternative, and the Refined LPA. Displacements would occur in the following cases:

- at certain proposed transit stops, transit centers, TPSS, and maintenance facilities where right-of-way for the transit feature could not be accommodated within the existing government owned right-of-way; and
- along proposed transit alignments where the existing roadway right-of-way would not be adequate for proposed project elements (e.g. widening of Kapiolani Boulevard at Kalakaua Avenue).

The analysis of displacement impacts is based on preliminary engineering plans as of November 2002, from which a list of potentially affected tax map keys (TMKs) was compiled. In the case of occupied TMKs, existing businesses, residences or institutions were specifically identified. The business names reflect tenants occupying those locations in early 2002. The number of employees at potentially affected businesses was estimated using the Hawaii Business Directory (1997, 1998, and 1999 versions) and by field checking locations as necessary between December 2001 and January 2002. Follow-up field checks were also conducted in September 2002.

Where an alternative would require additional right-of-way, the associated property acquisitions could result in total or partial displacement of existing land uses. For this initial analysis, a "total displacement" was defined as cases where enough of a property would be lost as to make the existing land use on that property no longer viable. A property was defined as a tax map key (TMK) parcel. For example, if a parcel were to lose a large portion of an occupied building, be segmented, and/or lose access to the street system, it was deemed a total displacement. A "partial displacement" determination was applied to cases where some land and/or building portion may be lost, but it was deemed that the continuation of the existing land use would be economically viable, based on information currently available. The "partial displacement" determination was also extended to circumstances where private parking may be affected, and includes impacts as minimal as the loss of marginal landscaping.

The TSM Alternative and the Refined LPA would be constructed within or adjacent to existing roadways as much as possible, in part to minimize costs and also to minimize business, residential and institutional displacements. Section 5.2.2 details business displacements under the TSM Alternative and the Refined LPA.

In summary, none of the alternatives would require any total displacements. The No-Build and TSM Alternatives would result in a partial displacement of agricultural land used by one farm. Under the Refined LPA, 23 properties would experience minor losses of land area, including the impact to the farm.

5.2.1 Residential Impacts

None of the project alternatives will require the total displacement of any residence. However, one property will be affected under the Refined LPA. Kapalama Makai, an apartment complex on the corner of Dillingham Boulevard and McNeill Street (1514 Dillingham Boulevard), will require a modification of its driveway, and would lose one or two parking spaces.

5.2.2 Business and Institutional Impacts

1) Total Displacements

None of the alternatives would require the total displacement of any business or institution.

2) Partial Displacements

The No-Build Alternative, TSM Alternative, and the Refined LPA assume the construction of a park-and-ride facility along the future North-South Road. The North-South Road Park-and-Ride would remove about two to four acres of active agricultural land; however, the farm would remain viable (See Table 5.2-1). There would be no other partial displacements for the No-Build or TSM Alternatives.

TABLE 5.2-1
PARTIAL DISPLACEMENTS WITH IMPACTS TO AGRICULTURE

TMK	Business or Institution	Industry or Use	Impact on Business or Institution	Project Element
9-1-018:005	Farm	Agriculture	Loss of approximately 2-4 acres of agriculture land	North-South Road Park and Ride Site

Source: R.M. Towill and Parsons Brinckerhoff, Inc., April 2002 and September 2002.

The In-Town BRT element of the Refined LPA will require additional right-of-way at certain locations along its alignment where roadway right-of-way is inadequate for the system, and for traction power supply stations (TPSS). Although these right-of-way requirements will not require any business or institutional relocations, 29 businesses or institutions will be affected by losses of land area, which may affect their driveway access, parking and/or landscaping. These impacts are described on Tables 5.2-2 and 5.2-3.

Eighteen businesses and institutions will be affected by partial displacements along Dillingham Boulevard, the alignment of the In-Town BRT Kalihi Branch. As stated on Table 5.2-2 and Table 5.2-3, they will generally be affected by modifications to their driveways (i.e., cut due to Dillingham Boulevard widening), and displacements of parking and/or landscaping.

The Kakaako, University and Waikiki Branches will require very little right-of-way from adjacent parcels, and the impacts would be displacements of relatively small amounts of landscaping. Lane widening for the University Branch on Pensacola Street will result in the displacement of some landscaping fronting McKinley

High School. The Waikiki Branch will require the widening of Kalia Road, which will result in the displacement of the Fort DeRussy landscaped area next to the road. No buildings would be affected, however.

TABLE 5.2-2
REFINED LPA PARTIAL DISPLACEMENTS WITH DRIVEWAY OR PARKING IMPACTS

TMK	Business or Institution	Industry or Use	Impact on Business or Institution	Project Element
1-2-013: 002	Oahu Community Correctional Center (OCCC)	Corrections Facility	Displacement of landscaping	Kalihi Branch
1-5-017:004	Honolulu Community College	School	Displacement of landscape/grassy area, and relocation of parking entrance	Kalihi Branch
1-5-028:019	City Bank	Bank	Displacement of 1 parking stall and landscaping	Kalihi Branch
1-5-028:022	Checker Auto Parts	Auto Parts Retailer	Displacement of 3 parking stalls and landscaping.	Kalihi Branch
1-5-029:050	Dillingham Shopping Plaza (two businesses potentially affected)	Shopping center	Displacement of landscaping and up to 8 shared parking stalls shared by two businesses, Sizzler's Restaurant and Hawaii National Bank	Kalihi Branch
2-6-005: 001	Fort DeRussy	Army military base and recreational facility	Displacement of landscaping	Waikiki Branches

Source: SSFM and Parsons Brinckerhoff, Inc., April 2000 and September 2002.

TABLE 5.2-3
REFINED LPA PARTIAL DISPLACEMENTS WITH IMPACTS TO LANDSCAPING

TMK	Business or Institution	Industry or Use	Impact on Business or Institution	Project Element
1-2-016:029	Love's Bakery	Bakery	Loss of landscaping	Middle St. maintenance facility
1-2-003:020	Building Industry Association of Hawaii	Trade Organization	Displacement of landscaping, and modification of sidewalk	Kalihi Branch
1-2-003:106	Island Recycling	Recycling Ctr.	Modification of driveway and displacement of parking	Kalihi Branch
1-2-009:011	Blood Bank of Hawaii	Blood Bank	Displacement of landscaping and modification of sidewalk	Kalihi Branch
1-5-015:010	Bank of Hawaii	Administrative Offices	Displacement of landscape/grassy area	Kalihi Branch
1-5-020:003	H&R Block	Tax Services	Displacement of landscape/grassy area	Kalihi Branch
1-5-020:003	Spot's Inn Plate Lunch	Restaurant	Displacement of landscape/grassy area	Kalihi Branch
1-5-020:007	Kapalama Shopping Ctr.	Shopping Plaza	Displacement of a small amount of landscaping	Kalihi Branch
1-5-020:007	Hilti	Construction Equipment Retailer	Displacement of a small amount of landscaping	Kalihi Branch
1-5-022:001	New Hope	Church	Displacement of a small amount of landscaping	Kalihi Branch
1-5-025:002	Kalihi Kai Elementary School	School	Displacement of landscaping and a large tree	Kalihi Branch
1-5-029:049	Tesoro	Gas Station	Displacement of landscaping	Kalihi Branch
1-5-029:049	Popeye's	Restaurant	Displacement of landscaping	Kalihi Branch
1-5-029:049	Burger King	Restaurant	Displacement of landscaping, and modification of sidewalk	Kalihi Branch
2-1-027:002	Federal Building	Office Building	Displacement of landscaping	Kakaako Mauka Branch
2-3-009:010	McKinley High School	High School	Displacement of landscaping/grassy area	University Branch

Source: SSFM and Parsons Brinckerhoff, Inc., May 2002 and September 2002.

If embedded plate technology is used, the In-Town BRT will require approximately 15 traction power supply stations (TPSS). Most of the TPSS could be incorporated into existing or future buildings, or could be placed in areas that are not considered to have aesthetic value, such as parking lots. Potential TPSS locations are designated on the preliminary engineering drawings provided in Appendix B (see Volume 4). However, since it would be 8 to 14 years before the EPT is installed depending on the segment, the locations shown on the design drawings are not site specific; each notation is intended only to indicate the general vicinity in which a TPSS would be placed. Site specific environmental assessments of each TPSS would be prepared prior to proceeding with implementation of EPT. Locations and design treatments would be established with community input.

5.2.3 Real Property Acquisition Program

Since federal funds would be used to assist project construction, the project would be subject to provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (49 CFR Part 24, 42 U.S.C. 4601, et seq.). State law on relocations is provided in Hawaii Revised Statutes (HRS) Chapter 111, Assistance to Displaced Persons.

Fair market compensation for land, buildings and uses would be provided to property owners directly affected by right-of-way requirements. For properties that would experience partial displacement but not relocation, mitigation would be provided at project cost, such as reconstruction of building façades and replacement of lost parking stalls. In addition, moving and other expenses would be reimbursed, as described below. The costs of the relocation assistance are included in the project's cost estimates, as described in Chapter 2.

5.3 NEIGHBORHOODS, COMMUNITY FACILITIES, AND ENVIRONMENTAL JUSTICE

5.3.1 General Impacts

This section discusses potential impacts to neighborhoods and community character during operation of the proposed alternatives.

None of the alternatives would adversely affect community or neighborhood character or facilities since the proposed transit improvements (changes in bus service) would operate over existing streets with minimal new construction. Although the P.M. zipper lane on the H-1 Freeway and expansion of the Kalihi/Palama (Middle Street) bus maintenance facility are elements of the Refined LPA, neither action would change the existing industrial and mixed business use character of the Airport, Mapunapuna, or Kalihi neighborhoods. Neighborhood character and cohesion in these areas would not be adversely affected.

With the Refined LPA, establishment of an In-Town transit spine and transit stops would enhance community cohesion at new stop locations, especially where redevelopment potential exists, such as the Iwilei and Kakaako areas of the corridor. Transit stops and transit centers would provide a focal point of activity in areas where, at present, there is little foot traffic and people activity.

1) Fire and Rescue Services/Police/Emergency Medical Services

Increases in traffic volumes and worsening congestion in the primary transportation corridor would continue under the No-Build and TSM Alternatives. Emergency response times would worsen, and access to services and facilities would become increasingly congested and dangerous, especially during peak hours. With the Refined LPA, response times for emergency vehicles would improve because they would be able to use the transit priority lanes of the Regional and In-Town BRT systems to bypass roadway congestion when in route to an emergency.

2) Schools

No adverse effects on school facilities from the No-Build and TSM Alternatives and Refined LPA are expected. Rather, access to schools in the corridor would be improved through enhanced transit service. For example, the Refined LPA would provide a BRT line from the Middle Street Transit Center to the University of Hawaii-Manoa campus. Construction would not interfere with campus facilities, and the Refined LPA would enhance access to the UH-Manoa campus. Other schools that would benefit under the Refined LPA are Honolulu Community College, McKinley High School, and Lunalilo and Jefferson Elementary Schools.

3) Parks and Recreation Areas

The No-Build and TSM Alternatives and Refined LPA would not adversely affect parks and recreation areas. With the Refined LPA, access would be improved to Thomas Square, Ala Moana Regional, Ala Wai, Makai Gateway, Kakaako Waterfront, Kuhio Beach and Kapiolani Parks. Impacts on parklands are discussed in more detail in Section 5.11.

4) Traffic and Parking

Traffic and parking impacts are discussed in Chapter 4. Overall, traffic volumes and congestion would increase the most with the No-Build Alternative. Transit stops, transit centers, and park-and-ride lots would generate localized increases in auto traffic during rush hours. The most noticeable effects would occur in areas where there is already substantial vehicle activity and in areas where small increases in existing low or low-to-moderate traffic levels may be perceptible. Construction of the Refined LPA in the street rights-of-way of the Ala Moana/Kakaako neighborhood on Pensacola Street and Ala Moana Boulevard, and of Moiliili on Kapiolani Boulevard and University Avenue, would result in loss of some on-street parking spaces. The net effect is that the people carrying ability of these streets would be increased under the Refined LPA.

5.3.2 Barriers to Social Interaction

None of the alternatives would create visual and psychological barriers within neighborhood boundaries. The In-Town BRT stops would be at-grade where social interaction can continue to take place.

5.3.3 Mitigation Measures

Sensitive design of the new stops and transit centers can help the new facilities blend with and enhance the existing environment. Use of appropriate design character, construction materials and landscaping would help lessen the visual intrusion of a new facility in or adjacent to a neighborhood. Other mitigating design features include installation of new pedestrian paths and bikeways or enhancement of such existing facilities.

5.3.4 System Safety and Security

System safety and security planning would be part of the overall system design for the Refined LPA. Primary concern would be for the safety of passengers and transit personnel, as well as pedestrians, motorists, and others that could be affected by the project. The design would provide a safe environment that would minimize the possibility of injury to anyone, or damage to transit system facilities and equipment.

The system design under the Refined LPA would aim to be such that no single equipment failure or human error could result in serious injury. An operating plan including a hazard analysis and risk assessment would be developed. This plan would include general approaches to failure management, including modes of operation under abnormal conditions. A separate maintenance plan would also prescribe preventive and corrective maintenance procedures. This plan would address equipment reliability, routine maintenance procedures and schedules, and safety assurance procedures for vehicles used in revenue service.

System security would be provided to protect the public and the transit system from crime and vandalism in the Refined LPA. The security system may include a combination of the following: transit system workers, special transit police, and local police. A comprehensive System Security Plan would be prepared during the final design phase to address passenger security, employee security, revenue security, vandalism, theft, crowd control, power/mechanical failures, fires, accidents, and other incidents.

Safety concerns have been taken into account in the locating and concept design of the median transit stops for the In-Town BRT element. Measures including bollards at the ends of the platforms and safety railings along the backside of the platforms on the transit medians would provide passengers a safe waiting environment. Further, median transit stops would be located at street intersections so that riders would be using crosswalks to get safely to and from the boarding area.

5.3.5 Environmental Justice (Executive Order 12898)

Presidential Executive Order (EO) 12898, signed on February 11, 1994, is called the Executive Order on Environmental Justice. It requires federal agencies to take appropriate and necessary steps to identify and avoid disproportionately high and adverse effects of federally assisted projects on minority and low-income populations' health or environment. Minority is defined as (OST Docket No. OST-95-1411):

- Black Americans, which includes persons having origins in any of the black racial groups of Africa;
- Hispanic Americans, which include persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race;
- Asian Americans, which include persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands; and
- American Indians and Alaskan Natives, which include persons having origins in any of the original people of North America and who maintain cultural identification through tribal affiliation or community recognition.

Low-income means a household income at or below the U.S. Department of Health and Human Services poverty guidelines, which, for 2002 in Hawaii, was an income at or below $20,820 per year for a family of four.

Figure 3.3-1 identifies the major neighborhoods in the study area. As described in Chapter 2, the proposed project would be implemented from Kapolei on the west end, to Manoa and Waikiki on the east end. However, the level of adverse impact and benefit on any particular neighborhood would depend on which elements of the project would be located within that neighborhood. As described in Section 3.3-1, minorities, as defined above, actually comprise the "majority" of the Oahu population. As indicated on Table 3.3-2, only Airport/Hickam/Pearl Harbor had a non-minority population of greater than 50 percent. Therefore, it is difficult to assess compliance with EO 12898 using only the minority criterion, or else almost every neighborhood in the study area, regardless of their socio-economic status, would be afforded protection under EO 12898, which is clearly not the intent of the executive order. However, by considering other factors, such as income, poverty and housing status (see Tables 3.3-4 and 3.3-5), the socio-economic differences between neighborhoods becomes apparent. In addition, it was necessary to analyze the socio-economic conditions of areas smaller than neighborhood units because the aggregated data on major neighborhoods (shown in Tables 3.3-2 through 3.3-5) could conceal information relevant to the identification of a smaller area within a neighborhood as a concentration of minority and low-income populations. It should be noted that Table 5.3-1 and Figures 5.3-1A through 5.3-1C use 1990 Census income data because as of June 2002, 2000 Census income data was not available.

Table 5.3-1 displays minority and low-income populations by neighborhood or sub-neighborhood in the study area, and Figures 5.3-1A through 5.3-1C show their locations. Race, household income, rental occupancy rates, and poverty levels were considered in identifying these populations. Another important factor considered was whether the neighborhood or sub-neighborhood has a high percentage of families within its total number of households. Neighborhoods with small average household sizes (i.e., small percentage of families), even though they may have relatively lower median household income and high renter-occupancy

TABLE 5.3-1
ENVIRONMENTAL JUSTICE
MINORITY AND LOW-INCOME POPULATIONS IN STUDY AREA
(BY NEIGHBORHOOD OR SUB-NEIGHBORHOOD)

Neighborhood or Sub-Neighborhood	Rationale[1]
Waipahu Town Center (sub) Census Tract (CT) 89.01 5,344 persons	80 percent minority population $33,200 median household income 6 percent family poverty rate 57 percent renter occupancy 90 percent of households are families
Waipahu Industrial Area (sub) Parts of CT 87.03 and 87.02 2,813 persons	77 percent minority population $19,811 median household income 35 percent family poverty rate 94 percent renter occupancy 82 percent of households are families
Waipahu Town (sub) Parts of CT 82, 87.02 and 88 3,850 persons	90 percent minority population $33,636 median household income 18 percent family poverty rate 69 percent renter occupancy 89 percent of households are families
Waipahu Triangle – Lower (sub) Parts of CT 82 and 87.01 3,404 persons	96 percent minority population $45,476 median household income 10 percent family poverty rate 38 percent renter occupancy 87 percent of households are families
Stadium (sub) Parts of CT 74, 75.01 and 76 3,114 persons	83 percent minority population $28,669 median household income 22 percent family poverty rate 60 percent renter occupancy 85 percent of households are families
Kalihi-Palama CT 53 (part), 54, 55, 56 57, 58, 59, 60, 61, 62.01 (part) and 62.02 40,144 persons	91 percent minority population $25,647 median household income 16 percent family poverty rate 71 percent renter occupancy 76 percent of households are families
Chinatown (sub) CT 52 2,480 persons	88 percent minority population $13,202 median household income 17 percent family poverty rate 97 percent renter occupancy 45 percent of households are families
Kaheka (sub) CT 36.01 5,151 persons	75 percent minority population $20,544 median household income 9 percent family poverty rate 69 percent rental occupancy 34 percent of households are families
Lower McCully (sub) 5,856 persons Parts of CT 24.01 and 25	78 percent minority population $24,208 median household income 12 percent family poverty rate 77 percent rental occupancy 49 percent of households are families

Source: Neighborhood Profiles, City and County of Honolulu Planning Department (now Department of Planning and Permitting), and Parsons Brinckerhoff, Inc., 1996
Note: [1] Data is from the year 1990 U.S. Census.
"Other race" was included in minority population.

FIGURE 5.3-1A
LOCATIONS OF MINORITY AND LOW-INCOME POPULATIONS: WAIPAHU – PEARL CITY

FIGURE 5.3-1B
LOCATIONS OF MINORITY AND LOW-INCOME POPULATIONS: AIEA – FORT SHAFTER

FIGURE 5.3-1C
LOCATIONS OF MINORITY AND LOW-INCOME POPULATIONS: KALIHI - UNIVERSITY

rates, were often not considered to be minority and low-income populations. Examples of such areas include residences near a college or university, or urban areas populated by young working adults (i.e., those who are not in their prime earning years) who have chosen an "urban lifestyle." However, some of these types of neighborhoods contained high poverty rates, and were therefore identified as containing minority and low-income populations.

Four sub-neighborhoods in Waipahu, the residential area near Aloha Stadium, Chinatown, Kaheka and Lower McCully were identified as sub-neighborhoods containing minority and low-income populations. The only major neighborhood identified with minority and low-income populations is Kalihi-Palama.

The TSM Alternative and Refined LPA would not cause disproportionately high and adverse health or environmental effects on these minority and low-income populations because:

- although some of the populations would be located near elements of the proposed project, such as the alignment of the In-Town BRT, the project would benefit these populations by improving their transit service;
- the alignments were selected in such a manner as to minimize adverse impact while maximizing travel benefits for minority and low-income residents (Chapter 2 contains a further discussion of the balancing of transportation benefits with environmental impacts leading to the selection of certain arterial streets for the alignment of the In-Town BRT system);
- the alignment goes through dozens of neighborhoods, most of which are not minority or low-income;
- minority and low-income areas are not being isolated by the project;
- the proposed project would not create health risks to minority and low-income populations; and
- project-related impacts to the minority and low income populations would be avoided, minimized or mitigated whenever possible.

In summary, minority and low-income areas would receive the positive benefit of improved access and would not be disproportionately affected by negative impacts.

Most of the minority and low-income populations identified on Table 5.3-1 are not located near construction activities associated with the proposed project and, therefore, would not experience disproportionate adverse health or environmental effects. The P.M. zipper lane would be the only project element near the minority and low-income populations in Waipahu. Similarly, the Stadium residential area would not be affected by the H-1 Freeway ramp at Luapele Drive, P.M. zipper lane and the Aloha Stadium Transit Center, the only project elements near this neighborhood.

Minority and low-income populations identified on Table 5.3-1 that would be directly affected by the project are located in Kalihi-Palama, Chinatown, Kaheka, and Lower McCully (see Figures 5.3-1A through 5.3-1C). The In-Town BRT would traverse the Kalihi-Palama and Chinatown neighborhoods, and be adjacent to the Kaheka and Lower McCully sub-neighborhoods. Because these neighborhoods have high rates of transit usage, moving the In-Town BRT alignment to avoid these neighborhoods would detract from the ability of the project to enhance service to minority and low-income populations. The Refined LPA would substantially improve the level of transit service (amenities, access and quality) provided to the minority and low-income populations in the urban core. The Refined LPA, as well as the TSM Alternative, would also improve transit service for minority and low-income populations outside the urban core, such as those populations in Waipahu, because of the conversion to a hub-and-spoke system and increase in service levels compared to the No-Build Alternative.

The benefit to the identified minority and low-income populations is improved transit service, without the drawback of disproportionate adverse health or environmental impacts. As described in Section 2.2.3, the In-Town BRT system would be constructed by converting general-purpose traffic lanes on city streets, which would eliminate the need for major right-of-way acquisitions.

Participation from residents and business owners serving the minority and low-income populations has been actively solicited throughout project planning (see Appendix A). Workshops, presentations and small group meetings have been held in communities throughout the island, including the five rounds of workshops within the Oahu Trans 2K process, the sub-area Working Groups, and individual meetings with community, environmental, business and civic organizations. Input from these public involvement activities has been influential in planning the proposed project.

Potential health risks to minority and low-income populations are related to traffic safety, adverse air quality and noise impacts, and the release of hazardous materials. However, these risks would not disproportionately affect minority or low-income populations, and potential impacts of these types would be minimal or mitigated, as described elsewhere in this document.

Potential traffic safety hazards could involve transit riders being exposed to In-Town BRT and other vehicles while walking to or waiting at the In-Town BRT median platforms. To mitigate potential traffic hazards, these median In-Town BRT stops would be located at intersections where crosswalks are provided, and the platforms would include bollards and railings for safety (see Section 5.3.4). Air quality impacts would not pose health risks because carbon monoxide (CO) levels throughout the project area would not exceed the National Ambient Air Quality Standards (AAQS), and would be generally the same as the No-Build Alternative (see Section 5.5). The State AAQS would be exceeded at certain intersections under all the alternatives. However, it should be noted that the State AAQS for CO is set at such a stringent level, that it is exceeded at many locations that have even moderate traffic volumes. Also, the air quality analysis is based on the assumption of worst-case meteorological conditions that may only occur once a year or even less.

The proposed project would cause noise impacts to an EJ population near Aloha Stadium, but this impact will be mitigated (see Section 5.6). Other adverse impacts to the minority and low-income populations adjacent to the project include construction impacts, and the removal of some landscaping. Whenever possible, measures to avoid, minimize, or mitigate adverse impacts would be implemented as described in relevant sections of this document.

Another potential adverse impact to minority and low-income populations is the proposed location of the Refined LPA's maintenance facility. The site is in the Kalihi-Palama neighborhood, integrated with the existing bus maintenance facility on Middle Street (see Section 2.2.3). This site was selected because of its proximity to the existing bus maintenance facility, the parcel zoning is industrial, and there are no residences immediately adjacent to the site (the nearest residences are several hundred meters to the east). Therefore, the placement of this facility in Kalihi-Palama does not represent a disproportionately high and adverse effect on minority and low-income populations.

In conclusion, the proposed project would be located at and near some minority and low-income populations. In accordance with EO 12898, federal projects must take appropriate and necessary steps to avoid disproportionately high and adverse effects on these populations. For those minority and low-income populations near elements of the project (in particular the Refined LPA), these populations would benefit from improved transit service without experiencing disproportionate health or environmental impacts. Even the proposed location of the Refined LPA system maintenance facility in Kalihi-Palama is not a disproportionately high and adverse impact, because residents would not be directly affected by such a facility.

5.4 VISUAL AND AESTHETIC RESOURCES

This section identifies the project elements that would result in visual impacts and discusses them in relation to the important visual resources identified in Section 3.4.

Potential visual impacts were determined by assessing the compatibility of the transportation improvements in the context of the existing environment. A key concept in visual quality assessment is the notion of visual compatibility between the alternatives and the existing landscape. "Visual compatibility" is defined as the degree to which the existing visual resources and the proposed transportation improvements can co-exist harmoniously. The degree of visual compatibility is greater when a transportation improvement blends in, *i.e.*, conforms, rather than contrasts, with surrounding visual resources.

5.4.1 Impacts

Regardless of the propulsion technology selected, the In-Town BRT in the Refined LPA will use bus-like vehicles without an overhead catenary system or fixed rails, running at-grade on existing roadways. Therefore, the enhanced operation of buses and the new BRT vehicles will not have a negative impact on visual resources along most of the proposed alignment. Priority treatments for buses will involve minimal physical changes to the vertical view plane, resulting in little or no visual impact on the existing landscape, regardless of land use. The embedded plate technology requires traction power supply stations (TPSS) about every 3,300 feet in sections where the BRT vehicles operate at two-minute headways and 6,600 feet apart in sections where vehicles operate at four-minute headways. A typical TPSS structure is approximately 35 feet by 15 feet by 10 feet high. Locations of the supply stations will be made as unobtrusive as possible. Where it is feasible, supply stations will be located within a proposed transit center, or within other existing or proposed buildings such as parking structures. In the absence of an available appropriate structure, TPSSs will be located in vacant lots or in lots shared with existing structures.

The Refined LPA provides opportunities to enhance the urban form -- not only in the urban core but also wherever transit improvements are proposed. These enhancements to activity centers serve as opportunities for mixed uses and public spaces. As an at-grade system, typically running within existing roadways and streets, it offers an opportunity to improve the visual quality of the streetscape and enhance the pedestrian experience. There will be a greater sense of visual order and unity because of the physical improvements and landscape treatments along the alignment. There will be special paving at crosswalks, street lighting, banners, street furniture, and plantings along the entire corridor, which will reinforce the character of the area and provide a visual sense of place.

In comparison, the TSM Alternative would have minimal visual impact, because transportation elements that would be most visually apparent would be sound barriers and transit centers. The No-Build Alternative would have little or no visual impact.

Some of the In-Town BRT stops would be located in areas with high visual or aesthetic value for several reasons, such as urban landscaping, cultural surroundings, open space, public and institutional establishments and environmental characteristics. Mitigation measures for these impacts are described in Section 5.4.2.

1) No-Build Alternative

The No-Build Alternative would not involve additional construction; therefore, no impacts on visual resources would occur.

2) TSM Alternative

Most proposed improvements are limited to existing roadways such as the H-1 Freeway; therefore, there would be little or no visual change.

3) Refined LPA

Transit centers/transit stops and road widening elements may have some visual impacts. Other structures such as bus ramps would not be visually intrusive to the existing surrounding views.

Transit centers and park-and-ride lots will include passenger shelters, street furniture, light standards, landscaping and in some cases passenger and community oriented retail and public facilities. These elements will be designed to be appropriate in each setting and could, in some cases, enhance the aesthetics of the area. Most transit centers will not be located in visually sensitive areas.

The Kapolei Transit Center and the North-South Road Park-and-Ride will occur in areas that are not yet fully urbanized, but will be increasingly urbanized in the next 5 to 20 years. This transit center and park-and ride lot will feature passenger shelters, street furniture, lighting, landscaping, and canopy trees. These elements could help to enhance the visual order of these areas, without disrupting existing mauka views.

Some transit stops will be located in or near visually sensitive areas. Special Districts have visual resources valued by visitors and residents; therefore, design of the transit system will be handled carefully through these areas. Kapiolani Boulevard will have some median and curbside transit stops. These canopied waiting areas will vary depending on the surrounding neighborhood but in general will look like the typical stops pictured in Figure 2.2-4. The In-Town BRT stops in the Chinatown, Thomas Square/Academy of Arts, and Hawaii Capital Special Districts will be designed so that none of the elements affect views of any important landmarks. The transit stop planned near the Duke Kahanamoku Statue on Kalakaua Avenue, also will not block views of the statue.

At the Working Group (See Section 1.0.) meetings, the participants brainstormed about the elements the BRT transit stops should include. Based on these sessions, the technical staff developed representative concepts for several of the transit stops and other visually important locations. These can be seen in Figures 5.4-1 through 5.4-10.

Other sensitive areas where transit stops are planned include the following, and therefore, transit stops in or near these areas may require special design treatment, which may also involve consultation with organizations that care for these resources:

- Downtown
- Waikiki Special District
- Hawaii Convention Center
- UH-Manoa
- Ala Moana Park
- Kalia Road in Fort DeRussy
- Along Kalakaua Avenue
- Kapiolani Park (including Honolulu Zoo)
- Makai Gateway Park

A new reversible bus ramp will be built to the H-1 Freeway off of Luapele Drive to serve the proposed Aloha Stadium Transit Center. The ramp would be constructed underneath the H-1 Freeway Viaduct in Halawa between existing piers and would partially be a tunnel. It would not create a new visual intrusion on the landscape.

To mitigate the noise impacts of the Aloha Stadium Transit Center on the Puuwai Momi residential complex (see noise impact discussion in Section 5.6), a sound wall will be erected along the existing fence line of the apartment complex on Salt Lake Boulevard at Kamehameha Highway. The wall would be a solid structure roughly 410 feet long and 10 feet high. Figure 5.4-11 is a visual rendering of how the sound wall could look; however, the noise wall will be designed in the next project phase – final design – which would include public input.

FIGURE 5.4-1
IOLANI PALACE (POST OFFICE) TRANSIT STOP CONCEPT

FIGURE 5.4-2
REFINED LPA PEDESTRIAN IMPROVEMENTS IN FRONT OF IOLANI PALACE

FIGURE 5.4-3
IOLANI PALACE (STATE LIBRARY) TRANSIT STOP CONCEPT

FIGURE 5.4-4
ALA MOANA / KEEAUMOKU TRANSIT STOP CONCEPT

FIGURE 5.4-5
ALA MOANA / KEEAUMOKU TRANSIT STOP CONCEPT

FIGURE 5.4-6
UNIVERSITY/KING (PUCK'S ALLEY) TRANSIT STOP CONCEPT.

FIGURE 5.4-7
UH-MANOA (SINCLAIR CIRCLE) TRANSIT STOP CONCEPT

FIGURE **5.4-8**
HOBRON (ILIKAI) TRANSIT STOP CONCEPT

FIGURE 5.4-9
HOBRON (ILIKAI) TRANSIT STOP CONCEPT

FIGURE 5.4-10
KUHIO AVENUE TRANSIT STOP CONCEPT

FIGURE 5.4-11
VISUAL RENDERING OF SOUND WALL AT PUUWAI MOMI APARTMENTS (VIEW FROM SALT LAKE BOULEVARD)

5.4.2 Mitigation

All project elements potentially causing visual impacts will be designed and landscaped to have the least possible negative visual effect. Project elements such as transit centers and transit stops will be designed to visually blend in with their surroundings.

The physical appearance of transit stops located in Special Districts will be determined during final design. Chinatown, the Capitol District, Thomas Square, Kapiolani Boulevard, Waikiki Beach, Kapiolani Park and UH-Manoa are considered potentially sensitive areas for transit stops. Stops will be designed to blend in with their surrounding contexts, based on public input and conformance with appropriate design standards. Effective planning with area businesses, residents, and agencies will result in design features unique to each area. For example, the transit stop at Kalakaua Avenue and Uluniu Avenue, will be designed to blend in with the recent Kuhio Beach improvements by using similar materials and design treatments. This stop will be a discreetly designed stop so as not to obstruct the view of the Duke Kahanamoku Statue and the ocean from the street.

5.5 AIR QUALITY

This section describes the potential air quality impacts of the No-Build and TSM Alternatives and the Refined LPA. Sections 5.5.1 and 5.5.2 provide descriptions of both the regional (i.e., Honolulu-wide) and microscale, or “hotspot,” air quality impacts of the alternatives, respectively. The analytical methods used to predict the impacts described in these sections are accepted by the U.S. Environmental Protection Agency (EPA) and the State of Hawaii Department of Health (HDOH). Section 5.5.3 discusses project conformity with the Statewide Implementation Plan.

The results of the regional analysis indicate that the No-Build Alternative would be expected to worsen regional air quality by approximately 12 percent as a result of more vehicles using the roadway system and increasing congestion. However, this impact would be partially offset by reductions in vehicle emissions per vehicle over time. The Refined LPA would improve regional air quality over the No-Build Alternative by about 21 percent.

At the microscale level, selected intersections representative of the primary transportation corridor were analyzed based on current and future No-Build and TSM Alternatives and the Refined LPA. Under current traffic and worst case meteorological conditions, carbon monoxide (CO) concentrations at most of these intersections are estimated to exceed the State Ambient Air Quality Standards. Under the No-Build Alternative, TSM Alternative, and the Refined LPA, most of the intersections are also predicted to experience higher CO concentrations. In comparing these future scenarios, CO concentrations would be better at some intersections and worse at others. On average, the TSM and Refined LPA Alternatives would not worsen air quality conditions compared to the No-Build Alternative, and there would be little difference between the build alternatives.

Section 5.5.4, discusses how the use of low or zero emission vehicles by the In-Town BRT under the Refined LPA would represent an improvement in terms of microscale air quality over the use of conventional diesel buses under the No-Build and TSM Alternatives for many of the urban core routes.

5.5.1 Regional (Mesoscale) Analysis

It is estimated that the daily total vehicle miles traveled (VMT) would increase from approximately 12.9 million in 2000 to approximately 17.6 million by the year 2025 under the No-Build Alternative. This represents a VMT increase of about 36 percent. Since the roadway network capacity in the project study area with all of the alternatives is not expected to increase at the same growth rate as VMT, it is expected that average travel speeds will decrease as a result of the added VMT and traffic congestion. Therefore, daily vehicle hours of delay (VHD) is estimated to increase from approximately 202,400 hours in 2000 to approximately 451,700 hours by the year 2025 under the No-Build Alternative, which is about a 123 percent increase. Average travel speeds are projected to drop from 25.7 mph in 2000 to 20.6 mph in 2025 with the No-Build Alternative. As shown in Table 5.5-1, the composite emission factors increase substantially with decreasing vehicle travel speed. The increase in emissions that would be expected from the decrease in travel speed would be partially offset by a reduction in emissions per vehicle over time.

TABLE 5.5-1
COMPOSITE EMISSION FACTORS FOR
PRIMARY CORRIDOR TRANSPORTATION PROJECT

Vehicle Travel Speed (mph)	Composite Emission Factor (grams per vehicle mile)					
	2000			2025		
	Hydro-carbons	Carbon Monoxide	Nitrogen Oxides	Hydro-carbons	Carbon Monoxide	Nitrogen Oxides
10	5.6	48.6	2.6	4.5	44.2	2.2
15	4.2	36.6	2.4	3.5	34.6	2.0
20	3.4	30.2	2.3	2.9	29.2	1.9
25	2.9	24.1	2.3	2.4	22.5	1.9

Source: U.S. EPA MOBILE5A Emission Factor Model.

As was presented in Chapter 4, total VMT estimates for the Refined LPA are 4.1 percent lower than the estimated total VMT for the No-Build Alternative. The 2025 VHD estimate for the Refined LPA is about 17 percent lower than the No-Build Alternative VHD. As a result, mesoscale emissions for the Refined LPA are expected to be substantially less than for the No-Build Alternative. Average speeds are projected to be lower and VHD is projected to be even higher with the TSM Alternative than with the No-Build Alternative, which means that mesoscale emissions would be higher than the No-Build Alternative and Refined LPA as well.

5.5.2 Microscale Analysis

Microscale, or “hot spot”, air quality impact analyses of the present conditions and year 2025 conditions under the No-Build Alternative, TSM Alternative, and the Refined LPA were performed at 23 intersections, using computer models to predict future carbon monoxide (CO) concentrations. These intersections, which were selected for analysis because they generally represent all intersections that would be affected by the project, are expected to experience peak CO concentrations. The microscale impact analyses involved assessing worst-case CO concentrations near all 23 selected intersections within the project area for both 1-hour and 8-hour averaging periods. These averaging periods correspond to the averaging times included in the State and the national AAQS.

Under worst-case methodology conditions, all three alternatives would result in CO concentrations above the stringent State ambient air quality standards at most locations or intersection studies. However, it should be noted that the predicted concentrations are probably conservatively high for all scenarios. This result is because EPA’s projections for emissions from motor vehicles have generally been revised downward since these studies were originally completed.

The CO concentrations estimated for the present or existing condition shown on Table 5.5-2 represent the results of quantitative analysis, not actual air quality monitoring. Six of the locations were not analyzed under the existing condition. The highest analyzed worst-case 1-hour concentration for the existing scenario is 21.7 mg/m^3 during the morning peak-traffic hour near the intersection of South King Street and Punchbowl Street. One-hour values for other locations and times under the existing condition range from 3.6 mg/m^3 during the afternoon at the intersection of Hotel Street and Bishop Street to 19.6 mg/m^3 during the morning near the intersection of Nimitz Highway and Sand Island Access Road. While the estimated worst-case

TABLE 5.5-2
ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS NEAR SELECTED INTERSECTIONS WITHIN THE PROJECT AREA
(milligrams per cubic meter)

Roadway Intersection	Present (1999)		Year 2025 Alternative					
			No-Build		TSM		Refined LPA	
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
Kahuapaani Street / Salt Lake Blvd.	NA	NA	12.6	14.4	12.6	14.4	12.0	14.2
Luapele Drive / Salt Lake Boulevard	NA	NA	9.2	9.8	9.2	9.8	9.1	9.3
N. King Street / Kalihi Street	15.4	14.6	16.7	17.4	16.2	15.6	17.2	17.9
Dillingham Boulevard / Kalihi Street	11.3	11.7	14.7	14.4	14.7	14.4	13.3	12.9
S. King Street / Bishop Street	17.6	13.8	26.1	19.3	28.9	20.4	23.9	17.7
Hotel Street / Bishop Street	6.1	3.6	8.3	4.7	7.1	5.0	14.2	9.0
S. King Street / Punchbowl Street	21.7	15.0	19.1	16.7	17.9	16.9	16.9	17.9
S. King Street / Ward Avenue	NA	NA	12.3	12.9	12.3	12.9	11.2	13.9
S. King Street / Pensacola Street	NA	NA	12.9	14.3	12.9	14.3	12.2	11.8
Kapiolani Boulevard / Pensacola Street	NA	NA	10.9	11.0	11.6	10.7	11.7	10.6
Kapiolani Boulevard / Kalakaua Avenue	18.8	13.3	20.4	16.4	19.6	16.4	20.4	16.4
S. King Street / Beretania Street / University Avenue	18.8	17.1	18.4	15.5	17.4	15.0	19.1	18.5
Dole Street / University Avenue	19.1	14.4	12.6	12.1	12.9	12.1	13.0	11.6
Nimitz Hwy. / Sand Island Access Road	19.6	16.8	20.0	16.8	19.9	16.8	15.4	13.6
Nimitz Highway / Waiakamilo Rd.	15.2	15.0	17.0	13.1	17.0	13.3	12.9	10.6
Ala Moana Blvd. / Richards Street	NA	NA	10.0	12.3	10.0	12.3	8.9	10.2
Ala Moana Boulevard / South Street	12.3	10.2	11.3	10.4	13.0	10.1	11.3	9.2
Ala Moana Boulevard / Atkinson Drive	17.1	15.4	17.8	19.7	17.8	19.7	16.1	17.8
Ala Moana Boulevard / Kalia Road	13.5	13.0	13.1	12.8	13.1	12.8	12.6	15.4
Kalakaua Avenue / Kaiulani Avenue	5.1	5.0	6.6	7.1	7.1	7.5	5.4	5.6
Kalakaua Avenue / Kapahulu Avenue	10.4	9.1	3.6	3.4	3.4	3.4	3.4	3.4
Kuhio Avenue / Kapahulu Avenue	9.0	6.2	7.7	7.9	7.7	7.9	7.2	7.7
Kuhio Avenue / Seaside Avenue	7.7	7.0	11.4	12.3	11.4	12.3	10.6	9.6

Source: B.D. Neal & Associates, 1999, 2001, and 2002.

Notes: NA: Not Analyzed
Hawaii AAQS: 10 mg/m^3 (9.5 ppm).
National AAQS: 40 mg/m^3 (35 ppm).
Underline indicates worst-case condition exceeds Hawaii AAQS.

concentrations for all locations and periods under the 1999 scenario are in compliance with the national 1-hour AAQS of 40 mg/m^3, the analyzed values exceed the more stringent State 1-hour AAQS of 10 mg/ m^3, except at the intersections of Hotel Street and Bishop Street, Kalakaua Avenue and Kaiulani Avenue, Kuhio Avenue and Kapahulu Avenue, and Kuhio Avenue and Seaside Avenue.

Under the No-Build Alternative, worst-case 1-hour concentrations are predicted to increase at eight locations analyzed under the existing condition. Under this alternative, the highest worst-case 1-hour value (26.1 mg/m^3) is predicted to occur near the intersection of South King Street and Bishop Street during the morning. Concentrations at other locations and times range between 3.4 mg/m^3 and 20.4 mg/m^3. Eighteen of the 23 locations studied are predicted to potentially exceed the State AAQS. However, none are predicted to exceed the national AAQS.

Under the TSM Alternative, worst-case 1-hour concentrations are predicted to remain relatively unchanged, when compared to the No-Build Alternative. Similar to the No-Build Alternative, the highest worst-case 1-hour concentration is predicted to occur near the intersection of South King Street and Bishop Street during the morning, at 28.9 mg/m^3. This is predicted to be the highest 1-hour value amongst all of the alternatives and locations studied. Eighteen of the 23 locations studied are predicted to potentially exceed the State AAQS. However, none are predicted to exceed the national AAQS.

Under the Refined LPA, worst-case 1-hour concentrations at most of the locations studied are predicted to be about the same as those under either the No-Build or the TSM Alternatives. Of the 23 intersections studied, 16 would experience reduced concentrations under the Refined LPA compared to the No-Build alternative during the AM peak hour, while five intersections would see increases, and two intersections would see no change. The change in concentrations during the PM peak hour would be similar with 15 intersections showing a decrease, six showing an increase, and two with no change. As shown in Table 5.5-2, nineteen of the 23 locations studied may exceed the State AAQS. None of the locations are predicted to exceed the national AAQS.

The estimated worst-case 8-hour concentrations at the 23 study locations under the four scenarios are shown in Table 5.5-3. Under existing conditions, modeled worst-case 8-hour concentrations range from 2.6 to 10.8 mg/m^3, with the highest value occurring at the intersection of South King Street and Punchbowl Street. As noted above, the existing condition concentrations represent the results of a quantitative analysis, not actual monitoring, and six of the locations were not analyzed. Thirteen of the locations were estimated to exceed the State AAQS. One of the locations (South King Street at Punchbowl) was estimated to exceed the national AAQS, but other locations are in compliance with the national AAQS by a small margin.

Under the No-Build Alternative, concentrations are predicted to increase at 10 locations analyzed under the existing condition. The predicted worst-case concentrations range from 1.8 to 13 mg/m^3. The predicted concentrations at 18 of the 23 locations studied would exceed the State AAQS, and predicted concentrations at three locations would exceed the national AAQS.

Under the TSM Alternative, the predicted worst-case 8-hour concentrations would remain about the same as the No-Build Alternative. The highest worst-case concentration would be 14.4 mg/m^3, which would occur at the intersection of South King Street and Bishop Street. Predicted concentrations would exceed the State AAQS at 18 of the 23 locations studied, and predicted concentrations at two locations would exceed the national AAQS.

Under the Refined LPA, the predicted worst-case 8-hour concentrations at the 23 representative locations would remain about the same as either the No-Build or TSM Alternatives. However, CO 8-hour concentrations at five locations are predicted to be higher under the Refined LPA than under either the No-Build or TSM Alternatives. The differences at the five intersections are small and within the accuracy limits of the model. The differences between the Refined LPA and the No-Build or TSM Alternatives reflect some additional queuing

TABLE 5.5-3
ESTIMATED WORST-CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS NEAR SELECTED INTERSECTIONS WITHIN THE PROJECT AREA
(milligrams per cubic meter)

Roadway Intersection	Present (1999)	Year 2025 Alternative		
		No-Build	TSM	Refined LPA
Kahuapaani Street / Salt Lake Boulevard	NA	7.2	7.2	7.1
Luapele Drive / Salt Lake Boulevard	NA	4.9	4.9	4.6
N. King Street / Kalihi Street	7.7	8.7	8.1	9.0
Dillingham Boulevard / Kalihi Street	5.8	7.4	7.4	6.6
S. King Street / Bishop Street	8.8	13.0*	14.4*	12.0*
Hotel Street / Bishop Street	3.0	4.2	3.6	7.1
S. King Street / Punchbowl Street	10.8*	9.6	9.0	9.0
S. King Street / Ward Avenue	NA	6.4	6.4	7.0
S. King Street / Pensacola Street	NA	7.2	7.2	6.1
Kapiolani Boulevard / Pensacola Street	NA	5.5	5.8	5.8
Kapiolani Boulevard / Kalakaua Avenue	9.4	10.2*	9.8	10.2*
S. King Street / Beretania Street / University Avenue	9.4	9.2	8.7	9.6
Dole Street / University Avenue	9.6	6.3	6.4	6.5
Nimitz Highway / Sand Island Access Road	9.8	10.0*	10.0*	7.7
Nimitz Highway / Waiakamilo Road	7.6	8.5	8.5	6.4
Ala Moana Boulevard / Richards Street	NA	6.2	6.2	5.1
Ala Moana Blvd. / South St.	6.2	5.6	6.5	5.6
Ala Moana Boulevard / Atkinson Drive	8.6	9.8	9.8	8.9
Ala Moana Boulevard / Kalia Road	6.8	6.6	6.6	7.7
Kalakaua Avenue / Kaiulani Avenue	2.6	3.6	3.8	2.8
Kalakaua Avenue / Kapahulu Avenue	5.2	1.8	1.7	1.7
Kuhio Avenue / Kapahulu Avenue	4.5	4.0	4.0	3.8
Kuhio Avenue / Seaside Avenue	3.8	6.2	6.2	5.3

Source: B.D. Neal & Associates, 1999, 2001, and 2002.
Notes: NA: Not Analyzed
Hawaii AAQS: 5 mg/m^3 (4.5 ppm).
National AAQS: 10 mg/m^3 (9 ppm).
Underline indicates worst-case condition exceeds Hawaii AAQS.
Asterisk indicates worst-case condition exceeds National AAQS.

that would result with the Refined LPA. Predicted concentrations would exceed the State AAQS at 19 of the 23 study locations, and the predicted concentration at one location would exceed the national AAQS.

On average, the TSM Alternative and Refined LPA would not worsen regional air quality in comparison to the No-Build Alternative. Therefore, no mitigation is proposed since the overall situation across the project area would improve with the Refined LPA. Under worst-case meteorology conditions, CO concentrations are predicted to exceed both the State and national standards at various locations under existing conditions and all of the future alternatives. Concentrations under the TSM Alternative and Refined LPA would be worse than under the No-Build Alternative at some locations and better at others. However, it should be noted that the predicted concentrations are probably conservatively high for all scenarios. This is because EPA's projections for emissions from motor vehicles have generally been revised downward since these studies were completed. The EPA computer model MOBILE5A was used for the microscale analyses (see Tables 5.5-2 and 5.5-3). EPA has developed an updated model, MOBILE6. A preliminary assessment of the analyzed intersections indicates that the newer model would result in lower concentrations for all three alternatives.

5.5.3 Conformity with Statewide Implementation Plan

The Regional and In-Town BRT are included in the Oahu regional transportation plan (TOP 2025). The Oahu Metropolitan Planning Organization adopted the TOP 2025 on April 6, 2001. The projects listed in the TOP 2025 have been evaluated for regional effects. The Primary Corridor Transportation Project is also included in the current Statewide Transportation Improvement Program (STIP) for Fiscal Years 2000-2002, approved in September 2001. As a result, this project is in conformance with the Statewide Implementation Plan (SIP). Oahu is a region that meets the standards for all air quality criteria.

5.5.4 Quality of Life

Air quality often affects the quality of urban life. In urban areas, emissions from motor vehicles, industrial facilities, and construction sites are the primary sources of air pollution. Motor vehicles in particular are the primary causes of poor air quality in many cities because they emit such pollutants as carbon monoxide, nitrogen oxides, and hydrocarbons.

Conventional diesel buses emit higher levels of particulate matter (black smoke) than gasoline-powered motor vehicles. While the total amount of particulate matter generated by buses is a small percentage of the total generated on a regional scale, it does contribute to the nuisance of smoke and soot along the curbside. Despite recent reductions in particulate levels from diesel buses, and the fact that emissions are exhausted at roof level rather than at street level, these particulate emissions can still be very annoying to people. In addition, the California Air Resources Board has identified diesel soot as a potential carcinogen. Diesel exhaust most easily enters the body by breathing, but may also cling to skin or hair and thereafter may be ingested as a consequence of hand-to-mouth activity. Therefore, since pedestrians utilizing the same streetscape as the transit system would be exposed to particulate matter emitted by passing buses, there is some level of health risk from the pedestrian perspective.

Technologies proposed for the Refined LPA include electric vehicles powered by a wayside traction power delivery system (embedded plate technology) or hybrid electric vehicles where the energy for the traction power is carried on-board the vehicle. The EPT vehicles would emit zero emissions. The hybrid electric vehicles would be low-emission vehicles because their diesel engines would always be operating at efficient levels. (The black smoke coming from the exhaust of a diesel bus typically occurs when the bus is accelerating and under slow-speed high-load conditions - non-optimal operating conditions). The No-Build and TSM Alternatives would use conventional diesel-powered buses, at least for the immediate future.

Since the Refined LPA would utilize either zero or low-emission vehicles, it would substantially reduce the level of particulate emissions (black smoke and soot) at certain intersections and street level locations in comparison to the No-Build and TSM Alternatives, which would continue to utilize conventional diesel buses. Unfortunately, there is no acceptable method or model to estimate the microscale impacts of particulate matter. There are accepted methods to estimate particulate matter on a regional scale. However, it is likely that the regional difference between the Refined LPA, and the No-Build and TSM Alternatives would be very small or non-existent because the reduction in particulate matter due to the replacement of some of the transit diesel buses with zero or low-emission vehicles would represent a very small percentage of the total particulate emissions in the region. However, the replacement of diesel buses with zero or low-emission vehicles would certainly reduce smoke and soot at the street level along the transit alignment, which would improve the pedestrian experience. Therefore, the Refined LPA would contribute more to improving the quality of urban life than the No-Build and TSM Alternatives.

5.6 NOISE AND VIBRATION

This section covers the noise and vibration impacts of the proposed alternatives including measures to mitigate noise impacts. Section 5.6.1 provides the methodology of the noise impact evaluation performed in conformance with the requirements of FTA and FHWA. Sections 5.6.2 and 5.6.3 disclose the noise and vibration impacts of the alternatives and proposed mitigation measures. Section 5.6.4 provides a discussion of noise levels in relation to the quality of urban life, with particular reference to the difference between conventional diesel buses and electric or hybrid buses with diesel/electric propulsion.

In general, the future noise levels along the alignment of the In-Town BRT would be lower than under the TSM or No-Build Alternatives because many of the future transit operations will use electric or hybrid electric vehicles, which produce substantially less noise than standard diesel buses. The amount of vibration produced by these vehicles is lower but not much different than standard diesel buses.

5.6.1 Methodology for Impact Evaluation

This section describes the methodology used for impact evaluation, in accordance with Federal and State requirements.

1) Transit Noise

The proposed BRT vehicles will be a single-articulated, low-floor electrically powered or hybrid electric buses. No overhead catenary or steel rail would be required. Electric powered vehicles would be supplied power from a wayside system referred to as an embedded plate system. Hybrid electric buses would be electrically propelled vehicles in which the electricity is produced by an on-board generator (alternator) powered by a diesel engine; electric propulsion would be provided by on-board batteries.

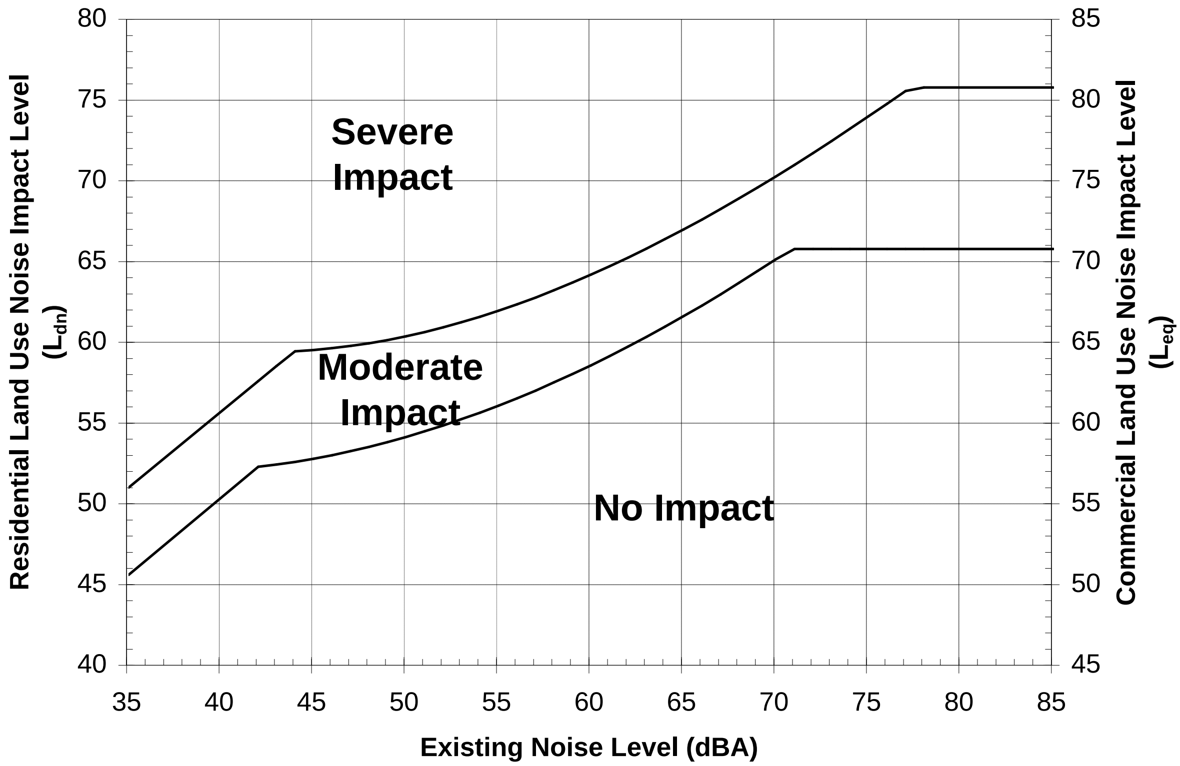
Noise levels from transit vehicle operations are typically a function of the speed, number of vehicles in the daytime and nighttime hours, and the distance from the transit lane to sensitive receptors. Because noise measurement data for the hybrid bus was not available at the time of this analysis, an estimated emission level was developed for the hybrid vehicle based on the FTA city bus reference sound levels. This estimate was used to model the potential noise impact of operating the hybrid vehicle in the Refined BRT Alternative. The FTA city bus reference level was reduced by 3 dBA to account for the constant speed operation of the diesel engine, which would be used to charge the alternator/batteries and not to power the vehicle directly. During acceleration and deceleration operations, diesel engine vehicles generate 5 dBA to 6 dBA higher noise levels than during passby operations when the engine is not operating under a sustained load. The other vehicle proposed is a wayside powered electric bus that would be similar to a rubber-tired Automated Guideway Transit (AGT) vehicle. The FTA noise reference level of an AGT was used to represent the operating noise levels of this type of vehicle.

The transit noise analysis for this project was performed in six steps:

- Inspect project area and categorize existing land use;
- Measure the existing area noise levels;
- Calculate the project-related noise levels;
- Combine the project related noise levels with the existing noise levels;
- Compare the change in noise levels to the FTA criteria; and
- Identify impacts and investigate mitigation measures.

The In-Town BRT transit noise levels were compared to the impact thresholds of the FTA criteria. The FTA criteria for residential land use and other uses with nighttime sleep activities are presented in Figure 5.6-1, which identifies the ranges of no impact, moderate impact, and severe impact for varying levels of existing and project-created noise. The criteria are based on either a 24-hour Ldn noise level for residences and buildings where people normally sleep, or a one-hour Leq noise level for land uses and buildings with primarily daytime activities. FTA requires that mitigation be evaluated for all areas where moderate impacts are projected, although consideration of factors such as cost-effectiveness can be incorporated into the decision about whether to specify mitigation for a particular area. FTA considers a severe impact to be a "significant adverse effect" under NEPA. Noise mitigation will normally be specified for severe impact areas, unless there is no practical method of achieving a reduction in noise level.

FIGURE 5.6-1
FTA NOISE IMPACT CRITERIA



2) Transit Vibration

As a rubber tired vehicle, ground vibration levels from the electric or hybrid electric buses would be minimal, and would not exceed the FTA criteria of 72 VdB for residential buildings and other structures where people normally sleep (Category 2) (see Table 5.6-1). There is no known land use along the alignment that has vibration-sensitive equipment and would be subject to lower vibration impact criteria.

TABLE 5.6-1
FTA GROUND-BORNE VIBRATION IMPACT CRITERIA

Land Use Category	Ground-borne Vibration Impact levels (VdB re 1 micro inch/sec)	
	Frequent Events[1]	Infrequent Events[2]
Category 1: Buildings where low ambient vibration is essential for interior operations.	65VdB[3]	65VdB[3]
Category 2: Residences and buildings where people normally sleep.	72 VdB	80 VdB
Category 3: Institutional land uses with primarily daytime use.	75 VdB	83 VdB

Source: Transit Noise and Vibration Impact Assessment, FTA, April, 1995.
Notes: [1] "Frequent Events" is defined as more than 70 vibration events per day.
[2] "Infrequent Events" is defined as fewer than 70 vibration events per day.
[3] This criterion is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes.

5.6.2 Noise Impacts

The following discussion analyzes the noise impacts that would arise from the transit elements of the proposed project for both the hybrid electric bus and the wayside-powered electric bus. Only those monitoring sites that lie on the proposed alignment are included in the discussion below.

Table 5.6-2 summarizes existing and projected transit noise levels for both the electric and hybrid electric vehicles at 31 noise monitoring locations along the In-Town BRT alignment (see Figures 3.6-3A and 3.6-3B). Noise impacts discussed below are defined by the FTA as either no impact, moderate, or severe.

1) No-Build Alternative

The only source of future noise levels would be traffic movements on the local arterials in the project area. Changes in 2025 automobile traffic are expected to result in no change to a one dBA increase in the existing 24-hour (Ldn) and peak hour (Leq) noise levels at each of the 31 noise measurement sites.

Under the No-Build Alternative, future local bus volumes would be different from existing local bus volumes. Increases in local bus volumes under the No-Build Alternative would raise existing noise levels by 1 to 2 dBA at noise measurement locations 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 17, 18, D, E, F, G, I, J, K and M. Decreases in local bus volumes under the No-Build Alternative would lower existing noise levels by 1 to 3 dBA at noise measurement locations 1, 13, 16, A, B, and L. These changes in noise level would be barely perceptible to most people. At the remaining noise measurement locations – sites 2, 14, 15, C, and H – there would be no change in noise levels associated with changes in local bus volumes.

TABLE 5.6-2
REFINED LPA
ESTIMATED FUTURE NOISE LEVELS AT REPRESENTATIVE SENSITIVE LAND USES

						REFINED LPA		
Site No.	**Location**	**FTA Land Use Category (1,2,3)**	**Existing Noise Level[1] (dBA)**	**No-Build Noise Level (dBA)**	**TSM Noise Level[2] (dBA)**	**Project Generated Noise (dBA)**	**Combined Noise Level – Existing + Project Generated (dBA)**	**FTA Level of Noise Impact[5]**
1	Bishop Garden Apartments at 1470 Dillingham Boulevard	2	66	66	67	65[3]/59[4]	68[3]/67[4]	**Moderate/** No Impact
2	2386 Kapiolani Boulevard	2	74	74	75	52/46	74/74	No impact
3	845 University Avenue	2	69	70	70	52/46	69/69	No impact
4	Apartment Building, 1720 Ala Moana Boulevard	2	77	78	78	56/50	77/77	No impact
5	Saratoga Road at Post Office	2	66	67	67	57/51	67/66	No impact
6	Apartments on Kuhio Avenue between Launiu & Kaiolu Streets	2	76	78	77	59/53	76/76	No impact
7	Outrigger Waikiki Islander Hotel	2	70	71	71	55/49	70/70	No impact
8	Waikiki Banyan Hotel	2	72	74	73	62/56	72/72	No impact
9	Queen Kapiolani Hotel on Kapahulu Avenue at Cartwright Road	2	70	72	71	55/49	70/70	No impact
10	Apartment Building, 1350 Ala Moana Boulevard	2	73	74	74	60/54	73/73	No impact
11	Executive Center at Hotel and Bishop Streets	2	77	78	78	57/51	77/77	No impact
12	Residences on King Street	2	66	68	67	56/50	66/66	No impact
13	1122 Elm Street Apartment on Pensacola Street	2	74	71	75	53/47	74/74	No impact
14	Harbor Square Condominiums – Ala Moana Boulevard side	2	76	76	77	59/53	76/76	No impact
15	Harbor Square Condominiums – Alakea Street side	2	73	73	74	55/49	73/73	No impact
16	Nakama Residence (near Blood Bank)	2	77	76	78	63/57	77/77	No impact
17	Chinatown Gateway Apartments	2	73	74	74	57/51	73/73	No impact
18	Straub Hospital	2	75	77	76	56/50	75/75	No impact
A	Kalihi Kai Elementary School	3	69	68	70	58/52	69/69	No impact
B	Honolulu Community College	3	72	71	73	60/54	72/72	No impact
C	Aala Park on King Street	3	68	68	69	61/55	69/68	No impact
D	Chinatown Gateway Park at Hotel and Bethel Streets	3	73	74	74	65/59	74/73	No impact
E	YWCA on Richards Street	3	68	69	69	58/52	68/68	No impact
F	Iolani Palace, on Richards Street	3	68	69	69	56/50	68/68	No impact
G	Iolani Palace, on King Street	3	75	77	76	53/47	75/75	No impact
H	Ala Wai Community Park	3	67	67	68	54/48	67/67	No impact

TABLE 5.6-2 (CONT.)
REFINED LPA
ESTIMATED FUTURE NOISE LEVELS AT REPRESENTATIVE SENSITIVE LAND USES

						REFINED LPA		
Site No.	**Location**	**FTA Land Use Category (1,2,3)**	**Existing Noise Level[1] (dBA)**	**No-Build Noise Level (dBA)**	**TSM Noise Level[2] (dBA)**	**Project Generated Noise (dBA)**	**Combined Noise Level – Existing + Project Generated (dBA)**	**FTA Level of Noise Impact5**
I	Buddhist Study Center (University of H) on University Avenue	3	70	71	71	56/50	70/70	No impact
J	Fort DeRussy, on mauka side of Kalia Road	3	66	67	67	58/52	67/66	No impact
K	Thomas Square on King Street	3	62	64	63	54/48	63/62	No impact
L	McKinley High School classroom building on Pensacola Street	3	61	58	62	56/50	62/61	No impact
M	McKinley High School building on South King Street	3	62	64	63	49/43	62/62	No impact

Source: Parsons Brinckerhoff Quade & Douglas, Inc, January 2002.
Notes: [1]FTA Category 2 existing noise levels are 24-hour Ldn levels. Category 3 existing noise levels are short-term one-hour Leq levels.
[2] Based upon future traffic projections, noise levels under the TSM Alternative are expected to be roughly 1 dBA higher than existing noise levels.
[3] Noise levels for a hybrid diesel/electric bus.
[4] Noise levels for a wayside-powered EPT bus.
[5] The level of impact is defined by the FTA as the comparison between existing and project-generated noise.

2) TSM Alternative

The proposed improvements under this alternative would only affect the peak hours of traffic activities. The overall change in traffic noise level would be similar to the future No-Build noise levels. Therefore, no impact is expected under the TSM Alternative.

3) Refined LPA Alternative

Severe noise impacts are not projected for any sites along the Refined LPA alignment. There would be a moderate noise impact at one location, Bishop Garden Apartments (Site 1), with the hybrid electric vehicle. No impacts are projected with the EPT vehicles.

Aloha Stadium Transit Center

The transit center operations and their potential noise impact on the nearby Puuwai Momi and Halawa Valley residential communities have been assessed. The noise sources associated with the transit center are: (1) on-site BRT vehicles idling within the Transit Center; and (2) the off-site movement of BRT vehicles and autos traveling to the Transit Center. Table 5.6-3 summarizes existing and projected transit center noise levels for both the diesel and hybrid electric vehicles at ten noise monitoring locations (see Figure 3.6-3B). There would be no severe noise impacts associated with the Aloha Stadium Transit Center. Moderate noise impacts would occur at the Puuwai Momi Apartments (99-102 Kalaloa Street) Buildings 1, 3, 4 and 5 (Sites AS-1, AS-2, and AS-3), and at least one single-family residence on Luaole Street (Site AS-10) using the diesel and hybrid electric technologies. The extent of potential noise impacts to other residences near the Luapele Ramp will be studied in the final design phase.

TABLE 5.6-3
ALOHA STADIUM TRANSIT CENTER
ESTIMATED FUTURE NOISE LEVELS AT REPRESENTATIVE SENSITIVE RECEPTORS

						TRANSIT CENTERS & REFINED LPA		
Site No.	Location	FTA Land Use Category (1,2,3)	Existing Noise Level - Ldn (dBA)	No-Build Noise Level[1] (dBA)	TSM Noise Level[1] (dBA)	Project Generated Noise Level (dBA)	Combined Noise Level – Existing + Project Generated (dBA)	FTA Level of Noise Impact[4]
AS-1	Puuwai Momi Apartments – Building 1	2	67	68	68	66[2]/65[3]	69[2]/69[3]	**Moderate/ Moderate**
AS-2	Puuwai Momi Apartments – Building 3	2	67	68	68	66/65	69/69	**Moderate/ Moderate**
AS-3	Puuwai Momi Apartments – Buildings 4 and 5	2	62	63	63	61/61	65/64	**Moderate/ Moderate**
AS-4	Single-family residence on Ohenana Loop, Halawa Valley Estates	2	55	56	56	55/55	58/58	No Impact/No Impact
AS-5	Single-family residence on Ohenana Loop, Halawa Valley Estates	2	60	61	61	57/56	62/61	No Impact/No Impact
AS-6	Single-family residence on Ohenana Loop, Halawa Valley Estates	2	60	61	61	56/55	62/61	No Impact/No Impact
AS-7	Single-family residence on Ohenana Loop, Halawa Valley Estates	2	69	70	70	59/56	69/69	No Impact/No Impact
AS-8	Single-family residence on Ohenana Loop, Halawa Valley Estates	2	69	70	70	59/56	69/69	No Impact/No Impact
AS-9	Single-family residence on Ohialomi Place, Halawa Valley Estates	2	72	73	73	61/58	72/72	No Impact/No Impact
AS-10	Single-family residence at 4509 Luaole Street	2	69	70	70	67/64	71/70	**Moderate/ Moderate**

Source: Parsons Brinckerhoff Quade & Douglas, Inc, July 2002.
Notes: [1] Based upon future traffic projections, noise level under the No-Build and TSM Alternatives are expected to be roughly 1 dBA higher than existing noise levels.
[2] Noise levels for a diesel bus.
[3] Noise levels for a hybrid diesel/electric bus.
[4] The level of impact is defined by the FTA as the comparison between existing and project-generated noise.

<u>Park-and-Rides</u>

The following four park-and-ride locations along the Refined LPA alignment have also been analyzed to assess any possible noise impacts to the surrounding community.

- North-South Road Park-and-Ride: The 590-space North-South Road park-and-ride is surrounded by agricultural land. There are no noise-sensitive receptors located in the vicinity of this site. Therefore, no noise impacts are projected here.
- Kapolei Transit Center/Park-and-Ride: The 470-space Kapolei Transit Center/Park-and-Ride is surrounded by currently undeveloped land. There are currently no noise-sensitive receptors located in the vicinity of this site. Therefore, no noise impacts are projected here.

Vehicular Traffic

In-Town

Future In-Town traffic volumes under the Refined LPA are projected to decrease at all but one of the noise measurement locations. Future noise levels, therefore, would be 1 to 3 dBA lower than existing noise levels at sites 1, 5, 7, 8, 12, 13, 16, A, B, C, G, I and M. Due to a slight increase in future traffic volumes at site 9, noise levels would increase 1 dBA at this location. These changes in noise level would be barely perceptible to most people. At the remaining noise measurement locations – sites 2, 3, 4, 6, 9, 10, 11, 14, 15, 17, 18, D, E, F, H, J, K, and L – there would be no change in noise levels associated with changes in future traffic volumes.

Regional

Under the No-Build and TSM Alternatives and the Refined LPA, traffic on the H-1 Freeway is expected to increase roughly 50% by the year 2025. This will increase noise levels along the H-1 Corridor by 1 to 2 dBA, which is barely perceptible to most people.

5.6.3 Mitigation

This section addresses mitigation measures for transit-related noise impacts.

For this analysis, sound walls were evaluated as mitigation for the In-Town BRT and Aloha Stadium Transit Center noise impacts. Sound walls are considered the most effective noise control measure for at-grade transit systems. To be effective, the walls must block the direct view of the noise source and must be solid with minimal openings. The use of sound walls along at-grade segments where transit is in the median of a street would not be feasible since it would affect normal traffic and pedestrian movements, and would restrict emergency vehicle access. The use of noise mitigation for the moderately affected Bishop Garden Apartments in Kalihi (Site 1) is not deemed to be feasible and will not be included as part of this project, because a wall at this location would impair driver visibility and interfere with pedestrian and traffic movements. Interior sound insulation of the affected apartment units could be a reasonable alternative to a noise barrier, including air-conditioning installation and replacement of windows and doors facing the BRT alignment.

Property line noise barriers would be effective in mitigating the noise impacts from the Aloha Stadium Transit Center to the Puuwai Momi Apartments. The noise barrier would be located at the rear of Buildings 1, 3, 4, and 5 and could incorporate doors to allow continued access from Salt Lake Boulevard to the rear of these buildings. (See discussion and visual renderings in Section 5.4.)

In accordance with FTA guidelines, a 10-foot high property line noise barrier wall is a feasible and reasonable mitigation measure that would provide 5 dBA or more noise reduction to the outdoor area and ground floor units of the Puuwai Momi Apartments. The wall would not provide noise abatement for the second or third floor apartment balconies. To provide noise abatement to these upper floors, the noise barrier height would have to be raised to 24 feet.

Noise barriers would not be feasible in mitigating noise impacts at any of the single-family residences in the vicinity of the Luapele Ramp (represented by Site AS-10), because the barrier would likely interfere with traffic and pedestrian movements. The final design phase will include studies to determine more specific noise impacts. Interior sound insulation and installation of air-conditioning in affected homes could be a reasonable alternative to a noise barrier for this area also.

5.6.4 Noise and Quality of Urban Life

The level of noise, defined as unwanted sound, greatly affects quality of life. This includes people using the transit system and those walking to work, shopping, eating, at play, and so forth along the alignment.

The average pedestrian is exposed to two different types of noise generated from vehicles: noise generated when the vehicle passes by at a constant speed and noise generated upon vehicle acceleration from a standing position.

The passby noise of a diesel bus operating at 30 mph at a distance of 50 feet is 81 dBA, in comparison to a rubber tired electric vehicle which has a passby level of 75 dBA. This is a difference of 6 dBA, which is a noticeable change in noise level that humans can hear. The hybrid diesel/electric vehicles would have a passby noise level midway between the diesel and electric powered vehicles.

There are also differences between acceleration noises for conventional diesel buses in the No-Build and TSM Alternatives and the electric or hybrid electric buses in the Refined LPA. Accelerating diesel buses are typically 3 to 6 dBA noisier than non-accelerating buses, which subjectively ranges from perceptible to clearly noticeable. For comparison, the hybrid electric buses would have acceleration noise levels that are comparable to the passby noise levels of diesel buses. Since the diesel engine in a hybrid electric bus operates at a constant, optimum rpm, its noise level would be substantially less than noise levels generated by a diesel engine when accelerating from a standing position. The all-electric vehicle would be 3 dBA to 6 dBA quieter than the hybrid electric bus during acceleration.

Thus, at the street level, a person’s environment along the transit spine would be less noisy with the Refined LPA than with the TSM and No-Build Alternatives. This difference is due to the use of the quieter electric or hybrid electric vehicles in the Refined LPA, versus the diesel buses operating in the TSM and No-Build Alternatives.

5.7 ECOSYSTEMS

5.7.1 Ecosystem Impacts

Natural habitat is very limited along the roadways and at the sites that would be affected by any of the alternatives. The sites do not represent unique or special habitat within the project area. The TSM Alternative and the Refined LPA would have no effect on the characteristics or size of populations of the resident wildlife or plant species in the area. The Refined LPA would include new landscaping in areas affected by construction.

A) Impacts on Protected Species

No State or federally listed, proposed, or candidate threatened or endangered plant or animal species described in Chapter 3, except for the white tern, is likely to be affected within areas proposed for construction. The State of Hawaii lists the Oahu population of the white tern (*Gygis alba*) as endangered. White terns are also federally protected species under the Migratory Bird Treaty Act.

DTS has conducted interagency coordination with the State Department of Land and Natural Resources Division of Forestry and Wildlife (DLNR-DOFAW) and the U.S. Fish and Wildlife Service (USFWS). Sites currently used by white terns on Oahu include Kapiolani Park, Thomas Square, Fort DeRussy, Iolani Palace, and parts of downtown and the Capital District. These areas are on the Refined LPA alignment, but white terns are well-adapted to urban environments, and no interaction with adults of this species is anticipated. The primary concern regarding white terns is to avoid disturbing their eggs, which are laid on bare tree branches. Most white terns typically nest from February to September when they are in Hawaii, but some pairs are resident year-round and nest multiple times a year.

The kooloaula *(Abutilon menziesii)*, an endangered plant, is found along the proposed alignment of North-South Road, but much further makai of the proposed Regional BRT park-and-ride site, which is mauka of Farrington Highway. Moreover, the proposed park-and-ride site is on actively cultivated farmland, making it unlikely that this endangered plant would be found on this site. Therefore, no impact is expected on the population of kooloaula in this area.

B) Tree Impacts

Preliminary engineering performed subsequent to publication of the MIS/DEIS indicated that there could have been a number of impacts on urban street trees. Because of concerns about the magnitude of tree impacts initially identified, DTS undertook concerted efforts to redesign portions of the In-Town BRT in ways that would minimize impacts to trees. Redesign efforts in various locations included shifting or eliminating bus stops, reducing the number or size of traffic and BRT lanes, converting some exclusive BRT lanes to semi-exclusive or mixed-traffic lanes, and designing bus stops around existing trees, among others. While there will still be tree impacts, the number of trees affected will be substantially less as a result of these redesign measures. No tree impacts are expected in the Regional BRT section.

Some trees and shrubs would be relocated or removed to allow the transit stops to be built or the roadway to be modified for the Refined LPA by the project's qualified, certified arborist. A tree survey and impact analysis identified 154 tree impacts, of which 34 were determined to be "notable" trees (Table 5.7-1). A "notable" tree is defined as a tree deemed to be important to the urban landscape character. This category includes individual trees or tree types, as well as groups of trees that together comprise a recognized and important element of the visual landscape. This number does not include those trees that will need pruning. Of particular concern were the monkeypods on Kapiolani Boulevard, which are part of the historic landscape of Kapiolani Boulevard, as identified by the State Department of Land and Natural Resources, Historic Preservation Division (SHPD, MIS/DEIS comment letter, Nov. 22, 2000). DTS also worked closely with The Outdoor Circle and the City's Department of Parks and Recreation to minimize and mitigate tree impacts. Three field visits were conducted with these stakeholders in November 2001 and January and February 2002 to review potential impacts and discuss mitigation measures. These mitigation measures are incorporated into this FEIS. A tree preservation program will be developed by a qualified certified arborist.

The project will make every effort to save all notable and healthy trees. It should be noted that even trees initially assessed to be "not transplantable" because of size or age were ultimately considered for relocation, if it is physically possible to transplant the tree. Original field assessments of the transplantability of trees had assumed that relocation is not a possibility if a tree is too large, over mature, or unhealthy.

The Refined LPA may also require tree trimming where the transit stops are located or the road needs to be widened to accommodate the transit vehicles. For example, several trees on the Ewa side of Pensacola Street and the mauka side of Kuhio Avenue will be trimmed to allow BRT vehicles to pass in the curbside lane, since these trees abut the curb and have very low branches or leaning trunks. The few trees in these areas for which the qualified certified arborist deemed that pruning was not a viable option are included in Table 5.7-1 as "remove/replace."

C) Other Ecosystem Impacts

The amount of undeveloped land required for both the TSM Alternative and the Refined LPA is minimal. Bus ramps, park-and-ride facilities, and transit centers will be built adjacent to current roadways for both alternatives. These sites are all near current transportation facilities, and no agricultural operations would be displaced by any of the proposed alternatives. Only the North-South Road Park-and-Ride will affect roughly four acres of agricultural land. This park-and-ride is proposed under all three alternatives, and the partial displacement of the farming business on this site is described in Section 5.2.

TABLE 5.7-1
NOTABLE TREE IMPACTS

BRT SEGMENT	TREE TYPE	RELOCATE On-Site	RELOCATE Off-Site	REMOVE/ REPLACE	TOTAL
Kalihi	**Kamani Trees (*Callophylum inophyllum*) on Dillingham Blvd. (all w/poor canopies)**	**8**	**0**	**2**	**10**
	Not Notable	11	12	3	26
	Sub-Total	*19*	*12*	*5*	*36*
Kakaako Mauka	**Monkeypods (*Samanea saman*) on Ala Moana Blvd.**	**5**	**0**	**0**	**5**
	Not Notable	3	7	0	10
	Sub-Total	*8*	*7*	*0*	*15*
Kakaako Makai	Not Notable	13	0	0	13
	Sub-Total	*13*	*0*	*0*	*13*
UH-Midtown	**Monkeypods (*Samanea saman*) on Kapiolani Blvd.**	**10**	**0**	**0**	**10**
	Not Notable	16	6	6	28
	Sub-Total	*26*	*6*	*6*	*38*
Waikiki	**Cluster of Date Palms (*Phoenix dactylatra*) and Royal Palms (*Roystonea regia*) on Saratoga Road (healthy palms only)**	**7**	**0**	**0**	**7**
	Banyans (*Ficus spp.*) on Kalia Road	**2**	**0**	**0**	**2**
	Not Notable	25	0	18	43
	Sub-Total	*34*	*0*	*18*	*52*
TOTALS	**Notable Trees**	**32**	**0**	**2**	**34**
	Not Notable Trees	68	25	27	120
	All Trees	100	25	29	154

Source: The Tree People, SSFM, and Parsons Brinckerhoff, July 2002.

Comments received about project costs led to a re-evaluation of the original intent to place a park-and-ride site near the junction of H-1 and Kunia Road. The North-South Road site was selected instead because it could be constructed adjacent to the proposed North-South Road, eliminating the need for a costly access road and special freeway ramps. This proposed site will allow utilization of the North-South Road ramps onto and off of H-1, rather than constructing a special access ramp as would have been required at the Kunia Road site. Moreover, although the North-South Road site will still affect agricultural land, the acreage impact will be less than it would have been at Kunia Road.

Under the Federal Farmland Protection Policy Act (FPPA), federal agencies must formally assess their projects' impact on agriculture. The U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) has determined that the land located at the proposed North-South Road Park-and-Ride site consists of prime, unique farmland of statewide or local importance. In accordance with 7 CFR 658.4(a), Form AD-1006, "Farmland Conversion Impact Rating" was submitted to NRCS and a Farmland Conversion Impact Rating score was determined. If a project receives a score equal to or greater than 160 points, alternatives that avoid farmland impacts must be evaluated.

The Combined Land Evaluation and Site Assessment Score for the North-South Road Park-and-Ride site is 194, which exceeds the 160 point threshold. Therefore, alternatives that do not affect farmlands were also evaluated.

In addition to the H-1/Kunia site which would have affected another farm, non-farm alternative sites considered included the mauka side of the H-1 Freeway near Kunia Road, the Koko Head side of the H-1/Kunia Interchange, and the existing Royal Kunia Park-and-Ride. The topography of the mauka side of the freeway made it impractical for a park-and-ride site. The lands to the Koko Head side of the interchange are highly developed and no parcels large enough to accommodate the land requirement of a park-and-ride were identified. The existing Royal Kunia Park-and-Ride was also considered, but was deemed to be too small to operate a park-and-ride of the scale required for the Refined LPA Alternative. Also, providing direct ramps to-and-from the H-1 express lanes would be very difficult from the existing Royal Kunia Park-and-Ride.

5.7.2 Aquatic Ecosystems

No adverse impacts on aquatic ecosystems would result from the proposed action. If more people were to ride transit and reduce VMT, as forecasted for the Refined LPA, less pollutants from roadway runoff would enter freshwater and marine ecosystems. Therefore, no mitigation is necessary for aquatic ecosystems.

5.7.3 Protected Species Mitigation

A survey of the project area will be conducted for white terns and their nests prior to final design. Sensitive trees and areas will also be monitored immediately prior to and/or during construction activities that involve tree relocation, removal, and/or trimming. All monitoring will be coordinated with the USFWS. DTS will also coordinate tree trimming with the Department of Parks and Recreation, which has standard procedures to avoid impacts to white terns and their eggs.

5.7.4 Mitigation Measures for Tree Impacts

Mitigation for landscaping impacts will consist of revegetation and landscape redesign along the alignment where possible. Although detailed planting plans will not be prepared until later stages of final design, desirable locations for special landscaping treatment include areas where (1) existing landscaping has been lost; (2) substantial opportunities exist for enhancement of existing streetscapes; (3) joint use is possible; (4) stops, transit centers, park-and-ride lots are proposed; (5) mitigation of specific impacts can be accomplished, such as adjacent to parks or historic sites; and (6) specific relevant goals have been established, such as within special districts.

Despite efforts made to minimize impacts on street trees, some trees will have to be relocated or removed/replaced to allow for necessary road widening, as shown in Table 5.7-1. A tree preservation program will be developed in conjunction with a “qualified arborist” to mitigate these unavoidable impacts. The City defines a “qualified certified arborist” as an arborist approved by the Department of Parks and Recreation (DPR), having at least three years of work experience. The tree preservation program will be in accordance with standard procedures used by the DPR in similar City contracts for tree maintenance. Community input will also play a role in identifying key components of the program. The working group concept will be carried out through the final design phase to ensure community input. A Street Tree Review will also be conducted by the Department of Planning and Permitting (DPP) as part of the construction plan review by the City. The DPP’s Street Tree Review applies only to those trees not located within a Special Design District; affected trees inside designated Special Design Districts will be addressed in the Special Design District Permit.

On-site relocation is the preferred mitigation option wherever possible, especially for notable trees. Those trees to be relocated on-site will be kept on the same street, but moved back farther from the curb to accommodate road widening. On-site relocation may require some pruning to prepare the tree for transplanting, but the canopy of even mature trees will be kept largely intact. Root balls of appropriate sizes will be contained to move each tree. Whether or not a tree can be relocated on-site was determined by assessing if there is enough space within or adjacent to the existing right of way. In the case of on-site relocation, land acquisition by the City may be necessary.

Trees to be relocated off-site are those trees in areas where on-site relocation does not appear to be a viable option, due to proximity to buildings or other barriers for street widening and tree planting. If a tree must be relocated off-site, the project team under direction from DTS and input from the appropriate working groups will identify suitable sites for relocating each individual tree. Sites to be considered include parks, schools, and other public areas, although private property owners may also have the opportunity to replant these displaced trees.

In some cases, relocating a tree is not advisable because the tree is too old, decayed, damaged, or otherwise inappropriate for successful transplantation. Such trees will be removed and replaced. The replacement tree will be replanted on the same section of the alignment when possible. If replacing the tree is not possible on that section of the alignment, the newer tree will be planted in one of the off-site relocation areas. A qualified certified arborist will work with a landscape architect on a case-by-case basis to determine the best available field stock material appropriate to replace each affected tree. The tree preservation program will contain mitigation measures determined in consultation with The Outdoor Circle. For example, for every Kamani tree removed from the makai side of Dillingham Boulevard, two 10 to 12-inch Kamani trees will be planted on the mauka side to infill existing gaps. Also, of the six Kamani trees on the makai side of Dillingham Boulevard Koko Head of Alakawa Street that would be impacted, three trees are proposed for replanting in the property at the makai Koko Head corner of Dillingham Boulevard and Alakawa Street.

Other trees that are removed will be replaced at a one for one ratio with trees of a similar caliper, if feasible, or trees will otherwise be replaced so as to maintain the appearance of the landscape as much as possible. Trees that are relocated on-site or off-site will be monitored for a year. If relocated trees do not survive the transplanting process, they will also be replaced at a one for one ratio with trees of a similar caliper, if feasible. Because tree impacts will be mitigated by relocation and/or replacement, there will be no net loss of trees resulting from this project. Therefore, there will be no cumulative impact on trees.

The monkeypod trees on Kapiolani Boulevard will be relocated on-site. This approach means that the trees will remain in the same general vicinity from which it came, such that the tree will remain visibly on Kapiolani Boulevard, but placed farther from the curb. The trees will be pruned minimally during the transplanting process, but their canopies will be kept largely intact. Therefore, because these tree impacts will be mitigated in this manner, the visual character of Kapiolani Boulevard will not be affected.

Generally, monkeypod trees pruned for replanting will take about one year to grow back their canopies, with full recovery in three to five years' time. The Kamani trees on Dillingham Boulevard will take a little longer to recover fully, about four to eight years.

The tree preservation program will also address methods to minimize tree trimming impacts. A qualified arborist will determine the appropriate amount of trimming with the least impact on each tree. The plan will also serve as a tree protection plan to be used during construction. Section 5.12 also addresses the tree protection plan to be implemented during construction and the Street Tree Review by DPP.

As described in Section 2.2.1, the City's Department of Design and Construction (DDC) also has plans for a reconstruction project that will affect trees on Kapiolani Boulevard between Ward and Kalakaua Avenues. In order to ensure that the monkeypod trees have enough time to recover in between construction projects, DTS commits not to start any In-Town BRT-related construction activities affecting the ten trees on Kapiolani Boulevard for a period of two years following the completion of the DDC project. This commitment is being made in order to provide the trees the best chance to recover from the possible impacts of the reconstruction work. A professional arborist has determined that the two-year period would exceed the reasonable time required for the trees to recover and therefore, after that period, it would be safe to relocate the trees. (Personal communication from DTS to The Outdoor Circle, May 8, 2003).

5.7.5 Mitigation Measures for Agricultural Impacts

The North-South Road Park-and-Ride will cause an unavoidable impact to agricultural land and an operating agricultural business. Mitigation measures to compensate for loss of land and revenue to the business on site are described in Section 5.2. The loss of agricultural land in this area is deemed necessary to the success of the Refined LPA, and represents a policy decision by the City to allow some agricultural lands to be used to promote transit ridership in the Ewa region.

It is expected that the farm on this site would be able to continue operating after construction of the park-and-ride. Any haul roads on the farm property affected by the park-and-ride's access road will be maintained or realigned to allow continued use.

5.8 WATER

No major impacts on water resources are expected for any of the proposed alternatives.

5.8.1 Surface Water

Any additional impervious surface from roadway pavement under all alternatives will increase runoff and associated contaminants discharged to storm-water systems and surface waters. However, with the Refined LPA, much of the proposed new or widened pavement would be located along existing streets. Dillingham Boulevard will be widened over the Kapalama Stream bridge by reinforcing the bridge with a new bridge beam. This work will be accomplished without modifying or altering the stream. In addition, Ala Moana Boulevard Bridge over Ala Wai Canal may require a retrofit. Further engineering studies will be conducted to determine if retrofit is needed and if so, whether this would involve additional foundations or piers in the canal waters. A Clean Water Act (CWA) Section 404 permit from the U.S. Army Corps of Engineers and a CWA Section 401 Water Quality Certification from the State Department of Health will be obtained if necessary.

The incremental increase in impervious surface and associated contaminants resulting from implementation of the Regional and In-Town BRT systems will be minor in comparison to the total existing drainage area and pollutant loading to storm-water systems and surface waterways from Honolulu's urban core. Nonetheless, specific control measures will be resolved during final design, and a best management plan will be developed to minimize or control surface water runoff, especially at the North-South Road Park-and-Ride, which will be located adjacent to Kaloi Gulch.

No long-term effect on surface water quality of area streams, lagoons, or harbors would be expected. Increasing transit patronage (with the Refined LPA) will reduce the non-point source pollution created by automobiles.

Moreover, the project should not increase demand for water resources. All landscaping will be selected to match environmental conditions and avoid unnecessary water use.

5.8.2 Groundwater

Because the Southern Oahu Basal Aquifer (SOBA) is a designated sole-source aquifer, EPA requires a Ground Water Impact Assessment (under Section 1424(e) of the Safe Drinking Water Act) to determine the project's impact on the quality of the groundwater in the SOBA. The EPA approved the federal financial assistance for the project under the provisions of Section 1424(e) (see Appendix A).

No long-term impacts on groundwater quality, quantity, or flow characteristics are anticipated. The Refined LPA would provide a clean, convenient public transportation alternative to single-occupant automobiles. By replacing single-occupant vehicles with electric and conventional buses and reducing total regional vehicle-miles traveled (VMT), the overall pollutant loading of roadway runoff would be reduced.

The In-Town BRT is not located in a recharge area for the SOBA. The potential for contamination of the SOBA from the In-Town BRT would be low due to the artesian conditions in the SOBA created by the great thickness and relative impermeability of the caprock.

The Regional BRT will run along the H-1 Freeway over some areas where the basalt containing the SOBA is not covered by a thick layer of caprock and surface waters can percolate into the SOBA. In these areas, there is the potential for contamination of the SOBA from roadway drainage and hazardous spills. Since the Refined LPA will reduce total regional VMT, the amount of roadway runoff and the risk of accidental spills will be reduced. Any new construction will be tied into the existing drainage system.

The alluvial cover on the SOBA is thin or nonexistent at the Luapele Drive Ramp. The Luapele Drive Ramp has been designed with a short tunnel necessary to bring the BRT vehicles back onto the H-1. Although borings have not been initiated (and are not anticipated to be initiated until the final design phase), it appears that the tunnel will be excavated in rock. A lined drainage channel will intercept runoff from inside the tunnel.

Drainage systems at the park-and-ride facility at North-South Road would collect stormwater runoff and inadvertent material releases and convey them outside the SOBA recharge area via Kaloi Gulch.

The small amount of impervious surface constructed as part of the Regional BRT will not measurably reduce the recharge of the SOBA.

No major disruption of groundwater flow will occur. The only tunnel or other underground structure is the short bus tunnel associated with the Luapele Drive ramp.

5.8.3 Floodplains

No adverse impacts are expected in the 100- or 500-year base floodplains. The proposed TSM Alternative and Refined LPA alignments will traverse some floodplains, as described in Section 3.8.3, but the transit systems will largely utilize existing or planned roadways and will not require any changes that may affect the potential for flooding. In other words, implementation of the project will result in only minimal encroachment on the floodplain and no changes to existing flood elevation levels, nor will it increase the risk of floods. Therefore, the project is in compliance with U.S. DOT Order 5650.2 on Floodplain Management and Protection. Any necessary construction will comply with the rules and regulations of the National Flood Insurance Program (NFIP) and all applicable ordinances for flood hazard districts, as stated in the City and County of Honolulu's Land Use Ordinance.

5.8.4 Wetlands

It is anticipated that no wetlands will be affected by any of the project alternatives, because the project area is highly urbanized and transit lanes will occur mostly within existing roadways. The Refined LPA alignment will traverse streams using existing bridges. It is expected that bridge modifications to accommodate the Regional and In-Town BRT will not involve dredging or filling any waters of the U.S., including wetlands. However, there is a possibility that new piers may be necessary for a bridge widening at the Waiawa Interchange and a potential retrofit of Ala Moana Boulevard bridge over Ala Wai Canal, but the need for new piers will not be determined until the final design phase. Construction of any piers would be in association with pre-existing bridges, and additional foundations or piers in the streams would be avoided wherever possible. The U.S. Environmental Protection Agency's Section 404(b)(1) Guidelines (40 CFR 230) are the substantive environmental criteria used to protect the waters of the U.S. through the control of discharges of dredged or fill material under Section 404 of the Clean Water Act. A Section 404 permit will be obtained from the U.S. Army Corps of Engineers (ACOE), if necessary. Based on field reconnaissance, one potential wetland area has been identified just to the south of the Luapele Drive ramp. Although in the project area, this wetland appears to be outside of the construction limits. In order to define the boundaries of this wetland, a wetland delineation will be conducted during the final design phase. At this time, no wetland impacts are anticipated.

5.8.5 Navigable Waters

It is anticipated that no navigable waters will be affected by the proposed alternatives, because the project area is highly urbanized and transit lanes will occur mostly within existing roadways. The Refined LPA alignment will traverse streams using existing bridges, which may necessitate alterations to some of the bridge structures (see Sections 5.8.1 and 5.8.4). Ala Wai Canal is considered navigable. Therefore, if Ala Moana Boulevard Bridge over the canal requires a retrofit, this may require a permit from the U.S. Coast Guard pursuant to pursuant to the Rivers and Harbor Act of 1899.

5.8.6 Coastal Zone Management (CZM) Areas

Because the proposed project is a federally funded activity, it must receive a consistency determination from the State CZM program to assure that the project meets the guidelines in the State policy. The Department of Business, Economic Development and Tourism (DBEDT), the agency administering the State's CZM program, concurred with DTS's CZM consistency determination (see Appendix A).

5.8.7 Water Recreation

The proposed project is not expected to affect any water recreation activities within or adjacent to the project area. No impact on water quality that could affect recreational uses will occur from any of the alternatives, and no restriction of access to water recreation activities will occur.

5.9 ENERGY

This section provides estimates of the energy that would be consumed under each alternative in the design year 2025. The analysis considers direct (operational) and indirect energy requirements. Direct energy consumption includes the fuel required for passenger vehicles (automobiles, vans, light trucks) and transit buses. It also includes the electrical power needed to power the In-Town BRT vehicles if an EPT system is selected. Indirect energy consumption includes what is required to construct any capital improvements, and to manufacture and maintain passenger vehicles and transit buses.

The Refined LPA would result in the least amount of direct energy consumption because it would lead to a substantial decrease in the vehicle miles traveled (VMT) for passenger vehicles, and a substantial increase in VMT for transit buses (and In-Town BRT vehicles). Although the per unit energy requirements of a transit bus (or In-Town BRT vehicle) are greater than an individual passenger vehicle, the greater passenger capacity of these vehicles makes them more energy efficient on a per person basis. The Refined LPA is estimated to consume up to 215,000 fewer barrels of oil than the No-Build Alternative, and up to 249,000 fewer barrels than the TSM Alternative in the design year 2025. If EPT is used as the In-Town BRT technology, these savings would be slightly less.

The Refined LPA would require the most indirect energy because it requires the most construction. The TSM and No-Build Alternatives would also consume indirect energy because they also include some construction activities. The Refined LPA would produce maintenance energy savings because it would lead to less use of passenger vehicles. Maintenance costs under the TSM Alternative are not anticipated to increase over the No-Build Alternative because of the increase in maintenance energy for transit buses. The Refined LPA would produce a savings of approximately 44,000 barrels of oil for maintenance over the No-Build Alternative and 55,000 barrels of oil over the TSM Alternative.

5.9.1 Analysis Methodology

1) Direct Energy (Operational)

The method used to estimate the direct energy consumption for the alternatives is outlined in the Reporting Instructions for the Section 5309 New Starts Criteria (FTA, June 2002). Direct energy consumption involves the fuel needed by the vehicles (automobile, truck, bus, or transitway vehicle) on the island. In assessing the direct energy impact, the following factors were used:

- Annual vehicle miles traveled (VMT) for automobiles, trucks, buses, and In-Town BRT vehicles.
- Fuel consumption rates by vehicle type.

Daily traffic volumes and the projected 2025 VMT were used in the direct energy analysis for each alternative. The 2025 daily traffic volumes for the island were developed as part of the traffic modeling process. The daily VMT was annualized using a factor of 308 days/year. Table 5.9-1 shows the fuel consumption rates, as measured in British thermal units (BTUs), that were used in the analysis. One BTU is the quantity of energy necessary to raise one pound of water one degree Fahrenheit. These rates were developed by Oak Ridge Laboratory and published in the 2001 Transportation Energy Book: Edition 21.

TABLE 5.9-1
1999 ENERGY CONSUMPTION RATES

Vehicle Type	Energy Consumption/Vehicle Mile
Passenger Vehicles (auto, van, light truck)	6,225 BTU/Vehicle Mile*
Transit Bus (all vehicle types)	42,955 BTU/Vehicle Mile

Source: U.S. Department of Energy, Office of Transportation Technologies, 2001.
*This is a weighted average.

A slight adjustment was made in calculating the direct energy consumption of the Refined LPA because it includes the In-Town BRT, a system that could potentially be exclusively electric. If so, the In-Town BRT vehicle would use a touchable surface contact system (embedded plate) (see Section 2.2.3). Unfortunately, there is no existing data on the electrical demand of an all-electric In-Town BRT vehicle. However, there is data on the electrical demand of light rail transit (LRT) systems. Since the In-Town BRT vehicle would require less electricity than a typical LRT vehicle, slight adjustments were made to this information, which resulted in an estimate of 11,300 kilowatts per day for the entire system. Hybrid- electric In-Town BRT vehicles could be used as an alternative to an EPT vehicle (see Section 2.2.3). The fuel consumption of the hybrid vehicle would be similar yet slightly less than for the standard diesel buses shown in Table 5.9-1.

2) Indirect Energy

Indirect energy involves the one-time, non-recoverable energy consumption associated with construction activities. In addition to fuel consumption of vehicles involved in the actual construction of different elements of the alternatives, construction energy consumption also includes the energy needed to produce construction materials. An Input-Output method was used to estimate construction energy consumption for the alternatives. Under this method, the construction cost for each alternative is converted into energy consumption based on 1998 base data on the construction of similar transportation systems in the U.S.

Indirect energy also involves the manufacturing and maintenance of vehicles. This includes passenger vehicles and transit buses.

5.9.2 Energy Impacts

1) Direct Energy (Operational)

Annual direct energy consumption estimates, in BTUs, in the year 2025 under the No-Build, TSM and Refined LPA Alternatives are provided in Table 5.9-2. This table also shows the BTU-equivalent barrels of crude oil. A discussion of the direct energy consumption impacts of each alternative is provided below.

TABLE 5.9-2
ESTIMATES OF ANNUAL DIRECT ENERGY CONSUMPTION IN YEAR 2025

	Alternative		
	No-Build	**TSM**	**Refined LPA**
PROJECTED VEHICLES MILES TRAVELED (in Millions)			
Daily Passenger Vehicle	19.64	19.64	18.84
Annual Passenger Vehicle	6,050.43	6,050.16	5,803.26
Daily Transit Bus	.063	.078	.084
Annual Transit Bus	19.3	24.0	26.0
ESTIMATED BTUs (in Billions)			
Passenger Vehicle	37,664	37,662	36,125
Transit Bus	829.0	1,030.9	1,116.8
SUMMARY			
Total BTUs (in Billions)	38,492	38,692	37,242[2]
Total Barrels of Oil (in Thousands)[1]	6,636	6,671	6,421[2]
Change in Barrels of Oil from No-Build Alternative (in Thousands)	N/A	35	-215

Source: Parsons Brinckerhoff, Inc., October 2002.
Note: [1] Barrel of Oil = 5.8 million BTUs (from U.S. Department of Energy, Office of Transportation Technologies, Transportation Energy Data Book: Edition 18 –1998).
[2] For Hybrid diesel/electric vehicles.

No-Build Alternative

Under the No-Build Alternative, the year 2025 Oahu VMT for passenger vehicles (automobiles, vans and light trucks) is projected to be approximately 6,050 million miles and approximately 19.3 million miles for transit buses. Based on fuel consumption rates provided on Table 5.9-1, these vehicles would consume approximately 38,492 billion BTUs, or approximately 6.63 million barrels of oil, in the year 2025.

TSM Alternative

Under the TSM Alternative, the year 2025 Oahu VMT for passenger vehicles is projected to be approximately 6,050 million miles and approximately 24 million miles for buses. Overall, the islandwide passenger vehicles VMT under the TSM Alternative is projected to be almost the same as the passenger vehicles VMT under the

No-Build Alternative. Improved transit service would create additional transit trips under the TSM Alternative; therefore, the VMT for buses would be approximately 4.7 million miles higher under the TSM Alternative. Based on these VMT projections, passenger vehicles and transit buses would consume approximately 38,692 billion BTUs, or 6.67 million barrels of oil, in the year 2025. This is about 200 billion BTUs, or 34,000 barrels of oil more than what would be consumed under the No-Build Alternative.

Refined LPA

Under the Refined LPA, the year 2025 Oahu VMT for passenger vehicles is projected to be 5,803 million miles, and approximately 26 million miles for transit buses. Compared to the No-Build and TSM Alternatives, the VMT for buses would be approximately 6.7 million and two million miles higher under the Refined LPA, respectively. However, the VMT for passenger vehicles would be approximately 247 million miles lower under the Refined LPA. Based on projected VMT for the Refined LPA, approximately 37,242 billion BTUs, or about 6.4 million barrels of oil would be consumed in the year 2025. This estimate assumes that hybrid electric In-Town BRT vehicles would be used.

If an all-electric In-Town BRT system (i.e. EPT) is used, the fuel consumption indicated on Table 5.9-2 would be lower under the Refined LPA. Furthermore, an EPT system would require approximately 11,300 kilowatts per day, which can be provided within the reserve capacity of existing electric power plants according to Hawaiian Electric Company. Nevertheless, an EPT system overall would consume a slightly greater amount of energy, estimated at 38.5 million BTUs per day on average, which is the equivalent to 6.6 barrels of oil. It should be noted that this modest additional energy demand of an EPT In-Town BRT would be offset by other advantages of such a system, such as the vehicle's zero air pollutant emissions and its lower noise levels.

In summary, operational energy consumption under the Refined LPA would be the lowest among the three alternatives. The Refined LPA would annually consume up to 215,000 fewer barrels of oil than the No-Build Alternative, and up to 250,000 fewer barrels than the TSM Alternative in the year 2025.

2) Indirect Energy (Construction)

Indirect energy consumption estimates under each alternative are provided in Table 5.9-3. This table also shows the BTU-equivalent barrels of crude oil. The energy consumption estimates under construction represents a one-time expenditure of energy. The indirect energy consumption impacts discussion for each alternative is provided below.

<u>No-Build Alternative</u>

The indirect energy consumption of the No-Build Alternative would include the manufacturing and maintenance of passenger vehicles and transit buses plus construction costs associated with programmed improvements to Oahu's transit center network. The construction and manufacturing activities required under the No-Build Alternative would consume approximately 1.5 million barrels of oil, and maintenance would require approximately 1.5 million barrels of oil in the forecast year 2025.

<u>TSM Alternative</u>

Under the TSM Alternative, construction activities would substantially increase the construction sub-total of the indirect energy consumption over the No-Build Alternative. It is estimated that such activities, in addition to the manufacturing of passenger vehicles and transit buses, would require 1.66 million barrels of oil, about 156,000 barrels more than what would be required under the No-Build Alternative. The energy required for the maintenance of passenger vehicles and transit buses would be slightly higher than what would be required under the No-Build Alternative because this alternative would result in greater use of transit vehicles.

<u>Refined LPA</u>

Construction of the Refined LPA would result in the greatest indirect consumption of energy compared to the other alternatives. Overall, it would require 727,000 and 571,000 barrels of oil more than the No-Build and TSM Alternatives, respectively. However, since the Refined LPA would result in less use of passenger vehicles compared to the other alternatives, energy consumption for maintenance under this alternative would be approximately 44,000 barrels of oil less than the No-Build Alternative.

TABLE 5.9-3
ESTIMATES OF INDIRECT ENERGY CONSUMPTION IN YEAR 2025

	Alternative		
	No-Build	**TSM**	**Refined LPA**
CONSTRUCTION[1] (in Billions BTU)			
Passenger Vehicle- Manufacturing	8,531	8,531	8,183
Transit Bus Manufacturing	67.0	83.3	90.2
Roadway	0	400.4	2,904
Parking	98.2	336.1	512.4
Structures	5.1	17.6	991.1
Maintenance Facility	0	234.8	235
Total Construction	8,701	9,603	12,916
Total Construction in Barrels of Oil (in Thousands)	1,500	1,656	2,227
Change in Barrels of Oil from No-Build Alternative (in Thousands)	N/A	155	727
MAINTENANCE[2](in Billions BTU)			
Passenger Vehicle	8,471	8,471	8,125
Transit Bus	253	315	342
Total Maintenance	8,724	8,785	8,466
Total Maintenance in Barrels of Oil (in Thousands)	1,504	1,515	1,460
Change in Barrels of Oil from No-Build Alternative (in Thousands)	N/A	11	-44
Total Indirect Energy Consumption (in Billions of BTUs)	17,425	18,388	21,382
Total Indirect Energy Consumption (in thousands of Barrels Of Oil)	3,004	3,170	3,687

Source: Parsons Brinckerhoff, Inc., October 2002.
Notes:
[1] Construction Energy Conversions (Caltrans, 1983):
Vehicle construction energy:
- Passenger vehicles – 1,410 BTUs/VMT
- Transit bus - 3,470 BTUs/VMT

Roadway – 27,500 BTUs/1977$
Parking – 61,615 BTU/1973$
Structures – 50,100 BTUs/1973$
Maintenance facility – 50,100 BTUs/1973$

[2] Maintenance conversions (Caltrans, 1983).
- Passenger vehicles – 1,400 BTUs/VMT
- Transit bus - 13,142 BTUs/VMT

5.10 HISTORIC AND ARCHAEOLOGICAL RESOURCES

This section discusses the potential impacts of the No-Build Alternative, TSM Alternative and the Refined LPA on the historic and archaeological resources in the study area. Consultation with the State Historic Preservation Division (SHPD) and other organizations interested in historic and cultural preservation was conducted throughout project planning in accordance with Section 106 of the National Historic Preservation Act (NHPA).

This section provides a summary of the Section 106 process conducted for this project. Effect determinations were rendered for the Refined LPA, and a Memorandum of Agreement (MOA) was prepared because the FTA rendered "adverse effects". A copy of the MOA is included in Appendix A.

5.10.1 Regulatory Context

Because of potential federal participation, this project is required to be in compliance with Section 106 of the NHPA. In accordance with Section 106, the "effect" of the project on historic or archaeological resources must be determined by the federal agency proposing or regulating the project. There are three possible "effect" findings:

- No historic properties affected;
- No adverse effect; and
- Adverse effect.

"No historic properties affected" means that either there are no historic properties present or there are historic properties present but the undertaking will have no effect upon them of any kind (that is, neither harmful nor beneficial). An "effect" means alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register of Historic Places (NRHP).

"No adverse effect" means that there could be an effect, but the effect would not be harmful to those characteristics that qualify the property for inclusion in the NRHP. In other words, it would not diminish or adversely affect the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

An "adverse effect" means an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration is given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the NRHP. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative. If an "adverse effect" is determined, a MOA between the federal agency and the State Historic Preservation Officer (SHPO) is prepared. Other parties are allowed to be MOA signatories.

5.10.2 Archaeological Resources

SHPD staff has indicated that because most of the project area is urban, with ground conditions consisting of fill and top soil that has already been highly disturbed by agriculture and construction, it is unlikely that the Refined LPA project area contains archaeological resources, such as archaeological and cultural remains, artifacts or sites, and Kupuna Iwi (ancestral native-Hawaiian burial site), at or near the ground surface.

No-Build Alternative

Under the No-Build Alternative, adverse effects to archaeological sites are not expected because no transit-related construction is proposed.

TSM Alternative

Like the No-Build Alternative, adverse effects to archaeological sites are not expected under the TSM Alternative because no transit-related construction is proposed.

Refined LPA

Construction of various elements of the Refined LPA, particularly certain segments of the In-Town BRT, could uncover subsurface archaeological resources.

Regional BRT elements will be constructed on existing roadways and rights-of-way with the exception of the Kapolei Transit Center and the North-South Road park-and-ride facility. The transit center and park-and-ride facility will be located on properties that have undergone substantial ground disturbance from past and present agricultural activities. Therefore, the probability of encountering archaeological resources would be very low.

Like the Regional BRT, the In-Town BRT will be constructed on existing roadways and rights-of-way, but may use embedded plate technology (see Section 2.2.3), which would require excavation along the alignments to install embedded plate modules and underground power cables. Off-street elements of the In-Town BRT include the TPSS at various locations.

Installing embedded plate modules and power cables would require excavation of about two to three feet deep along the corridor. This activity would have a moderate to high probability of uncovering subsurface archaeological resources along the following segments:

- Kamehameha Highway and Dillingham Boulevard in Kalihi;
- Chinatown, the Financial District and the Capital District in Downtown Honolulu;
- Kakaako;
- University of Hawaii; and
- Ala Moana and Waikiki.

Construction of the TPSSs along the above segments may also uncover subsurface archaeological resources.

5.10.3 Historic-Period Resources

There are no historic-period resources (historic buildings, structures and objects constructed or erected after western contact) within the Area of Potential Effect (APE) of the TSM Alternative.

As described in Section 3.10, the Refined LPA's APE for historic-period resources includes the non-street properties being used for transit stops, transit centers and park-and-rides, the Regional and In-Town BRT transitways (street and highway lanes), additional rights-of-way needed for the transitway and parcels directly adjacent to transit stops or transit centers. Table 5.10-1 lists the historic districts and historic-period resources within the APE of the In-Town BRT element of the Refined LPA. There are no historic-period resources within the APE of other elements of the Refined LPA. The transitway of the Regional BRT would only affect existing rights-of-way, and future transit centers and park-and-ride lots of the Regional BRT would be placed on vacant land (Kapolei Transit Center and North-South Road Park-and-Ride Lot).

As shown on Table 5.10-1, the Federal Transit Administration (FTA), through the City of Honolulu, Department of Transportation Services (DTS), has determined that the Refined LPA will have "no adverse effect" on many of the resources in the APE because they will not be affected by right-of-way acquisition, nor will they be affected by being in proximity to transit stops. Discussion of these historic-period resources, and why right-of-way impacts or being in proximity to transit stops will not cause them to be adversely affected by the project is provided below:

- The Fort Street Mall (Ewa-Bound) Transit Stop will be located next to the Portland Building. However, the building will not be directly affected. The transit stop will not be substantially different from the existing Union Mall bus stop, which has sheltered benches. Therefore, the stop was evaluated as having "no adverse effect" on the Portland Building.

- The UH-Manoa branch alignment on Kapiolani Boulevard near Sheridan Street will require a small amount of right-of-way on the property with a building containing the Blue Cross Animal Hospital. The building was constructed in 1938, and has maintained its architectural integrity. The FTA rendered a "no adverse effect" determination because the right-of-way take will not affect the building.

TABLE 5.10-1
EFFECT DETERMINATION ON HISTORIC PERIOD RESOURCES

Location	Resource	FTA/DTS Determination
Chinatown Transit Stop	Chinatown Historic District	Adverse Effect
	--Lung Doo Benevolent Society*	No Adverse Effect
	--Yew Char Building*	No Adverse Effect
	--Hotel Street Sidewalk Features	Adverse Effect
Union Mall Transit Stop	Portland Building	No Adverse Effect
Iolani Palace Transit Stop	Hawaii Capital Historic District	Adverse Effect
	--U.S. Post Office, Custom House and Court House (Federal Building)	Adverse Effect
	--Hawaii State Library	Adverse Effect
Thomas Square/NBC Transit Stop	Thomas Square	Adverse Effect
UH-Manoa transitway on Kapiolani Boulevard in the vicinity of Piikoi Street and Ala Moana/Keeaumoku Transit Stop	Kapiolani Boulevard historic landscape	Adverse Effect
	Blue Cross Animal Hospital*	No Adverse Effect
University/King Transit Stop	Varsity Theater*	No Adverse Effect
UH-Manoa Transit Stop	University of Hawaii Historic District	No Adverse Effect
	--Bachman Hall	No Adverse Effect
Bishop Transit Stop	Dillingham Transportation Building	No Adverse Effect
Ala Moana Park Transit Stop	Ala Moana Park	No Adverse Effect
Kapahulu Transit Stop	Kapiolani Park	No Adverse Effect[1]
Historic Sidewalk and Curb Elements		
Alakea Transit Stop	Lava curbs: Alakea Street between Queen Street and Nimitz Highway	Adverse Effect
Bishop Transit Stop	Lava curbs: Bishop Street between Queen Street and Nimitz Highway	Adverse Effect
Thomas Square/ Neal Blaisdell Center Transit Stop	Lava curbs: South King Street in front of Thomas Square and Neal Blaisdell Center	Adverse Effect
King/Pensacola Transit Stop	Lava curbs: South King Street in front of Kaiser Honolulu Clinic	Adverse Effect
Saratoga Transit Stop	Lava curbs: Saratoga Road, Ewa sidewalk	Adverse Effect

Source: Federal Transit Administration (FTA), through the City and County of Honolulu, Department of Transportation Services, July 2002.

Notes: * Preliminary assessment of historic based on consultation with the SHPD.
NBC: Neal Blaisdell Center
[1] The July 2002 effect determination rendered an "adverse effect" on Kapiolani Park, but due to the relocation of the Kapahulu Transit Stop, it was changed to a "no adverse effect".

- The University/King Transit Stop will be located near Varsity Theater. Since right-of-way will not be required from the building property and the transit stop will not use the sidewalk fronting the theater, a "no adverse effect" determination was rendered.

- The UH-Manoa Transit Stop will be within the University of Hawaii Historic District (State Site 80-14-1352), which contains several listed individually historic buildings and structures, such as Founders Gate and Hawaii Hall, as well as eligible buildings, such as Bachman Hall. Since the transit stop will be located at Sinclair Circle, which is already used as a bus terminus for the City Express route, providing a transit stop, even with sheltered benches and other furnishings, will not affect the historic integrity of the University, including the nearby Bachman Hall.

- The Bishop Transit Stop will be located near the Dillingham Transportation Building. The transit stop will be located on the opposite sidewalk from the historic structure, fronting the AMFAC center. Therefore, a "no adverse effect" determination was rendered.

- The Ala Moana Park Transit Stop will be on the sidewalk next to Ala Moana Park (State Site 80-14-1388), but will not require any park property, and will not affect the value of the property as a major regional park. The FTA rendered a "no adverse effect" determination because a relatively large bus shelter already occupies the site and has no effect on the historic characteristics of the park.
- The proposed Kapahulu Transit Stop was originally located on the sidewalk next to Kapiolani Park (State Site 80-14-9758) on the block between Kalakaua Avenue and the makai driveway of the Honolulu Zoo parking lot. Although no park property would have been acquired and use of the park would not have been affected, the FTA rendered an "adverse effect" determination because the stop's furnishings would have the potential to adversely affect the property's visual integrity (see Section 5.11). Since the July 2002 effect determinations, the Kapahulu Transit Stop was moved to a location on the mauka side of the parking lot driveway, but still within the roadway right-of-way. The backdrop of the relocated stop would be the landscaped zoo parking lot. Although the parking lot is part of the historic Kapiolani Park, it does not have nearly the same visual value or integrity as the park proper. Therefore, the effect determination regarding Kapiolani Park was changed to a "no adverse effect".

FTA, through DTS, rendered "adverse effect" determinations regarding two of the historic districts in the APE, Chinatown and the Capital District, and other historic-period resources that have visually integrity (i.e., views of the property are an important historic characteristic). The transit stops at or near these resources will include reconstruction of curbs and sidewalks and include benches, shelters, signage and other furnishings. Therefore, the transit stops have the potential to adversely affect the visual integrity of these properties. Discussion of the potential impacts to these historic-period resources is provided below.

<u>Chinatown Historic District</u>

The Chinatown Transit Stop will be located in the Chinatown Historic District (State Site 80-14-9986), which contains a large number of small businesses that utilize the street-level frontage of buildings for entrances and retail activities. Many shop owners utilize the sidewalk area for additional product displays, creating an outdoor street market atmosphere that contributes to the historic character of the district. The addition of a transit stop at the Hotel Street and Kekaulike Mall intersection could affect existing activities fronting a number of small street-level shops. In addition, Chinatown has a distinct architectural style, which will need to be reflected in the transit stop.

Hotel Street Sidewalk Features, which include granite paving blocks and lava rock curbs, were determined eligible for the NRHP in 1980 because of their contribution to the Chinatown Historic District. Since these curbs will be temporarily removed during construction of the transit stop, an "adverse effect" assessment was made regarding this specific historic property.

Although an "adverse effect" was rendered for the Chinatown district, the FTA determined that the transit stop will have "no adverse effect" on two nearby Chinatown buildings (see Table 5.10-1), Lung Doo Benevolent Society and Yew Char Buildings. Although both buildings will be adjacent to the stop, neither will be affected in a manner that will change their historic integrity.

<u>Hawaii Capital Historic District</u>

The Iolani Palace Transit Stop will be within the Hawaii Capital Historic District (State Site 80-14-1321), which includes numerous individual historic properties, such as Iolani Palace and Grounds, State Capitol, Honolulu Hale, and King Kamehameha Statue. The Koko-Head-bound stop will be in front of the U.S. Post Office, Custom House and Court House (State Site 80-14-9952), and the Ewa-bound stop will be in front of the Hawaii State Library (State Site 80-14-1307). The transit stops have the potential to adversely affect the district's visual integrity. The stops may also adversely affect the visual integrity of the U.S. Post Office, Custom House and Court House and the Hawaii State Library, even though a landscaped parking lot is in between the former and the Koko-Head-bound stop and the Ewa-bound stop will be set back from the sidewalk so as not to cause pedestrian congestion in front of the library (See Figure 5.4-4.).

Other Areas

The Thomas Square/NBC (Ewa-Bound) Transit Stop will be on the sidewalk next to Thomas Square (State Site 80-14-9990). Although no park property will be acquired and the value of the property as an urban park will not be affected (see Section 5.11), the FTA rendered an "adverse effect" determination because the transit stop's furnishings may adversely affect the visual integrity of the property.

The transitway along Kapiolani Boulevard and the Ala Moana/Keeaumoku Transit Stop will displace some of the monkeypod trees that are part of the Kapiolani Boulevard historic landscape. Although the project has committed to relocating all affected notable and healthy trees, the FTA rendered an "adverse effect" determination because of the tree displacements (see Section 5.7.1).

The FTA has determined that the Alakea Street, Bishop Street, Thomas Square/NBC, King/Pensacola and Saratoga Transit Stops will "adversely affect" lava rock curbs, which are considered "historic" by the SHPD, because they will be temporarily removed during construction, similar to the impacts described above regarding the Hotel Street Sidewalk Features.

5.10.4 Traditional Cultural Properties

Traditional cultural properties (TCPs), like archaeological and historic-period resources, are another type of historic properties that are afforded protection under Section 106. Some of the identified TCPs in the study area are from the many ethnicities and cultures of Hawaii that have adapted to the urbanized environment of Honolulu. The TCPs within the APE affected by the Refined LPA are Chinatown and Kupuna Iwi. Potential impacts to Chinatown are discussed in Section 5.10.3. Potential impacts to Kupuna Iwi are discussed in Section 5.10.2, and may be an issue during construction in certain areas.

5.10.5 Mitigation Measures

1) Construction

The project's MOA specifies that archaeological monitoring will be conducted during excavation in areas along the In-Town BRT alignment with moderate to high levels of probability of uncovering archaeological resources (see Appendix A). However, the monitoring stipulations for the In-Town BRT would only apply if the embedded plate technology were used.

If a burial or archaeological artifact is uncovered during construction, regardless of archaeological monitoring, work will stop and the SHPD will be notified immediately. Should a burial site be found during construction, specific legal procedures and cultural practices, such as involvement by the Oahu Island Burial Council, will need to be performed as specified in the MOA. Construction would resume upon approval of the appropriate authorities.

2) Historic Districts and Historic-Period Resources

The design of the transit stops in historic districts or near historic buildings with high visual integrity will be developed so that they are compatible with the surrounding area.

The project's MOA contains stipulations that require consultation with the SHPD and other stakeholders on the design of those transit stops that may adversely affect historic properties. The consultation will focus on the type, number and size of structures, architectural style, and protection of important viewsheds and historic characteristics of affected properties. DTS agreed to conduct a good faith effort to consider and understand the historic preservation concerns communicated by the SHPD and other stakeholders, and to reflect these concerns in its plans and design of affected transit stops. Meanwhile, SHPD agreed to conduct a good faith effort to consider and understand the service needs of future In-Town BRT riders, such as compliance with the Americans with Disabilities Act and protection from the elements.

5.10.6 Coordination

Consultation with the SHPD and stakeholders will continue as additional project details are developed and studies continue, as specified in the MOA.

5.11 PARKLANDS AND SECTION 4(f) EVALUATION

This section discusses potential impacts to parks and recreational resources in the project area. None of the alternatives would change the character, function or use of any park or recreational resource in the study area, although the two build alternatives will use the Aloha Stadium Kamehameha Highway (overflow) parking lot as a transit center/park-and-ride lot. The TSM Alternative and the Refined LPA would enhance transit access to parks and recreational resources in the project area by improving the level of transit service to parks along the alignments of these alternatives.

Vehicular access to Ala Moana Regional Park would be adversely affected under the Refined LPA because of the conversion of two general-purpose lanes to transit lanes on both Ala Moana and Kapiolani Boulevards.

5.11.1 Impacts to Parks and Recreation Areas

With the exception of the Aloha Stadium overflow parking lot, none of the alternatives would require land from or cause proximity impacts to any existing park or recreational resource. In general, the Refined LPA, and to a lesser extent the TSM Alternative, would enhance the value of the park and recreational resources in the study area by improving their accessibility for transit users. However, there is the potential for indirect impacts because of changes proposed to certain roadways and the proposed locations of certain transit stops near visually important parks.

The In-Town BRT element of the Refined LPA would reprioritize general-purpose lanes on major arterials in Honolulu. As a result, automobile access to Ala Moana Regional Park would be reduced. On-street parking along Ala Moana Boulevard near the park, which is allowed on most weekends and holidays, would be eliminated. The TSM Alternative would convert certain general-purpose lanes to semi-exclusive bus lanes, which would also require the removal of on-street parking. There would not be any impacts under the No-Build Alternative because roadway capacity for automobiles and parking would not change.

As noted in Section 5.4, Visual and Aesthetic Resources, proposed transit stops adjacent to Thomas Square, Ala Moana Park and Kapiolani Park have the potential to adversely affect the aesthetic characteristics of these parks, even though these transit stops will not use park property. Therefore, these transit stops will require special design treatment because of their proximity to these parks. Please see Sections 5.4.2 and 5.10.5 for proposed mitigation.

5.11.2 Section 4(f) Evaluation

Section 4(f) of the Department of Transportation Act, 49 U.S.C. 303 and 23 U.S.C. 138 (referred to hereafter as "Section 4(f)"), permits the use of land for a transportation project from a significant publicly owned public park, recreation area, wildlife and waterfowl refuge, or a historic site only when it has been determined that there is no feasible and prudent alternative to such use; and the project includes all possible planning to minimize harm to the property resulting from such use. The purpose of Section 4(f) is to limit the circumstances under which such land can be "used" for transportation projects. The word "use" in this case means:

- land is permanently incorporated into a transportation facility;

- there is a temporary occupancy of land that is adverse in terms of preservation of the resource; or
- the project's proximity to the site substantially impairs those functions that qualify the site as a Section 4(f) resource even though no land is permanently or temporarily acquired. This is called "constructive use."

The avoidance of Section 4(f) resources was an important consideration in developing and screening the alternatives. Therefore, of the many existing and planned public parks and recreational resources and historic properties in the project area identified in Sections 3.11 and 3.10, respectively, none will be affected by the alternatives such that there would be a Section 4(f) use. Although elements of the Refined LPA will traverse historic districts, no buildings important to the integrity of these districts will experience a Section 4(f) use. Also, there will be no Section 4(f) use of the Kapiolani Boulevard historic landscape and the lava rock curbs considered "historic" by the SHPD (see Section 5.10.3) because both resources are within roadway rights-of-way. The project's MOA (see Appendix A) specifies the relocation of affected trees and replanting of the Kapiolani Boulevard Historic Landscape to maintain its historic characteristics. The MOA also specified that historic sidewalk and curb elements be reused possibly as part of the project if practical.

There will be no cases of constructive use. For example, the loss of weekend/holiday parking on Ala Moana Boulevard would not be a constructive use because this would not cause Ala Moana Park's value in terms of public enjoyment to be substantially reduced. Park users will still be able to access the park by private vehicle, by buses or by BRT. In addition, transit stops in proximity to Thomas Square, Ala Moana Park and Kapiolani Park will not in any way affect park usage or the recreational value of these parks.

5.12 IMPACTS OF CONSTRUCTION ACTIVITIES

5.12.1 Overview

This section presents an assessment of the temporary impacts of construction and mitigation measures related to those impacts. A more detailed discussion of construction techniques for the various project elements is in the Construction Technical Memorandum (March 2000). The Refined LPA along with many of the other transit facilities related to the Refined LPA would be placed within the same rights-of-way as the existing surface roadway system, which must remain operational throughout construction. The project is being planned, designed and scheduled to meet this challenge with minimal disruption. However, some impacts on the environment, nearby facilities, and established patterns of activity are inevitable. These impacts would be temporary, and their severity would depend largely on the type of construction methods employed, how it would be carried out, and what controls are exercised.

The No-Build Alternative has the fewest impacts. The TSM Alternative has slightly more. The TSM Alternative mainly involves operational changes to the bus system and these changes in themselves are not considered in this document. The Refined LPA incorporates the TSM Alternative but includes additional new construction and therefore has a greater impact. The Refined LPA will require standard construction mitigation measures including noise, dust, sediment, and erosion control.

5.12.2 Transportation and Circulation

Most of the impacts to land-based transportation are associated with the Refined LPA. The No-Build and TSM Alternatives would have little impact on traffic during implementation.

The Construction Management Program would include development of a "Maintenance of Traffic Plan". This plan, which will be reviewed and approved by the City Department of Planning and Permitting (DPP), would include systemwide as well as subarea consideration of the most important traffic and transportation issues and mitigation measures. Specifically, the plan would include:

- Overall maintenance of traffic and transportation goals, project commitments, and identification of key project elements which have been specifically designed to meet maintenance of traffic objectives;

- A systemwide maintenance of traffic program to maintain mobility and accessibility and to address project-wide issues such as parking, commuter transportation systems and traffic system management;
- Project subarea maintenance of traffic measures focused on the specific detours, disruptions, problems, and issues expected in each subarea during each stage of construction;
- A coordination program for continued development of the Maintenance of Traffic Plan, including provisions for interaction with public agencies, local communities and the private sector; and
- Procedures for finalizing, monitoring, and implementing the Maintenance of Traffic Plan during construction, as a part of the Construction Management Program.

The Plan would include such policies as:

- Construction activities which would close traffic lanes would be restricted to off-peak hours whenever feasible;
- Construction activities would be phased so as to minimize traffic impacts to any one area;
- During final design, detailed Work Zone Traffic Control Plans, which would include detour plans, would be formulated in cooperation with all affected jurisdictions;
- Existing bus service would be maintained, as well as vehicle and pedestrian movements;
- Unless unforeseen circumstances dictate, no designated major or secondary highway would be closed to vehicular or pedestrian traffic. No local street or alley would be completely closed, preventing vehicular or pedestrian access to residences, businesses or other establishments; and
- An extensive public information program would be implemented which would provide motorists, residents and businesses with information on the location and duration of construction activities, and anticipated traffic conditions.

Truck traffic will be using existing routes except near construction areas. Signage and traffic cones would be provided to re-route truck traffic around construction zones where necessary.

Bus routes and stops would generally be maintained, although buses may be re-routed over temporary detours and bus stops may be temporarily relocated. Moreover, public transportation facilities and services would be expanded during project construction as part of the Maintenance of Traffic Plan.

Bicycle routes would be included in the re-routing of surface transportation systems. Signage would be provided to re-route established bicycle facilities around construction zones.

Local access to residences and businesses would be maintained during all phases of the construction work. Pedestrian movements would be maintained, but may be temporarily relocated to provide safe passage through work areas. Alternative pedestrian routes, including attractive, well-lighted, safe walkways, would be provided around or through construction areas.

Measures to minimize the impact of loss of parking during construction would be implemented, including temporary parking facilities, staging of construction to minimize parking loss, and remote parking for project construction workers.

In most cases, the nature of the construction for the In-Town BRT would not require street closures or detours because much of the work would occur in the median or curb lanes of the roadway, allowing vehicles to pass the construction zone using the remaining lanes. Although there would be localized lane reductions in the construction area, curb parking would be temporarily and/or permanently eliminated in many places, so that traffic flow using the remaining lanes would be maintained under most situations. (Parking losses and mitigation measures are discussed more fully in Section 4.2.4). Some presently allowed turning movements could be restricted when construction is occurring within an intersection.

The Refined LPA (and to a very minor extent, the TSM Alternative) would create truck traffic associated with the transport of construction materials and wastes. Times and routes of construction vehicles would be planned as part of the development of the Maintenance of Traffic Plan. Planning would occur with the intent of minimizing the effect of construction traffic.

5.12.3 Displacements, Relocation and Restricted Access for Existing Uses

Section 5.2 discusses permanent displacements and relocations that could be necessary for the project. The discussion in this section is limited to only those areas that would be needed temporarily during construction.

The Refined LPA would require temporary areas for construction staging of the In-Town BRT transitways. There are a number of vacant sites along the alignment that could serve as construction staging areas.

Staging areas would also be necessary for construction of the Regional BRT ramp and zipper lane improvements.

5.12.4 Neighborhoods and Businesses

Adverse impacts to neighborhoods and businesses near construction sites would be related primarily to disruptions of local transportation and circulation patterns, and air and noise emissions caused by construction vehicles and equipment, and vehicles delayed by construction. Air quality and noise impacts during construction and proposed mitigation measures are discussed in Sections 5.12.5 and 5.12.6.

Although a maintenance of traffic plan will be prepared and implemented (see Section 5.12.2), construction will cause motorists, bicyclists and pedestrians to experience delay and inconvenience when traveling on affected streets undergoing construction activities. Bus routes on or crossing affected streets will generally be maintained throughout the construction period, but they may be routed over localized, temporary detours, and bus stops may be temporarily relocated.

Local access to residences, businesses, and nearby parks, such as Thomas Square and Ala Moana Park, will be maintained when construction is conducted on adjacent roadways. However, travel to and from these destinations may be delayed as a result of increased congestion levels. Pedestrian movements will be maintained, but may be temporarily relocated to provide safe passage through work areas. Existing bike lanes, such as those along University Avenue, will be temporarily closed when construction is conducted on affected streets.

Even with an effective maintenance of traffic plan (see Section 5.12.2), construction-related traffic disruptions will cause inconveniences to residents living near construction sites, and may cause certain businesses to lose revenue, especially those that rely on drive-by customers. These types of businesses include fast-food restaurants and convenience stores. Construction on a particular street would cause some motorists to choose alternate routes, bypassing those businesses along affected streets.

5.12.5 Air Quality

Contractors would be required to comply with all applicable air quality laws to limit adverse effects on air quality from demolition, clearing, material processing and construction activities, as well as from construction vehicles.

Construction would cause emissions of fugitive dust, airborne particulate matter of relatively large size. Fugitive dust would be generated by particulate matter being kicked up by such activities as excavation, demolition, clearing, stockpiling, hauling, vehicle movement, and dirt tracking onto paved surfaces at access points. Fugitive dust also would be generated from the material processing and storage that would occur at the stockpile areas associated with recycling usable portions of excavated material.

To minimize the amount of construction-generated fugitive dust, the following measures would be followed:

- minimize land disturbance;
- apply water or other environmentally acceptable material to control dust generation;
- cover trucks when hauling dirt or other dust-generating materials;
- stabilize the surface of dirt piles if not removed immediately or other material storage areas;
- use windbreaks;
- limit vehicular paths and stabilize temporary roads;
- pave all unpaved construction roads and parking areas to road grade for a length no less than 50 feet where such roads and parking areas exit the construction site;
- use dust suppressants on traveled paths that are not paved;
- apply dust control and suppression techniques to the material processing activities at the stockpile sites;
- remove unused material and dirt piles when they are no longer needed; and
- revegetate areas where existing landscaping was removed for construction.

As discussed in Section 3.5, carbon monoxide (CO) is the principal pollutant of concern in localized areas. Since emissions of CO from motor vehicles increase with decreasing vehicle speed, disruption of traffic during construction could result in short-term elevated concentrations of CO. To minimize CO emissions, efforts would be made during construction to limit disruptions to traffic through prior planning of alternate routing, traffic control, and public notices, especially during peak travel periods.

5.12.6 Noise and Vibration

Construction noise would adversely affect nearby residences, schools, office buildings, and other noise-sensitive activities.

Table 5.12-1 presents typical maximum noise levels (Lmax) of heavy mobile construction equipment and compressors measured at a distance of 50 feet. Since construction activities would take place within 50 feet of noise sensitive receptors, the values in Table 5.12-1 would be representative of the noise levels to be expected during various stages of construction.

To minimize the level of impact, a specification for noise and vibration limits from construction activities would be developed and enforced. The specification would be submitted to Hawaii Dept. of Health (HDOH) for their review. An industrial hygienist would monitor compliance with the specification during construction through on-site noise and vibration monitoring during various stages of construction.

The HDOH also has Community Noise Control standards, which apply to construction noise. The project cannot exceed the noise levels stipulated by these standards unless a Noise Permit and/or Variance is granted by HDOH. Variances are only granted if they are in the public interest and the construction noise would not substantially endanger human health and safety.

The Construction Management Program would explicitly address the minimization of noise levels generated during construction, and would include the following mitigation measures:

- Design Considerations: during the early stages of Construction Management Plan development, the deployment of noisy equipment would be considered. For example, no stationary equipment would be located near schools or hospitals;

TABLE 5.12-1
CONSTRUCTION EQUIPMENT NOISE EMISSION LEVELS

Equipment	Typical Noise Level (dBA) 50 feet from Source
Air Compressor	81
Backhoe	80
Compactor	82
Concrete Mixer	85
Concrete Pump	82
Concrete Vibrator	76
Crane, Derrick	88
Crane, Mobile	83
Dozer	85
Generator	81
Grader	85
Impact Wrench	85
Jack Hammer	88
Loader	85
Paver	89
Pile Driver (Impact)	101
Pile Driver (Sonic)	96
Pneumatic Tool	85
Pump	76
Rock Drill	98
Roller	74
Saw	76
Scarifier	83
Scraper	89
Shovel	82
Truck	88

Source: *Transit Noise and Vibration Impact Assessment*, Federal Transit Administration (FTA), 1995.

- Sequence of Operations: noisy operations would be scheduled to occur at the same time (as opposed to being spread throughout the day), and, as feasible, noisy operations would be scheduled to occur when schools are not in session or other noise sensitive activities are not occurring;
- Noise barriers would be employed where feasible;
- Source Control: many types of noise emissions can be controlled at the source and in such cases, noise reduction systems would be employed. For example, noise reducing muffler systems lower exhaust noise by at least 10 dBA; and
- Time and Activity Constraints: as much as possible, noisier activities would be limited to daytime hours.

Vibration levels at adjacent structures would be monitored and the structures protected from vibration impacts, as necessary.

5.12.7 Water Quality

During construction, impacts to surface and groundwater resources potentially could occur. Impacts to surface water would be associated with point and non-point source stormwater discharges and dewatering discharges. These discharges could contain particulate (sediment) and chemical contaminants. Potential sediment sources include unstabilized, exposed soil at excavations; drainage from material stockpiles; discharges from haul trucks; and dewatering activities.

Sediment and Erosion Control

Erosion and sediment discharges would be minimized through the application of Best Management Practices (BMPs) techniques designed to minimize erosion and capture sediment prior to discharge. Examples of BMPs include:

- Use of chemical crusting agents or other stockpile coverings;
- planting of vegetation and/or mulching on highly erodible or critically eroding areas;
- Use of temporary landscaping;
- Use of silt fences;
- Use of sediment control traps,
- Use of straw bale filters,
- proper design and construction of access roads;
- use of inlet system sediment control traps;
- installation of debris basins;
- use of stilling basins to reduce the levels of sediments and other pollutants entering surface and coastal waters;
- construction of dikes or diversions to avoid runoff across erodible areas; and
- monitoring of sediment discharge.

Together, the BMPs would effectively minimize the potential for water quality impacts or off-site impacts from eroded material. Important BMPs would include maintenance of the sediment and erosion control systems, an ongoing monitoring program to determine the effectiveness of the BMPs, and adjusting the sediment and erosion control program as required.

Details of the BMPs would be developed during final design stages and detailed erosion and sediment control plans would be included in the final construction plans for the project. Through the agency reviews conducted as part of the permit process, the use of proper sediment control techniques would be assured.

Studies at specific locations to identify potential chemical contaminants in dewatering and stormwater discharges and stockpile drainage would be performed during later design phases, and appropriate treatment measures would be employed based on the character of the discharge and the water quality standards of the receiving water body.

Spills associated with construction activities pose a potential threat to water resources. Development of a Spill Containment Control and Countermeasure Plan, including maintenance of clean-up equipment on-site, along with detailed spill prevention measures, would mitigate the impact of inadvertent releases.

Dewatering Discharges

For most construction operations, groundwater encountered during excavations would need to be removed during construction (dewatering), and groundwater disposal and ground subsidence would have to be considered. Such dewatering would be temporary, limited to the time required for excavation and construction.

The water removed from excavations must be returned to the groundwater system, added to the stormwater drainage system or discharged to adjacent surface waters. The groundwater would contain suspended sediment and possibly chemical contaminants, and could adversely affect the water quality of receiving surface water bodies by increasing their turbidity and sedimentation rates.

Any dewatering discharge would require a dewatering permit that could only be obtained after designing an appropriate treatment process to ensure that the discharge meets water quality standards. For example, sediment would be removed prior to discharge through a sedimentation or filtering system. A monitoring program would assure compliance with water quality standards.

The groundwater could be contaminated (e.g., petroleum product) at several locations where excavations are required. The contamination potential would be studied in subsequent stages of project planning. Contaminants would be removed in accordance with standards established by the State of Hawaii Department of Health. For example, removal of petroleum products might require the use of oil water separators, strippers or other remediation techniques. Additional studies would be required during the final design phase to determine the precise methods to be employed.

Depression of the natural groundwater table caused by dewatering can induce consolidation of subsoil and subsequent ground settlement (subsidence). Subsidence can cause cracking and other damage to buildings and facilities. To mitigate the potential impacts of subsidence, a structural survey of buildings, roadways and other facilities adjacent to dewatering sites would be performed prior to construction. During construction, a monitoring program would be conducted that would include such techniques as inclinometers to measure relative lateral movement of soil at different elevations, settlement points, and observation wells to study groundwater draw down. Monitoring data would be reviewed immediately to ensure minimal disturbance to existing facilities. Recharging the groundwater outside the excavation and other measures could be utilized to help minimize the effects of dewatering.

The project area is underlain by the Southern Oahu Basal Aquifer (SOBA). Mitigation measures, as discussed above, would be implemented during construction to ensure that no adverse effects on the aquifer would occur.

Construction Equipment Use and Maintenance

Since many of the proposed facilities would be built using cast-in-place concrete construction, large amounts of concrete would be transported to the construction site. Each time concrete is transported, residue remaining in the concrete truck must be washed out before it hardens. This wastewater contains fine particles and could cause sedimentation and turbidity if discharged to surface waters.

Concrete trucks would be washed out in accordance with procedures to ensure that water quality standards are not violated. Project specifications would prohibit the washing out of concrete trucks at the project site, or a filtration or settling system would be constructed to prevent fine material from being discharged into surface waters.

The use and maintenance of construction equipment can pose a threat to surface and ground waters. Potential spills associated with vehicle maintenance, such as changing oil and refueling equipment, can introduce new contaminants into the environment at the construction staging area. The servicing and maintenance of construction equipment would be restricted to the base yards of the mobile equipment. At these vehicle maintenance areas, strict enforcement of BMPs would be required. Clean up equipment would be maintained on site and clean up response plans would contain detailed spill response measures.

5.12.8 Ecosystems

Wildlife habitat is very limited along the transitways and at other sites proposed for road, ramp and transit center construction. Construction would directly affect individuals of species inhabiting the construction area that are relatively immobile or have small home ranges. The removal of this habitat would have little overall effect on wildlife populations. The sites do not represent unique or special habitats within the project area. The proposed build alternatives would have no major effect on the characteristics or size of populations of the resident wildlife species in the area.

The Regional and In-Town BRT alignments of the Refined LPA will cross streams in the study area on existing structures (bridges). Some of these bridges will require widening, but most of them, if not all, will not require new or reconstructed bridge piers within the streams. New piers may be necessary for a bridge widening at the Waiawa Interchange, but the need for new piers will not be determined until the final design phase. Construction of any piers would be in association with pre-existing bridges. Wherever possible, additional foundations or piers in the streams would be avoided. Construction impacts to water quality that may affect aquatic wildlife would be avoided through mitigation measures agreed to by the ACOE, the HDOH, and the DLNR during final design.

Every precaution possible will be taken during construction to protect street trees. The tree impacts of the Refined LPA are described in Section 5.7. The construction impacts will consist of permanent removals and/or relocations of trees that are not compatible with the road widening requirements of the project, as well as tree trimming. Mitigation is addressed in Section 5.7 and will be described in detail in the tree preservation plan to be developed with a qualified certified arborist. A qualified certified arborist will also prepare a tree protection plan to be used during construction. The plan will specify precautionary measures to be taken to protect trees that are being relocated, as well as measures to protect other nearby trees during construction. Community input will be a component in preparing the tree protection plan. Construction mitigation measures will include tree protection zones that will be observed, except in cases where earthwork at or near the base of a tree is necessary, construction watering of trees, and prohibiting construction vehicles from being parked under trees to avoid soil compaction. A Street Tree Review will also be conducted by the DPP as part of the construction plan review by the City. The DPP’s Street Tree Review applies only to those trees not located within a Special Design District.

In general, monkeypod trees pruned for replanting will take about one year to grow back their canopies, with full recovery expected in three to five years. The Kamani trees on Dillingham Boulevard will take a little longer to recover fully, about four to eight years.

<u>5.12.9 Solid and Hazardous Wastes</u>

1) Solid Waste

The volumes of solid waste that would be generated with all of the alternatives are not anticipated to be beyond the ability of existing landfills to handle. Coordination would be conducted with the DPP for a grubbing, grading, and stockpiling permit. Waste generated by grubbing of the sites and all wastes generated during construction will be disposed of properly.

2) Contaminated Materials

While chemicals would not contaminate much of the solid waste that would be generated by construction, portions of the solid waste would likely be contaminated. Contaminants that could exist in solid wastes generated by construction include petroleum hydrocarbons, pesticides, herbicides, organic solvents, metals, PCBs, corrosives, organic lead, contaminants contained in landfill leachate, and other parameters. For these contaminated fractions of the solid waste stream, the level of impact would depend upon:

- the type of contamination;
- location of the area generating the contaminated wastes;
- proximity to surface waters;
- groundwater flow direction and depth relative to site;
- whether a contaminant release has occurred on the property;

- status of the release;
- the nature and extent of such release;
- the proximity of the release to the alignment; and
- the nature of project construction activities near a potentially contaminated area.

A hazardous materials study was conducted in order to help identify potentially contaminated sites that would have an adverse impact on the project. Section 3.9 discusses the relationship of the Refined LPA to potentially contaminated sites.

The information provided for this study phase is not detailed enough to make an exact determination of potential impacts. It is merely an identification of sites where a potential source of contamination may exist. Contamination can only be positively identified by sampling and laboratory analysis. There is the possibility that the project could affect sites that were not identified in the study or that sites identified as potential sources of contamination would not have an adverse impact on the project. During future phases of the project, additional evaluation would be required to provide more information on construction activities of the Refined LPA. The additional evaluations could include, but not necessarily be limited to: additional record review, agency consultation, and soil, surface water, and groundwater sampling and analysis. For example, additional Phase I investigations of hazardous material sites would be completed where appropriate during the design phase. Specific recommendations, which could include Phase II sampling, would be prepared.

The presence of asbestos-containing material and lead-based paint must be assessed for buildings, which would be razed as part of project construction. As part of assembling the right-of-way for the project, buildings that would be acquired would be evaluated for hazardous materials and possible additional demolition costs.

The Refined LPA bus routes themselves are not expected to involve contamination, because the transit vehicles will travel on existing roadways. As discussed in Section 3.9, only off street transit facilities such as transit centers and traction power supply stations (TPSS) may have the potential for petroleum, PCB, or other hazardous material contamination. The approximately 15 TPSS sites to be located intermittently along the In-Town BRT alignment would each have a roughly 500 square-foot footprint. In most cases, they would be located inside existing or proposed buildings. Potential TPSS locations are designated on the preliminary engineering drawings provided in Appendix B (see Volume 4). However, since it would be 8 to 14 years before the EPT is installed depending on the segment, the locations shown on the design drawings are not site specific; each notation is intended only to indicate the general vicinity in which a TPSS would be placed. Site specific environmental assessments of each TPSS would be prepared prior to proceeding with implementation of EPT. Locations and design treatments would be established with community input.

The selection of mitigation measures would consider avoidance of exposure, minimizing impacts through redesign, and remediation. The need for and type of mitigation measures that would be required would depend on the nature of the contamination, the construction methods and the development plans (i.e. where structures and pavements will be located). The information collected during additional evaluations would be used to define the impacts and develop appropriate measures to minimize or eliminate any adverse impacts from site contamination.

In addition, issues relating to worker health and safety are required to be considered during construction because the health and safety of on-site personnel could be affected if they are exposed to contaminants. When contaminants are identified, the level of Personal Protective Equipment (PPE) that may be required and/or the need for special handling procedures would be assessed. However, it is likely that many types of contaminants that would be encountered would not require special protective equipment, but would require special handling to reduce potential exposure. A Contaminant Management Plan (CMP) detailing contaminant handling procedures and remedial response action would be prepared.

Project specifications should note the potential presence of methane at certain sites and at certain areas along the In-Town BRT route, and should require the contractor to take appropriate measures to protect workers.

Next steps would depend on whether the contaminated site was already owned by a government agency or whether site acquisition from a private owner is contemplated. If the site was to be acquired, necessary remediation activities would become a factor in the real estate negotiations. Often, the present owner is required to remediate the site before transfer to government ownership. Tenants should be required to remove all their equipment and materials when they vacate the properties.

Any site remediation would be performed in accordance with applicable State and federal laws. Required monitoring and remediation plans would be designed in coordination with the HDOH and other agencies, and the plans would be implemented prior to construction. Both soil and groundwater contamination would be addressed. In addition, the contractor would develop an Emergency Response Plan in coordination with the HDOH and other agencies to establish procedures should hazardous materials be encountered during construction. The handling, treatment, and disposal of any contaminated materials encountered would occur in full compliance with all appropriate requirements.

5.12.10 Utility Service

The Refined LPA would affect few major utilities but many minor ones, particularly if the embedded-plate traction power system is selected. Substantial planning would occur so that interruptions in utility service to customers are minimized. Coordination with utility providers during planning, final design, and construction would identify problems and provide opportunities to resolve them prior to construction. Replacement and/or relocation of utilities would be closely coordinated with roadwork and stop construction to minimize disruption to adjacent properties and traffic. Disruptions to utility service, if necessary, would be restricted to short-term localized events. Careful scheduling of these disruptions and prior notification of adjacent properties that would be affected by temporary service cut-off would mitigate some of the utility relocation impacts.

Many of the utilities that are to be buried underground or moved to another underground location could be relocated simultaneously with existing utilities to minimize the need for multiple excavations. As much as possible, relocated utilities would be buried together or coordinated with infrastructure improvements already planned by the City or other agencies.

A preliminary review of the Refined LPA alignment, stops, and transit centers in relation to siren locations for the Civil Defense Warning System indicates that no significant impact will occur. If sirens need to be relocated as a result of the project, they would remain in the same vicinity and be placed and designed to maintain comprehensive emergency warning coverage. Locations would be coordinated with Oahu Civil Defense during final design.

Coordination of utility relocations would be scheduled, programmed, and monitored as a part of the Construction Management Plan and Public Participation Program.

5.12.11 Economic

Construction activities associated with the Refined LPA would result in over 9,400 person-year jobs generated (see Section 5.1.5). During construction of the Refined LPA, local businesses could be negatively affected by increased congestion in front of their properties or by reduced access. Location-specific measures, including access, safety, noise and aesthetic requirements of adjacent businesses, would be identified during final design and incorporated into construction contracts. A public information program for commuters, tourists, local residents and the business community would be sustained. A community and government agency mitigation involvement program would be initiated to allow for the exchange of information and ideas.

5.12.12 Aesthetic and Visual

The construction work for the Refined LPA would occur in highly visible and traveled areas. Therefore, orderly and clean work sites would be required and enforced throughout construction. Landscaping would be left in place and protected for as long as possible and replaced as soon after construction as possible. Plans for re-landscaping the impacted areas will be reviewed by the DPP to maintain cohesive visual corridors.

5.12.13 Historic Resources and Archaeology

Discussion of the potential impacts on historic properties is provided in Section 5.10. Historic-period resources will not be affected by construction because these properties will not be in the construction area, nor will they be used to store equipment and vehicles or used as staging areas. There is a chance that construction along certain sections of the study area, such as in Waikiki, would uncover Kupuna Iwi (ancestral bones) or other archaeological artifacts. However, the project area is mostly urban and has been substantially altered for many years. In addition, most of the project requires little excavation. The project's MOA will provide procedures in the unlikely event that unanticipated resources are encountered during construction. The SHPO would be notified immediately if any bones, artifacts or other signs of historic occupation are observed.

5.13 OTHER ENVIRONMENTAL CONSIDERATIONS

5.13.1 Indirect Impacts

Indirect impacts (also referred to as secondary impacts) are those caused by the proposed action and are "later in time or farther removed in distance, but still reasonably foreseeable…." (40 CFR 1508.8)

Because investment in a fixed transitway can have major effect on land use and development, the largest indirect impact of the Refined LPA is that of inducing transit-oriented development, as discussed in more detail in Section 5.1. The route of the Refined LPA was selected for its consistency with officially adopted land use plans that direct and manage growth. A transportation system, like other infrastructure, is part of the management of such growth. The Refined LPA will constitute a governmental investment in a fixed transit system, reinforcing long-term patterns for the primary urban center.

The Refined LPA may stimulate planned commercial and residential development, such as in Kakaako, Kapolei, and the UH West Hawaii campus, among others – all areas designated for growth and development. Transit-oriented development and/or re-development such as mixed-use high-density residences and pedestrian-scale commercial districts could flourish in areas immediately surrounding transit centers and transit stops, which may otherwise take longer to develop. Higher land values may provide opportunities for urban renewal in areas that previously would not have been feasible to redevelop.

These changes will encourage some agricultural lands in Ewa and Central Oahu to be converted to urban use. Development of areas surrounding transit centers and transit stops would be guided by existing and proposed land uses, plans, regulations, zoning, and market conditions.

Such developments spurred by improvements in transit may result in additional demands on water and energy resources, civil services, and infrastructure, as well as some adverse impacts on air and water quality, additional pollution. Again, official government policies call for concentration of such services as a matter of policy.

5.13.2 Cumulative Impacts

A cumulative impact is an "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions…." (40 CFR 1508.7).

The cumulative impacts of an investment in transportation infrastructure in the primary transportation corridor would stem from urban development and re-development, as described in Section 5.13.1 above. Since a key purpose of this project is to focus future development in the urban core and Kapolei, the cumulative impacts of the project are viewed as positive. Investment in other infrastructure systems will be necessary to support the increase in development density. Without the project, urban living would be less attractive, and low density and sprawl development would continue. Continuation of current low density development patterns is inconsistent with the vision for Oahu that was articulated by the public during the Oahu Trans 2K community involvement activities, and is inconsistent with the project purpose of concentrating development. Further discussion of possible cumulative impacts resulting from the project is provided below.

1) Land Use

The No-Build Alternative would result in deterioration in current levels of mobility as existing suburban growth patterns continue along with an increase in vehicles on the roadways. In the absence of sufficient people-carrying capacity, it would be more difficult to achieve the desired concentrated growth pattern. The No-Build Alternative would encourage suburban growth patterns and the conversion of open space to low density subdivisions.

With the TSM Alternative, people-carrying capacity would be increased, but not to a degree sufficient to encourage the types of transit-oriented developments that would arise with the Refined LPA.

The Refined LPA would substantially enhance mobility by increasing people-carrying capacity. Growth would be attracted to locations along the alignment of the In-Town BRT system in the urban core.

Higher density redevelopment in a transit-supportive manner, particularly at transit centers and transit stops, would be encouraged. The Refined LPA would be more effective than the TSM and No-Build Alternatives in supporting an urban growth strategy that integrates land use and infrastructure planning. It would help facilitate desired land use development patterns consistent with the vision for the island.

2) Farmland

Agricultural activities occur in Ewa and Central Oahu. State and City policies encourage urban development, particularly in Ewa. Consistent with State and City policies, urban development would convert some open space to urban land uses.

3) Displacements and Relocations

Subsequent urban development and redevelopment projects and those associated with the Refined LPA could displace existing land uses temporarily as well as permanently. These displacements would be specified and analyzed during the environmental review of the subsequent development projects.

4) Socioeconomic

After the transportation investment is made, subsequent developments would enhance short- and long-term employment. Economic efficiency would increase through the improvement of transportation service and mobility.

5) Transportation

Planned transportation projects, including the alternatives addressed in this document, would enhance transportation service and mobility.

6) Air Quality and Noise

The project area has good ambient air quality conditions (see Section 3.5), and planned projects or developments would not substantially change air quality.

As urban development proceeds and density increases, ambient noise levels from various human activities may be expected to rise.

7) Water Resources

Impacts on water resources are highly regulated. As urban development proceeds, water quality impacts of each project would be assessed during the environmental review and permitting processes.

8) Biological

Subsequent development would affect ecosystems in the primary transportation corridor, but such ecosystems are already highly modified by human activity. Existing ecosystems would be replaced by incorporating appropriate landscaping into each development project. The biological impacts of each project would be assessed through its environmental review process

9) Historic and Archaeological

Historic buildings and structures are protected under federal and State law. As subsequent development proceeds, project proponents are required to coordinate with the SHPD before construction affects an historic property. Impacts to archaeological sites are not expected because the primary transportation corridor is largely urban or previously disturbed open space. However, should there be inadvertent encounters with burials, the SHPD must be informed, and appropriate actions taken.

10) Parklands

The parklands of Oahu are publicly owned. Development associated with the Refined LPA would not affect parklands except to provide for greater access. Subsequent developments would not encroach on parks. Any potential impacts on parklands would be assessed during the environmental review process for each subsequent development.

11) Visual and Aesthetic

Visual conditions would change as urban development proceeds. Visual impacts associated with the Refined LPA would be positive since the vehicles would be operating on existing roadways and transit stops would be designed to be visually compatible with and where possible enhance the surrounding land uses. Visual resource impacts associated with other development would be assessed during the environmental review process for specific projects.

12) Infrastructure and Utilities

A transportation infrastructure investment in the primary transportation corridor would increase people-carrying capacity and mobility, and facilitate higher density development. Therefore, as development density increases, more demand would be placed on other infrastructure and utility systems such as water supply, sewage systems, and electric distribution. Investments in these other infrastructure systems would be necessary to accommodate increased development density.

5.13.3 Relationship Between Local Short-Term Uses Versus Long-Term Productivity

Short-term uses of the environment versus long-term productivity refers to the interplay between typically adverse, short-term, construction-phase impacts, and the benefits of the project upon completion. The relative balance between these factors must be disclosed.

A transportation infrastructure investment in the primary transportation corridor would create short-term, confined adverse impacts during construction. These impacts are discussed in more detail in Section 5.12, but include temporary, localized increases in fugitive dust emissions, noise, and traffic congestion. Utility services could be temporarily affected, and erosion from exposed areas would need to be prevented. Construction-phase impacts would be mitigated, as described in Section 5.12.

A transportation infrastructure investment would counterbalance the temporary, construction-phase impacts. The investment would promote long-term productivity, and improve the quality of life for Oahu residents and visitors. Specifically, transportation improvements would:

- Improve public transportation service on Oahu, especially within the urban core of Honolulu—Kalihi-Palama to the University of Hawaii/Waikiki, and to and from the Kapolei/Ewa region.
- Support and encourage desired land use development patterns, such as higher density development in the urban core and in Kapolei.
- Provide improved travel time for transit patrons, thereby providing an attractive alternative to the private automobile.

The long-term productive uses listed above outweigh the temporary nature of the adverse construction-phase impacts of the project, which would be mitigated. The No-Build Alternative would not achieve the long-term productivity enhancements listed above.

5.13.4 Commitments of Resources

Given the urban setting of the primary transportation corridor, irreversible commitments of resources would be those associated with the construction process, such as use of energy, construction materials, and labor. Once applied to this project, these resources would not be available for other projects. This commitment of energy, materials and labor is not a drawback since these resources would otherwise be committed to a different construction project.

5.13.5 Unresolved Issues

The extensive public involvement, coordination, and consultation that have occurred during the project has resulted in substantial input on issues and concerns relative to the proposed project. Most issues raised have been addressed in this FEIS, although some issues remain unresolved. The unresolved issues are presented below with a brief discussion regarding resolution of the issue.

3. BRT Vehicle Technology. The In-Town BRT vehicles will be hybrid diesel-electric. The City is tracking the development of an all-electric touchable embedded plate system; and its impacts are included in this FEIS. However, no decision on using such a system would be made until it is proven

revenue service-worthy and additional environmental review is conducted. If embedded plate technology is selected, the locations of traction power supply stations will need to be identified and their impacts disclosed in a separate document prior to its implementation.

4. BRT Stop Design. The design of the architectural elements of the BRT stops will be completed during the next project phase, final design. The final design of BRT stops will involve public and agency input.

5. Noise Wall Design. The design of the noise walls required at the Puuwai Momi Apartments will be completed during the next project phase, final design. The final design of the noise walls will involve public input.

6. Tree Relocations. The exact locations where affected trees will be replanted will be determined during final design.

7. Ground Water Impacts. Ground Water Impact Assessment (under Section 1424(e) of the Safe Drinking Water Act) and coordination with the EPA to address potential impacts to the Southern Oahu Basal Aquifer (SOBA) is being completed by DTS.

8. Hazardous Materials. Phase I investigations of hazardous material sites will be completed where appropriate during the next project phase, final design. As a result of that investigation, specific recommendations, which could include Phase II sampling would be prepared and executed.

9. Parking and Loading Zone Mitigation. In areas where a large concentration of on-street parking spaces will be affected, replacement parking in new off-street parking facilities will be considered during final design, but only if they meet other livable community objectives and are the result of community-based planning. Likewise, loading zone impact mitigation will be considered during final design and community-based planning will be an integral part of the design phase to address mitigation measures for loading zone impacts.

10. Section 404 permit (Nationwide). New piers will be necessary for bridge widening at the Waiawa Interchange. Retrofitting the Ala Moana Boulevard bridge over Ala Wai canal may also require pier modifications. The need for this work will not be determined until the final design phase. If necessary, a Clean Water Act Section 404 permit will be obtained from the U.S. Army Corps of Engineers (ACOE).

IOS - INITIAL OPERATING SEGMENT OF THE REFINED LPA
IWILEI TO WAIKIKI

This Final Environmental Impact Statement (FEIS) for the Primary Corridor Transportation Project (PCTP) was prepared pursuant to the National Environmental Policy Act of 1969. Public comments will be accepted by the Department of Transportation Services (DTS) and the Federal Transit Administration (FTA) on this FEIS for 30 days after its Notice of Availability (NOA) is published in the Federal Register. The FTA will consider these comments in its determination on the issuance of the Record of Decision (ROD) for the Initial Operating Segment (IOS) of the Refined Locally Preferred Alternative (Refined LPA). It is planned that a separate ROD cover the remainder of the LPA at a future time.

The PCTP Major Investment Study/Draft Environmental Impact Statement (MIS/DEIS) was published in August 2000 and the LPA was selected in November 2000. A major change identified after the MIS/DEIS was published was the need for an additional line to serve the Kakaako Makai area, which by then had been selected as the site of the University of Hawaii Medical School and related facilities currently under construction. The new fourth line to serve Kakaako Makai was added to the LPA in August 2001 and the Supplemental Draft Environmental Impact Statement (SDEIS) for it was published in March 2002.

A State FEIS (under HRS Chapter 343) was accepted in November 2002, addressing all public and agency comments received on the MIS/DEIS and SDEIS. Project refinements were made incorporating comments that made the LPA more cost effective or increased its service.

This Federal EIS (under NEPA) also addresses the comments to the MIS/DEIS and SDEIS and it places special attention to the section of the LPA that will be constructed first. This is the 5.6 miles between Iwilei and Waikiki along the Kakaako Makai alignment. Impacts for the IOS are stated within each FEIS chapter as well as in this self-contained chapter which has been added for the convenience of readers. The first segment that will be constructed is between Iwilei and Waikiki, and it is called the IOS in this document. Construction will consist of concrete lanes, signal priority, and widening of sections of Ala Moana Boulevard and Kalia Road. Construction at the stops will include a 13-inch high raised platform, benches, and canopies (except in historically sensitive locations). The IOS will use hybrid diesel-electric vehicles which operate at-grade in exclusive or semi-exclusive lanes for 2.5 miles, and in mixed traffic for 3.1 miles. The IOS will provide frequent service and direct access to major activity destinations and residential neighborhoods. BRT service will operate every six minutes during peak hours and every ten minutes during off-peak hours.

The total capital cost for the IOS is estimated to be $48.1 million in 2002 dollars ($50.9 million in YOE dollars) and is already fully funded. The estimated $4-5 million cost of the ten hybrid diesel-electric BRT vehicles that are required for IOS operations is not included in the capital cost of the IOS, since all of the vehicles will be purchased with City funds as part of the fleet replacement program, with or without IOS implementation.

Construction of the IOS will take two years. Passenger service will begin in 2005. No significant adverse impacts are expected to result from implementing the IOS.

IOS.0 INTRODUCTION

The purpose of this chapter is to provide self-contained details on the first segment of the Refined LPA to be constructed, referred to in this document as the IOS. This chapter identifies potential impacts resulting from its implementation, describes proposed mitigation measures, and presents the funding plan. If deemed appropriate, FTA will issue a Record of Decision (ROD) for the IOS. The remainder of the Refined LPA will be the subject of a separate ROD at a future time.

The IOS section from Iwilei to Waikiki is a subset of the Refined LPA; it will be in place and impacts realized by 2006. As more sections of the Refined LPA are implemented, the impacts and benefits will be realized more widely. This IOS chapter is differentiated from the rest of the FEIS because it discloses those features that will be realized in the early years of BRT operation, starting in 2006; whereas the analysis of the full Refined LPA uses the future year 2025 for reviewing impacts. Said another way, the IOS describes the project as it will exist in 2006, where the Refined LPA describes it in 2025.

At each stage of implementation of the BRT system, including the IOS, the elements in place at that time will work with the rest of the transit system to improve the transportation service available to the public. Benefits will start accruing immediately with the IOS, and the level of benefit will increase as more BRT components are added through time.

IOS.1 OVERVIEW

Figure IOS.0-1 shows the elements of the IOS between Iwilei and Waikiki. Construction of the IOS will take two years with passenger service beginning in 2005.

Table IOS.0-1 summarizes the transportation and environmental impacts that are anticipated as a result of implementing the IOS. The impact analyses of the IOS reflect conditions in 2006, shortly after opening of the IOS. Additional details on these anticipated impacts and proposed mitigation are provided in Sections IOS.4 and IOS.5. No significant adverse impacts are expected to result from implementing the IOS.

IOS.1.1 Purpose and Need

The purposes and needs identified for the entire Primary Corridor Transportation Project include:

1. Increase the people-carrying capacity of the transportation system in the primary transportation corridor by providing attractive alternatives to the private automobile.
2. Support desired development patterns.
3. Improve the transportation linkage between Kapolei, which is designated as a “new city”in Honolulu’s Urban Core.
4. Improve the transportation linkages between communities in the Primary Urban Center (PUC) to increase the attractiveness of in-town living.

Because the IOS does not include the Regional BRT providing service to and from Kapolei, the purpose and need related to Kapolei would not be accomplished by the IOS. However, it serves a new land-use pattern selected for Kakaako Makai, which has become the site for the UH Medical School and related facilities that are now under construction and will be completed in the Spring of 2005.

Among the reasons why the Iwilei-Waikiki IOS was selected as the first segment to be constructed are the following:

- It will reduce auto trips and improve the quality of the environment within some of the most cherished pedestrian precincts on the island;
- It connects many existing major destinations and supports proposed development locations for new waterfront uses and for in-town living not presently well-served by transit;
- It is relatively easy to construct, since there are less widening and utility relocations required compared to the other In-Town BRT branches;

TABLE IOS.0-1
SUMMARY OF IOS IMPACT ASSESSMENTS AND MITIGATION MEASURES

	IOS IMPACTS	MITIGATION
TRANSPORTATION FACTORS		
Transit	Because the IOS will serve the same function as the existing Route 8, Route 8 will be replaced by the IOS. The segments of Routes 55, 56, and 57 between Downtown and Ala Moana Center are also redundant and these routes will terminate in Downtown, allowing quicker turnaround of these buses. The IOS is forecast to result in approximately 4,500 new transit riders per day in 2006.	None necessary.
Urban Intersections	Very little change in intersection operations are proposed, so there will be minimal changes in delays at intersections and in the LOS at any of the intersections analyzed along the IOS route.	None necessary.
Parking	The IOS will displace unrestricted parking spaces on Queen Street (5 marked spaces), Saratoga Road (5 marked spaces), and Kapahulu Avenue (12 marked spaces).	There are large existing off-street parking facilities with reserve capacity near each location where on-street parking will be removed. Therefore, parking displaced by the IOS will not be replaced.
Loading Zones	Preliminary engineering for the IOS has taken into consideration the need to avoid impacts to as many passenger and freight loading zones as possible. The IOS will not result in any loading zone impacts.	None necessary.
Bicycling	Due to the provision of exclusive and semi-exclusive BRT lanes, the IOS will improve bicycle tranportation on Auahi Street, portions of Ala Moana Boulevard, Kalia Road, Saratoga Road in the vicinity of Fort DeRussy, and a segment of Kalakaua Avenue between Saratoga Road and Uluniu Street.	None necessary.
Pedestrians	All transit stops will be in conformance with the Americans with Disabilities Act (ADA). The IOS will contribute to an improved urban walking experience through the use of environmentally friendly transit vehicles that produce less noise and air pollution.	None necessary.

TABLE IOS.0-1 (CONT.)
SUMMARY OF IOS IMPACT ASSESSMENTS AND MITIGATION MEASURES

	IOS IMPACTS	MITIGATION
ENVIRONMENTAL FACTORS		
Land Use, Development, and Plan Consistency	Consistent with HCDA Kakaako Makai Plan. Serves UH Medical School and related facilities currently under construction.	None necessary.
Business and Residential Displacements	Displacement of some landscaped areas at Fort DeRussy. No buildings or structures will be affected.	Landscaping removed at Fort DeRussy will be replaced with similar landscaping nearby along Kalia Road.
Neighborhoods and Environmental Justice	The IOS will not cause disproportionately high and adverse health or environmental effects on any minority and low-income population and will provide many positive transit benefits.	None necessary.
Visual Character	IOS transit stops located in areas with high visual or aesthetic value may cause adverse visual impacts. Landscaping altered by the project may cause changes to the visual environment at certain locations.	IOS transit stops located in areas with high visual or aesthetic value will be designed to be appropriate in each setting and where possible will enhance the aesthetics of the area. Any existing landscaping affected by the IOS will be mitigated through provision of new street plantings and tree replacements.
Air Quality	No impact.	None necessary.
Noise/Vibration	No impact.	None necessary.
Ecosystems – Faunal Species	White terns (State of Hawaii endangered species on Oahu) occur in the IOS corridor, but no adverse impacts are expected.	Even though no adverse impacts are expected, a survey of the IOS corridor will be conducted for white terns and their eggs prior to completing final design. If sensitive trees or areas are identified, they will be monitored immediately prior to and/or during construction. Relocation and/or trimming of trees will be coordinated with the City's Department of Parks and Recreation.
Ecosystems – Botanical Resources	Construction of the IOS will displace 47 trees, of which nine are "notable" trees on Kalia Road. Some tree trimming will be required. No designated exceptional trees will be affected.	A tree preservation plan will be prepared. Affected trees will be relocated near their original locations or replaced in accordance with the tree preservation program.

TABLE IOS.0-1 (CONT.)
SUMMARY OF IOS IMPACT ASSESSMENTS AND MITIGATION MEASURES

	IOS IMPACTS	MITIGATION
Water	No impact.	None necessary.
Energy Consumption	No adverse impact.	None necessary.
Historic and Archaeological Resources	Development of the Alakea and Saratoga Transit Stops may "adversely affect" lava rock curbs, which are considered historic. Development of the IOS is not expected to uncover buried archaeological resources or native-Hawaiian ancestral burial sites.	In accordance with the project's Memorandum of Agreement, DTS will work with the State Historic Preservation Division (SHPD) and other interested parties to explore using the lava rock curb material in the design of the two IOS transit stops affected. If burials or archaeological artifacts are uncovered during construction, work will stop and the SHPD will be notified immediately for appropriate action.
Parklands	The IOS will generally improve transit access to parks in the study area. Transit stops adjacent to parks could adversely affect their visual and aesthetic characteristics, even though no park property is used.	Transit stops near parks will require special design treatment.
Indirect and Cumulative	Substantial land use changes are not anticipated. The IOS may stimulate planned transit-oriented commercial and residential development. The IOS will be an important addition to the transportation infrastructure, supporting planned developments in Kakaako and Waikiki. The IOS and other planned developments will enhance short- and long-term employment.	None necessary.
Construction Impacts	Construction impacts will be temporary. Construction activities on streets will likely result in temporary traffic delays, detours, and bus stop relocation. Construction equipment and vehicles delayed by construction activities will increase emissions of fugitive dust and automotive air pollutants, such as carbon monoxide. Construction equipment also emits relatively high noise emissions, which could disturb nearby residences, schools, office buildings, and other noise-sensitive uses. Impacts to surface and groundwater resources are not expected due to best management practices. Utility services may be disrupted causing inconveniences to affected residences and businesses.	The Construction Management Program for the IOS will address all standard construction-period traffic and transportation issues. In addition, contractors will be required to comply with all applicable air quality, noise, and water quality laws. Substantial planning, including resident and business notifications, will be conducted to minimize inconveniences should interruptions in utility service be required.

Source: Parsons Brinckerhoff, Inc., April 2003.

FIGURE IOS.0-1
INITIAL OPERATING SEGMENT

- Unlike the Regional BRT which requires phasing in conjunction with other State of Hawaii Department of Transportation (SDOT) planned H-1 improvements that are not ready to proceed yet, the Iwilei-Waikiki IOS can be implemented immediately;
- There is community and business support along the route;
- It is viable as a stand-alone BRT route, as well as a building block for additional branches; and
- It is cost-effective.

IOS 1.1.1 Local Decision Making Process

In May 2002, the Honolulu City Council selected the Iwilei-Waikiki segment as the Initial Operating Segment. Their decision followed a widely publicized series of open public meetings that were well attended and included extensive testimony and questions. The Council appropriated funding for the IOS in the Fiscal Year (FY) 2003 Capital Improvement Program (CIP). The selection of the Iwilei-Waikiki segment as the IOS was again confirmed in June 2002, after additional open public meetings, when the City Council amended the Primary Urban Center Development Plan Public Facilities Map to incorporate the Iwilei-Waikiki segment improvements.

IOS.1.2 Differences Between IOS and 2025 Iwilei-Waikiki Branch

One of the advantages of BRT compared to a rail system is its flexibility for staging. Not only can segments be built sequentially, but features of each segment can be phased over time as well. For example, there are some sections along the IOS where priority BRT lanes will be needed and can be justified at the outset, and other sections where priority lanes are more appropriately deferred until ridership builds to the level sufficient to warrant the lane conversion. The IOS is therefore not identical to the Iwilei-Waikiki Branch that will be in place ultimately, and which is described in Chapter 2 as part of the 2025 system.

The primary differences between the IOS and the 2025 Iwilei-Waikiki Branch are:

- Until the Iwilei Transit Center opens in 2007, the Ewa terminus for the IOS will be Aala Park. Aala Park is a major bus transfer point today. Ewa bound BRT vehicles will continue from Hotel Street onto N. King Street and make a clockwise loop around Aala Park to return Koko Head bound on Hotel Street. The IOS will use existing bus stops on N. King Street and on Beretania Street.
- The elements connecting Dillingham Boulevard and Hotel Street will not be part of the IOS.
- Although the BRT will stop along Hotel Street, the Chinatown and Union Mall Transit Stop improvements will not be part of the IOS.
- Operations will be in mixed-flow traffic on Ala Moana Boulevard between Queen Street and the Ala Wai Canal. The ultimate improvements on this segment are not part of the IOS. Future 2025 BRT operations will be in exclusive and semi-exclusive lanes on Ala Moana Boulevard.
- Operations will be in mixed-flow traffic on Kuhio Avenue in Waikiki. In the future, there will be a semi-exclusive Ewa-bound lane along this section.

IOS.2 DESCRIPTION OF INITIAL OPERATING SEGMENT (IOS) FROM IWILEI TO WAIKIKI

This section contains a detailed description of the Initial Operating Segment (IOS) from Iwilei to Waikiki.

IOS.2.1 Initial Operating Segment

As shown in Figure IOS.0-1, the IOS will be a 5.6-mile high-capacity transit route providing dependable and frequent service with direct access to major activity destinations and residential neighborhoods along its alignment between Iwilei and Waikiki. BRT service will operate every six minutes during peak periods and every ten minutes during off-peak periods.

The IOS alignment will help to provide transportation connections between emerging redevelopment areas such as Kakaako Makai, located between Downtown and Ala Moana, and other existing major activity locations along the IOS alignment including Victoria Ward (Ward Warehouse and Ward Center). The first and second buildings in the new UH Medical School complex in Kakaako Makai are scheduled for completion in the Fall of 2004 and the Fall of 2005, respectively.

The IOS will have travel time between its end points in Downtown (Aala Park stop on Beretania Street) and Waikiki (Kapahulu Avenue stop) via the Ala Moana Boulevard corridor of between 28 and 33 minutes, including average wait and walk times. Of this, between 25 and 30 minutes are in-vehicle time. This compares to travel time between these same points using either the existing Route 19, Route 20, or Route 42 local buses of approximately 38 to 48 minutes.

The IOS will provide transportation connections between emerging redevelopment areas such as Kakaako Makai, located between Downtown and Ala Moana, and other major activity locations along the IOS alignment. The IOS will provide new direct service to Waikiki for the Kakaako Makai and Victoria Ward areas. Currently, transit riders need to walk from the Kakaako Makai area to Ala Moana Boulevard to catch a local bus to Waikiki area, and transit riders need to transfer from a Route 6 to a Route 8 bus to reach Waikiki from the Victoria Ward area. From the UH Medical School in Kakaako Makai, the IOS will provide an eight (five in-vehicle) minute travel time to the Union Mall stop in Downtown, while it takes 16 (9 in-vehicle) minutes today, including walk time and average wait time for TheBus. Similarly, travel time using the IOS between the the Waikiki Trade Center (Kuhio/Seaside stop) and Harbor Square (Alakea Street stop) will be 21 (18 in-vehicle) minutes versus 33 (30 in-vehicle) minutes using today's transit service. Travel time between Ward Centre (Kamakee Street stop) and Waikiki Beach is 33 (27 in-vehicle) minutes by today's transit service. This travel time will be shortened by 15 minutes to 18 (15 in-vehicle) minutes with the IOS, including average wait and walk times.

Additional refinements have been incorporated into the Refined LPA in response to comments received on the SDEIS during the public comment period. The only refinement pertinent to the IOS is the shifting of a short one block section of the Kakaako Makai branch alignment to Forrest Avenue rather than Channel Street, as shown in the Kakaako Makai Plan. This refinement has no significant effect as far as the impacts of the proposed action and it was made at the request of the Hawaii Community Development Authority (HCDA) to be consistent with their most recently adopted plan.

Convenient connections between the IOS and circulator, local, and express buses will occur at Aala Park, along Hotel Street in Downtown, at Ala Moana Center, and along Kuhio Avenue in Waikiki.

Along a portion of the IOS's length, BRT vehicles will operate at-grade in exclusive or semi-exclusive transit lanes. In other locations, the IOS will operate in mixed traffic. Figures IOS.2-1A and IOS.2-1B depict the locations of the IOS exclusive and semi-exclusive lanes.

The BRT stops will provide more amenities than the typical bus stop with 13-inch high raised platforms that provide level boarding to low-floor vehicles and covered waiting areas with seating, lighting and landscaping.

FIGURE IOS.2-1A
IOS PRIORITY LANES AND TRANSIT STOPS

FIGURE IOS.2-1B
IOS PRIORITY LANES AND TRANSIT STOPS

Some variations will occur due to space limitations. A rendering of the proposed Hobron Stop in Waikiki is provided in Figure IOS.2-2A, as an example; a drawing of a typical stop is shown in Figure IOS 2-2B. Some of the stops will also be provided with signs indicating the waiting time until the next vehicle arrives. The entire IOS system will be designed in compliance with the Americans with Disabilities Act (ADA).

IOS.2.1.1 IOS Routing

Travelling in the Koko Head direction, the IOS will start at Aala Park and proceed to the Hotel Street Transit Mall via Beretania and River Streets. From the Hotel Street Transit Mall, it will continue in the makai direction on Bishop Street to Aloha Tower Drive. From Aloha Tower Drive, the IOS will continue in the Koko Head direction on Ala Moana Boulevard and then turn in the makai direction onto Forrest Avenue. It will then turn in the Koko Head direction onto Ilalo Street which becomes Ward Avenue on the mauka side of Ala Moana Boulevard.

From Ward Avenue, the alignment turns Koko Head onto Auahi Street, where the BRT will be in extra-wide semi-exclusive curb lanes that permit the on-street parking to remain. At the Koko Head end of Auahi Street, the route will turn onto the short Queen Street segment to rejoin Ala Moana Boulevard and head Koko Head towards Waikiki. Along Ala Moana Boulevard, between Queen Street and the Ala Wai Canal, the BRT will operate in the curb lane in mixed traffic. Between the Ala Wai Canal and Kalia Road, Ala Moana Boulevard will be reconfigured to allow an additional lane in each direction. These lanes, formed by reducing the median and narrowing the travel lanes, will be semi-exclusive curb lanes shared with local buses, private buses and right-turning vehicles.

From Ala Moana Boulevard, the route will turn makai on Kalia Road and enter Fort DeRussy. The route will continue along Kalia Road to Saratoga Road, with Kalia Road being widened by one lane in each direction between the Hale Koa Hotel and Saratoga Road. The alignment will turn mauka on Saratoga Road. The BRT will be in semi-exclusive lanes on Kalia Road from Maluhia Street to Saratoga Road, and on Saratoga Road from Kalia Road to Kalakaua Avenue. At the intersection of Saratoga Road and Kalakaua Avenue, the route will split into a one-way couplet on Kalakaua and Kuhio Avenues. The Koko Head-bound transit lane will be semi-exclusive, using the makai curb lane of Kalakaua Avenue until after the stop at Uluniu Street where it will transition mauka in mixed traffic to turn onto Kapahulu Avenue. The Kapahulu transit stop will be on the Koko Head side of Kapahulu Avenue and will not affect Kapiolani Park. The transit stop improvements at this site will be within the 18-foot-wide public sidewalk area. The return loop will turn Ewa onto Kuhio Avenue, and the Ewa-bound buses will operate in mixed traffic using the mauka curb lane of Kuhio Avenue. The alignment will turn onto the Ewa side of Kalaimoku Street to return to Saratoga Road. Within Waikiki, the BRT lanes will mostly be curbside semi-exclusive lanes shared with local buses and private transit vehicles. The exceptions will be the Kalaimoku contra-flow lane which will be an exclusive BRT lane; and Kapahulu and Kuhio Avenues which will be mixed-flow operations.

In the Ewa direction, the IOS will travel Ewa from Kalaimoku Street in Waikiki following the reverse routing described for the Koko Head-bound direction, except that, at the intersection of Bishop Street/Nimitz Highway, the branch will turn Koko Head onto Nimitz Highway, then mauka onto Alakea Street, left on Hotel Street and then travel along Hotel Street to the North King Transit Stop at Aala Park.

Existing attractions that will be served by the IOS include Chinatown, the Central Business District, Aloha Tower Marketplace, Hawaii Maritime Museum, Piers 10 and 11 cruise ship terminal, Restaurant Row, Kakaako Waterfront Park, Children's Discovery Center, Ward Centre and Entertainment Complex, Ala Moana Center, Ala Moana Beach Park, Fort DeRussy, Kapiolani Park, and major hotels, high-rise residences, offices, and commercial/recreation destinations in Waikiki. Future land uses that would be served include future phases of Aloha Tower Marketplace, a new cruise ship terminal at Pier 2, the proposed University of Hawaii School of Medicine and related bio-medical research facilities, the proposed Hawaii Science and Technology

FIGURE IOS.2-2A
RENDERINGS OF HOBRON LANE STOPS

FIGURE IOS.2-2B
TYPICAL SECTION OF BRT STOPS

Center, commercial plus retail development at Kewalo Basin, and the Waikikian and Outrigger redevelopment projects in Waikiki.

IOS.2.1.2 Transit Stops

The following describes the 20 locations where transit stops will be located along the IOS (see Figures IOS.2-1A and IOS.2-1B). The stops will provide direct access and encourage pedestrian-friendly, transit-oriented development and infill near stops in areas designated and zoned for redevelopment:

- N. King Street and Beretania Street (Aala Park): The first Koko Head-bound stop will be on Beretania Street next to Aala Park. The Ewa-bound terminus will be on N. King Street on the opposite side of Aala Park. Since these will be temporary stops until the Iwilei Transit Center is constructed, the BRT vehicles will use the existing bus stops at this location. There will be no construction at these existing bus stops for the IOS.
- Chinatown: The BRT stops will be the existing curbside bus stops on Hotel Street at Kekaulike Street, and will serve Chinatown. There will be no construction at these existing bus stops for the IOS.
- Union Mall: This pair of transit stops will be the existing bus stops located between Fort Street and Union Malls and will serve the Central Business District. There will be no construction at these existing bus stops for the IOS.
- Bishop: This Koko Head-bound transit stop will be located adjacent to the Topa Financial Center (previously known as Amfac Center) on Bishop Street just makai of Queen Street.
- Alakea: This Ewa-bound transit stop will be located adjacent to the Harbor Square tower on Alakea Street.
- Aloha Tower: This pair of transit stops will be located on Aloha Tower Drive just to the Koko Head side of Bishop Street by the Hawaii Maritime Museum.
- Fort Armstrong: This pair of transit stops will be located on Ala Moana Boulevard near the U.S. Immigration Station/Department of Health Building, Restaurant Row, and the site of a future passenger ship terminal at Pier 2.
- Coral: This pair of transit stops will be located along Ilalo Street between Coral and Cooke Streets in the center of the Kakaako Community Development District Makai Area.
- Kewalo Basin: This pair of transit stops will be located along Ilalo Street adjacent to Ahui Street.
- Kamakee: This pair of transit stops will be located on Auahi Street and will provide access to the Victoria Ward developments and Kewalo Basin.
- Ala Moana Park: This pair of transit stops will use the existing bus stops located next to Ala Moana Beach Park and Ala Moana Center. There will be no construction at these existing bus stops for the IOS.
- Hobron: This pair of transit stops will be located on Ala Moana Boulevard at Hobron Lane, serving the nearby residential area and hotels.
- Fort DeRussy: This pair of transit stops will be located on Kalia Road adjacent to Fort DeRussy and the Hilton Hawaiian Village and Hale Koa Hotels.
- Saratoga: This pair of transit stops will be located near the Waikiki Post Office at the Koko Head end of Fort DeRussy, and hotels on Saratoga and Kalia Roads.
- Kalakaua/Seaside: This Koko Head-bound transit stop will be adjacent to the Royal Hawaiian Shopping Center, and surrounding hotel and retail areas.
- Kalakaua/Uluniu: This Koko Head-bound transit stop will be located near Kuhio Beach across from the Hyatt Regency Hotel.
- Kapahulu: This on-street transit stop will be located on the Koko Head side of the intersection of Lemon Road and Kapahulu Avenue. The stop will serve the Honolulu Zoo, Kapiolani Regional Park,

and nearby hotels and residences. The stop will be located within the public right-of-way, not on park land.

- Kuhio/Liliuokalani: This Ewa-bound transit stop will be located by the Radisson Waikiki Prince Kuhio Hotel.
- Kuhio/Seaside: This Ewa-bound transit stop will be located across from the Waikiki Trade Center.

The transit stops will provide more amenities than the typical bus stop. The most obvious will be 13-inch high raised platforms that provide level boarding to low-floor vehicles. Typical amenities that will be provided include seating, lighting, landscaping, and canopies, which will be attractive and non-obtrusive. The architectural design of transit stops in sensitive areas, such as the Kalakaua/Uluniu and Kapahulu Transit Stops, will involve public and agency consultation. All of the transit stops will be designed in compliance with the Americans with Disabilities Act.

IOS.2.1.3 Priority Lanes

To give transit the priority necessary to make it an attractive alternative to the private automobile, some lanes along the IOS alignment will need to be converted from general-purpose lanes to semi-exclusive transit only lanes. This will result in an increase in the person-carrying capacity of these streets but will result in a reduced number of lanes for general-purpose traffic. Table IOS.2-1 summarizes the proposed distribution of lanes with the IOS. The changes from the current distribution of lanes are:

- Conversion of the curb lanes on Auahi Street, between Ward Avenue and Queen Street, to semi-exclusive lanes. These will be extra-wide lanes (19 to 20 feet) to permit on-street parking to remain;
- To permit a semi-exclusive lane in each direction, a new lane will be added in each direction on Ala Moana Boulevard; between the Ala Wai Canal and Kalia Road in the Koko Head bound direction, and between Kalia Road and Hobron Lane in the Ewa bound direction. The lanes will be added without changing the sidewalks by reducing a portion of the median and narrowing the width of the travel lanes;
- Addition of a lane in each direction on Kalia Road, between Maluhia Street and Saratoga Road, for semi-exclusive use by all buses and right-turning vehicles;
- Restriping of Saratoga Road to permit one semi-exclusive and one general purpose travel lane in each direction. This will require the conversion of one mauka-bound general purpose lane and removal of on-street parking on the Ewa-side;
- Conversion of the makai curb lane on Kalakaua Avenue to semi-exclusive use, between Saratoga Road and Uluniu Avenue;
- Widening of Kuhio Avenue sidewalks, a separate City project, which will reconfigure a Koko Head bound travel lane. The sidewalk widening will be implemented concurrently with the IOS. The BRT and other buses will operate in mixed-traffic on Kuhio Avenue during the initial phase of operations; and,
- Addition of a contra-flow lane by restriping Kalaimoku Street to allow BRT buses to travel makai-bound.

IOS.2.1.4 Construction Elements

Construction is scheduled to commence before the end of 2003, with completion projected in 2005. The major construction elements of each roadway segment are summarized in Table IOS.2-2. The improvements include construction of transit stops, concrete bus lanes, pavement rehabilitation, transit priority traffic signal improvements, roadway widening, landscaping, utility relocations, modifications to wheelchair ramps, sidewalks, and driveways, signage, striping, roadway lighting, and other work related to signal prioritization.

TABLE IOS.2-1
PROPOSED DISTRIBUTION OF LANES BETWEEN IWILEI AND WAIKIKI

	NUMBER OF LANES				
	EXISTING		PROPOSED		
Location	General Purpose	Exclusive Transit	General Purpose	Semi-Exclusive Transit	Exclusive Transit
Beretania Street					
N. King St. – River St.	6	0	6	0	0
River Street					
Beretania St. – Hotel St.	2	0	2	0	0
N. King Street					
Beretania St. – Iwilei Rd.	6	0	6	0	0
Iwilei Rd. - River St.	4+1 turning	1	4+1 turning	0	1
Hotel Street					
N. King St. - Alakea St.	0	2	0	0	2
Alakea St.					
S. Hotel St. – S. King St.	6	0	6	0	0
S. King St. – Queen St.	4	0	4	0	0
Queen St. – Nimitz Highway.	4+1 turning	0	4+1	0	0
Auahi St.					
Ward Ave. – Queen St.	4	0	2	2	0
Queen St.					
Auahi St. - Ala Moana Blvd.	4+1 turning	0	3+1 turning	1	0
Ala Moana Blvd.					
Queen St. - Ala Wai Canal	6+1 turning	0	6+1 turning	0	0
Ala Wai Canal – Hobron Lane	6+1 turning	0	6+1 turning	1	0
Hobron Lane – Kalia Road	6+1 turning	0	6+1 turning	2	0
Kalia Rd.					
Ala Moana Blvd. – Maluhia St.	5	0	5	0	0
Maluhia St. - Saratoga Rd.	2	0	2	2	0
Saratoga Rd.					
Kalia Rd. - Kalakaua Ave.	3	0	2	2	0
Kalakaua Ave.					
Saratoga Rd. - Kaiulani Ave.	4	0	3	1	0
Kaiulani Ave. – Uluniu Ave.	3	0	2	1	0
Uluniu Ave. – Kapahulu Ave.	3	0	3	0	0
Kapahulu Ave.					
Kalakaua Ave. - Kuhio Ave.	4	0	4	0	0
Kuhio Ave.					
Kapahulu Ave. - Kalaimoku St.	4+1 turning	0	3+1 turning	0	0
Kalaimoku St.					
Kuhio Ave. - Kalakaua Ave.	2	0	2	0	1
Bishop St.					
S. Hotel St. – Queen St.	5	0	5	0	0
Queen St. – Nimitz Highway	4	0	4	0	0
Nimitz Highway – Aloha Tower Dr.	4	0	4	0	0

TABLE IOS.2-1 (CONT.)
PROPOSED DISTRIBUTION OF LANES BETWEEN IWILEI AND WAIKIKI

	NUMBER OF LANES				
	EXISTING		PROPOSED		
Location	General Purpose	Exclusive Transit	General Purpose	Semi-Exclusive Transit	Exclusive Transit
Aloha Tower Dr.					
Bishop St. – Connector St.	3	0	3	0	0
Connector St. – Ala Moana Blvd.	1	0	1	0	0
Ala Moana Blvd.					
Connector St. – Forrest Ave.	6	0	6	0	0
Forrest Ave.					
Ala Moana Blvd. – Ilalo St.	4	0	4	0	0
Ilalo St.					
Forrest Ave. – Ahui St.	2	0	2	0	0
Ward Ave.					
Ahui St. – Auahi St.	5	0	5	0	0
Ala Moana Blvd					
Forrest Ave. – Connector St.	6	0	6	0	0
Connector St. (Richard St. Extension)					
Ala Moana Blvd. – Aloha Tower Dr.	2	0	2	0	0
Nimitz Highway					
Bishop St. – Alakea St.	6+2 turning	0	6+2 turning	0	0

Source: Parsons Brinckerhoff, March 2003.

TABLE IOS.2-2
SUMMARY OF MAJOR ITEMS OF WORK

Roadway Segment	Major Items of Work
Hotel Street	Curb/sidewalk modifications at Bishop St. and Alakea St. intersections.
Bishop Street	Transit stop construction with a 13-inch high raised platform.
Alakea Street	Transit stop construction with a 13-inch high raised platform.
Aloha Tower Drive	Transit stop construction with a 13-inch high raised platform and pavement rehabilitation.
Richards Street Extension	Pavement rehabilitation.
Nimitz Highway/Ala Moana Blvd.	Transit stop construction with 13-inch high raised platforms and pavement rehabilitation
Ilalo Street	Transit stop construction with 13-inch high raised platforms.
Auahi Street	Transit stop construction with 13-inch high raised platforms, concrete pavement construction, and pavement rehabilitation.
Queen Street	Concrete pavement construction.

TABLE IOS.2-2 (CONT.)
SUMMARY OF MAJOR ITEMS OF WORK

Ala Moana Boulevard (Ala Wai Canal to Kalia Road)	Roadway widening to accommodate two semi-exclusive bus lanes, transit stop construction with 13-inch high raised platforms, concrete pavement construction, pavement rehabilitation, utility relocations, landscaping, and roadway lighting improvements.
Kalia Road	Roadway widening to accommodate two semi-exclusive bus lanes, transit stop construction with 13-inch high raised platforms, concrete pavement construction, pavement rehabilitation, landscaping, and roadway lighting improvements.
Saratoga Road	Transit stop construction with 13-inch high raised platforms, concrete pavement construction, and pavement rehabilitation.
Kalakaua Avenue	Concrete pavement and transit stop construction with 13-inch high raised platforms.
Kapahulu Avenue	Transit stop construction with a 13-inch high raised platform.
Kuhio Avenue	Transit stop construction with 13-inch high raised platforms, concrete pavement construction between Seaside Avenue and Kanekapolei Street, concrete pavement rehabilitation, roadway lighting improvements, and traffic signal modifications.
Kalaimoku Street	Concrete pavement construction.

Source: Parsons Brinckerhoff, June 2003.

IOS.2.1.5 Transit Technology for IOS

The City plans to use hybrid diesel-electric BRT buses, replacing the existing diesel buses, to operate on the IOS because this technology best harmonizes with the higher densities and pedestrian orientation of Honolulu's Urban Core. A key objective is to enhance the quality of urban life by minimizing adverse noise and air pollution impacts from buses. The City intends to order new low floor hybrid diesel-electric buses prior to the start of IOS operations in 2005.

An advantage of the hybrid diesel-electric technology is that regardless of the speed of the vehicle, its internal combustion engine can be operated at a constant revolutions per minute for optimum efficiency. Running the engine at optimum efficiency maximizes fuel economy while minimizing air and noise emissions. The on-board batteries can also be used to move the bus if there is a problem with the engine or alternator.

IOS.2.1.6 Maintenance Facility

Storage and maintenance of the ten hybrid diesel-electric buses needed for the IOS will occur at the existing Kalihi-Palama Bus Maintenance Facility on Middle Street. Since the total size of the City's bus fleet will not change with implementation of the IOS, and will remain at 525 buses, no modification of the existing service bays will be necessary to accommodate the ten IOS buses, nor will the facility need to be expanded.

Later as the fleet grows with implementation of the rest of the In-Town BRT, expansion of the Kalihi-Palama facility will be needed. This expansion will be coordinated with the development of the Middle Street Transit Center. The expansion site will be adjacent to and makai of the existing Kalihi-Palama Bus Maintenance Facility.

IOS.2.2 How IOS Connects to Balance of the Transit Network

Local bus routes within the Urban Core will be modified to minimize overlap with the IOS, and some routes will be reconfigured to provide feeder service to the IOS.

The IOS traverses a route that is similar to Route 8 Waikiki-Ala Moana Center but will provide limited stop express service. Therefore, Route 8 service will be replaced by the IOS when the IOS is implemented.

Between Downtown and Ala Moana, Routes 55, 56, and 57 will overlap the IOS route. These routes currently provide service between windward Oahu and Downtown and Ala Moana Center. Turning Routes 55, 56, and 57 around in Downtown instead of at Ala Moana Center will remove this overlap. Local bus service along Ala Moana Boulevard will continue to be provided by Routes 19, 20, and 42. These modifications will enable the IOS BRT service to effectively interface with major local and express bus routes in Downtown and will enable it to provide BRT service within the Ala Moana Boulevard corridor where it does not exist today.

The existing CityExpress! Route A from Waipahu to UH-Manoa via Pearlridge will continue to provide fast, frequent cross-town service through Downtown Honolulu. City Express! Route B will continue to offer limited-stop service between Middle Street and Waikiki, although its routing will be slightly modified so that it does not overlap much with the IOS. Route B service frequency will be every 15 minutes, 7 days a week. The existing CountryExpress! Route C that provides fast service from Makaha to Downtown Honolulu and Ala Moana Center will also continue, as it is today.

IOS.2.3 Capital Costs

This section presents estimates of capital costs for the IOS. The costs are for the improvements to be in place in 2006 and are expressed in 2002 dollars.

IOS.2.3.1 Cost Estimation Methodology

During this phase of the project, cost estimates are referred to as preliminary estimates, since they are based on preliminary design rather than detailed final design. The level of design detail available for the project affects the accuracy of the cost estimates. Unit costs were derived from historical data from comparable transit systems, such as the BRT system in Orlando, Florida, as well as various private and public infrastructure projects recently bid within the State of Hawaii. Costs are based on in-place costs, including labor, construction, permanent equipment, and permanent materials. To account for differences between Hawaii and mainland costs, a Hawaii adjustment factor was applied to items such as the price of materials and the cost of labor.

Basic assumptions used in developing the capital cost data are:

- Estimates were prepared using 2002 dollars;
- No premium time on labor costs was included;
- Normal productivity rates as historically experienced were utilized; and
- Adequate experienced craft labor is assumed to be available.

Typical facility costs are based on the preliminary engineering developed for each work item. Costs are developed by combining the costs of components applicable to a typical cross-section into one unit cost. These parametric unit costs have detailed unit price development backup to substantiate the parametric unit costs. Once the facility costs have been determined, they are subject to add-on factors. Add-on factors cover engineering, program administration, insurance, and contingencies. They are referred to as add-on factors because they are added to the unit costs.

Capital costs were developed utilizing a "bottom up" estimating approach and checked for reasonableness using per mile cost data from other similar projects. With a "bottom up" approach, the cost of each major category of work is determined by totaling the cost of their component parts. Based on the preliminary engineering, the quantities of the major work elements are defined. Unit prices for each major work element are developed and combined with the estimated quantities to determine the cost of each major category of work, such as transit stops, transit platforms, roadway pavement, and so forth.

An eight percent allowance for add-on costs has been provided. Add-ons include engineering design, construction inspection, and start-up. A ten percent contingency is included in the capital cost estimate to account for unforeseen items, quantity fluctuations and variances in unit costs (Note: a 25 percent contingency was used in the MIS/DEIS; this was reduced in the FEIS due to preliminary engineering). The cost of the State of Hawaii general excise tax is included as a percentage (4.166) of the total capital cost of all categories.

IOS.2.3.2 Capital Costs

The total capital cost for the IOS components is estimated to be $48.1 million in 2002 dollars ($50.9 million in YOE dollars). Components include site preparation, sidewalks and roadways, landscaping and utility work, BRT stops, and restoration of adjacent utility infrastructure. The project is fully funded through a combination of FTA sources matched by City General Obligation Bonds. The IOS capital cost funding will come from a $31.0 million city appropriation (FY 2003) and two FTA appropriations in FY 2002 and FY 2003 totaling $19.85 million. The IOS construction should be completed by 2005.

As stated in Section IOS.2.4.2, some of the existing bus routes will be modified to avoid service duplication with the IOS. The total size of the City's bus fleet will not change with implementation of the IOS. The cost of the IOS vehicles is separate from the capital cost of the IOS since all ten vehicles needed for the IOS operation will be purchased with City (non-Federal) funds as part of the regular fleet replacement program that will occur with or without IOS implementation. The cost by component in 2002 dollars is shown in Table IOS.2-2.

TABLE IOS.2-2
CAPITAL COST SUMMARY
(MILLIONS OF 2002 DOLLARS)

Project Component	Estimated Cost
Sidewalks/ Roadways	$20.57
BRT stops	$6.91
Landscaping	$6.03
Traffic Signal Improvements	$8.23
Utilities	$6.34
Total	**$48.08**

Sources: Rider Hunt Levett & Bailey Ltd., November 2002.

Note: The cost of the ten vehicles needed for the IOS operation is not included, because the vehicles are part of the existing fleet replacement program.

IOS.2.4 OPERATING AND MAINTENANCE COSTS

This section presents estimates of annual operating and maintenance (O&M) costs for the entire bus system including the IOS. The costs are for the service plan proposed for 2006 and are expressed in 2002 dollars.

IOS.2.4.1 Cost Estimation Methodology

Costs are produced using an estimation methodology for bus supply characteristics, calibrated to Oahu Transit Services' (OTS's) annual expenses for 2002. The inputs to the estimation are derived from the travel demand forecasting models and consist of passenger loading assigned to the bus routes, as coded for the travel demand forecasting models, for the a.m. peak period, the p.m. peak period and the off-peak period, as well as the estimated running time and distance for each bus route. Based on these inputs, the frequency of bus service and number of vehicles – either standard buses, minibuses, articulated buses, or BRT vehicles – needed to accommodate the estimated demand during each of the three time periods is estimated. It further estimates the vehicle hours and miles that would be provided for the entire day. These daily estimates are then increased to an annual estimate and used to estimate annual bus operating costs. All steps in the process rely on data provided by OTS about its operating practices on a daily and annual basis.

The O&M costs for hybrid diesel-electric vehicles are estimated to be the same as for existing 60-foot articulated diesel vehicles. This assumption is based on experience in testing prototype hybrid diesel-electric, 60-foot articulated vehicles in other cities.

IOS.2.4.2 O & M Costs

Table IOS.2-3 presents the annual O&M costs in 2002 dollars using the methodology described above. O&M costs for the entire bus system, including the IOS , but not TheHandi-Van operations, would be about $119.3 million (in 2002 dollars).

TABLE IOS.2-3
ANNUAL OPERATING AND MAINTENANCE COST SUMMARY, 2006
(2002 DOLLARS, EXCLUDING THEHANDI-VAN O&M COSTS)

No-Build Condition	IOS	Difference
$119,595,000	$119,330,279	- $264,721

Source: Parsons Brinckerhoff, March 2003.

The proposed bus system with the IOS will yield about $264,700 in annual O&M savings, as compared to the No-Build condition (in 2002 dollars). The amount of new BRT service will be offset by a slightly larger reduction in existing services. The proposed BRT service will add about 48,000 revenue-hours and 404,000 revenue-miles annually. Offsetting changes to Routes 8, 55, 56, and 57 will save about 55,000 revenue-hours and 424,000 revenue-miles annually.

IOS.3 NO-BUILD CONDITION AND AFFECTED ENVIRONMENT

This IOS section references the Year 2006 No-Build condition. The 2006 No-Build condition is different from the No-Build Alternative described and analyzed elsewhere in this FEIS. Passenger service on the IOS will start in Year 2005, with construction of the entire IOS system being completed in the same year.

Therefore, the environmental analysis presented in this IOS chapter compares the 2006 No-Build condition with the proposed IOS during its first full year of operation. Because 2006 is less than three years from the time of the preparation of this document, it is projected that most environmental and social conditions of the 2006 No-Build condition will be approximately the same as the existing conditions described in Chapter 3 of this FEIS.

IOS.4 TRANSPORTATION IMPACTS AND MITIGATION

This section presents a summary of the potential transportation impacts associated with the IOS, as anticipated for the year 2006.

IOS.4.1 Transit Impacts

The IOS will operate in a combination of exclusive, semi-exclusive and mixed flow transit lanes. There will also be traffic signal priority at selected intersections to speed up BRT service.

The proposed average transit headways for the IOS is six minutes during peak periods and ten minutes during off-peak periods. Ten BRT vehicles will be needed to provide peak period service.

Most existing local and express bus service will be maintained, including Routes 19 and 20 that travel on Ala Moana Boulevard as local service and Routes 201 and 202 that travel on Ala Moana Boulevard as express routes. Because the IOS will serve the same function as the existing Route 8, Route 8 will be replaced by the IOS. Likewise, Routes 55, 56, and 57 that provide suburban bus service from the windward side of Oahu to Downtown and then Ala Moana Center will terminate in Downtown. It is projected that there would be 63 fewer transit vehicles per day on Kuhio Avenue, due to the replacement of Route 8 with IOS.

With these proposed changes, the forecasted Year 2006 linked transit trips and the daily transit boardings for the IOS are as summarized in Table IOS.4-1. The proposed enhancements included in the IOS are projected to result in approximately 4,500 new transit riders per day more than the No-Build in 2006 or about a fourth of the boardings on the IOS buses.

TABLE IOS.4-1
PROJECTED YEAR 2006 TRANSIT RIDERSHIP

	Estimated Daily Trips/Boardings
Systemwide No-Build Daily Linked Transit Trips	199,680
Systemwide IOS Daily Linked Transit Trips	204,190
Projected New Transit Riders to System	4,510
Daily IOS Boardings	16,370

Source: Parsons Brinckerhoff, April 2003.

IOS.4.2 Urban Intersection Impacts

Because auto capacity along streets within the urban core of Honolulu is governed by intersection operations, intersection analyses were performed to assess the impacts of the IOS in relation to the No-Build condition.

The signalized intersection method of intersection operations analysis as documented in the 2000 Highway Capacity Manual was used to evaluate projected Year 2006 intersection conditions during the A.M. and P.M. peak hours. This evaluation method uses level of service (LOS) to characterize intersection operations at the intersections evaluated. LOS is based on average stopped delay expressed in seconds per vehicle (sec/veh) and ranges from LOS A for very little delay to LOS F for congested, forced flow conditions.

Twenty-five key intersections along the IOS route were evaluated. These intersections were grouped into four areas for ease of discussion, and because traffic issues within these groupings tend to be similar. These areas are Downtown, Kakaako, Ala Moana-Fort DeRussy, and Waikiki.

IOS.4.2.1 Downtown Traffic Operations

Year 2006 traffic volume forecasts for Downtown are based on previously conducted traffic turning movement counts and 24-hour traffic volume counts conducted by the State of Hawaii Department of Transportation (HDOT) in Year 2002. An analysis of previous studies and historical trends in the area indicate that a 0.5% annual growth rate is appropriate to linearly extrapolate traffic to Year 2006 levels. The IOS will add ten BRT vehicles per hour and these are assumed to be equivalent to 20 passenger vehicles per hour in the operational analyses. Table IOS.4-2 summarizes the intersection LOS in the Downtown area for the IOS and No-Build conditions.

TABLE IOS.4-2
PROJECTED YEAR 2006 PEAK HOUR INTERSECTION OPERATIONS
DOWNTOWN AREA

Intersection	Peak Time Period	No-Build		IOS	
		LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
Bishop Street and	A.M.	C	28.8	C	28.8
King Street	P.M.	B	19.0	B	19.0
Alakea Street and	A.M.	B	17.8	B	17.9
King Street	P.M.	C	20.7	C	20.7
Bishop Street and	A.M.	C	21.6	C	22.5
Nimitz Highway	P.M.	C	22.5	C	22.6
Alakea Street and	A.M.	C	22.0	C	22.3
Ala Moana Blvd. (Nimitz)	P.M.	C	20.2	C	20.4

Source: Parsons Brinckerhoff, April 2003.

As shown in the table, the IOS will result in little difference from the No-Build condition in terms of traffic LOS. The maximum projected increase in intersection delay is 0.9 seconds, and this would occur at the Nimitz Highway/Bishop Street intersection. The key reasons for this small difference is that there are no lane configuration changes involved, since BRT vehicles will be traveling mostly in mixed flow, and the additional traffic due to ten BRT vehicles is minor.

The impact of the IOS on the Hotel Street Transit Mall was qualitatively evaluated. Currently, the Hotel Street Transit Mall is restricted to transit vehicles except for a short segment between Alakea and Richards Streets. Adding approximately ten BRT vehicles per hour in each direction during peak hours is not expected to affect existing transit operations negatively on the transit mall. The BRT vehicles will only stop twice: once in Chinatown and once at Union Mall.

IOS.4.2.2 Kakaako Traffic Operations

Forecasted volumes for the Kakaako area in year 2006 are based on traffic volume data collected in 1999 and 2000 and 24-hour traffic volume data collected by the SDOT. Based on these data, an annual growth rate of 1.4% was used to linearly extrapolate traffic volumes up to Year 2006. Based on the forecasted peak hour traffic volumes, intersection operations analyses were conducted and the results are summarized in Table IOS.4-3.

As shown in Table IOS.4-3, there is very little difference in intersection operations between the No-Build and IOS conditions. The lane geometry and signal operation of the intersections summarized in this table are expected to remain the same between the No-Build and IOS conditions. Most of the Ilalo Street intersections within the Kakaako Makai area are unsignalized with the through movement on Ilalo Street having the right-of-way. The Ilalo Street intersections at Ahui Street and Cooke Street are exceptions. They will be configured as

TABLE IOS.4-3
PROJECTED YEAR 2006 PEAK HOUR INTERSECTION OPERATIONS
KAKAAKO AREA

Intersection	Peak Time Period	No-Build LOS	No-Build Delay (sec/veh)	IOS LOS	IOS Delay (sec/veh)
Punchbowl Street and Ala Moana Boulevard	A.M. P.M.	B D	15.1 38.7	B D	15.1 39.5
Forrest Ave/South St. and Ala Moana Boulevard	A.M. P.M.	D D	37.9 44.1	D D	38.0 46.8
Cooke Street and Ilalo Street (4-way STOP)	A.M. P.M.	A A	7.8 8.4	A A	7.9 8.5
Ward Avenue and Ala Moana Boulevard	A.M. P.M.	D D	45.4 50.7	D D	45.8 52.3
Kamakee Street and Auahi Street	A.M. P.M.	B B	12.4 12.9	B B	12.4 12.9
Ala Moana Boulevard and Queen Street	A.M. P.M.	C C	26.8 31.2	C C	27.5 32.0
Ala Moana Boulevard and Piikoi Street	A.M. P.M.	D D	39.9 40.2	D D	42.6 43.1

Source: Parsons Brinckerhoff, April 2003.

4-way STOP controlled intersections based on traffic studies conducted for the University of Hawaii Health and Wellness Center. The Ilalo Street/Cooke Street intersection was selected as representative of this type of intersection, and it was analyzed using the unsignalized intersection method documented in the 2000 Highway Capacity Manual. The BRT vehicles are projected to have minimum impacts along this corridor.

Along Auahi Street, the BRT vehicle will travel in semi-exclusive curb lanes. Operations at the Kamakee and Auahi Streets intersection will continue to operate at LOS B. The IOS is proposed to operate in mixed traffic along the section between Queen Street and the Ala Wai Bridge. The lane conversions that are part of the Refined LPA will take place in the future when more of the Refined LPA segments are in place and the diversion of motorists to transit is sufficient to offset the traffic impacts of the lane conversions.

IOS.4.2.3 Ala Moana-Fort DeRussy Traffic Operations

The Ala Moana-Fort DeRussy analysis area is located between Atkinson Drive on the Ewa end and Fort DeRussy on the Koko Head end. Forecasted volumes for Year 2006 were projected using traffic volumes obtained from past traffic studies in Waikiki and from traffic volume counts conducted by the HDOT at the Ala Wai Canal Screenline. The yearly growth rate of 1.4% was found to be consistent with both past studies in the area and HDOT yearly trends, and it was applied to linearly extrapolate turning movement traffic volumes to the Year 2006 analysis year.

Ala Moana Boulevard, between Atkinson Drive and Kalakaua Avenue, experiences periods of congestion today. To help lessen the congestion, the IOS will add a semi-exclusive transit lane in each direction on Ala Moana Boulevard between Holomoana Street and Kalia Road by reducing the width of the existing raised median and narrowing existing traffic lanes. Figure IOS.4-1 shows the configuration of traffic lanes on Ala Moana Boulevard between Holomoana Street and Kalia Road.

In the Koko Head-bound direction, the semi-exclusive lane will added to the existing three general-purpose lanes. BRT vehicles, local buses, tour buses and trolleys, and vehicles making right-turns will be allowed into this semi-exclusive lane. The lane will begin just Ewa of Holomoana Street and continue to Kalia Road. This will result in the following lane configuration at Hobron Lane: three lanes dedicated to through traffic movement, an exclusive left-turn lane, and a semi-exclusive lane. At Kalia Road, the semi-exclusive lane will become a right-turn-only lane into Kalia Road. Two of the three general-purpose lanes will continue through the Kalia Road intersection, while one general-purpose lane will become a right-turn only lane. There will also be an exclusive left-turn lane for turns onto Ena Road from Ala Moana Boulevard. The net effect in the Koko Head-bound direction will be to create a double right-turn movement, helping to accommodate the substantial existing and projected future right-turning traffic at Kalia Road.

In the Ewa-bound direction, the semi-exclusive lane will begin at the Kalia Road intersection. It will continue to Hobron Lane, where it will become a right-turn only lane except for City buses. City buses in the semi-exclusive lane will be given an advance green signal to allow BRT and other City buses to transition into the general purpose lanes without conflicting with other Ewa-bound through traffic on Ala Moana Boulevard. Ewa of Hobron Lane, the lane configurations will be the same for the No-Build and IOS conditions.

It is assumed that by the Year 2006 time frame, a new full movement, signalized intersection will be constructed on Ala Moana Boulevard at Dewey Lane. Existing Dewey Lane is a connector road between Holomoana Street and Ala Moana Boulevard located between the Renaissance Ilikai Hotel and the Hilton Hawaiian Village. Dewey Lane intersects a short frontage road of Ala Moana Boulevard currently used as a municipal bus stop and tour bus loading area. The traffic analysis takes into account the future development plans proposed in the Waikikian Development Plan EIS.

Table IOS.4-4 summarizes projected 2006 traffic conditions for the Ala Moana-Fort DeRussy area.

TABLE IOS.4-4
PROJECTED YEAR 2006 PEAK HOUR INTERSECTION OPERATIONS
ALA MOANA-FORT DERUSSY AREA

Intersection	Peak Time Period	No-Build		IOS	
		Auto LOS	Delay (sec/veh)	Auto LOS	Delay (sec/veh)
Ala Moana Boulevard and	A.M.	D	50.8	D	48.3
Atkinson Drive	P.M.	E	58.3	E	57.2
Ala Moana Boulevard and	A.M.	C	34.8	C	30.9
Hobron Lane	P.M.	D	37.2	C	32.3
Ala Moana Boulevard and	A.M.	B	18.6	B	17.6
Dewey Lane	P.M.	C	26.3	C	26.4
Ala Moana Boulevard and	A.M.	D	40.9	D	41.3
Kalia Road	P.M.	D	40.1	D	41.1
Kalia Road and	A.M.	C	24.9	C	25.0
Saratoga Road	P.M.	C	27.9	C	28.2

Source: Parsons Brinckerhoff Inc., April 2003.

The above analyses show little difference between the No-Build and IOS conditions in terms of LOS for these intersections.

FIGURE IOS.4-1:
TRAFFIC LANE CONFIGURATION ON ALA MOANA BOULEVARD BETWEEN HOLOMOANA STREET AND KALIA ROAD

Kalia Road, is currently configured with five traffic lanes (2 Koko Head bound, 2 Ewa bound, and 1 median left-turn lane) between Ala Moana Boulevard and Maluhia Road (Hale Koa Hotel and Fort DeRussy entrances). Koko Head of Maluhia Road, Kalia Road is a two-lane roadway with one lane in each direction and left-turn lanes provided at key intersections. The IOS includes widening of the two-lane segment of Kalia Road by one lane in each direction, with these lanes being designated as semi-exclusive lanes. BRT, local buses, private buses, and autos turning right into driveways on Kalia Road will be able to use these lanes. Removing these vehicles from the existing general-purpose lanes will provide room for other local traffic along this segment.

The Kalia Road/Ala Moana Boulevard intersection is expected to have similar LOS between the No-Build and IOS conditions. Kalia Road currently transitions from a two-way street to an Ewa-bound one-way street at Saratoga Road. The existing Saratoga/Kalia Road intersection is STOP-sign controlled. In the projected 2006 scenario, the IOS project will modify this intersection to make traffic movements between the Ewa Kalia leg and the Saratoga leg the through movement. The Koko Head Kalia leg will form a T-intersection with this through movement and will be signalized.

IOS.4.2.4 Waikiki Traffic Operations

The Waikiki area includes key intersections along Kalakaua and Kuhio Avenues between Saratoga Road and Kapahulu Avenue.

Forecasted volumes for the year 2006 were projected using traffic volumes obtained from past traffic studies in Waikiki and from traffic volume counts conducted by the SDOT at the Ala Wai Canal Screenline. The yearly growth rate of 1.4% was found to be consistent with both past studies in the area and the HDOT yearly trends, and it was applied to linearly extrapolate turning movement traffic volumes to the Year 2006 analysis year.

Lane configurations for intersections within this segment of the IOS alignment are the same for the No-Build and IOS conditions with the following exceptions: the makai curb lane on Kalakaua Avenue between Saratoga Road and Uluniu Avenue will be converted to a semi-exclusive lane in the IOS. This lane will be available for right turning vehicles and buses, both public and private. Another exception will occur at Kalaimoku Street. Currently, this street is a two-lane, one-way, mauka-bound street from Kalakaua Avenue to Ala Wai Boulevard. As part of the IOS, this street will be modified to accommodate an additional lane in the makai-bound direction between Kuhio Avenue and Kalakaua Avenue. The additional lane will be provided by eliminating on-street parking and narrowing the existing lanes on Kalaimoku Street. This configuration will allow BRT vehicles to return to Saratoga Road, which is a two-way street. The mauka-bound capacity for traffic on Kalaimoku Street will remain the same as with existing conditions. Also, on Saratoga Road at Kalakaua Avenue, a new lane will be added in the mauka-bound direction to allow an additional right turn movement onto Kalakaua Avenue.

The Waikiki Livable Communities Study has undertaken a comprehensive review of Waikiki with the intent of providing a more walkable environment for visitors and residents. There are many pieces being examined by the study, one of which is the widening of sidewalks along Kuhio Avenue. The sidewalk widening, to be done concurrent with the IOS, will displace one lane of traffic on Kuhio Avenue. The IOS in 2006 will operate in mixed traffic along Kuhio Avenue so that the traffic impacts of further reducing auto capacity are avoided. The Refined LPA calls for the conversion of one of the Ewa bound lanes in the future to a semi-exclusive transit lane when the ultimate systemwide beneficial effects of the Refined LPA of diverting motorists to transit and of reducing in half the number of buses operating on Kuhio Avenue can offset the loss of another traffic lane on Kuhio Avenue.

Table IOS.4-5 summarizes the projected Year 2006 Waikiki intersection levels of service for the weekday A.M. and P.M. peak hour time periods.

TABLE IOS.4-5
YEAR 2006 PEAK HOUR INTERSECTION OPERATIONS
WAIKIKI

Intersection	Peak Time Period	No Build LOS	No Build Delay (sec/veh)	IOS LOS	IOS Delay (sec/veh)
Kalakaua Avenue and Saratoga Road	A.M. P.M.	B B	14.2 16.0	B B	14.3 16.3
Kalakaua Avenue and Seaside Avenue	A.M. P.M.	A A	8.9 9.2	A A	8.9 9.2
Kuhio Avenue and Kapahulu Avenue	A.M. P.M.	B C	16.1 32.7	B C	16.1 32.8
Kuhio Avenue and Liliuokalani Avenue	A.M. P.M.	C C	20.6 34.1	C C	20.7 34.1
Kuhio Avenue and Kanekapolei Street	A.M. P.M.	B B	12.8 13.5	B B	12.8 13.5
Kuhio Avenue and Seaside Avenue	A.M. P.M.	B B	10.0 14.1	B B	10.0 14.2
Kuhio Avenue and Royal Hawaiian Avenue	A.M. P.M.	B B	11.3 12.3	B B	11.3 12.3
Kuhio Avenue and Lewers Street	A.M. P.M.	B C	11.8 23.0	B C	11.8 23.0
Kuhio Avenue and Kalaimoku Street	A.M. P.M.	B B	11.4 16.6	B B	11.4 16.8

Source: Parsons Brinckerhoff, 2003.

Minimal impacts are projected for the Waikiki segment when comparing the IOS to the No-Build condition. The BRT vehicles will run in mixed flow on Kuhio Avenue and Kapahulu Avenue and in semi-exclusive lanes on Kalakaua Avenue. On Kalakaua Avenue, the semi-exclusive lanes will be shared by BRT vehicles, tour buses, and vehicles making right turns onto cross streets. Analyses indicate that with this configuration traffic LOS will not be significantly different compared to the No-Build condition.

The Kalakaua Avenue/Saratoga Road intersection will have the most difference in peak hour operation with the IOS operating with slightly more delay per vehicle during the A.M. peak hour.

IOS.4.3 Parking Impacts

IOS.4.3.1 On-Street Parking Impacts

The only potential parking impacts with the IOS will be to on-street parking.

Curbside parking spaces were counted as being affected if their expected use in Year 2006 will be affected in any way, either all day long or by limiting their use to off-peak hours. Parking spaces are categorized by availability during peak and off-peak hours. “Unrestricted parking” spaces are defined as those currently available during peak and off-peak hours.

"Restricted parking" spaces refer to all other types, namely spaces that currently have some time restriction on parking, with most such spaces typically available only during off-peak hours. These spaces will not be affected by peak-period transit operations, because their use already is not allowed during the peak traffic hours. The definition of restricted parking also includes spaces that are available for use only on weekends, holidays, and overnight on weekdays, such as on Ala Moana Boulevard.

The number of affected parking spaces was determined from City and County striping plans and/or independent field checks. Where curb parking spaces were not marked by parking meters and/or parking space stripings, the linear curbside distance available for parking (exclusive of driveways and other uses such as bus stops, loading zones, no parking zones, etc.) was measured and divided by 22 feet, a typical parking space length according to the current City and County's Traffic Standards Manual (DTS, July 1976).

The IOS will affect a total of 22 existing unrestricted spaces. Unrestricted spaces will be affected on Queen Street (5 marked spaces), Saratoga Road (5 marked spaces), and Kapahulu Avenue (12 marked spaces). The parking for the Kakaako Makai area will be coordinated with the Hawaii Community Development Authority (HCDA).

The IOS will not affect weekend, holiday, or overnight parking on the makai side of Ala Moana Boulevard adjacent to Ala Moana Park. The IOS will travel to Waikiki using the center lane during the off-peak times when vehicles are legally allowed to park along the curb.

IOS.4.3.2 Parking Impact Mitigation

Near each of the locations where on-street parking will need to be removed there are large existing off-street parking facilities with reserve capacity to absorb the on-street parkers. Replacement of the removed parking is therefore not deemed necessary.

IOS.4.4 Loading Zone Impacts

Most loading zones are restricted to use by commercial vehicles, which are primarily tour buses and freight vehicles with permits. Other vehicles that may stand briefly in such loading zones include taxicabs, armored cars, and special transit service vehicles. Existing municipal bus stops are not considered loading zones.

Preliminary engineering for the IOS has taken into consideration the need to avoid as much as possible impacts to passenger and freight loading zones. The IOS will not result in any loading zone impacts. The following discussion provides additional detail on how some potential loading zone impacts in Waikiki were avoided. In Waikiki, the IOS will not preclude use of any existing commercial passenger (taxi) loading zones or any tour bus or trolley loading/unloading locations on Kuhio and Kalakaua Avenues.

On Kuhio Avenue, the BRT will operate in mixed-traffic in the mauka curb lane. Presently, freight loading is generally permitted along both sides of the street from 10 P.M. to 7:30 A.M. With the widening of sidewalks to be constructed concurrently with the IOS as part of a separate City project, turnout bays and widened curbside lanes will be provided along both sides of Kuhio Avenue to allow commercial freight vehicles, tour buses, taxis, and trolleys to load and still allow moving vehicles to pass parked vehicles. The separate City project will provide additional loading areas on side streets between Seaside Avenue and Walina Street, where the heaviest loading activities occur.

On Kalakaua Avenue, there will not be any noticeable impact to freight loading. Commercial freight carriers will be allowed to use the makai-side, semi-exclusive curb lane during legal delivery hours (10 P.M. to 9 A.M.). The BRT will simply pass around a stopped loading truck by using the adjacent traffic lane. Passenger and freight loading operations that use the existing pullouts on the makai curb will not be affected by the BRT.

An existing tour bus loading zone on Saratoga Road, mauka of its intersection with Kalia Road will be relocated under a redevelopment plan for Outrigger Hotels that has already been approved by the City Council. Therefore, the BRT stop proposed at this location will not displace the tour bus loading zone, and there will be no loading zone impacts on Saratoga Road.

IOS.4.5 Bicycling Impacts

This section describes potential impacts of the IOS to existing and currently proposed bicycle systems in the study area, as described in the Honolulu Bicycle Master Plan (April 1999) and the Draft Bike Plan Hawaii: State Master Plan (May 2003). Both master plans are consistent in recommending the development of a regional bike corridor, which would be a grid of east-west and mauka-makai bikeways. Implementation of the bicycle master plans will continue with the IOS.

One of the primary purposes of the IOS is to enhance in-town mobility by restoring a balanced transportation system that includes measures that encourage transit, bicycle, and pedestrian modes. Therefore, the IOS has been designed to provide concurrent systems enhancing transit, bicycle and pedestrian travel within the very limited space of the existing roadway rights-of-way. All buses will have bike racks to accommodate intermodal transit. New bike parking racks will continue to be installed around the city.

Although most of the IOS alignment is not designated as a "bikeway", roadways along the segment are used by cyclists to varying degrees because of the paucity of bikeway facilities. As stated in Section IOS 2.1, semi-exclusive/exclusive BRT curbside lanes will be provided on Auahi Street, portions of Ala Moana Boulevard, Kalia Road, Saratoga Road in the vicinity of Fort DeRussy, and a segment of Kalakaua Avenue between Saratoga Road to Uluniu Street. Cyclists will be allowed to use these semi-exclusive/exclusive BRT curbside lanes, which will be an improvement in bicycle transportation over existing conditions where curbside lanes along these street segments are used by mixed or general traffic. In addition, bicycle transportation will improve on Kuhio Avenue in Waikiki because as part of another project to widen this road's sidewalks (see Section IOS 2.1.3), the curbside lanes will be widened, improving the ability of cyclists to share the lanes with motorists. The level of bicycle access and transportation service along the rest of the IOS will remain the same as today.

IOS.4.6 Pedestrian and Special Event Impacts

The IOS will be constructed primarily on existing roadways and existing pedestrian street crossings will be preserved or enhanced. Pedestrian access will be provided at transit stops in conformance with the Americans with Disabilities Act (ADA).

Moreover, the IOS will provide benefits for all pedestrians in a number of ways. Transit uses less space to carry more people than automobiles. The environmentally friendly transit vehicles that will be used with the IOS will produce less noise and air pollution. These factors will contribute to an improved urban walking experience.

Waikiki is a frequent venue for parades, races, and road closures. During these times, the IOS route will detour to Kuhio Avenue along with other vehicular traffic, such as occurs at the current time.

IOS.5 ENVIRONMENTAL ANALYSES AND CONSEQUENCES

This section provides discussion on the potential impacts of the IOS within a time frame shortly after implementation of this segment (2006).

IOS.5.1 Land Use and Employment

IOS.5.1.1 Land Use and Development

The IOS is located in the Primary Urban Center (PUC), one of the eight planning areas in the City and County of Honolulu. The PUC extends from Pearl City at the Ewa end to Waialae-Kahala at the Koko Head end, and is bounded on the north by the Koolau Mountain Range and on the south by the coastline. The PUC is the most urban and heavily populated area on the island and in the State. The portion of the PUC served by the IOS includes high-density residential, business, hotel and commercial districts, such as downtown Honolulu, the city's central business district, and Waikiki, the State's largest resort area. The area between downtown and Waikiki is Kakaako-Ala Moana, an area containing mostly commercial businesses, such as Ala Moana Center and Victoria Ward Centre, which are two of the State's larger shopping centers, and several high-rise apartment condominiums.

As shown in Table IOS.5-1, Major Destinations Served by the IOS, the IOS will provide transit service to many of the important economic centers and cultural/ recreational attractions in the PUC. Included along the IOS alignment are some of the island's most significant destinations including Downtown Honolulu, Ala Moana Center, and Waikiki.

TABLE IOS.5-1
MAJOR DESTINATIONS SERVED BY THE IOS, IWILEI TO WAIKIKI

Location	Size or Service Levels
Iwilei Industrial District	320 acres
Chinatown	30 acres
Downtown Financial District	60,000 daytime population
Aloha Tower Marketplace / Maritime Center	22 acres
Kakaako	600+ acres; 20,000 workers
Kakaako Waterfront Park	30 acres
Victoria Ward Centers	250,000+ square feet
Ala Moana Center	2 million square feet GLA
Ala Moana Park	About 120 acres
Waikiki	3.7 million annual visitors; 19,720 residents.
Honolulu Zoo	700,000 attendees/year
Kapiolani Park	155 acres
Hilton Hawaiian Village	22 acres; 2,545 rooms; 1,900+ employees
Hale Koa Hotel, Fort DeRussy	72 acres; 817 rooms; 900+ employees
Royal Hawaiian Shopping Center	279,000 square feet GLA; 1,500+ employees

Sources: City Department of Planning and Permitting, State Department of Business, Economic Development and Tourism, and Parsons Brinckerhoff, September 2002.
Note: GLA = gross leaseable area

The development pattern along the IOS alignment is unlikely to change much within the next four or five years, with the exception of new growth in Kakaako Makai. Implementing the IOS will convey the message to the development community that government is willing to invest in a more fixed transit system, one that would provide a sense of permanence in the primary transportation corridor. Such investments combined with favorable policies and market conditions have strongly influenced transit-oriented development in other cities with mixed-use high-density residences and pedestrian-scale commercial districts.

IOS.5.1.2 Consistency with Land Use Plans and Policies

The IOS is consistent with the plans and policies of the State of Hawaii and the City and County of Honolulu. It is consistent with plans for transportation, recreation, educational institutions, military installations, and major private sector developments.

State Plans, Policies and Programs

Hawaii State Plan

The Hawaii State Plan (June 1991) consists of comprehensive goals, objectives, policies and priorities in all areas of government functions, such as the protection of the physical environment, the provision of public facilities, and the promotion and assistance of socio-cultural advancement. The IOS is consistent with the objectives and policies of the State Plan, in particular those relating to public welfare and economic development because it further develops the transportation infrastructure.

State Land Use Classifications

The State Land Use Commission (SLUC) regulates land use statewide by establishing four categories: Urban, Agriculture, Conservation, and Rural. The lands within the service area of the IOS are classified as Urban. The IOS is consistent with this classification.

Coastal Zone Management Program

The objectives and policies of the Hawaii Coastal Zone Management (CZM) Program are intended to protect and manage Hawaii's valuable coastal areas and resources. Pursuant to 15 CFR 930.32, federally permitted, licensed, or assisted activities undertaken in or affecting Hawaii's coastal zone must be consistent with the objectives and policies of the CZM program. The Department of Business, Economic Development and Tourism (DBEDT), the agency administering the State's CZM program, concurred with DTS's CZM consistency determination (see Appendix A).

Kakaako Mauka and Makai Area Plans

The Kakaako Community Development District Plan was initially adopted in 1982 and is continuously updated. It serves as the basis for guiding public and private development activities in Kakaako. The district has been divided into two planning areas, and major investment, both public and private, is taking place as a result of the plans. The dividing line is Ala Moana Boulevard and the two planning areas (called Mauka and Makai) serve different functions and land uses.

The Mauka Plan establishes a set of zones for commercial, retail and residential parcels. The Makai Plan adopts a mixed use district for waterfront uses, cruise ship piers, parks, recreation, museums, the University of Hawaii Medical School, and medical/biotech research facilities.

The IOS runs through the heart of the Makai Planning Area for its entire length and then crosses over Ala Moana Boulevard to run through the retail portion of the Mauka District. The IOS connects the Mauka and Makai Areas to each other as well as to the two adjacent districts of Downtown and Waikiki. Thus, the IOS supports the mixed use development plans for both Kakaako areas.

Aloha Tower Development Plan, Honolulu Waterfront Master Plan and Oahu Commercial Harbors 2020 Master Plan.

The Aloha Tower Master Plan, prepared in the late 1980s, proposed maritime facilities, restaurants, retail shops, offices, a hotel, and residential condominiums at Piers 5 to 14. Thus far, only the first phase, the Aloha Tower Marketplace development at Piers 8 to 10, has been completed. The master plan is being updated for Piers 5/6, 10/11 and 12 – 14. The 1989 Honolulu Waterfront Master Plan Final Report (1989) included a variety of mixed-use developments in the harbor vicinity. The Oahu Commercial Harbors 2020 Master Plan (May 1997) (OCHMP) covered all of the commercial harbors on the island: Honolulu Harbor, Kalaeloa Barbers Point Harbor, and Kewalo Basin, updating separate 2010 plans, including the Waterfront Plan. The OCHMP only addressed issues and needs relating to the maritime industry (e.g., cargo and passenger movements and fishing), unlike the Waterfront Plan, which addressed additional waterfront issues, such as commercial development and landside recreation.

By providing improved transit access to Aloha Tower and the Downtown waterfront, the IOS will help support implementation of these plans.

State Cruise Ship Terminal Needs Assessment

A study by the SDOT Harbors Division recommended a cruise ship terminal at Pier 2 in Honolulu Harbor. The IOS alignment would be near the proposed cruise ship terminal and will provide improved transit access for employees and other users of the proposed terminal at Pier 2.

UH Health and Wellness Center

The UH is constructing a new campus for the John A. Burns School of Medicine in Kakaako Makai. The UH Health and Wellness Center is located between Ilalo Street and Kakaako Waterfront Park. The IOS will support the transportation needs of the facility and could help reduce the demand for parking.

Military Installation Planning: Armed Forces Recreation Center – Fort DeRussy

Fort DeRussy in Waikiki has been redeveloped recently to fulfill its primary mission of recreation for military personnel. The redevelopment included pedestrian and landscape improvements at the mauka end of Kalia Road. The IOS will include the widening of part of Kalia Road, but this will not affect the installation's recreational facilities or recent pedestrian and landscape improvements.

City and County of Honolulu Plans, Policies, and Controls

General Plan

The General Plan (revised 1992) includes broad statements on the objectives and policies of the City and County of Honolulu with regard to overall physical and economic development of the island, as well as the health and safety of the island's residents. The Plan "address[es] the need for a balanced system for the pedestrian, bikeway, public transportation, and automobile". It also calls for a variety of attractive and convenient travel modes, including "public transportation-for travel to and from work…through a mass transit system including exclusive right-of-way rapid transit and feeder-bus components…." The IOS will support the transportation-related objectives of the General Plan because it will help balance the city's transportation modes compared to current conditions.

Primary Urban Center Development Plan (PUCDP)

The PUCDP is currently being revised. Until the revision is adopted, the previously approved PUCDP remains in force. According to the PUCDP (Revised Ordinances of Honolulu, 1990, Chapter 24, Article 2), the PUC shall accommodate relatively intensive commercial, governmental, residential, and recreational functions while safeguarding and adding to the existing amenities of the City's urban environment. The area to be served by the IOS contains intensive commercial, governmental, residential, and recreational land uses. Therefore, by providing improved transit service, the IOS will support the land uses envisioned in the PUCDP.

Special Management Area

In accordance with the 1975 Shoreline Protection Act and Hawaii Revised Statutes (HRS) Chapter 205A, the City and County of Honolulu has the authority to issue permits for development within the Special Management Area (SMA). The Department of Planning and Permitting (DPP) administers the SMA use permit program, but permitting approval on major SMA use permits is made by the City Council. No part of the IOS will adversely affect shoreline access or viewsheds to, from or along the shoreline. The IOS will also not introduce structures that will affect beach processes or present hazards along the shoreline.

Honolulu Bicycle Master Plan

As discussed in Section IOS.4.5, the IOS will be consistent with the Honolulu Bicycle Master Plan.

Hub-and-Spoke Bus Route Revision Program

The DTS is converting its radial bus network to a hub-and-spoke configuration. Hub-and-spoke networks provide an integrated system of convenient and accessible circulator, local and express routes, organized around transit centers. The IOS has been planned and coordinated with the hub-and-spoke program.

Oahu Metropolitan Planning Organization

The Oahu Metropolitan Planning Organization (OMPO), a joint State of Hawaii and City and County of Honolulu organization, is responsible for preparing the Oahu Regional Transportation Plan (ORTP). The Transportation for Oahu Plan 2025 (TOP 2025), adopted in April 2001, updates the 2020 ORTP in response to the changing transportation needs of Oahu and extends the planning horizon to Year 2025. The Refined LPA is included in the TOP 2025 Plan. The IOS, which is the first phase of the Refined LPA, is therefore also consistent with this plan.

Private-Sector Plans

Waikikian Development Plan

The Hilton Hotels Corporation is planning to replace the former Waikikian Hotel, located along Ala Moana Boulevard between the Hilton Hawaiian Village and the Renaissance Ilikai Hotel, with a new 350-room hotel building and other amenities. The IOS will benefit this development by providing improved transit access.

Waikiki Beach Walk

Outrigger Enterprises, Inc. is planning to redevelop its landholdings makai of Kalakaua Avenue in Waikiki, along Lewers Street, Kalia Road, Beach Walk, and Saratoga Road, to upgrade five existing hotels, demolish six older hotels, and provide a new entertainment retail complex, a new hotel, and enhanced public areas. The IOS will benefit this development by providing improved transit access.

IOS.5.1.3 Economic Impacts to Private Bus Operators

The IOS is designed to serve trips by Oahu residents going to-and-from home, work, school, shopping and other purposes. The IOS is not designed to serve the tourist market. Unlike private sector buses taxis, and vans, the transit vehicles of the IOS will not pick-up passengers at their hotels, transfer them to-and-from the airport, take them directly to a desired tourist destination non-stop, or accommodate luggage unless the luggage can fit on the passenger's lap. Although the IOS is not ideally suited for tourists, some may choose to use the IOS since it serves some activity centers that attract tourists, but these places are also major employment sites or sites where local residents go to as well. It is expected tourists will use the public transit system that includes the IOS at the same proportion as they do today, which is estimated at five to ten percent system-wide and 20-25 percent in Waikiki.

The priority lane treatments in Waikiki that are part of the IOS will benefit private bus operators as well as City buses. The lanes added to Ala Moana Boulevard and Kalia Road, and conversion of the makai curb lane on Kalakaua Avenue to a semi-exclusive lane will allow private buses to by-pass traffic in the other lanes during periods of congestion.

IOS.5.2 Displacements and Relocations

In general, the IOS facilities will be constructed within existing roadways, with the exception of the widening of Kalia Road in Fort DeRussy. The IOS will not result in the displacement of any residence, business or institution. At Fort DeRussy, there will be a partial displacement of landscaped areas next to the road, however, no buildings or structures will be affected. The removed landscaping will be replaced with similar landscaping along Kalia Road.

IOS.5.3 Neighborhoods, Community Facilities, and Environmental Justice

IOS.5.3.1 Community Cohesion and Activities and Public Safety

The IOS will not adversely affect community or neighborhood characteristics within its service area, which includes Chinatown, Kakaako and Waikiki. The IOS requires minimal additional right-of-way and would largely be limited to existing streets. Therefore, the IOS will not result in any visual and psychological barrier within neighborhoods. The IOS improvements will be at-grade, and will not impede neighborhood social interaction. In addition, the IOS transit stops will be designed to blend with and enhance the environment or neighborhoods in which they are located. Use of appropriate design character, construction materials and landscaping will help lessen the visual intrusion of a new facility in or adjacent to a neighborhood. Other design features include installation of new pedestrian paths or enhancement of such existing facilities.

The IOS will not displace any residence, business, or institution. The IOS transit stops, located at various locations in the corridor, will enhance community cohesion by providing transit-related gathering points.

The IOS will not adversely affect response times for emergency vehicles. The transit vehicles will be similar in maneuverability to the articulated buses now in use by TheBus for its CityExpress! routes, which are able to allow emergency vehicles to pass. Emergency vehicles will benefit by being able to use the semi-exclusive and exclusive transit priority lanes along certain segments of the IOS alignment during emergencies.

The IOS will enhance access to schools, parks, and recreation facilities along the alignment. Among these are Jefferson School, Ala Moana Regional Park, Kakaako Makai Gateway Park, and Kakaako Waterfront Park, Kuhio Beach, and Kapiolani Park. As discussed in Section IOS.5.11, there will be no adverse impacts to schools and parks. On the contrary, there will be beneficial impacts due to improved transit access.

System safety and security planning has been and will continue to be part of the overall system design for the IOS. The primary concern is for the safety of passengers and transit personnel, as well as pedestrians, motorists, and others using the affected streets. Specific safety and security measures to be used for the IOS will be developed during final design and operations planning. These measures will be consistent with those described in Section 5.3.4 of this FEIS.

IOS.5.3.2 Environmental Justice (Executive Order 12898)

Presidential Executive Order (EO) 12898, called the Executive Order on Environmental Justice (EJ) requires federal agencies to take appropriate and necessary steps to identify and avoid disproportionately high and adverse effects of federally assisted projects on minority and low-income populations' health or environment.

Two minority and low-income populations are within the IOS service area: Kalihi-Palama and Chinatown. Both populations are located on the west side of the IOS alignment. The IOS will not cause disproportionately high and adverse health or environmental effects on these two minority and low-income populations. On the contrary, the IOS will provide improved transit service for these neighborhoods without causing them to be divided or isolated from the greater community. In addition, the IOS will not create health risks, such as traffic safety hazards, for these populations out of proportion with health risks to other populations or groups in the corridor.

Public participation activities for the Primary Corridor Transportation Project (PCTP) occurred island-wide from 1998-2003. General outreach efforts included the project website <www.oahutrans2k.com>, print ads, newspaper articles, legal and public notices, Progress Report newsletters, and mass mailings that included EJ populations.

The meetings listed below were held in EJ neighborhoods or sub-areas within the IOS that may contain EJ populations. These meetings are only a portion of the numerous public meetings that were held for the project (see Appendix A).

Chinatown/Kalihi/Palama/Lower McCully/Kaheka Oahu Trans 2K Meetings

- 9/28/98-Oahu Trans 2K-Round One Public Workshop (Central Honolulu)
- 11/16/98-Oahu Trans 2K-Round Two Public Workshop (Central Honolulu)
- 3/27/99- Oahu Trans 2K-Round Three Public Workshop (Makiki/McCully-Moiliili/Manoa)
- 4/10/99-Oahu Trans 2K-Round Three Public Workshop (Kalihi-Palama)
- 4/13/99-Oahu Trans 2K-Round Three Public Workshop (Ala Moana/Kakaako/ Chinatown/Downtown)
- 10/25/99-Oahu Trans 2K-Round Four Public Workshop (Honolulu)
- 8/14/01-Oahu Trans 2K-Round Five Community Open House

Downtown/Kakaako Working Group

- 2/20/01-Downtown/Kakaako Working Group Meeting Number One
- 3/20/01-Downtown/Kakaako Working Group Meeting Number Two
- 4/10/01-Downtown/Kakaako Working Group Meeting Number Three
- 5/1/01-Downtown/Kakaako Working Group Meeting Number Four
- 5/22/01-Downtown/Kakaako Working Group Meeting Number Five
- 6/12/01-Downtown/Kakaako Working Group Meeting Number Six
- 6/26/01-Downtown/Kakaako Working Group Meeting Number Seven

Kalihi Working Group

- 3/15/01-Kalihi Working Group Meeting Number One
- 3/29/01-Kalihi Working Group Meeting Number Two
- 4/19/01-Kalihi Working Group Meeting Number Three
- 5/17/01-Kalihi Working Group Meeting Number Four
- 5/31/01-Kalihi Working Group Meeting Number Five
- 6/14/01-Kalihi Working Group Meeting Number Six
- 6/28/01-Kalihi Working Group Meeting Number Seven
- 8/4/01- Islandwide Vision Meeting and Working Group Mahalo Luncheon

IOS.5.4 Visual and Aesthetic Resources

Areas with high visual character and quality along the IOS alignment are:

- Chinatown Special District
- Nimitz Highway portion fronting Downtown Honolulu
- Ala Moana Boulevard fronting Ala Moana Park
- Kalia Road in Waikiki
- Kalakaua Avenue along Waikiki Beach
- Kapahulu Avenue between Kalakaua and Kuhio Avenues

The IOS will provide opportunities to enhance the visual quality of a portion of urban Honolulu by developing public spaces with more landscaping and street-level amenities that will improve the visual quality of the streetscape and enhance the pedestrian experience. The physical improvements and landscape treatments of the IOS could reinforce the character of neighborhoods and provide a visual sense of place.

Some IOS transit stops will be located in areas with high visual or aesthetic value, and may cause visual impacts if transit stop structures such as canopies and kiosks visually intrude upon important surrounding viewsheds. Therefore, each transit stop will be uniquely designed to fit appropriately into each setting and, where possible, to enhance the aesthetics of the area.

Sensitive areas where construction of transit stops is planned include:

- Downtown
- Aloha Tower
- Kakaako Makai Gateway and Waterfront Parks
- Ala Moana Park
- Fort DeRussy and along Kalakaua Avenue
- Kapiolani Park

The IOS transit stops in or near these areas will require special design treatment, which may also involve consultation with organizations that care for or have an interest in these areas. Moreover, all of the IOS transit stops will be designed to blend in with their surrounding contexts, based on public input and conformance with appropriate design standards. Effective planning with area businesses, residents, and agencies will result in design features sensitive to each area.

Under the IOS, no construction will be conducted at the Chinatown and Ala Moana Park stops; therefore, there would be no adverse impacts on views of any important landmarks or historic properties.

IOS.5.5 Air Quality

Honolulu meets the State and national Ambient Air Quality Standards (AAQS) for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone, carbon monoxide (CO) and particulate matter 10 microns in diameter (PM-10), as indicated by data from State of Hawaii Department of Health (HDOH) air quality monitoring stations. Honolulu and the State are presently attainment areas for all national AAQS. Despite the excellent air quality conditions, CO concentrations near congested intersections could exceed the State AAQS at times. The State AAQS for CO is more stringent than the national AAQS. By 2006, islandwide traffic conditions with the IOS would be similar to current conditions. Therefore, mesoscale, or islandwide, air quality conditions with the IOS are projected to be about the same as current conditions because overall emissions by all vehicles operating on the island will be similar.

Microscale, or "hot spot", air quality conditions under the IOS in 2006 are projected to be similar to existing conditions or the 2006 No-Build condition such that no mitigation is required. Microscale air quality impact analyses involve assessing worst-case CO concentrations near busy intersections that experience congested conditions for at least part of the day. Impacts are identified when CO concentrations are predicted to exceed State or national AAQS. Table IOS.5-2 provides 1-hour and 8-hour CO concentrations at selected intersections within the IOS corridor. The figures provided in this table represent the results of quantitative analysis, not actual air quality monitoring. The South King Street/Bishop Street intersection was analyzed as having the highest worst-case 1-hour and 8-hour concentrations at 17.6 mg/m^3 during the morning peak-traffic hour and 8.8 mg/m^3, respectively. One-hour values at other locations and times under the existing condition range from 3.6 mg/m^3 during the afternoon at the intersection of Hotel Street/Bishop Street to 17.1 mg/m^3 during the morning near the intersection of Ala Moana Boulevard/Atkinson Drive. Eight-hour values for other locations range from 2.6 mg/m^3 at the Kalakaua Avenue/Kaiulani Avenue intersection to 8.6 mg/m^3 at the Ala Moana Boulevard/Atkinson Drive intersection. Five of the selected nine intersections exceed State AAQS, but none exceed the less stringent national AAQS.

TABLE IOS.5-2
CURRENT WORST-CASE 1-HOUR AND 8-HOUR CARBON MONOXIDE CONCENTRATIONS NEAR SELECTED INTERSECTIONS WITHIN THE IOS CORRIDOR
(MILLIGRAMS PER CUBIC METER)

Roadway Intersection	Existing 1-Hour		Existing 8-Hour
	A.M.	P.M.	
S. King Street / Bishop Street	17.6	13.8	8.8
Hotel Street / Bishop Street	6.1	3.6	3.0
Ala Moana Boulevard / South Street	12.3	10.2	6.2
Ala Moana Boulevard / Atkinson Drive	17.1	15.4	8.6
Ala Moana Boulevard/ Kalia Road	13.5	13.0	6.8
Kalakaua Avenue / Kaiulani Avenue	5.1	5.0	2.6
Kalakaua Avenue / Kapahulu Avenue	10.4	9.1	5.2
Kuhio Avenue / Kapahulu Avenue	9.0	6.2	4.5
Kuhio Avenue / Seaside Avenue	7.7	7.0	3.8

Source: B.D. Neal & Associates, 1999, 2001, and 2002.
Notes: Information provided on this table represent the results of quantitative analysis, not actual air quality monitoring. Underline indicates worst-case condition exceeds Hawaii AAQS. The worst-case conditions do not exceed National AAQS.
Hawaii AAQS: 1-Hour: 10 mg/m^3 ; 8-Hour: 5 mg/m^3.
National AAQS: 1-Hour: 40 mg/m^3 ; 8-Hour: 10 mg/m^3 .

IOS.5.6 Noise and Vibration

Existing noise levels throughout the primary transportation corridor vary widely due to differing land uses and noise sources. Table IOS.5-3 lists existing noise levels at selected noise sensitive locations throughout the IOS corridor (see Figure IOS.5-1). The long-term locations are land uses with nighttime sleep activities, such as residences and hotels. The short-term locations represent daytime land uses that are noise sensitive, such as schools and certain parks. The Ldn (adjusted for nighttime noise sensitivity) noise levels at all but one of the long-term locations are in the 70 to 77 decibel range. The Leq (adjusted to 15-minute intervals) noise levels at the short-term locations are in the 66 to 73 decibel range. These are relatively high noise levels when compared to a suburban or rural setting, but are not surprising given the highly urban setting of the IOS corridor, an environment with substantial traffic and noisy activities.

TABLE IOS.5-3
MEASURED EXISTING NOISE LEVELS AT LOCATIONS ALONG THE IOS CORRIDOR

Receiver Location	Land Use Category[1]	Address	Ldn/Leq[2]
LONG-TERM 24-HOUR SITES			
1	FTA 2	Apartment Building, 1720 Ala Moana	77/75
2	FTA 2	Saratoga Road at Post Office	66/63
3	FTA 2	Apartments on Kuhio Avenue between Launiu & Kaiolu Streets	76/78
4	FTA 2	Outrigger Waikiki Islander Hotel	70/76
5	FTA 2	Waikiki Banyan Hotel	72/72
6	FTA 2	Queen Kapiolani Hotel on Kapahulu at Cartwright Road	70/68
7	FTA 2	Apartment Building at 1350 Ala Moana Boulevard	73/71
8	FTA 2	Executive Centre at Hotel and Bishop Streets	77/77
9	FTA 2	Harbor Square Condominiums – Ala Moana Boulevard side	76/74
10	FTA 2	Harbor Square Condominiums – Alakea Street side	73/71
11	FTA 2	Chinatown Gateway Apartments	73/72
SHORT-TERM 15-MINUTE SITES			**Leq**
A	FTA 3	Aala Park on King Street	68
B	FTA 3	Chinatown Gateway Park at Hotel and Bethel Streets	73
C	FTA 3	Fort DeRussy, on mauka side of Kalia Road	66

Source: Parsons Brinckerhoff, Inc. September 2002.
Notes: [1] Land use category descriptors:
FTA Category 2 = Residences and other buildings where people sleep, such as hotels, apartments and hospitals.
FTA Category 3 = Institutional land uses with primarily daytime and evening use, including schools, libraries and churches.
[2] Ldn is used for land uses with nighttime noise sensitivity and for residential areas where FTA rather than FHWA noise procedures are applicable. Peak-hour Leq is used for commercial, industrial, and other land uses that do not have nighttime noise sensitivity.

Under the IOS condition in 2006, no adverse noise impacts are expected, with noise impacts at the analyzed locations likely being the same or potentially slightly lower than existing conditions.

The rubber-tired hybrid diesel-electric buses used for the IOS are not expected to cause ground vibration levels that would exceed the FTA criterion of 72 VdB for residential buildings and other structures where people normally sleep. There is no known land use along the alignment that has vibration-sensitive equipment and would be subject to lower vibration impact criteria.

FIGURE IOS.5-1
NOISE MONITORING SITES LOCATED ALONG THE IOS OF THE REFINED LPA

IOS.5.7 Ecosystems

IOS.5.7.1 Faunal Species

The habitat within the IOS corridor is highly modified and used mostly by introduced wildlife species that are highly adaptable to urban conditions. Surface waters within the IOS area, such as Nuuanu Stream and the Ala Wai Canal, are highly modified and are of relatively poor ecological quality. These surface waters provide habitat for introduced and indigenous fish, as well as migrating shorebirds. There is no unique or special habitat within the IOS corridor.

The IOS area (Downtown Honolulu to Waikiki) is not known to be used by threatened or endangered animal species, with the exception of white terns (*Gygis alba*). White terns are a State of Hawaii designated endangered species on Oahu, which use Kapiolani Park and Fort DeRussy as habitat, among other areas. The DTS has conducted interagency coordination with the State Department of Land and Natural Resources Division of Forestry and Wildlife and the U.S. Fish and Wildlife Service (USFWS). White terns are well adapted to urban environments, and the IOS is not expected to cause adverse interactions with this species, including its eggs, which are laid on bare tree branches. Nevertheless, a survey of the IOS corridor will be conducted for white terns and their eggs prior to completing final design. If sensitive trees or areas are identified, they will be monitored immediately prior to and/or during construction. If affected trees are relocated or trimmed (see Section 5.7.2), monitoring will be coordinated with the USFWS, and the City's Department of Parks and Recreation will be consulted because they have standard procedures to avoid impacts to white terns and their eggs.

The USFWS also noted other federal trust species, including the Hawaiian hoary bat (*Lasiurus cinereus semotus*), four species of Hawaiian waterbirds (coot, duck, moorhen and stilt), and the Oahu elepaio (*Chaoiempis sandwichensis ibidis)*, that are known to exist on Oahu. However, none of these species are expected to use the highly urban environment of the IOS corridor regularly, although sporadic sightings may occur.

IOS.5.7.2 Botanical Resources

The vegetation within the IOS corridor consists mostly of maintained plantings, such as landscaping on roadway medians and shoulders and adjacent properties. Some of the roadway landscaping includes trees and shrubs. Construction of the IOS transit stops and semi-exclusive and exclusive transit lanes will displace some of the corridor's landscaping, which will require the relocation or removal of trees. A total of 47 trees will be affected by implementation of the IOS. Nine of these trees are considered "notable", which is defined as a tree deemed to be important to the urban landscape character. A notable tree may be an individual tree or part of a group of trees that together comprise a recognized and important element of the visual landscape. The nine notable trees include a cluster of Date (*Phoenix dactylatra*) and Royal Palms (*Roystonea regia*) on Saratoga Road (healthy palms only) and banyans (*Ficus spp.*) on Kalia Road.

Measures to mitigate impacts to corridor landscaping will consist of re-vegetation and landscape redesign along the alignment where possible. All 47 trees affected by the IOS will be relocated on-site or replaced as part of the tree preservation program.

IOS.5.8 Water

IOS.5.8.1 Surface Water

In addition to the Pacific Ocean, the IOS will be in proximity to the following surface water bodies:

- Nuuanu Stream
- Honolulu Harbor
- Kewalo Basin
- Ala Wai Canal and Boat Harbor

These water bodies are listed by HDOH as "Water Quality-Limited Segments," in accordance with the Clean Water Act Section 305(b) and defined by 40 CFR 130.8. Water Quality-Limited Segments are water bodies having pollutants in excess of the established water quality standards, such that they cannot reasonably be expected to attain or maintain State water quality standards without additional action to control sources of pollution. Additional impervious surfaces, like roadway pavement, may increase the amount of storm water runoff that discharge contaminants such as oil and grease into surface waters. However, new or widened pavement constructed as part of the IOS will be located within existing street rights-of-way, with the exception of Kalia Road in Fort DeRussy. Although Kalia Road will be widened to provide transit lanes, the incremental increase in impervious surface resulting from this and other aspects of the IOS will be minute in comparison to the total existing drainage area and pollutant loading of storm water systems and surface waterways in Honolulu's urban core. Therefore, surface water quality will not be significantly affected by the increase in impervious surfaces with the IOS.

IOS.5.8.2 Groundwater

The Southern Oahu Basal Aquifer (SOBA) is the island's principal freshwater aquifer, underlying all of southern Oahu. The SOBA occurs as a basal freshwater lens floating on saline groundwater. It is recharged by rainfall in mauka areas of Honolulu and the Leeward Coast. Caprock, which is less permeable than water-bearing lava flows near the Koolau Range, provides a barrier that retards the seaward flow of groundwater. Water in the caprock is brackish and not potable. The caprock layer thins with distance from the shoreline and ends at varying distances inland, and the basalt layer is exposed or underlies surficial materials. As a consequence, inland areas of central Honolulu have the highest water tables in southern Oahu.

In accordance with the 1984 Sole Source Aquifer Memorandum of Understanding between the Federal Highway Administration (FHWA) and the EPA, a Ground Water Impact Assessment was prepared for the overall Primary Corridor Transportation Project (Refined LPA) for the purpose of meeting coordination requirements of Section 1424(e) of the Safe Drinking Water Act. The assessment found that the Refined LPA would cause no long-term impacts on groundwater quality, quantity, or flow characteristics. Similarly, the IOS is not expected to cause impacts to groundwater resources.

IOS.5.8.3 Floodplains

Flood Insurance Rate Maps (FIRMs) indicate several areas along the IOS alignment falling within the 100- or 500-year base floodplains, such as Ala Moana Regional Park, Ala Moana Center, and portions of Waikiki.

Although portions of the IOS alignment are within floodplains, development of the system will largely be limited to areas within or near existing roadways and do not involve the types of changes that would affect floodplains or the potential for flooding. In other words, implementation of the project will result in only minimal encroachment on the floodplain and no changes to existing flood elevation levels, nor will it increase the risk of floods. Therefore, the project is in compliance with U.S. DOT Order 5650.2 on Floodplain Management and Protection. Any required construction will comply with the rules and regulations of the National Flood Insurance Program (NFIP) and all applicable ordinances for flood hazard districts, as stated in the City and County of Honolulu's Land Use Ordinance.

IOS.5.8.4 Wetlands

There appears to be no wetlands along the IOS alignment because the system traverses a highly urbanized environment. Streams occurring in the corridor are hardened, and the IOS will operate along existing roadways. Therefore, the IOS is not expected to cause wetland impacts.

IOS.5.8.5 Navigable Waters and Water Recreation

Waters subject to tidal influence are generally defined as navigable. Further, navigability is defined by usage, such that non-tidal streams carrying commercial traffic are deemed navigable. The navigable waters in the IOS corridor include Nuuanu Stream and Ala Wai Canal. The Ala Wai Canal is heavily used for recreational canoeing and kayaking. The IOS will not in any way restrict navigation activities, because transit lanes and stops will operate along existing roadways.

IOS.5.9 Energy

Although the per unit energy requirements of a transit vehicle, such as the hybrid diesel-electric transit bus to be used for the IOS, are greater than an individual passenger vehicle, the greater passenger capacity of these vehicles makes them more energy efficient per person. In addition, hybrid diesel-electric transit buses are generally more energy efficient than conventional diesel buses because their engines are smaller and they operate at constant revolutions per minute. Therefore, the IOS is not projected to result in an adverse impact on energy resources.

IOS.5.10 Historic and Archaeological Resources

Section 106 of the National Historic Preservation Act requires that actions that are federally funded, authorized or carried out to take into account the effect of such actions on any district, site, building, structure or object that is included in or eligible for inclusion in the National Register of Historic Places (NRHP). Such resources are called “historic properties.” Section 106 requires coordination and consultation with the State Historic Preservation Officer (SHPO) and with other agencies and organizations that may have an interest in or is mandated to protect historic properties. HRS Chapter 6E places similar responsibilities on State agencies to evaluate their projects. Since the project involves both federal and State agencies, both HRS Chapter 6E and Section 106 apply to the project.

The Section 106 and Chapter 6E processes consist of: (1) identification of historic properties in the Area of Potential Effect (APE); (2) assessment of potential project “effects” on the historic properties in the APE, and, (3) if necessary, mitigation of adverse impacts.

The project’s APE was limited to affected streets and areas of new right-of-way. If structures were involved, such as transit stops, the APE was extended to the new right-of-way or those properties immediately adjacent to the structure. However, what is meant by adjacent can vary depending on the property. In a letter dated March 8, 2000, the SHPO concurred with the project’s APE definition (see Appendix A).
The “effect” of the project on historic or archaeological resources must be determined by the federal agency proposing or regulating the project. There are three possible “effect” findings:

- No historic properties affected;
- No adverse effect; or
- Adverse effect.

The FTA has determined that the IOS will adversely affect some historic-period resources.

IOS.5.10.1 Archaeological Resources

The IOS corridor is a highly urban environment, with ground conditions consisting of fill and topsoil that has already been highly disturbed by development. Therefore, it is highly unlikely that the IOS corridor contains archaeological resources, such as archaeological and cultural remains, artifacts or sites, and burial sites at or near the ground surface. However, subsurface archaeological resources have been discovered in the Fort DeRussy area and along Kalakaua Avenue in Waikiki. While some of these discoveries were unexpected, the soil conditions suggest the possibility for the discovery of burial sites. The construction of IOS transit lanes and stops will excavate to much less depths than previous construction activities.

In the unlikely event that a burial or archaeological artifact is uncovered during construction, work will stop and the State Historic Preservation Division (SHPD) will be notified immediately. Should a burial site be found during construction, specific legal procedures and cultural practices will be followed, such as involvement by the Oahu Island Burial Council. Construction would resume upon approval by appropriate authorities.

IOS.5.10.2 Historic-Period Resources

Historic-period resources are historic or potentially historic buildings, structures or objects constructed or erected after western contact, including historic districts. Table IOS.5-4 lists the historic-period resources within the APE of the IOS (also see Figure IOS.5-2). The FTA, through the DTS, has had extensive ongoing coordination with SHPD and they have jointly determined that, except for the temporary removal of some lava rock curbs during construction, the IOS will have "no adverse effect" on many of the resources in the APE because they will not be affected by right-of- way acquisition, nor will they be affected by being in proximity to transit stops. Discussion of these historic-period resources, and why they will not be adversely affected by the IOS project is provided below:

- The FTA, through DTS, rendered an "adverse effect" determination in July 2002 regarding Chinatown (State Site 80-14-9986), which included its historic sidewalk features, because of the proposed development of the Chinatown BRT transit stop. However, there will be no construction work at the Chinatown stop that is part of the IOS. Therefore, the IOS will not have an adverse effect on Chinatown, its historic sidewalk features, or two nearby Chinatown buildings (see Table IOS.5-4), the Lung Doo Benevolent Society and Yew Char Buildings.
- The Union Mall (Ewa Bound) Transit Stop will be located next to the Portland Building. However, the building will not be affected. The IOS will use the existing bus stop at Union Mall, which has sheltered benches. Therefore, the stop was evaluated as having "no adverse effect" on the Portland Building.
- The Bishop Transit Stop will be located across the street from the Dillingham Transportation Building. Since the transit stop will be located on the opposite sidewalk from the historic structure, fronting the Topa Financial Center, a "no adverse effect" determination was rendered.
- The Ala Moana Park Transit Stop will be on the existing sidewalk next to Ala Moana Park (State Site 80-14-1388). However, there will be no construction work at the Ala Moana Park stop that is part of the IOS.
- The proposed Kapahulu Transit Stop will be located within the roadway right-of-way mauka of the Honolulu Zoo parking lot driveway across from Lemon Road. The stop will be adjacent to the historic Kapiolani Park (State Site 80-14-9758), with the backdrop of the transit stop being the landscaped zoo parking lot. The FTA rendered a "no adverse effect" determination because the transit stop would not detract from the visual value or integrity of the park proper, and will not affect the park.

The FTA has determined that the Alakea and Saratoga Transit Stops will "adversely affect" lava rock curbs, which are considered "historic" by the SHPD, because they will be temporarily removed during construction.

FIGURE IOS.5-2

HISTORIC-PERIOD RESOURCES IN THE AREA OF POTENTIAL EFFECT OF THE IOS OF THE REFINED LPA

To mitigate long-term impacts, the DTS will reuse the lava rock curb material in the design of the two IOS affected transit stops.

TABLE IOS.5-4
EFFECT DETERMINATION ON HISTORIC PERIOD RESOURCES WITHIN APE OF IOS

Location	Loc. No.	Resource	FTA/DTS Determination
Chinatown Transit Stop	1	Chinatown Historic District	No Adverse Effect[1]
	2	--Lung Doo Benevolent Society*	No Adverse Effect
	3	--Yew Char Building*	No Adverse Effect
	NA	--Hotel Street Sidewalk Features	No Adverse Effect[1]
Union Mall Transit Stop	4	Portland Building	No Adverse Effect
Bishop Transit Stop	5	Dillingham Transportation Building	No Adverse Effect
Ala Moana Park Transit Stop	6	Ala Moana Park	No Adverse Effect
Kapahulu Transit Stop	7	Kapiolani Park	No Adverse Effect[2]
Historic Sidewalk and Curb Elements			
Alakea Transit Stop	NA	Lava curbs: Alakea Street between Queen Street and Nimitz Highway	Adverse Effect
Saratoga Transit Stop	NA	Lava curbs: Saratoga Road, Ewa sidewalk	Adverse Effect

Source: Federal Transit Administration (FTA), through the City and County of Honolulu, Department of Transportation Services, July 2002.

Notes: * Preliminary identification as a historic resource based on consultation with the SHPD.

[1] An "adverse effect" determination was rendered in July 2002. However, this was based on the Chinatown BRT transit stop of the Refined LPA. As stated in Section IOS 1.2, this transit stop will not be developed for the IOS.

[2] The July 2002 effect determination rendered an "adverse effect" on Kapiolani Park, but due to the relocation of the Kapahulu Transit Stop, it was changed to a "no adverse effect".

IOS.5.10.3 Traditional Cultural Properties

Traditional cultural properties (TCPs), like archaeological and historic-period resources, is another category of historic properties that is afforded protection under Section 106. Some of the identified TCPs in the study area are from the many ethnicities and cultures of Hawaii that have adapted to the urbanized environment of Honolulu. The TCPs within the IOS APE are Chinatown and burial sites. Potential impacts to Chinatown and proposed mitigation measures are discussed in Section IOS.5.10.2. Potential impacts to burial sites and proposed mitigation measures are discussed in Section IOS.5.10.1.

IOS.5.11 Parklands

A number of park and recreational facilities are located within the IOS corridor (see Table IOS.5-5 and Figure IOS.5-3). In general, the IOS will enhance the value of the park and recreational resources in the study area by improving their accessibility for transit users. In addition, the IOS will not require land from or cause proximity impacts to any of these park or recreational resources. However, the transit stops adjacent to Ala Moana Park, Kapiolani Park and Kuhio Beach Park have the potential to adversely affect the aesthetic characteristics of these parks, even though these transit stops will not use park property. Therefore, as discussed in Section IOS.5.4, these transit stops will require special architectural design treatment.

FIGURE IOS.5-3
PARKLAND RESOURCES NEARBY THE IOS OF THE REFINED LPA

TABLE IOS.5-5
PARKLAND RESOURCES ADJACENT TO INITIAL OPERATING SEGMENT

Map Key	Park	Street	Total Area (in acres)	Classification	Jurisdiction
1	Aala Park	North King Street	6.69	Urban Park	City and County
2	Fort Street Mall	Fort Street	0.87	Mall	City and County
3	Chinatown Gateway Park	Bethel Street	0.40	Urban Park	City and County
4	Union Street Mall	Between Hotel and Bishop Streets	0.36	Mall	City and County
5	Open space adjacent to federal building	Ala Moana Boulevard and Halekauwila Street	N/A	Urban Park	United States
6	Ala Moana Regional Park, including Aina Moana Recreation Area (Magic Island)	Ala Moana Boulevard	119.18	Regional Park	City and County
7	Ala Wai Promenade	Kalakaua Avenue	4.43	Urban Park	City and County
8	Duke Paoa Kahanamoku Beach Park	Paoa Place	0.43	Beach Park	City and County
9	King Kalakaua Park (formerly Waikiki Gateway)	Kalakaua Avenue	0.57	Urban Park	City and County
10	Beachwalk Triangle	Beachwalk and Kalakaua Ave.	0.15	Urban Park	City and County
11	Princess Kaiulani Triangle	Kaiulani and Kuhio Avenues	0.12	Urban Park	City and County
12	Kuhio Avenue Mini Park	Kuhio Avenue	0.12	Mini Park	City and County
13	Kuhio Beach Park	Kalakaua Avenue	3.40	Beach Park	City and County
14	Kapiolani Regional Park (includes Honolulu Zoo)	Kapahulu and Kalakaua Avenues	154.73	Regional Park	City and County
15	Kapiolani Beach Park	Kalakaua Avenue	12.09	Beach Park	City and County
16	Waikiki Beach	Kalakaua Avenue	N/A	Various	Various (City, State, and Private)
17	Irwin Memorial Park	Aloha Tower Drive	0.7	Urban Park	State of Hawaii
18	Kakaako Makai Gateway Park	Ilalo Street	6	Community Park	State of Hawaii
19	Kakaako Waterfront Park	Kelikoi Street	30	State Park	State of Hawaii
20	Tamarind Park	Bishop/King Streets	N/A	Urban Park	Private

Sources: Parsons Brinckerhoff Inc., Initial Field Survey 1989, Update January 1992; City and County of Honolulu Department of Parks and Recreation, Index of Oahu Parks and Facilities, 1997; DLNR, State Parks Division, Existing State Parks and Other Areas, 1998, Agency Interviews, December 1999.

Notes: Map key refers to numbers on Figure IOS.5-3.

IOS.5.12 Construction Impacts

This section presents an assessment of the temporary impacts of construction of the IOS and mitigation measures related to those impacts. Most of the IOS will be placed within the same rights-of-way as the existing surface roadway system, which must remain operational throughout construction. The IOS is being planned, designed and scheduled to meet this challenge with minimal disruption. However, some impacts on the environment, nearby facilities, and established patterns of activity are inevitable. These impacts will be temporary, and their severity will depend largely on the type of construction methods employed, how it will be carried out, and what controls are exercised.

IOS.5.12.1 Transportation and Circulation

The Construction Management Program for the IOS will include development of a "Maintenance of Traffic Plan". This plan, which will be reviewed and approved by the City Department of Planning and Permitting (DPP), will include systemwide as well as subarea consideration of the most important traffic and transportation issues and mitigation measures. A community advocacy firm will be selected to assist in communicating details of the plan to the public. Specifically, the plan will include:

- Overall maintenance of traffic and transportation goals, project commitments, and identification of key project elements which have been specifically designed to meet maintenance of traffic objectives;
- An areawide maintenance of traffic program to maintain mobility and accessibility and to address project-wide issues such as parking, commuter transportation systems and traffic system management;
- Project subarea maintenance of traffic measures focused on the specific detours, disruptions, problems, and issues expected in each subarea during each stage of construction;
- Coordination program for continued development of the Maintenance of Traffic Plan, including provisions for interaction with public agencies, local communities and the private sector; and
- Procedures for finalizing, monitoring, and implementing the Maintenance of Traffic Plan during construction, as a part of the Construction Management Program.

The Plan will include such policies as:

- Construction activities which would close traffic lanes will be restricted to off-peak hours;
- Construction activities will be phased so as to minimize traffic impacts to any one area;
- During final design, detailed Work Zone Traffic Control Plans, which will include detour plans, will be formulated in cooperation with affected neighborhoods;
- Existing bus service will be maintained, as well as vehicle and pedestrian movements;
- No designated major or secondary highway will be completely closed to vehicular or pedestrian traffic. No local street or alley will be completely closed, preventing vehicular or pedestrian access to residences, businesses or other establishments; and
- An extensive public information program will be implemented which will provide motorists, residents and businesses with information on the location and duration of construction activities, and anticipated traffic conditions.

Truck traffic will be using existing routes except near construction areas. Signage and traffic cones will be provided to re-route truck traffic around construction zones where necessary.

Bus routes and stops will be maintained, although buses may be re-routed over temporary detours and bus stops may be temporarily relocated. Moreover, public transportation facilities and services will be expanded during project construction as part of the Maintenance of Traffic Plan.

Bicycle routes will be included in the re-routing of surface transportation systems. Signage will be provided to re-route established bicycle facilities around construction zones.

Local access to residences and businesses will be maintained during the construction work. Pedestrian movements will be maintained, but may be temporarily relocated to provide safe passage through work areas. Alternative pedestrian routes, including attractive, well-lighted, safe walkways, will be provided around or through construction areas.

Measures to minimize the impact of loss of parking during construction will be implemented, including temporary parking facilities, staging of construction to minimize parking loss, and remote parking for project construction workers.

In most cases, the nature of the construction for the IOS will not require street closures or detours because much of the work will occur in the curb lanes of the roadway, allowing vehicles to pass the construction zone using the remaining lanes. Although there will be localized lane reductions in the construction area, curb parking will be temporarily and/or permanently eliminated in many places, so that traffic flow using the remaining lanes will be maintained under most situations. Some presently allowed turning movements may need to be restricted when construction is occurring within an intersection.

The IOS will create truck traffic associated with the transport of construction materials and wastes. Times and routes of construction vehicles will be planned as part of the development of the Maintenance of Traffic Plan. Planning will occur with the intent of minimizing the effect of construction traffic.

IOS.5.12.2 Displacements, Relocation and Restricted Access for Existing Uses

No permanent displacements and relocations will be necessary for the IOS. The discussion in this section is limited to only those areas that will be needed temporarily during construction.

The IOS will require temporary areas for construction staging. There are a number of vacant sites along the IOS alignment that could serve as construction staging areas.

IOS.5.12.3 Neighborhoods and Businesses

Adverse impacts to neighborhoods and businesses near construction sites will be related primarily to disruptions of local transportation and circulation patterns, and air and noise emissions caused by construction vehicles and equipment, and vehicles delayed by construction. Air quality and noise impacts during construction and proposed mitigation measures are discussed in Sections IOS.5.12.4 and IOS.5.12.5.

Although a maintenance of traffic plan will be prepared and implemented, construction of the IOS will cause motorists, bicyclists and pedestrians to experience delay and inconvenience when traveling on affected streets undergoing construction activities. Bus routes on or crossing affected streets will generally be maintained throughout the construction period, but they may be routed over localized, temporary detours, and bus stops may be temporarily relocated.

Local access to residences, businesses, and nearby parks, such as Kakaako Waterfront Park and Ala Moana Park, will be maintained when construction is conducted on adjacent roadways. However, travel to and from these destinations may be delayed as a result of increased congestion levels. Pedestrian movements will be maintained, but may be temporarily relocated to provide safe passage through work areas.

Even with an effective maintenance of traffic plan, construction-related traffic disruptions will cause inconveniences to residents living near construction sites, and may cause certain businesses to lose revenue, especially those that rely on drive-by customers. These types of businesses include fast-food restaurants and convenience stores. Construction on a particular street could cause some motorists to choose alternate routes, bypassing those businesses along affected streets.

IOS.5.12.4 Air Quality

Contractors will be required to comply with all applicable air quality laws to limit adverse effects on air quality from demolition, clearing, material processing and construction activities, as well as from construction vehicles.

Construction will cause emissions of fugitive dust, airborne particulate matter of relatively large size. Fugitive dust will be generated by particulate matter being kicked up by such activities as excavation, demolition, clearing, stockpiling, hauling, vehicle movement, and dirt tracking onto paved surfaces at access points. Fugitive dust also will be generated from the material processing and storage that will occur at the stockpile areas associated with recycling usable portions of excavated material.

To minimize the amount of construction-generated fugitive dust, the following measures will be followed:

- minimize land disturbance;
- apply water or other environmentally acceptable material to control dust generation;
- cover trucks when hauling dirt or other dust-generating materials;
- stabilize the surface of dirt piles if not removed immediately or other material storage areas;
- use windbreaks;
- limit vehicular paths and stabilize temporary roads;
- pave all unpaved construction roads and parking areas to road grade for a length no less than 50 feet where such roads and parking areas exit the construction site;
- use dust suppressants on traveled paths that are not paved;
- apply dust control and suppression techniques to the material processing activities at the stockpile sites;
- remove unused material and dirt piles when they are no longer needed; and
- revegetate areas where existing landscaping was removed for construction.

As discussed in Section IOS.5.5, carbon monoxide (CO) is the principal pollutant of concern in localized areas. Since emissions of CO from motor vehicles increase with decreasing vehicle speed, disruption of traffic during construction could result in short-term elevated concentrations of CO. To minimize CO emissions, efforts will be made during construction to limit disruptions to traffic through prior planning of alternate routing, traffic control, and public notices, especially during peak travel periods.

IOS.5.12.5 Noise and Vibration

Noise generated from construction of the IOS could adversely affect nearby residences, schools, office buildings, and other noise-sensitive activities.

To minimize the level of impact, a specification for noise and vibration limits from construction activities will be developed and enforced. The specification will be submitted to the Hawaii Department of Health (HDOH) for their review. An industrial hygienist will monitor compliance with the specification during construction through on-site noise and vibration monitoring during various stages of construction.

The HDOH also has Community Noise Control requirements, which apply to construction noise. The project cannot exceed the noise levels stipulated by these standards unless a Noise Permit and/or Variance is granted by HDOH. Variances are only granted if they are in the public interest and the construction noise would not substantially endanger human health and safety.

The Construction Management Program for the IOS will explicitly address the minimization of noise levels generated during construction, and will include the following mitigation measures:

- Design Considerations: during the early stages of Construction Management Plan development, limits on the deployment of noisy equipment will be considered. For example, no stationary equipment will be located near schools or hospitals;
- Sequence of Operations: noisy operations will be scheduled to occur at the same time (as opposed to being spread throughout the day), and, as feasible, noisy operations will be scheduled to occur when schools are not in session or other noise sensitive activities are not occurring;
- Noise barriers will be employed where feasible;
- Source Control: many types of noise emissions can be controlled at the source and in such cases, noise reduction systems will be employed. For example, noise reducing muffler systems lower exhaust noise by at least 10 dBA; and
- Time and Activity Constraints: as much as possible, noisier activities will be limited to daytime hours.

Vibration levels at adjacent structures will be monitored and the structures protected from vibration impacts, as necessary.

IOS.5.12.6 Water Quality

During construction of the IOS, impacts to surface and groundwater resources potentially could occur. Impacts to surface water would be associated with point and non-point source stormwater discharges and dewatering discharges. These discharges could contain particulate (sediment) and chemical contaminants. Potential sediment sources include unstabilized, exposed soil at excavations; drainage from material stockpiles; discharges from haul trucks; and dewatering activities.

Sediment and Erosion Control

Erosion and sediment discharges will be minimized through the application of Best Management Practices (BMPs) techniques designed to minimize erosion and capture sediment prior to discharge. Examples of BMPs include:

- use of chemical crusting agents or other stockpile coverings;
- planting of vegetation and/or mulching on highly erodible or critically eroding areas;
- temporary landscaping;
- use of silt fences;
- use of sediment control traps,
- use of straw bale filters;
- use of inlet system sediment control traps;
- installation of debris basins;
- use of stilling basins to reduce the levels of sediments and other pollutants entering surface and coastal waters;
- construction of dikes or diversions to avoid runoff across erodible areas; and

- monitoring of sediment discharge.

Together, the BMPs will effectively minimize the potential for water quality impacts or off-site impacts from eroded material. Important BMPs will include maintenance of the sediment and erosion control systems, an ongoing monitoring program to determine the effectiveness of the BMPs, and adjusting the sediment and erosion control program as required.

Details of the BMPs will be developed during final design of the IOS and detailed erosion and sediment control plans will be included in the final construction plans for the IOS. Through the agency reviews conducted as part of the permit process, the use of proper sediment control techniques will be assured.

Studies at specific locations to identify potential chemical contaminants in dewatering and stormwater discharges and stockpile drainage will be performed during final design of the IOS, and appropriate treatment measures will be employed based on the character of the discharge and the water quality standards of the receiving water body.

Spills associated with construction activities pose a potential threat to water resources. Development of a Spill Containment Control and Countermeasure Plan, including maintenance of clean-up equipment on-site, along with detailed spill prevention measures, will mitigate the impact of inadvertent releases.

Dewatering Discharges

Construction along Ala Moana Boulevard will likely encounter groundwater during excavation operations. The groundwater will need to be removed during construction (dewatering), and groundwater disposal will have to be considered. Such dewatering will be temporary, limited to the time required for excavation and construction.

The water removed from excavations must be returned to the groundwater system, added to the stormwater drainage system or discharged to adjacent surface waters. The groundwater could contain suspended sediment and possibly chemical contaminants, and could adversely affect the water quality of receiving surface water bodies by increasing their turbidity and sedimentation rates.

Any dewatering discharge will require a dewatering permit that could only be obtained after designing an appropriate treatment process to ensure that the discharge meets water quality standards. For example, sediment will be removed prior to discharge through a sedimentation or filtering system. A monitoring program will assure compliance with water quality standards.

The project area is underlain by the Southern Oahu Basal Aquifer (SOBA). Mitigation measures will be implemented during construction to ensure that no sedimentation or chemical quality effects on the aquifer will occur.

Construction Equipment Use and Maintenance

Since many of the proposed improvements will be built using poured-in-place concrete construction, large amounts of concrete will be transported to the construction site. Each time concrete is transported, residue remaining in the concrete truck must be washed out before it hardens. This wastewater contains fine particles and could cause sedimentation and turbidity if discharged to surface waters.

Concrete trucks will be washed out in accordance with procedures to ensure that water quality standards are not violated. Project specifications will prohibit the washing out of concrete trucks at the project site, or a filtration or settling system will be constructed to prevent fine material from being discharged into surface waters.

The use and maintenance of construction equipment can pose a threat to surface and ground waters. Potential spills associated with vehicle maintenance, such as changing oil and refueling equipment, can introduce new contaminants into the environment at the construction staging area. The servicing and maintenance of construction equipment will be restricted to the base yards of the mobile equipment. At these vehicle maintenance areas, strict enforcement of BMPs will be required. Clean up equipment will be maintained on site and clean up response plans will contain detailed spill response measures.

IOS.5.12.7 Ecosystems

Wildlife habitat is very limited along the IOS alignment and construction of the IOS will have no major effect on the characteristics or size of populations of the resident wildlife species in the area.

The IOS will cross streams in the study area on existing structures (bridges). The IOS will not require new or reconstructed bridge piers within the streams.

Every precaution possible will be taken during construction to protect street trees. The tree impacts of the IOS are described in Section IOS.5.7. The construction impacts will consist of permanent removals and/or relocations of trees that are not compatible with the road widening of Kalia Road. Mitigation is addressed in Section IOS.5.7 and will be described in detail in the tree preservation plan to be developed with a qualified certified arborist. A qualified certified arborist will also prepare a tree protection plan to be used during construction. The plan will specify precautionary measures to be taken to protect trees that are being relocated, as well as measures to protect other nearby trees during construction. Community input will be a component in preparing the tree protection plan. Construction mitigation measures will include tree protection zones that will be observed, except in cases where earthwork at or near the base of a tree is necessary, construction watering of trees, and prohibiting construction vehicles from being parked under trees to avoid soil compaction. A Street Tree Review will also be conducted by the DPP as part of the construction plan review by the City. The DPP's Street Tree Review applies only to those trees not located within a Special Design District.

IOS.5.12.8 Solid and Hazardous Wastes

1) Solid Waste

The volumes of solid waste that will be generated by the IOS is not anticipated to be beyond the ability of existing landfills to handle. Coordination will be conducted with the DPP for a grubbing, grading, and stockpiling permit. Waste generated by grubbing of the sites and all wastes generated during construction will be disposed of properly.

2) Contaminated Materials

Since the IOS will involve construction within existing roadway rights-of-way, no contaminated soils or other materials are expected to be encountered. If this turns out not to be the case, construction will be halted in the suspect area, appropriate sampling and testing performed, and a detailed mitigation plan prepared and approved before construction resumes.

The selection of mitigation measures would consider avoidance of exposure, minimizing impacts through redesign, and remediation. The need for and type of mitigation measures that would be required would depend on the nature of the contamination, the construction methods and the development plans (i.e. where structures and pavements will be located). The information collected during additional evaluations would be used to define the impacts and develop appropriate measures to minimize or eliminate any adverse impacts from site contamination.

In addition, issues relating to worker health and safety are required to be considered during construction because the health and safety of on-site personnel could be affected if they are exposed to contaminants. Any site remediation would be performed in accordance with applicable State and federal laws. Monitoring and remediation plans, if required, would be designed in coordination with the HDOH and other agencies, and the plans would be implemented prior to resuming construction.

IOS.5.12.9 Utility Service

The IOS will affect few major utilities but many minor ones. Substantial planning will occur so that interruptions in utility service to customers are minimized. Coordination with utility providers during final design and construction will identify problems and provide opportunities to resolve them prior to construction. Replacement and/or relocation of utilities will be closely coordinated with roadwork and construction of the BRT stops to minimize disruption to adjacent properties and traffic. Disruptions to utility service, if necessary, will be restricted to short-term localized events. Careful scheduling of these disruptions and prior notification of adjacent properties that would be affected by temporary service cut-off will mitigate some of the utility relocation impacts.

Many of the utilities that are to be buried underground or moved to another underground location could be relocated simultaneously with existing utilities to minimize the need for multiple excavations. As much as possible, relocated utilities will be buried together or coordinated with infrastructure improvements already planned by the City or other agencies.

A preliminary review of the IOS alignment and stops in relation to siren locations for the Civil Defense Warning System indicates that no significant impact will occur. If sirens need to be relocated as a result of the project, they will remain in the same vicinity and be placed and designed to maintain comprehensive emergency warning coverage. Locations will be coordinated with Oahu Civil Defense during final design.

Coordination of utility relocations will be scheduled, programmed, and monitored as a part of the Construction Management Plan and Public Participation Program.

IOS.5.12.10 Economic

Construction activities associated with the IOS will result in temporary construction related jobs. During construction of the IOS, local businesses could be negatively affected by increased congestion in front of their properties or by reduced access. Location-specific measures, including access, safety, noise and aesthetic requirements of adjacent businesses, will be identified during final design and incorporated into construction contracts. A public information program for commuters, tourists, local residents and the business community will be sustained. A community and government agency mitigation involvement program will be initiated to allow for the exchange of information and ideas.

IOS.5.12.11 Aesthetic and Visual

The construction work for the IOS will occur in highly visible and traveled areas. Therefore, orderly and clean work sites will be required and enforced throughout construction. Landscaping will be left in place and protected for as long as possible and replaced as soon after construction as possible. Plans for re-landscaping the impacted areas will be reviewed by the DPP to maintain cohesive visual corridors.

IOS.5.12.12 Historic Resources and Archaeology

Discussion of the potential impacts on historic properties is provided in Section IOS.5.10. Historic-period resources will not be affected by construction of the IOS because these properties will not be in the construction area, nor will they be used to store equipment and vehicles or used as staging areas. There is a chance that construction along certain sections of the IOS, such as in Waikiki, could uncover Kupuna Iwi (ancestral bones) or other archaeological artifacts. However, the alignment is mostly urban and has been substantially altered for many years. In addition, most of the project requires little excavation. The project's MOA will provide procedures in the unlikely event that unanticipated resources are encountered during construction of the IOS. The SHPO will be notified immediately if any bones, artifacts or other signs of historic occupation are observed.

IOS.5.13 Other Environmental Considerations

IOS.5.13.1 Indirect Impacts

Because investment in a fixed transitway can have an effect on land use and development, the IOS may induce transit-oriented development. As discussed in Section 5.1, the Refined LPA, of which the IOS is a subset, will convey government's willingness to invest in a fixed transit system.

The IOS may help stimulate planned commercial and residential development in areas such as Kakaako. Transit-oriented development and/or re-development such as mixed-use high density residences and pedestrian-scale commercial districts could flourish in areas immediately surrounding transit centers and transit stops, which may otherwise take longer to develop. However, implementation of the IOS alone is unlikely to produce desired development. It will only occur in combination with favorable land use, plans, policies, regulations, zoning, and market conditions.

Development spurred by improvements in transit may result in increased demands on water and energy resources, civil services, and infrastructure, as well as some incremental pollution. However, the Primary Urban Center is already highly urbanized, and the IOS in the year 2006 will have minimal impact on new development and the supporting infrastructure compared to the 2006 No-Build condition.

IOS.5.13.2 Cumulative Impacts

By 2006, the cumulative impacts of the IOS and other actions expected by 2006 (see Section IOS.5.1.2) are not anticipated to be serious due to the near-term time frame, and because of the large and highly urban nature of the IOS corridor.

Substantial land use changes are not anticipated other than continued development in Kakaako, and certain spot locations in Waikiki (see Section IOS.5.1.2). The IOS will be an important addition to the transportation infrastructure of the corridor and will support planned developments in Kakaako and Waikiki. Major investments in additional infrastructure, such as for water, sewage, and electricity, are not expected to be necessary by 2006 to accommodate planned development.

The planned developments may require some displacements of existing land uses, but along with the IOS, they will also enhance short- and long-term employment. The IOS and other developments are unlikely to adversely change ambient air quality and noise conditions, or encroach on parks or other public recreational facilities. They are also unlikely to adversely affect the corridor ecosystem since it is already highly modified by human activity. Water resources are highly regulated, and as urban development proceeds, cumulative water quality impacts of each project would be assessed during the environmental review and permitting processes. Similarly, historic properties are protected under federal and State law, and as subsequent development proceeds, project proponents are required to coordinate with the SHPD. The DTS is committed to designing the transit stops of the IOS to be visually compatible with their surrounding environments.

IOS.5.13.3 Relationship Between Local Short-Term Uses Versus Long-Term Productivity

Short-term uses of the environment versus long-term productivity refers to the interplay between typically adverse, short-term, construction-phase impacts, and the benefits of the project upon completion. The relative balance between these factors must be disclosed.

Construction of the IOS will create short-term, confined adverse impacts, which are discussed in more detail in Section 5.12. Such impacts include temporary, localized increases in fugitive dust emissions, noise, and traffic congestion. Utility services could be temporarily affected, and erosion from exposed areas will need to be prevented. The IOS's long-term transportation improvements would counterbalance its temporary, construction-phase impacts by accomplishing the following:

- Improving public transportation service on Oahu, especially between Downtown Honolulu and Waikiki; and
- Providing improved travel time for transit patrons, thereby providing an attractive alternative to the private automobile.

IOS.5.13.4 Commitments of Resources

Given the urban setting of the IOS corridor, irreversible commitments of resources will be those associated with the construction process, such as use of energy, construction materials, and labor. Once applied to this project, these resources will not be available for other projects. This commitment of energy, materials, and labor is not a drawback since these resources would otherwise be committed to other construction projects.

IOS.6 FINANCIAL ANALYSIS

A financial analysis was conducted to identify the capital and operating costs and the timing and level of financial commitments needed from federal and local sources to build and operate the IOS.

IOS.6.1 Funding of Capital Costs

To determine the adequacy of the funding already approved to meet the capital requirements of the IOS, the capital costs presented in 2002 dollars in Section IOS.2.3 were converted to year of expenditure (YOE) dollars. Over the roughly two-year implementation period for the IOS (FY 2003 -2005) the capital costs are projected to total $50.9 million in YOE dollars. This assumes an annual compounded cost escalation rate of 2.5 percent.

Proposed funding for the IOS capital improvements will be $7.95 million from the Federal Transit Administration (FTA) Section 5309 Bus Capital Program, $11.90 million from the FTA Section 5309 New Starts Program, and the remaining $31.0 million from City General Obligation (G.O.) Bonds. The $31.0 million of City funding has already been approved in the City's FY 2003 capital improvement budget. The required federal funding has been appropriated by Congress in the FY 2003 Omnibus Appropriations Bill (P.L. 108-7) and the FY 2002 U.S. DOT and Related Agencies Appropriations Act (P.L. 107-87). The IOS is therefore fully funded.

IOS.6.2 Funding of Operating Costs

As indicated in Section IOS.2.4, the 2006 systemwide bus operating and maintenance (O&M) costs with the IOS in place, excluding TheHandi-Van, will be $119.3 million in 2002 dollars. This slight and lower difference from the No-Build condition is due to corollary service changes and use of more efficient vehicles. The system-wide O&M costs, excluding TheHandi-Van, will be $131.7 million in 2006 YOE dollars. Sources of funding for O&M costs in 2006 will be passenger fares (27.3%), FTA Section 5307 formula funds for preventive maintenance (6.4%) and City General Fund (66.3%).

IOS.7 REQUIRED PERMITS AND APPROVALS

Construction of the IOS may require the following regulatory approvals and permits. They will be obtained during final design.

State of Hawaii

- State Department of Transportation Permit to Perform Work Upon a State Highway
- HDOH – National Pollutant Discharge Elimination System (NPDES) Permit – stormwater associated with construction activity
- HDOH – Noise Variance (if nighttime construction is required)
- Disability and Communication Access Board Approval

City and County of Honolulu

- Special Design District Permit
- Building Permit
- Special Management Area Use Permit
- Grubbing, Grading, Excavation, and Stockpiling Permit
- Street Tree Review
- Permit to Excavate on Public Right-of-Way (Trenching)
- Street Usage Permit

IOS.8 UNRESOLVED ISSUES

Most issues raised during the extensive public involvement, coordination, and consultation conducted for this project have been addressed in the FEIS, although some issues remain unresolved. The unresolved issues are presented below with a brief discussion regarding resolution of the issue.

1. Transit Stop Design. The design of the architectural elements of the transit stops along the IOS corridor will involve public and agency input. When transit stops are near visually important areas, they will be given special design consideration to ensure there is no negative visual impact.

2. Tree Relocations. The exact locations where affected trees will be replanted will be determined during final design. The replanting plan will be prepared in concert with a certified arborist and with community input.

CHAPTER 6 FINANCIAL ANALYSIS AND EVALUATION

CHAPTER OVERVIEW AND ORGANIZATION

This chapter contains two parts. Section I provides the financial analysis for the IOS of the Refined LPA, based on the first full year of IOS operations in 2006. The analysis presented in Section II of this chapter describes the financial analysis for the 2025 No-Build Alternative, TSM Alternative, and Refined LPA. Section II also contains an evaluation of the degree to which various 2025 Alternatives satisfy the project purposes and needs presented in Chapter 1.

The financial analysis is presented in year-of-expenditure (YOE) dollars to provide a better understanding of the actual funds that would need to be expended and of the relative effect of inflation on costs and revenues.

The year 2002 is used as a base for comparison because it is the latest full year that costs can be verified. Baseline costs came from City budget documents (actual expenditures are slightly lower because of savings on expenditure restrictions).

Readers of this FEIS document who have reviewed previous documents will observe that project costs have dropped considerably from the DEIS and SDEIS due to the project refinements explained throughout the document. This has further improved project cost-effectiveness while enhancing service.

I. IWILEI TO WAIKIKI (IOS)

A financial analysis was conducted to identify the capital and operating costs and the timing and level of financial commitments needed from federal and local sources to build and operate the IOS.

The IOS construction is scheduled to be completed by 2005.

1) Capital Costs

The capital cost of the IOS is estimated to be $48.1 million in 2002 dollars. To determine the adequacy of the funding already approved to meet the capital requirements of the IOS, the capital costs presented in 2002 dollars were converted to year of expenditure (YOE) dollars. Over the roughly two-year implementation period for the IOS (FY 2003 -2005) the capital costs are projected to total $50.9 million in YOE dollars. This assumes an annual compounded cost escalation rate of 2.5 percent.

The IOS project will be fully funded through a combination of FTA sources matched by City General Obligation bonds. Funding for the IOS capital improvements will be $7.95 million from the Federal Transit Administration (FTA) Section 5309 Bus Capital Program, $11.90 million from the FTA Section 5309 New Starts Program, and the remaining $31.0 million from City General Obligation (G.O.) Bonds. The $31.0 million of City funding has already been approved in the City's FY 2003 capital improvement budget. The required federal funding has been appropriated by Congress in the FY 2003 Omnibus Appropriations Bill (P.L. 108-7) and the FY 2002 U.S. DOT and Related Agencies Appropriations Act (P.L. 107-87). The IOS is therefore fully funded.

The estimated $4-5 million cost of the ten hybrid-diesel-electric BRT vehicles that are required for IOS operations is not included in the capital cost of the IOS since all of the vehicles will be purchased with City funds as part of the regular fleet replacement program that will occur with or without the IOS being implemented. The total size of the City's bus fleet is not expected to change with implementation of the IOS and will remain at 525 buses, including the ten hybrid diesel-electric vehicles.

2) Operating and Maintenance Costs

System-wide operating and maintenance (O&M) costs were forecast for conditions in FY 2006 with and without the IOS. This will be the first full year of operations after the IOS construction is completed in 2005. It is planned that the Kalihi and Kakaako Mauka branches of the In-Town BRT will be opened for service in the latter part of FY 2006. To isolate the O&M cost difference between the IOS and No-Build condition, the O&M costs for these other branches and for TheHandi-Van are not included in the IOS analysis presented in this section. The O&M costs of the other branches and for TheHandi-Van are reflected in the financial plan for the entire Refined LPA discussed in Section II (2025 Alternatives) of this chapter and in the cash flow tables presented in Appendix C.

The FY 2006 system-wide bus O&M cost excluding the Kalihi and Kakaako Mauka branches and TheHandi-Van is estimated to be $119.3 million in 2002 dollars. This is a $264,700 savings because of corollary service changes compared to the No-Build condition. The system-wide O&M costs excluding the Kalihi and Kakaako Mauka brances and TheHandi-Van in 2006 YOE dollars will be $131.7 million. Similar to today, this will be financed through a combination of passenger fares, FTA formula funds and City general funds. Sources of funding for O&M costs in 2006 will be passenger fares (27.3%), FTA Section 5307 formula funds for preventive maintenance (6.4%) and City General Fund (66.3%).

II. 2025 ALTERNATIVES

This section presents the financial analysis for the corridor-wide alternatives - No-Build Alternative, Transportation Systems Management (TSM) Alternative, and Refined Locally Preferred Alternative (LPA), which were described in Chapter 2. This section also presents the alternatives' comparison, which were in Chapter 7 in the Major Investment Study/Draft Environmental Impact Statement (MIS/DEIS) and Supplemental Draft Environmental Impact Statement (SDEIS).

The proposed financial plans for capital and for operations and maintenance (O&M) of the Refined LPA are presented within the context of the comparative costs and revenues associated with each alternative.

The Bus Rapid Transit (BRT) systems in the Refined LPA will be implemented between Fiscal Years (FYs) 2003-2016. As defined in the City and County of Honolulu's Revised Charter, fiscal years extend from July 1 through June 30. Over the 14-year implementation period, the capital cost of the Refined LPA BRT Program is projected to be $487.6 million in Year of Expenditure dollars (YOE $). Of this total, $243.2 million will be for the In-Town BRT system and $244.4 million will be for the Regional BRT system. If Embedded Plate Technology was to be implemented, $129.1 million would be added to the capital cost. The capital cost of the IOS is estimated to be $50.9 million (YOE).

Also included in the Refined LPA's financial analysis are the capital costs required for the acquisition and replacement of the entire bus and TheHandi-Van fleet and other system-wide improvements. These amount to $426.0 million (in YOE $) over the 2003 - 2016 period in which the Refined LPA BRT Program is implemented. For the 2003 through 2025 forecasting period used for environmental analyses in this FEIS the capital cost of the bus and TheHandi-Van acquisition and replacement program and other system-wide improvements is projected to be $723.3 million (in YOE $). The fleet would be replaced twice during this time period. The total estimated capital cost for the Refined LPA including vehicle acquisition and systemwide improvements is therefore $1.04 billion for the period 2003 through 2016, and $1.34 billion for the period 2003 through 2025. These are in YOE dollars.

The City's annual debt service payment between FYs 2003 and 2016 would increase $7.7 million for the Refined LPA over the No-Build Alternative, and $3.9 million over the TSM Alternative.

The FEIS financial analysis for the Refined LPA differs from the MIS/DEIS and SDEIS financial analyses in four primary ways:

- Refined LPA capital costs reflect additional refinements made to the proposed project, including alignment modifications. These have lowered the cost;
- State highway funding has been removed as a capital revenue source;
- City highway funding has been removed as a capital revenue source; and
- The implementation phasing plan for the Refined LPA has been adjusted to accommodate a conservative estimate of revenues over the 14-year period extending from FY 2003 to FY 2016.

The financial analysis concludes that the Refined LPA, along with the system-wide bus replacement and expansion program, can be funded without adding new taxes or raising taxes using the following revenue sources:

Capital Funding for the Refined LPA Program	
FTA Section 5307 Urbanized Area Formula (UZA) Funds	22%
FTA Section 5309 Fixed Guideway Modernization (FGM) Funds	2%
FTA Section 5309 Bus Capital Funds	5%
FTA Section 5309 New Starts Funds	23%
Federal Highway Administration (FHWA) Funds	13%
City General Obligation (GO) Bonds	35%
TOTAL	100%

Bus and BRT Operations & Maintenance Funding	
Passenger Fares	27%
FTA Section 5307 UZA Funds	7%
City Operating Support	66%
TOTAL	100%

In comparing the alternatives, the Refined LPA will provide the greatest increase in ridership within the Primary Corridor with an increase of over 13 percent. The Refined LPA will help achieve a more balanced transportation infrastructure in the Primary Transportation Corridor compared to the No-Build and TSM Alternatives. Compared to the No-Build and TSM Alternatives, the Refined LPA will result in higher islandwide and commuter transit ridership; carry more people during the morning peak hour, and improve the transportation linkage between Downtown Honolulu and Kapolei, Waikiki, UH-Manoa, and Kalihi. The $5.01 and $4.52 incremental cost per new transit rider for the Refined LPA over the No-Build and TSM Alternatives respectively is very favorable compared to the $6.25 incremental cost per new transit rider for the TSM Alternative over the No-Build.

Implementation of the Refined LPA will be phased over 14 years, the first phase consisting of construction of the Initial Operating Segment (IOS), which is scheduled to begin with award of a construction contract in Calendar Year 2003. The IOS Chapter presents the financial analysis for the implementation of this phase.

The conceptual funding plan for the Refined LPA was approved by the City Council when it adopted the LPA. Funding for the Refined LPA is also incorporated in the OMPO regional transportation plan (TOP 2025). For each phase of the total project to be implemented, there needs to be appropriations by the City Council and a commitment of federal matching funds. These appropriations exist for the IOS and will need to be obtained for the balance of the project.

In the discussion below, Section 6.1 describes the financial analysis for the proposed project, including the costs and the proposed funding of the project elements. Section 6.2 addresses differences among the No-Build Alternative, TSM Alternative, and the Refined LPA, based on multiple factors. Section 6.3 lists the permits and approvals that are anticipated for the Refined LPA.

6.1 FINANCIAL ANALYSIS

The Honolulu City Council has supported the financial approach to funding this project with primarily Federal funds and City GO Bonds. Resolution No. 99-338 adopted in December 1999, stated, in part, that "Be it further resolved that the Council strongly supports a preliminary financial approach to include phased use of federal transportation funds, local highway funds and City GO Bonds to provide the necessary funding;…" The Council's intentions are incorporated in the key elements and assumptions of this financial analysis.

This section summarizes the financial implications by presenting the capital and operating financial plans for each alternative. The financing plans are constructed to be affordable on an annual basis. A description is provided of the assumed revenue sources, commitment of these sources, and schedule of annual outlays planned.

Major existing sources of revenues were examined to determine the adequacy of sources of funds for the capital and operating requirements of the alternatives. Capital costs were then compared to the revenues projected to be available from these sources over the fourteen-year period of FYs 2003 to 2016, the years in which the projects would be implemented. Operating and maintenance costs were compared to the revenues projected to be available over the ten-year period of Fys 2007 to 2016. The reason that O&M costs and revenues are for a different time period than the capital costs is that the In-Town BRT is not scheduled to be completed and in full operation until 2007 (The IOS will start service in 2005). Costs and revenues for capital and O&M costs were, however, also compared over the 23-year period of FYs 2003 to 2025.

The financial analysis is presented in year-of-expenditure (YOE) dollars. This provides a better understanding of the actual funds that would need to be expended and of the relative effect of inflation on costs and revenues. A baseline rate of inflation of 2.5 percent has been assumed. The 2.5 percent rate is consistent with recent trends in the U.S. national inflation rate and one percent higher than Hawaii's inflation rate of 1.5 percent per year for the past five years. Year-of-expenditure dollar values are computed by multiplying 2002 dollar values by the compounded escalation factor for the relevant year. For example, in year-of-expenditure dollars, $1.00 in 2002 is equivalent to $1.025 in 2003 and $1.051 in 2004, using the assumed baseline inflation rate of 2.5 percent.

The financial analyses have been prepared on the basis of the information and assumptions set forth in this chapter. The projections may be affected by fluctuating economic conditions and are dependent on the occurrence of future events. Therefore, future financial requirements may vary from the projections and such variations could be material. These financial plans are based on specific implementation schedules and estimates of capital costs made during preliminary engineering which will be refined during final design. If available funding, construction costs, planning issues or other factors impact the schedule or the ability of the City to secure financing, the implementation schedules will need to be adjusted to accommodate the changed conditions. The financial plans for the alternatives assume that responsibility for funding and implementation will be shared among the City and federal transit and highway agencies. After environmental clearance is achieved, the respective roles and responsibilities of the various involved parties will be further clarified and their respective commitments of funding confirmed.

6.1.1 Key Measures of Financial Performance

The financial assessment uses a cash flow analysis to evaluate the ability of the various sources of capital and operating revenues to fund the estimated annual capital and O&M costs of the alternatives over the entire period FYs 2003 – 2025. As indicated above, selected averages for representative years in between have been used for comparing the Alternatives. The sources and uses cash flow analysis consists of four basic components: Capital Costs, O&M Costs, Capital Revenues, and Operating Revenues.

Key measures have been used to assess the financial performance of the alternatives and to contrast the Refined LPA to the No-Build and TSM Alternatives. These measures are:

CAPITAL PERFORMANCE MEASURES

- Total Capital Cost;
- GO Bonds Issued by the City;
- FTA New Starts Funding Required;
- FHWA Funding Required;
- Average Annual Debt Service Payment (Post-2003 Debt);
- Ratio of Debt Service on GO Bonds (including Self-Supporting Bonds) to the City's Total Operating Budget: Maximum Ratio Reached; and
- Ratio of Debt Service on Direct Debt (excluding Self-Supporting Bonds) to General Fund revenues: Maximum Ratio Reached.

OPERATING PERFORMANCE MEASURES (FY 2007-2016)

- Average Annual O&M Costs;
- Average Annual City Operating Support for Transit O&M;

CAPITAL AND O&M PERFORMANCE MEASURES (FY 2007-2016)

- Average Annual Total City Contribution Required for Debt Service and O&M;
- Average Annual Increase in Total City Contribution Over the No-Build Alternative; and
- Average Annual Increase in Total City Contribution Over the TSM Alternative.

The results associated with these measures are discussed in Section 6.1.5.

6.1.2 Costs

The capital and O&M costs of the alternatives were computed in 2002 dollars over the FYs 2003–2025 period. These costs were then inflated to reflect year-of-expenditure dollars based on the proposed implementation schedule for each alternative. The financial analyses and tables focus on the first fourteen years for capital costs, which is the implementation period for the Refined LPA, and Fys 2007-2016 for O&M costs. The sections below summarize the capital and O&M costs of the alternatives.

1) Capital Costs

Table 6.1-1 summarizes the capital cost estimates for the No-Build Alternative, TSM Alternative, and Refined LPA in YOE dollars, by major cost component, over the fourteen-year implementation period of FYs 2003-2016. The capital cost estimates include construction costs and soft-costs such as final design and construction management costs, as well as set-asides for contingencies. To assure consistency, the implementation schedules used in the financial analyses are consistent with the schedules shown in Chapter 2.

TABLE 6.1-1
CAPITAL COSTS, BY ALTERNATIVE
FISCAL YEARS 2003 – 2016
(YOE $, 000)

	No-Build	TSM	Refined LPA
SYSTEM-WIDE IMPROVEMENTS			
Bus Acquisitions	$267,755	$296,837	$356,426
TheHandi-Van Vehicle Acquisitions	$22,905	$22,905	$22,905
Bus Maintenance Facility Expansion	--	$35,668	$35,668
Transit Centers and Parking	$10,061	$31,702	--
Kamehameha Highway Corridor and Transit Centers	$10,882	$10,882	$10,982
Park-and-Ride	--	$6,076	--
Bus Priority Treatment	--	$34,434	--
Zipper Lane	--	$14,982	--
Subtotal, System-Wide Improvements	***$311,602***	***$453,486***	***$425,982***
IN-TOWN BRT COMPONENT			
In-Town BRT Fixed Facilities	--	-- --	$227,793
Net Cost of In-Town BRT Vehicles	--	-- --	$15,446
Subtotal, In-Town BRT Component	**--**	**-- --**	**$243,239**
EMBEDDED PLATE TECHNOLOGY (EPT) COMPONENT			
EPT Fixed Facilities	**--**	**--**	$97,826
Net Cost of EPT Vehicles	**--**	**--**	$31,246
Subtotal, EPT Component	**--**	**--**	***$129,072***
Subtotal, In-Town BRT and EPT Components			***$372,310***
REGIONAL BRT COMPONENT			
BRT Transit Centers and /Parking	--	--	$31,744
BRT Zipper Lanes	--	--	$142,410
BRT Priority Ramp Improvements	--	--	$70,225
Subtotal, Regional BRT Component	**--**	**--**	***$244,379***
Subtotal, In-Town BRT, EPT, and Regional BRT	**--**	**--**	***$616,689***
TOTAL CAPITAL COSTS	**$311,602**	**$453,486**	**$1,042,671**

Source: Sharon Greene & Associates, November 2002.
Note: Rounding of numbers may affect subtotals and totals.

2) Operating and Maintenance (O&M) Costs

The O&M costs for the No-Build Alternative, TSM Alternative, and Refined LPA include some or all of the following:

- Bus O&M;
- TheHandi-Van O&M; and
- In-Town BRT System O&M.

Tables 6.1-2A and 6.1-2B summarize O&M costs of the alternatives for two fiscal years in FY 2002 constant dollars. The fiscal years selected are FY 2007, at completion of In-Town BRT System's fixed facilities (in the Refined LPA) and FY 2017 when the Refined LPA is fully operational using Embedded Plate Technology. To facilitate comparison with current costs for transit operation, these costs are presented in 2002 constant dollars and compared to the actual O&M costs for FY 2002 in Table 6.1-2A and 6.1-2B, respectively. Annual O&M costs for each alternative through FY 2025 are reported in Year of Expenditure dollars in the Appendix C cash flow tables. It should be noted that actual O&M costs in FY 2002 were 5.3 percent below the budget.

To be conservative, the budgeted rather than the actual costs in FY 2002 were used as the baseline to project future O&M costs in the financial analyses.

TABLE 6.1-2A
COMPARISON OF FY 2007 ESTIMATED OPERATING AND MAINTENANCE COSTS, BY ALTERNATIVE, TO FY 2002 O&M BUDGET (IN 2002 CONSTANT $, 000)

	FY 2002 Budget	FY 2007		
		No-Build	TSM	Refined LPA
Bus	$114,075	$119,653	$121,579	$126,808
TheHandi-Van	$12,688	$14,067	$14,067	$14,067
TOTAL	$126,763	$133,720	$135,646	$140,875

Source: Sharon Greene & Associates, November 2002.
Note: At completion of In-Town BRT System fixed faculties.

TABLE 6.1-2B
COMPARISON OF FY 2017 ESTIMATED OPERATING AND MAINTENANCE COSTS BY ALTERNATIVE TO FY 2002 O&M BUDGET (IN 2002 CONSTANT $, 000)

	FY 2002 Budget	FY 2017		
		No-Build	TSM	Refined LPA
Bus	$114,075	$120,233	$130,699	$142,286
TheHandi-Van	$12,688	$15,129	$15,129	$15,129
TOTAL	$126,763	$135,362	$145,828	$157,415

Source: Sharon Greene & Associates, November 2002.
Note: At first year of operation of the Refined LPA using Embedded Plate Technology.

In addition to O&M costs for bus and TheHandi-Van service, an estimated $798,500 (in 2002 constant dollars) will be needed for Zipper lane O&M costs attributable to the Regional BRT system in the Refined LPA from the beginning of their use to FY 2025. Additional funds will also be needed for O&M costs attributable to Zipper lane improvements in the TSM Alternative. Since the zipper lane project elements in these alternatives are part of the Interstate highway system and the lanes are shared with high-occupancy vehicles, the financial plans assume that the costs will be borne by the State of Hawaii Department of Transportation (SDOT) as part of their annual O&M costs. Therefore, O&M costs associated with the Zipper lanes are not included in the financial analyses for the TSM Alternative and the Refined LPA.

6.1.3 Revenue Sources

The City's conceptual funding plans propose six revenue sources to fund the capital costs associated with the various cost elements comprising the alternatives. These sources consist of four specific Federal Transit Administration grant programs, Federal Highway Administration funds from various potential sources, and City general obligation bond funds. Three revenue sources are proposed to fund operating and maintenance costs.

1) Revenue Sources for Capital Costs

Revenue sources for the capital costs associated with the alternatives include the following proposed FTA and City sources and potential FHWA sources from a combination of FHWA programs:

Federal Transit Administration (FTA) Funds

- FTA Section 5307 Urbanized Area (UZA) Formula Grants;
- FTA Section 5309(m)(1)(A), Capital Investment Grants and Loans - Fixed Guideway Modernization Formula Grants;
- FTA Section 5309(m)(1)(B) Capital Investment Grants and Loans - New Starts Discretionary Grants; and
- FTA Section 5309 (m)(1)(C) Capital Investment Grants and Loans - Bus Capital Discretionary Grants.

Federal Highway Administration (FHWA)

- Surface Transportation Program (STP) 23 U.S.C. Section 133;
- Congestion Mitigation and Air Quality Program (CMAQ) 23 U.S.C. Section 149;
- Interstate Maintenance Program (IM) 23 U.S.C. Section 119; and
- National Highway System Program (NHS) 23 U.S.C. Section 103(b).

City GO Bond Proceeds

Tables 6.1-3A through 6.1-3C identify the potential capital sources assumed to fund the annual capital costs of the program elements over the FYs 2003-2016 period for each alternative. Costs are presented in year of expenditure dollars. The conceptual funding plans for the FEIS differ from those shown in the MIS/DEIS and SDEIS in four primary ways:

- Refined LPA capital costs reflect additional refinements made to the proposed project, including alignment modifications. These have lowered the overall cost;
- State highway funding has been removed as a capital revenue source and replaced with City GO bond proceeds and FTA Section 5309 New Start grant funds;
- City highway funding has been removed as a capital revenue source and replaced with City GO bond proceeds; and
- The implementation phasing plan for the Refined LPA has been adjusted to accommodate a conservative estimate of revenues over the 14-year period extending from FY 2003 to FY 2016

Federal Transit Administration (FTA) Funds

FTA currently provides federal assistance for the City's mass transit program under the Transportation Equity Act for the 21st Century (TEA-21), as amended, which authorizes FTA programs from Federal Fiscal Year (FFY) 1998 through FFY 2003. New legislation is presently being developed that will authorize FTA's continued operation for another four to six years.

The statute related to transit laws is codified in Title 49 United States Code (U.S.C.) Chapter 53. The various FTA funding sources identified in the financial analyses are described below. The term "apportionment" refers to a statutorily prescribed division or assignment of funds based on formulas in the law. The term "allocation" refers to an administrative or Congressional distribution of those funds that do not have statutory distribution formulas.

While the guaranteed transit funding levels in TEA-21 provide greater certainty about the annual flow of federal transit monies, FTA funds are appropriated on a yearly basis by Congress. Some level of uncertainty remains regarding the amount and timing of the discretionary and formula funds assumed for the alternatives. The conceptual Capital Financial Plans assume an annual apportionment of FTA Section 5307 Urbanized Area formula funds and $242.0 million in FTA Section 5309 New Starts funds for the BRT component. The continued authorization of FTA grant programs is assumed through FY 2025.

TABLE 6.1-3A
NO-BUILD ALTERNATIVE
CAPITAL FUNDING PLAN
FISCAL YEARS 2003 – 2016 (IN YOE $, 000)

Description *	Costs 2003-2016	UZA	*FTA* FGM	Bus Discr	*City* GO Bonds	FHWA	Total Revenue
Transit Centers	**$10,061**	**$0**	**$0**	**$0**	**$10,061**	**$0**	**$10,061**
Bus Acquisitions	**$267,755**	**$129,584**	**$20,839**	**$0**	**$117,332**	**$0**	**$267,755**
TheHandi-Van Vehicle Acquisitions	**$22,905**	**$13,616**	**$0**	**$0**	**$9,289**	**$0**	**$22,905**
Kamehameha Hwy Corridor and Transit Ctrs	**$10,882**	**$0**	**$0**	**$8,664**	**$2,218**	**$0**	**$10,882**
TOTAL NO-BUILD ALTERNATIVE	**$311,602**	**$143,200**	**$20,839**	**$8,665**	**$138,899**	**$0**	**$311,602**
% OF TOTAL NO-BUILD ALTERNATIVE		**45%**	**7%**	**3%**	**45%**	**0%**	**100%**

Source: Sharon Greene & Associates, November 2002.
Note: * See Chapter 2 for a detailed description of the project elements in the No-Build Alternative.

TABLE 6.1-3B
TRANSPORTATION SYSTEMS MANAGEMENT ALTERNATIVE
CAPITAL FUNDING PLAN
FISCAL YEARS 2003 – 2016 (IN YOE $, 000)

Description *	Cost 2003-2016	UZA	*FTA* FGM	Bus Discr	*City* GO Bonds	FHWA	Total Revenue
CAPITAL COSTS							
Transit Centers & Parking	**$31,702**	$3,405	$0	$0	$28,297	$0	**$31,702**
Bus Acquisitions	**$296,837**	$132,336	$20,839	$0	$143,661	$0	**$296,837**
TheHandi-Van Vehicle Acquisitions	**$22,905**	$12,077	$0	$0	$10,829	$0	**$22,905**
Expansion of Bus Maintenance Facility	**$35,668**	$4,695	$0	$0	$30,973	$0	**$35,668**
Park-And-Ride	**$6,076**	$0	$0	$0	$6,076	$0	**$6,076**
Bus Priority Treatment	**$34,434**	$0	$0	$0	$34,433	$0	**$34,434**
Zipper Lane	**$14,982**	$0	$0	$0	$2,998	$11,985	**$14,982**
Kamehameha Hwy Corridor &Transit Ctrs	**$10,882**	$0	$0	$8,665	$2,216	$0	**$10,882**
TOTAL TSM ALTERNATIVE	**$453,486**	**$152,513**	**$20,839**	**$8,665**	**$259,484**	**$11,985**	**$453,486**
% OF TOTAL TSM ALTERNATIVE		**34%**	**5%**	**2%**	**56%**	**3%**	**100%**

Source: Sharon Greene & Associates, November 2002.

Note: * See Chapter 2 for a detailed description of the project elements in the TSM Alternative.

TABLE 6.1-3C
REFINED LOCALLY PREFERRED ALTERNATIVE
CAPITAL FUNDING PLAN
FISCAL YEARS 2003 – 2016 (YOE $, 000)

	Cost		*FTA*		New Start		*City*		
Description *	2003-2016	UZA	FGM	Bus Discr	In-Town	Regional	GO	FHWA	Total Revenue
CAPITAL COSTS									
IN-TOWN BRT PROGRAM									
Fixed Facilities	$227,793	$0	$0	$0	$113,896	$0	$113,897	$0	$227,793
Net Cost for Hybrid-Electric Vehicles	$15,446	$0	$0	$2,345	$7,723	$0	$5,378	$0	$15,446
SUBTOTAL, IN-TOWN BRT COMPONENT	$243,239	$0	$0	$2,345	$121,619	$0	$119,275	$0	$243,239
% OF IN-TOWN BRT COMPONENT		0%	0%	1%	50%	0%	49%	0%	100%
EMBEDDED PLATE TECHNOLOGY									
Fixed Facilities	$97,826	$0	$0	$0	$48,913	$0	$48,913	$0	$97,826
Net Cost of EPT Vehicles	$31,246	$0	$0	$9,374	$15,623	$0	$6,249	$0	$31,246
SUBTOTAL, EMBEDDED PLATE TECHNOLOGY	$129,072	$0	$0	$9,374	$64,536	$0	$55,162	$0	$129,072
% OF EMBEDDED PLATE TECHNOLOGY		0%	0%	7%	50%	0%	43%	0%	100%
TOTAL, IN-TOWN BRT COMPONENT AND EPT	$372,310	$0	$0	$11,719	$186,155	$0	$174,437	$0	$372,310
% OF IN-TOWN COMPONENT AND EPT		0%	0%	3%	50%	0%	47%	0%	100%
REGIONAL BRT PROGRAM									
BRT Transit Centers and Parking	$31,744	$0	$0	$0	$0	$14,818	$6,349	$10,577	$31,744
BRT Zipper Lanes	$142,410	$0	$0	$0	$0	$15,540	$28,482	$98,388	$142,410
BRT Priority Ramp Improvements	$70,225	$0	$0	$0	$0	$25,487	$14,045	$30,693	$70,225
SUBTOTAL, REGIONAL BRT COMPONENT	$244,379	$0	$0	$0	$0	$55,845	$48,876	$139,658	$244,379
% OF REGIONAL BRT COMPONENT		0%	0%	0%	0%	23%	20%	57%	100%
SUBTOTAL, IN-TOWN, EPT, AND REGIONAL BRT	$616,689	$0	$0	$11,719	$186,155	$55,845	$223,313	$139,658	$616,689
% OF IN-TOWN, EPT, AND REGIONAL BRT		0%	0%	2%	30%	9%	36%	23%	100%
SYSTEM-WIDE IMPROVEMENTS									
Bus Acquisitions	$356,426	$185,056	$20,839	$27,281	$0	$0	$123,250	$0	$356,426
Handi-Van Vehicle Acquisitions	$22,905	$14,656	$0	$0	$0	$0	$8,249	$0	$22,905
Bus Maintenance Facility	$35,668	$22,801	$0	$0	$0	$0	$12,867	$0	$35,668
Kamehameha Highway Corridor and Transit Centers	$10,982	$0	$0	$8,745	$0	$0	$2,237	$0	$10,982
SUBTOTAL, SYSTEM-WIDE IMPROVEMENTS	$425,982	$222,514	$20,839	$36,026	$0	$0	$146,603	$0	$425,982
% OF SYSTEM-WIDE IMPROVEMENTS		52%	5%	8%	0%	0%	35%	0%	100%
TOTAL, BRT ALTERNATIVE	$1,042,671	$222,514	$20,839	$47,744	$186,155	$55,845	$369,917	$139,658	$1,042,671
% OF TOTAL BRT ALTERNATIVE		22%	2%	5%	18%	5%	35%	13%	100%

Source: Sharon Greene and Associates, November 2002.

Note: *See Chapter 2 for a detailed description of the project elements in the Refined LPA.

Urbanized Area (UZA) Formula Program, 49 U.S.C. Section 5307

The UZA Formula Program provides FTA funds for transit capital (including preventative maintenance) and planning. The term "preventive maintenance" is defined as all maintenance costs. The federal share for capital and planning assistance projects under the UZA Formula Program is up to 80 percent of the net project cost. The City is the direct recipient of Section 5307 funds.

A total of $25.3 million is assumed as the City's FY 2003 Section 5307 apportionment amount. This aggregated amount for the Honolulu and Kaneohe urbanized areas was calculated by FTA using the U.S. Department of Transportation's proposed FFY 2003 budget. From this total, $1.7 million will be transferred to FHWA in 2003 for the State's vanpool program, with $1.0 million assumed to be transferred annually thereafter. The City's annual Section 5307 apportionments are projected to increase 2.3 percent per year, consistent with the forecast assumptions of the General Accounting Office.[1]

The financial analyses allocate $20.0 million in Section 5307 funds for preventive maintenance in 2003 and 2004. Beginning in 2005, 30 percent of the City's annual Section 5307 apportionments are earmarked for preventive maintenance, up to the maximum statutory limit. The remaining 70 percent is used for other capital and planning activities. In years in which the entire 70 percent is not required for capital or planning activities, the remaining amounts are used for preventive maintenance. The Section 5307 assistance for preventive maintenance reduces the City's annual subsidy for transit operating and maintenance (O&M) costs. Section 5307 funds are used for all alternatives. Over the FY 2003-2016 period, a total of $730.5 million is projected to be received.

Capital Investment Grants and Loans, 49 U.S.C. Section 5309

Under 49 U.S.C. Section 5309, FTA makes grants to assist in financing capital projects under the following three categories of projects:

- Modernization of fixed guideway systems, 49 U.S.C. Section 5309(m)(1)(A);
- Construction of new fixed guideway systems and extensions (New Starts), 49 U.S.C. Section 5309(m)(1)(B); and
- Bus and bus-related facilities, 49 U.S.C. Section 5309(m)(1)(C).

<u>Fixed Guideway Modernization (FGM)</u>

Capital projects to modernize or improve fixed guideway systems are eligible for Fixed Guideway Modernization assistance. The term "fixed guideway" refers to any transit service that uses exclusive or controlled rights-of-way or rails, entirely or in part. The term includes the portion of motor bus service operated on exclusive or controlled rights-of-way, and high occupancy vehicle (HOV) lanes. Eligible projects include, but are not limited to, the purchase of rolling stock, signals and communications, operational support equipment, and preventive maintenance. This funding source is used for bus acquisition in the capital financing plans for each alternative.

The City is the direct recipient of Section 5309 FGM funds. Approximately $1.3 million is assumed as the City's FY 2003 Section 5309 FGM apportionment amount. The amount was calculated by FTA using the US Department of Transportation's proposed FFY 2003 budget. The City's annual FGM apportionments are

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[1] "Budget of the United States Government, Analytical Perspectives, Fiscal Year 2003," Chapter 7. Table 7-3: Federal Investment Spending and Capital Budgeting. Federal Investment Budget Authority and Outlays: Grant and Direct Federal Funds, page 137.

projected to increase two percent per year. A total of $20.8 million is Section 5309 FGM funding is projected over the FY 2003-2016 period. The City would qualify for higher levels of FGM funding when the BRT fixed guideway systems in the Refined LPA are at least seven years old. The potential increases in future FGM funding are not included in the financial analyses and result in a conservative estimate of future funding levels from this source.

New Starts

The term “New Starts” refers to a project that involves building a new fixed guideway system or extending an existing fixed guideway. Projects become candidates for funding by successfully completing the appropriate steps in FTA’s major capital investment planning and project development process. Capital projects under this category include, but are limited to, preliminary engineering, acquisition of real property (including relocation costs), final design, construction, and initial acquisition of rolling stock for the system.

FTA Section 5309 New Starts funding is proposed only for the Refined LPA. New Starts funds are assumed to pay for 39 percent of the BRT systems in the Refined LPA. By BRT system component, New Start monies will fund 50 percent of the cost of the In-Town BRT system, 50 percent of the cost of the EPT, and 23 percent of the cost of the Regional BRT system, with FTA Bus Capital, FHWA, and local funds paying the balance. A total of $242.0 million in FTA New Starts funding is proposed. The City would be the direct recipient of FTA New Starts funding allocations for the Refined LPA.

Bus and Bus-related Facilities (Bus Capital)

The major eligible items under this category are buses and other rolling stock, ancillary equipment, and the construction of bus facilities. This category also includes bus rehabilitation and leasing, park-and-ride facilities, parking lots associated with transit facilities, and bus passenger shelters.

Section 5309 Bus Capital funds are assumed in the financial analysis of all alternatives. Over the FY 2003-2016 period, a total of $8.7 million in Section 5309 Bus Capital funding is proposed for the No-Build and TSM Alternatives and $47.7 million for the Refined LPA. Funding for Bus Capital projects is at the discretion of Congress or the Secretary of Transportation, and is not allocated using a statutory formula. The City would be the direct recipient of Section 5309 Bus Capital funds allocated for its bus and bus-related facility projects.

Federal Highway Administration (FHWA) Funds

Like FTA, FHWA is authorized to provide federal aid under TEA-21 until FFY 2003. The next surface transportation authorization act will also include FHWA programs. The State of Hawaii Department of Transportation is the direct recipient of FHWA funds and currently receives between $116.0 million to $120.0 million each year. Funding for the Refined LPA is projected to use about 17 percent of the total FHWA funds available for transportation projects, not including any formula increases after the TEA-21 authorization period. The funding plan for the Refined LPA is included in the Transportation for Oahu Plan (TOP) 2025, approved by Oahu Metropolitan Planning Organization (OMPO) on April 6, 2001.

Federal highway law is codified in Title 23 U.S.C. The FHWA programs that are potential sources of funds are described below. The funds under these programs are all apportionment funds. The financial analyses assume that the FHWA program funds would provide up to 80 percent of the eligible costs with City general obligation bonds providing a local match of at least 20 percent. Approximately $12.0 million in FHWA funds is assumed in the financial analysis for the TSM Alternative. For the Refined LPA, a total of $139.6 million is assumed, with a $20.0 million annual maximum during the FYs 2003-2016 period. The annual levels of FHWA funding proposed in the financial analysis will require the City to utilize GO bond proceeds and/or short-term financing in advance of receiving FHWA funds to pay for the transit-related highway capital elements in certain years. These advances will be reimbursed after FHWA funds are received and are credited back to the City in the cash flow analysis.

Surface Transportation Program (STP), 23 U.S.C. Section 133

The STP provides funding that may be used by states and localities for projects on any Federal-aid highway, bridge projects on any public road, transit capital projects, and intracity and intercity bus terminals and facilities. Zipper Lane enhancements proposed in the TSM Alternative and Refined LPA are eligible for STP funding. Costs of the regional transit centers and park-and-ride lots, and BRT priority ramp improvements associated with the Refined LPA are also eligible for STP funding.

Congestion Mitigation and Air Quality Improvement (CMAQ) Program, 23 U.S.C. Section 149

The primary purpose of the CMAQ Program is to fund projects and programs in air quality non-attainment and maintenance areas for ozone, carbon monoxide, and small particulate matter which reduce transportation-related emissions. As a state that does not have and never has had a non-attainment area under the Clean Air Act, Hawaii is authorized to use its annual CMAQ apportionment for any project eligible for STP funds.

Interstate Maintenance (IM) Program, 23 U.S.C. Section 199

The Interstate Maintenance Program provides funding for resurfacing, restoring, rehabilitation and reconstructing most routes on the Interstate System. Costs associated with the H-1 Zipper Lane and direct access ramps are eligible under the Interstate Maintenance Program.

National Highway System (NHS) Program, 23 U.S.C. Section 103(b)

This program provides funding for improvements to rural and urban roads that are part of the National Highway System, including the Interstate System and designated connections to major intermodal terminals. Under certain circumstances, NHS funds may also be used to fund transit improvements in NHS corridors.

The TSM Alternative and Refined LPA incorporate transit-related highway improvements on portions of the State and federal highway system. In the TSM Alternative, FHWA funds are assumed to pay 80 percent of the cost of proposed improvements to the zipper lane. In the Refined LPA, FHWA funds are proposed to be used for a portion of the cost of the regional transit centers and park-and-ride lots, zipper lane enhancements, and BRT priority ramp improvements. These projects are eligible for funding from one or more of the federal highway sources described above. All of the projects are eligible for Surface Transportation Program (STP) and Congestion Mitigation and Air Quality (CMAQ) funds. The H-1 Zipper Lane and access ramp improvements are eligible for receipt of Interstate Maintenance (IM) funds. Most of the projects are on the National Highway System and are therefore eligible for National Highway System (NHS) High Priority Project funds. The financial analyses do not identify revenues from definitive FHWA sources because programming of FHWA funds for specific projects is done through joint FTA/FHWA regulatory planning processes.

<u>General Obligation Bonds</u>

The City issues general obligation (GO) bonds for the construction of major capital facilities. GO bonds are direct obligations of the City for which its full faith and credit are pledged.

City GO Bonds are proposed to finance the local funding share required for transit capital improvements. Proceeds from the GO Bonds will be used for on-going system-wide bus and TheHandi-Van vehicle acquisitions and replacements and other capital projects proposed in the City's annual Six-Year Capital Improvement Program, as well as for the In-Town and Regional BRT systems in the Refined LPA. Issuance of GO Bonds will be required to meet annual cash flow requirements during the FYs 2003-2016 capital project implementation period for all alternatives. Due to limitations assumed on the annual levels of FHWA highway funds received over this period, the City will also need to issue bonds in order to advance funds in place of the federal highway monies to be received in subsequent years for the Refined LPA.

To accommodate the annual levels of capital funding required through FY 2016, a total of $259.5 million and $369.9 million in bonds would be needed for the TSM Alternative and Refined LPA respectively with $138.9 million in bonds required for the No-Build Alternative. Over the FY 2017 to 2025 period, an additional $84.3 million and $92.6 million in bonds will also need to be issued to assist in funding the annual costs of bus and TheHandi-Van vehicle replacements of the TSM Alternative and Refined LPA, respectively, with an additional $64.9 million in bonds needed for the No-Build Alternative.

There are several policy criteria assumed in the use of GO Bonds. First, the annual level of outstanding bond indebtedness is assumed to be capped relative to projected City revenues. The assumption is that property values will remain flat and that the City will maintain the current property tax rate. This creates a ceiling on the amount of GO Bonds the City would be able to issue because it limits the City's debt service payment capacity to the current level of property tax revenues. Second, and related to the first criterion, is the assumption that the City will retain its AA-/Aa3 Credit Rating for GO Bonds and its associated discounted cost of borrowing.

With regard to the first criterion, the Council of the City and County of Honolulu adopted Resolution No. 02-140, CD1. This resolution enunciates the Debt and Financial Policies under which the City manages its operating and capital programs and budgets and its debt program. In accordance with the Debt Policies contained in the resolution, the City has established affordability guidelines in order to preserve credit quality. The affordability guidelines, "which may be suspended for emergency purposes or because of unusual circumstances," are as follows:

a) Debt service for GO bonds as a percentage of the City's total operating budget should not exceed 20 percent; and

b) Debt service on direct debt, excluding self-supporting bonds, as a percentage of General Fund revenues should not exceed 20 percent.

An analysis was conducted to assure compliance with the City's Debt and Financial Policies, which included debt service payments on outstanding bonds issued before FY 2003, planned future notes and bonds as projected by the City, and additional bonds required as a result of this project. The analysis shows that there is additional bonding capacity in each of the project years. The second criterion assumes that the City will retain its GO Bond Rating (Aa3 from Moody's and AA- from Standard & Poor's) throughout the plan period. The City's high credit quality allows it to borrow at a lower cost than if it had a lesser credit rating. Therefore, the level of GO Bonds that are outstanding in any given year is assumed not to increase to an extent that will threaten the City's credit rating. There are many other factors that are included in a GO Bond credit rating in addition to the amount of outstanding direct bonded debt.[2] Broadly speaking, these are the socioeconomic and assessed property value base that generates tax revenues, the City's financial operations (current account and budget balances), legal bond considerations, financial management and other factors.

Consistent with current City practice, the financial terms and conditions of the GO Bonds assumed in the financial analyses are a 25-year maturity with a 5.5 percent interest rate and interest-only payments in the first three years. The interest rate reflects the Bond Buyer 11 High Grade GO Bond Index. The annual level of bonding for all Alternatives was capped so as not to exceed $50.0 million in bonds issued in any one year.

While prudent relative to current market conditions, the financing costs associated with the GO Bonds assumed in this analysis are subject to potential fluctuations in the market. These assumptions should be

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[2] The most important factor is the value of property. Honolulu has experienced a decline in property values since the early 1990s and has also seen an increase in appeals by homeowners to reassess the value of their property. The City has processed the majority of these requests and has stabilized the decline in property tax revenues.

periodically reviewed and updated, as required. It should be noted that financing costs associated with New Starts projects are eligible for New Starts and other FTA funding. While no such funding has been assumed in the financial plans for this purpose at this time, the availability of such funding would serve to reimburse the City for up to 50 percent of the financing costs on GO bonds associated with the New Starts BRT systems within the Refined LPA.

City Highway Fund

The City Highway Fund is earmarked by State law for highway and related activities. Major revenue sources include the City fuel tax, vehicle weight tax, and public utility franchise tax. While there have been fluctuations in the annual rate of growth of the Highway Fund, over the most recent ten year period Highway Fund revenues increased at a compound annual growth rate of 0.62 percent, with the major revenue sources in the Fund projected by the City to increase 1.6 percent annually over the next five years. For purposes of the financial analysis, the City Highway Fund was projected to increase 0.5 percent per year. Thus, to provide a conservative estimate, the assumed annual growth rate of the Highway Fund is below that of the past ten years and is one-third the rate of the City's projections.

City Highway Fund revenues are used to pay highway-related expenses of executive agencies. In addition, portions of the Highway Fund are transferred annually to the City General Fund for payment of transportation-related debt service and to the City Bus Transportation Fund for partial payment of bus transportation operating costs. In projecting the level of funds available for debt service in a particular year, the non-debt service expenditures made from the Fund were assumed to grow 1.0 percent annually, or at twice the rate of growth of the Fund itself. The balance remaining in the Fund after deduction of these other expenses was assumed to be the maximum amount of City Highway Fund revenues that would be available for debt service payments in that year.

2) O&M Funding Sources

O&M funding for the alternatives is derived from three main sources:

- Fare box revenues;
- FTA Section 5307 funds for preventive maintenance; and
- City Operating Support for Transit O&M.

Fare box Revenues

Fare box revenue projections for each of the three alternatives were developed in conjunction with the ridership forecasting process, and reflect current fare levels and an adopted City Council policy requiring the bus fare box recovery ratio to not fall below 27 percent nor exceed 33 percent. This fare box recovery ratio policy does not apply to TheHandi-Van. Based on the analysis results, bus fares including fares for BRT service are expected to cover roughly 27 percent of bus O&M costs over the FYs 2003 - 2025 period. TheHandi-Van fares are projected to cover roughly 11 percent of TheHandi-Van O&M costs. Together, bus and TheHandi-Van fare revenues are projected to provide 26 percent of transit O&M costs. These projected fare box recovery levels are consistent with historical levels.

FTA Section 5307 Urbanized Area (UZA) Formula Funds For Preventive Maintenance

As noted earlier, FTA Section 5307 UZA formula funds for capital assistance can also be used for preventive maintenance costs associated with the transit system. The financial plan proposes that $20.0 million in FTA Section 5307 funds be reserved for preventive maintenance in FYs 2003 and 2004. In other years, a target level of at least 30 percent of the formula funds is used for preventive maintenance. Over the FY 2003-2016 period, the total level of FTA Section 5307 funds projected to be used for preventive maintenance purposes is $253.6 million for the No-Build Alternative, $244.3 million for the TSM Alternative, and $174.3 million for the Refined LPA. FTA Section 5307 UZA funds used for preventive maintenance are projected to cover 11, 10, and 7 percent of O&M costs in the No-Build Alternative, TSM Alternative, and Refined LPA, respectively. This decrease in the share of FTA Section 5307 UZA funds used for preventive maintenance is attributable to the larger share of such funds used for capital in the more capital-intensive alternatives.

Use of FTA Section 5307 funds for preventive maintenance serves to reduce the level of City operating support required.

City Operating Support

The City provides annual funding support for transit O&M. This operating support is provided chiefly through transfers from the City Highway Fund and the City General Fund to the Bus Transportation Fund. These transfers supplement fare revenues and prior year carryover monies in the Bus Transportation Fund. The City Highway and General Fund transfers to the Bus Transportation Fund provide the largest source of O&M funding and cover 63, 65, and 67 percent of the O&M costs of the No-Build Alternative, TSM Alternative, and Refined LPA, respectively. The City's FY 2003 Operating Budget Ordinance (Ordinance 02-26) identifies approximately $75.8 million to be transferred from the City Highway Fund ($35.1 million) and the City General Fund ($40.7 million) to the Bus Transportation Fund.

Within the financial analyses, the FY 2003 level of City operating support for all alternatives was estimated to be $81.9 million, or higher than the FY 2003 Budget. Over the FY 2003 – 2016 period for completing the In-Town and Regional BRT systems in the Refined LPA, the level of City operating support transfers into the Bus Transportation Fund is projected to increase (in Year of Expenditure dollars) to an annual average of $102.0 million for the No-Build Alternative, $107.4 million for the TSM Alternative, and $119.3 million for the Refined LPA. In 2002 constant dollars, the equivalent levels of annual average operating support are projected to be $86.0 million, $90.4 million, and $100.4 million for the alternatives respectively. For all three alternatives, the increased levels of City operating support are required to offset annual increases in O&M costs attributable to inflation. For the TSM Alternative and the Refined LPA, the increases are also attributable to the incremental O&M costs associated with the higher levels of service.

Noted in the discussion of the City Highway Fund above, the funds transferred from the City Highway Fund to the Bus Transportation Fund are assumed to grow at 1 percent per year, or below the rate of growth in O&M costs. As a result, the share of City operating support derived from the City Highway Fund is projected to decrease annually while the share derived from the City General Fund increases annually. By 2016, the share of City operating support from the Highway Fund and General Fund respectively are projected to be 25 percent and 75 percent.

6.1.4 Cash Flow Requirements

Tables 6.1-4 and 6.1-5 summarize the capital and O&M funding required by source for the No-Build Alternative, TSM Alternative, and Refined LPA. Table 6.1-4 compares the levels of capital funding required by source for each alternative over the fourteen-year implementation period of FYs 2003-2016. Table 6.1-5 contrasts the levels of O&M funding required, by source, for the representative years of FY 2007 and FY 2016.

The alternatives differ with regard to their relative levels of reliance on individual funding sources. With regard to capital revenues, sources such as FTA Section 5307 UZA and FTA Section 5309 FGM grants are common to all alternatives. While the two sources assume the same annual apportionment levels for each alternative, the alternatives differ with respect to the amount of FTA Section 5307 UZA funds used as capital sources.

FTA Section 5309 Bus Capital grants and GO Bond proceeds are common to all alternatives but provide different levels of funds. FHWA funds are common to the TSM Alternative and Refined LPA, but at different levels of funding. FTA Section 5309 New Starts grant funds are unique to the Refined LPA.

TABLE 6.1-4
FUNDING SOURCES FOR CAPITAL COSTS, BY ALTERNATIVE
FISCAL YEARS 2003- 2016 (YOE $, 000)

	NO-BUILD	TSM	Refined LPA
CAPITAL SOURCES			
Federal Transit Administration			
Sec. 5307 UZA Formula	$143,200	$152,513	$222,514
Sec. 5309 FGM	$20,839	$20,839	$20,839
Sec 5309 Bus Capital	$8,665	$8,665	$47,744
Sec. 5309 New Starts	--	--	$242,000
Federal Highway Funds			
FHWA	--	$11,985	$139,659
Local Funds			
G.O. Bonds	$138,899	$259,48	$369,917
TOTAL CAPITAL FUNDS	**$311,602**	**$453,486**	**$1,042,671**

Source: Sharon Greene & Associates, November 2002.
Note: Totals may differ due to rounding.

TABLE 6.1-5
FUNDING SOURCES FOR O&M COSTS, BY ALTERNATIVE
FISCAL YEARS 2007 AND 2017 (YOE $, 000)

	NO-BUILD	TSM	Refined LPA
FY 2007 OPERATING REVENUES			
Passenger Fares (Bus)	$37,195	$37,252	$39,199
TheHandi-Van Fares	$1,705	$1,705	$1,705
FTA Sec. 5307 UZA Funds (Preventive Mtnce)	$18,760	$19,995	$12,838
General Fund Revenues (for transit support)	$93,632	$94,519	$105,645
TOTAL O&M REVENUES	**$151,292**	**$153,471**	**$159,387**
FY 2017 OPERATING REVENUES			
Passenger Fares (Bus)	$49,976	$51,649	$57,621
TheHandi-Van Fares	$2,346	$2,346	$2,346
FTA Sec. 5307 UZA Funds (Preventive Mtnce)	$16,114	$16,114	$11,133
General Fund Revenues (for transit support)	$127,608	$141,093	$156,885
TOTAL O&M REVENUES	**$196,045**	**$211,202**	**$227,984**

Source: Sharon Greene & Associates, November 2002.
Notes: Includes TheHandi-Van O&M costs.
Totals may differ due to rounding.

As indicated in Table 6.1-5, the differences in annual O&M revenues for the alternatives increase over time, from a differential when comparing the Refined LPA to the No-Build Alternative of approximately $8 million in

FY 2007 with completion of the In-Town BRT system's fixed facilities, to a differential of approximately $32 million in FY 2017 when the Refined LPA is fully operational using embedded plate technology. These system-wide O&M cost estimates include TheHandi-Van.

1) Annual Cash Flow Requirements: FYs 2003 to 2016

Tables 6.1-3A through 6.1-3C presented earlier summarized the capital funding that would be required by source over the FYs 2003-2016 implementation period for the Alternatives as a whole and for the major project elements comprising them. In the absence of a major capital investment, the transit capital program represented by the No-Build Alternative would consist primarily of bus and TheHandi-Van vehicle acquisition and replacement costs. These would be funded chiefly with FTA Section 5307 Urbanized Area Formula Grant funds, supplemented with FTA Section 5309 Fixed Guideway Modernization, FTA Section 5309 Bus Capital funding, and City GO bond proceeds. Beyond the No-Build Alternative level, the capital program additions included in the TSM Alternative and the Refined LPA will require utilization of higher levels of City bonding to provide annual revenues sufficient to meet capital expenditure levels concentrated over the 14-year implementation period. While the Refined LPA assumes FTA Section 5309 New Starts funding and funding from FHWA highway sources, additional City short or long term bonding will also be required as a result of the $20 million cap on the annual level of FHWA funding. In the years in which the deferred FHWA funds are received, they are treated as reimbursements within the cash flow analysis.

Funding Plan for In-Town Bus Rapid Transit

As shown in Table 6.1-6, the capital cost of the In-Town BRT project element of the Refined LPA is $243.2 million (in YOE $). This amount includes $227.8 million in cost for the In-Town BRT fixed facilities and $15.4 million for the net cost of acquiring 30 hybrid-electric vehicles to operate In-Town BRT service prior to adding EPT. "Net cost" refers to the incremental cost for acquiring low-emission, environmentally-friendly hybrid-electric vehicles to operate along the In-Town BRT alignment fixed facilities relative to the base cost of similarly sized conventional diesel-powered buses that would be acquired for initial In-Town BRT service. While the incremental cost of the hybrid-electric vehicles is considered part of the In-Town BRT program, the base cost of $ 16.5 million (YOE $) for these vehicles is included in the System-Wide capital cost component of the Refined LPA.

TABLE 6.1-6
CAPITAL FUNDING SOURCES FOR IN-TOWN BUS RAPID TRANSIT SYSTEM
FISCAL YEARS 2003 – 2016 (YOE $, 000)
(REFINED LPA)

Source	Total $ (%)	In-Town BRT Elements
FTA Sec. 5309 New Starts	$121,619 (50%)	• In-Town BRT fixed facilities • Net cost of hybrid-electric vehicles
FTA Sec. 5309 Bus Capital	$2,345 (1%)	• Net cost of hybrid-electric vehicles
City GO Bonds	$119,275 (49%)	• In-Town BRT fixed facilities • Net cost of hybrid-electric vehicles
TOTAL	**$243,239 (100%)**	

Source: Sharon Greene & Associates, November 2002.

The In-Town BRT component is proposed to be funded with 50 percent FTA Section 5309 New Starts funds, matched with 49 percent in local capital funds in the form of City GO Bonds. FTA Section 5309 Bus Capital Funds would contribute the remaining one percent.

Funding Plan for Embedded Plate Technology (EPT)

As shown in Table 6.1-7, the capital cost of the EPT project element of the Refined LPA is $129.1 million (YOE $). This amount includes the cost of EPT fixed facilities and the net cost of the EPT vehicles. The incremental cost of the EPT components of the vehicles is considered part of the EPT component. The base cost for these vehicles is included in the System-Wide capital cost component of the Refined LPA.

TABLE 6.1-7
CAPITAL FUNDING SOURCES FOR EMBEDDED PLATE TECHNOLOGY SYSTEM
FISCAL YEARS 2010 - 2016 (YOE $, 000)
(REFINED LPA)

Source	Total $ (%)	EPT Elements
FTA Sec. 5309 New Starts	$64,536 (50%)	• EPT fixed facilities • Net cost of EPT vehicles
FTA Sec. 5309 Bus Capital	$9,374 (7%)	• EPT fixed facilities • Net cost of EPT vehicles
City GO Bonds	$55,162 (43%)	• EPT fixed facilities • Net cost of EPT vehicles
Total	**$129,072 (100%)**	

Source: Sharon Greene & Associates, November 2002.

The EPT component is assumed to be funded with 50 percent FTA Section 5309 New Starts funds matched with 43 percent in local capital funds in the form of City GO Bonds. FTA Section 5309 Bus Capital funds would contribute the remaining seven percent.

Funding Plan for Regional Bus Rapid Transit (BRT)

As shown in Table 6.1-8, the total capital cost of the Regional BRT element of the Refined LPA is projected to be approximately $244.4 million (in YOE $). This total includes the cost of the Regional BRT transit centers and parking facilities, Zipper lane, and BRT priority ramp improvements. Many of the Regional BRT components are improvements to provide dedicated or priority treatment for both buses and HOVs on portions of the Interstate system, including construction of bus-only access ramp improvements. Therefore, the conceptual financial plan calls for 57 percent of the cost of the Regional BRT to be paid for with FHWA funds. Project elements such as the transit centers and parking, Zipper lanes and priority ramp improvements are also eligible for FTA Section 5309 New Starts funds, shown in this plan to provide 23 percent of the funding for the Regional BRT, with City funds in the form of GO Bonds contributing the remaining 20 percent.

Funding Plan for Combined In-Town BRT, EPT, and Regional BRT Systems

Table 6.1-9 summarizes the funding plan for the combined In-Town, EPT, and Regional BRT systems in the Refined LPA over the FYs 2003–2016 implementation period. As shown in the table, the total cost of the combined In-Town, EPT, and Regional BRT Program is projected to be $616.7 million (YOE $).

As shown in the table, the combined BRT components are proposed to be funded with approximately 39 percent FTA New Starts funds, 36 percent City GO Bonds, 23 percent FHWA highway funds, and two percent FTA Section 5309 Bus Capital funds.

TABLE 6.1-8
CAPITAL FUNDING SOURCES FOR REGIONAL BUS RAPID TRANSIT SYSTEM
FISCAL YEARS 2003 - 2016 (YOE $, 000)
(REFINED LPA)

Source	Total $ (%)	Regional BRT Elements
FTA Sec. 5309 New Starts	$55,845 (23%)	• BRT transit centers and parking • Zipper lane • BRT priority ramp
FHWA	$139,658 (57%)	• BRT transit centers and parking • Zipper lane • BRT priority ramp improvements
City GO Bonds	$48,876 (20%)	• BRT transit centers and parking • Zipper lane • BRT priority ramp improvements
Total	**$244,379 (100%)**	

Source: Sharon Greene & Associates, November 2002.

TABLE 6.1-9
CAPITAL FUNDING SOURCES IN-TOWN, EPT, AND REGIONAL BRT SYSTEMS
FISCAL YEARS 2003 – 2016 (YOE $, 000)
REFINED LPA

Source	Total $ (%)	Project Element
FTA Sec. 5309 New Starts	$242,000 (39%)	• All project elements
FTA Sec. 5309 Bus Capital	$11,719 (2%)	• Regional BRT transit centers and parking • Zipper lane • BRT priority ramp improvements
FHWA	$139,658 (23%)	• Regional BRT transit centers and parking • Zipper lane • BRT priority ramp improvements
City GO Bonds	$223,313 (36%)	• All project elements
TOTAL	**$616,689 (100%)**	

Source: Sharon Greene & Associates, November 2002.
Note: Totals may differ due to rounding.

2) Funding Plan for Operating and Maintenance

Table 6.1-10 compares the TSM Alternative and Refined LPA to the No-Build Alternative with regard to the average annual O&M cost over the FY 2007-2016 period in which BRT service would be fully operational. As shown in the table, the alternatives differ by over 12 percent with regard to projected average annual O&M costs. The projected average annual O&M costs of the Refined LPA are 12.2 percent higher than the No-Build Alternative and 7.9 percent higher than the TSM Alternative.

As the projected average annual O&M costs in the Table 6.1-10 are in year of expenditure dollars, a comparison to current O&M costs requires presentation of the data in constant dollars. Table 6.1-11 compares O&M costs for the bus and TheHandi-Van service components of the alternatives to the estimated 2003 O&M costs using 2002 constant dollars.

TABLE 6.1-10
ESTIMATED AVERAGE ANNUAL OPERATING AND MAINTENANCE COSTS OVER FISCAL YEARS 2007 – 2016 (YOE $, 000)

Alternative	Average Annual O&M Cost	% Increase Over No-Build
No-Build	$170,469	
TSM	$177,280	4.0%
Refined LPA	$191,263	12.2%

Source: Sharon Greene & Associates, November 2002.
Note: Includes TheHandi-Van O&M costs.

TABLE 6.1-11
ESTIMATED AVERAGE ANNUAL OPERATING AND MAINTENANCE COSTS OVER FISCAL YEARS 2007 – 2016 (CONSTANT 2002 $, 000)

Alternative	Bus	TheHandi-Van	Total
FY 2003 Estimated	$119,421	$13,663	$133,084
NO-BUILD	$119,914	$14,539	$134,453
TSM	$125,111	$14,539	$139,650
Refined LPA	$136,047	$14,539	$150,586

Source: Sharon Greene & Associates, November 2002.

As shown in Table 6.1-11, expressed in 2002 constant dollars, the average annual O&M cost of the alternatives range from $134.5 million for the No-Build to $150.6 million for the Refined LPA. In comparison to the estimated FY 2003 O&M cost of $133.1 million, the No-Build Alternative, TSM Alternative, and Refined LPA are within 1 percent, 5 percent, and 13 percent of the FY 2003 estimated O&M cost. In addition to bus and TheHandi-Van O&M costs, the Refined LPA includes the cost of providing and maintaining the Regional and In-Town BRT service within the bus costs.

With respect to vanpool service, the cost of administering the Vanpool Hawaii program is assumed to equal the direct revenues received plus federal funding. None of the alternatives include the cost of the vanpool program currently borne by the SDOT. These costs would be common to all alternatives in the event the City assumed the vanpool program. If that were to occur, the City would receive an additional $1 million annually in FTA Section 5307 UZA funds that are assumed to be transferred to FHWA for SDOT operation of the program.

Revenues for the O&M costs associated with the alternatives would come from the following sources:

- Bus fares: these would cover a minimum of 27 percent of bus O&M costs;
- TheHandi-Van fares: these would cover roughly 11 percent of TheHandi-Van O&M costs;
- City Operating Support; and
- FTA Section 5307 Urbanized Area formula grant funds used for bus preventive maintenance.

In the absence of any new revenues to fund the higher local operating subsidy required, the financial analysis indicates that the City will have the financial capacity to fund the increased level of subsidy using existing sources of revenue through appropriations from the City's General Fund.

6.1.5 Financial Performance Measures

The results of the financial analyses are summarized in Tables 6.1-12 through 6.1-15 and are discussed below. The financial analyses focus on the performance of the Refined LPA relative to the No-Build and TSM Alternatives with respect to the following key measures:

Capital Funding and Debt Service Requirements, FYs 2003 – 2016[3]

- Total and Annual Capital Funding Required;
- Level of City GO Bonding Required;
- FTA Section 5309 New Starts Funding Required;
- FHWA Funding Required;
- Average Annual Debt Service Payment Required (Post-2003 Debt);
- Ratio of Debt Service on GO Bonds (including Self-Supporting Bonds) as a Percentage of the City's Total Operating Budget (By policy, should not exceed 20 percent); and
- Ratio of Debt Service on Direct Debt (excluding Self-Supporting Bonds) as a Percentage of General Fund Revenues (By policy, should not exceed 20 percent).

Operating And Maintenance Funding Requirements, FYs 2007 - 2016

- Average Annual Operations and Maintenance Costs; and
- Average Annual City Operating Support for Transit O&M.

Capital, Debt Service, and Operating Funding Requirements, FYs 2007 – 2016

- Average Annual Total City Contribution Required for Debt Service and Operating Support;
- Average Annual Increase in Total City Contribution over No-Build; and
- Average Annual Increase in Total City Contribution over TSM.

Detailed cash flow analyses were conducted for each alternative to assess total and annual financial requirements over the 2003 -2025 period. The analyses were performed using year of expenditure dollars inclusive of inflation. The detailed cash flow analyses are provided in Appendix C.

1) Capital Funding Requirements

The sections below summarize the key findings related to the seven capital funding evaluation measures:

- Total and Annual Capital Funding Required;
- Level of City GO Bonding Required;
- FTA Section 5309 New Starts Funding Required;
- FHWA Funding Required;
- Average Annual Debt Service Payment Required (Post-2003 Debt);
- Ratio of Debt Service on GO Bonds (including Self-Supporting Bonds) to the City's Total Operating Budget (Maximum Ratio Reached); and
- Ratio of Debt Service on Direct Debt (excluding Self-Supporting Bonds) to General Fund revenues (Maximum Ratio Reached).

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[3] FTA Section 5307 funding is not included as a key measure since the City's annual apportionment would be the same for all alternatives.

Total and Annual Capital Funding Required, FYs 2003 - 2016

Table 6.1-12 summarizes the total annual capital funding required for the No-Build Alternative, TSM Alternative, and Refined LPA over the 14-year implementation period. The capital costs of the Alternatives increase with the level of service being proposed. To an extent, the alternatives represent a spectrum, ranging from the No-Build Alternative, to the introduction of BRT-type elements in the TSM Alternative, to a high level of service provided by the In-Town and Regional BRT components in the Refined LPA. The spectrum of costs ranges from $311.6 million for the No-Build Alternative to $453.5 million for the TSM Alternative, to $1.04 billion for the Refined LPA.

TABLE 6.1-12
SUMMARY OF KEY FINANCIAL MEASURES BY ALTERNATIVE
OVER FYs 2003 - 2016 (YOE $, 000)

	No-Build	TSM	Refined LPA
CAPITAL PERFORMANCE MEASURES: FY 2003–2016			
Total Capital Cost	$311,602	$453,486	$1,042,671
GO Bonds Issued	$138,899	$259,484	$369,916
FTA New Starts Funding Required	--	--	$242,000
FHWA Funding Required	--	$11,985	$139,659
Average Annual Debt Service Payment (Post-2003 Debt)	$9,986	$13,800	$17,664
Ratio of Debt Service on GO Bonds (including Self-Supporting Bonds) to the City's Total Operating Budget: Maximum Ratio Reached	19.09% (FY 2004)	19.24% (FY 2004)	19.05% (FY 2004)
Ratio of Debt Service on Direct Debt (excluding Self-Supporting Bonds) to General Fund revenues: Maximum Ratio Reached	15.49% (FY 2011)	15.61% (FY 2011)	15.70% (FY 2011)
OPERATING PERFORMANCE MEASURES: FY 2007-2016			
Average Annual Operations and Maintenance Costs	$170,469	$177,280	$191,263
Average Annual City Operating Support for Transit O&M	$108,328	$115,540	$129,240
CAPITAL AND OPERATING PERFORMANCE MEASURES: FY 2007- 2016			
Average Annual Total City Contribution Required for Debt Service and O&M(Post-2003 Debt)	$120,678	$132,965	$151,899
Average Annual Increase in Total City Contribution Over No-Build		$12,287	$31,221
Average Annual Increase in Total City Contribution Over TSM			$18,934

Source: Sharon Greene & Associates, November 2002.

Tables 6.1-3A through 6.1-3C presented earlier summarize the capital funding requirements for the alternatives over the FYs 2003 -2016 implementation period. As shown in the tables, different levels of GO bonding, FTA Section 5309 New Starts funding, and FHWA funding are required to provide adequate funding during this period.

Level Of City GO Bonding Required, FYs 2003 - 2016

The financing plans for the No-Build Alternative, TSM Alternative, and Refined LPA assume that the City would use a portion of its GO bonding capacity. Table 6.1-13 summarizes the annual level of GO bonding required for each alternative. As shown in Table 6.1-13, the level of GO bonding required corresponds to the relative capital cost of the alternative over Fys 2003 to 2016. The highest cost alternative (Refined LPA) would have the greatest need for bonding ($369.9 million) compared with $138.9 million and $259.5 million for the No-Build and TSM Alternatives respectively. A portion of the GO bonding required in the Refined LPA would be to provide capital funding in advance of receipt of FHWA federal grant funds. Table 6.1-13 summarizes the annual bonding that would be required for the Refined LPA over the FYs 2003-2016 period.

TABLE 6.1-13
ANNUAL GENERAL OBLIGATION BONDING REQUIRED BY ALTERNATIVE OVER FISCAL YEARS 2003 – 2016 (YOE $, 000)

Fiscal Year	NO-BUILD	TSM	REFINED LPA
2003	$20,437	$22,181	$23,232
2004	$21,642	$33,882	$45,712
2005	$26,497	$44,776	$49,984
2006	$18,994	$30,240	$46,589
2007	$11,365	$19,649	$16,384
2008	$5,754	$7,162	$21,276
2009	$1,025	$1,548	$28,977
2010	$844	$3,315	$16,265
2011	$1,955	$12,817	$24,508
2012	$80	$10,318	$5,299
2013	$3,618	$7,673	$12,003
2014	$1,396	$17,780	$20,258
2015	$8,584	$30,076	$28,673
2016	$16,758	$18,068	$30,756
TOTAL	**$138,899**	**$259,484**	**$369,916**

Source: Sharon Greene & Associates, November 2002.

FTA Section 5309 New Starts Funding

Table 6.1-14 summarizes the level of FTA Section 5309 New Starts funding required for the Refined LPA. On an annual basis, the financial plan assumes availability of New Starts funding for the Refined LPA at the expenditure levels presented in the table.

As shown in Table 6.1-14 and earlier in Table 6.1-3C, New Starts funding would provide approximately 39 percent for the total BRT Program. New Starts funding would constitute 50 percent of the capital revenues for the In-Town BRT related components, 50 percent for the EPT component, and 23 percent for the Regional BRT, with revenues received over the FYs 2003-2016 period. A total of $242.0 million in New Starts funding would be used for the Refined LPA.

FHWA Funding Required

The financial plan proposes that FHWA funding would be available for eligible projects components in the TSM Alternative and Refined LPA, up to an annual ceiling. The total level of FHWA funding over the FYs 2003-2014 periods is proposed not to exceed $20.0 million per year. FHWA funds are assumed to provide 80 percent of capital costs for eligible projects, with a 20 percent match coming from City GO Bonds. Actual

[4] FTA Section 5307 funding is not included as a key measure since the City's annual apportionment would be the same for all alternatives.

annual Federal highway funding levels and the relative shares from each FHWA program source would be determined through the federal programming process.

TABLE 6.1-14
FTA SECTION 5309 NEW STARTS FUNDING
ANNUAL EXPENDITURE LEVELS
FOR THE REFINED LPA
FISCAL YEARS 2003 – 2016 (YOE $, 000)

Fiscal Year	Amount
2003	$3,515
2004	$25,028
2005	$45,000
2006	$39,745
2007	$12,507
2008	$0
2009	$3,711
2010	$19,109
2011	$30,170
2012	$17,646
2013	$19,604
2014	$12,830
2015	$5,331
2016	$7,803
TOTAL	**$242,000**

Source: Sharon Greene & Associates, November 2002.

Table 6.1-15 summarizes the schedule assumed for receiving FHWA highway funds through the State of Hawaii for the TSM Alternative and Refined LPA. Even with the higher levels of FHWA funding required for the Refined LPA, less than 50 percent of the funds from eligible categories (IM, NHS, STP and CMAQ) and 13 percent of the total FHWA funding received by the State would be used over the 12-year period.

The financial analysis in the MIS/DEIS and SDEIS called for a total of $160.0 million in FHWA funding. This amount has been reduced by $20.4 million in the FEIS as a result of additional refinements made to the proposed project, including alignment modifications.

Average Annual Debt Service Payment Required

Table 6.1-12 summarizes the average annual debt service payment on post-2003 bond issues required for the alternatives. In comparison to the $10.0 million and $13.8 million in additional average annual debt service payments required for the No-Build and TSM Alternatives respectively, the additional average annual debt service payment required for the Refined LPA is $17.7 million.

2) O&M Funding Requirements

Two comparative measures have been used to evaluate the Alternatives:

- Average Annual Operating and Maintenance Costs; and
- Average Annual Operating Support for Transit O&M.

TABLE 6.1-15
ANNUAL FEDERAL HIGHWAY FUNDING REQUIRED
FOR THE TSM ALTERNATIVE AND REFINED LPA
FISCAL YEARS 2003-2016 (YOE $, 000)

Fiscal Year	TSM Alternative	Refined LPA	Amount Available for Other Statewide Projects with Refined LPA
2003	$0	$0	$86,327
2004	$0	$0	$87,190
2005	$0	$0	$88,062
2006	$858	$1,207	$87,736
2007	$5,495	$11,587	$78,245
2008	$5,632	$20,000	$70,730
2009	$0	$20,000	$71,639
2010	$0	$20,000	$72,555
2011	$0	$20,000	$73,480
2012	$0	$20,000	$79,361
2013	$0	$20,000	$75,358
2014	$0	$6,865	$84,587
2015	**$0**	**$0**	**$0**
2106	**$0**	**$0**	**$0**
TOTAL	**$11,985**	**$139,659**	**$955,270**
	1%	**13%**	**87%**

Source: Sharon Greene & Associates, November 2002.
Note: Includes NHS, STP, CMAQ, and IM funding categories only. FY 2003 amount is from the estimated TEA-21 apportionment, as provided by the State Department of Transportation. Estimates for FY 2004 and beyond are calculated at a conservative 1.00% increase per year. Funding for FHWA Bridge Rehabilitation and Replacement, Metropolitan Planning, Innovative Projects / Rec. Trails, High Priority Projects, and Minimum Guarantee categories are not included in the total.

Average Annual Operating and Maintenance Costs: FY 2007-2016

As shown in Table 6.1-12, over the FY 2007-2016 period in which the In-Town BRT program becomes fully operational, the average annual O&M cost for bus and TheHandi-Van service is projected to range from $170.5 million for the No-Build Alternative to $177.3 million and $191.3 for the TSM Alternative and Refined LPA respectively. The percentage difference between the TSM and No-Build Alternatives is 4 percent, with a 12 percent difference between the Refined LPA and the No-Build. Between the Refined LPA and the TSM Alternative, the percentage difference is 8 percent.

Average Annual City Operating Support for Transit O&M: FY 2007-2016

All of the alternatives would require City operating support to supplement fares and FTA Section 5307 UZA funds for the O&M costs of the bus and TheHandi-Van services. As shown in Table 6.1-12, over the FY 2007-2016 period in which the In-Town BRT program becomes fully operational, the average annual City operating support for O&M would be $108.3 million for the No-Build Alternative, $115.5 million for the TSM

Alternative, and $129.2 million for the Refined LPA. The difference between the lowest (No-Build) and highest (Refined LPA) average annual level of City operating support would be $20.9 million.

The Operating and Maintenance Financial Plans reflect an 11.9 percent increase over the TSM in the annual level of local operating support for the Refined LPA. If actual O&M costs are higher than the projections, or if actual fare revenues are lower, there still remain a variety of means for the needed level of support to be met. For example, changes in the fare structure could be made that would minimize impacts on transit dependents yet maintain or increase revenues. As another example, increases in the "cap" within which employers may fund employee transit expenses without these being considered "income" for Internal Revenue Service reporting purposes would also enhance transit's ability to increase operating revenue from the fare box. Thus, many ways exist to meet the levels of operating support assumed in this analysis.

3) Capital and Operating Performance Measures

Three comparative measures have been used to evaluate the alternatives with respect to total City contribution required for both capital and for O&M funding:

- Average Annual Total City Funding Support Required for Debt Service and O&M;
- Average Annual Increase in Total City Contribution over the No-Build Alternative; and
- Average Annual Increase in Total City Contribution over the TSM Alternative.

Average Annual Total City Funding Support Required for Post-2003 Debt Service and O&M

As shown in Table 6-1.12, higher levels of City financial support would be required for the TSM Alternative and Refined LPA relative to the No-Build Alternative. The average annual level of City contribution required for post-2003 debt service and operating support for Fys 2007 to 2016 would be $120.7 million for the No-Build Alternative, $133.0 million for the TSM Alternative, and $151.9 million for the Refined LPA.

Average Annual Increase in Total City Funding Support over the No-Build Alternative

Relative to the No-Build Alternative, the average annual incremental level of City contribution required for Fys 2007 to 2016 would range from an additional $12.3 million per year for the TSM Alternative to $31.2 million for the Refined LPA.

Average Annual Increase in Total City Funding Support over the TSM Alternative

Relative to the TSM Alternative, the average annual incremental level of City contribution for FY 2007 to 2016 would be $18.9 million per year for the Refined LPA.

6.2 ALTERNATIVES COMPARISON

In the MIS/DEIS and SDEIS, the alternatives comparison was presented in Chapter 7. This discussion is being presented in this chapter. Chapter 7 presents the responses to comments received in response to the MIS/DEIS and SDEIS. This section compares how and the degree to which the alternatives satisfy the project purposes and needs presented in Chapter 1. It discusses the financial and environmental costs of satisfying these needs. Finally, this section reports the cost-effectiveness and equity (distribution of benefits) of each alternative; these are two criteria that the Federal Transit Administration (FTA) considers in deciding whether to qualify a new transit system for federal funding.

The alternatives are compared using cost, mobility, growth-shaping, land use, quality of life, environmental impact, cost-effectiveness, and equity criteria. Table 6.2-1 summarizes the evaluation findings for those criteria. This analysis is meant only to reconfirm selecting the BRT as the Locally Preferred Alternative (LPA).

TABLE 6.2-1
SUMMARY OF KEY EVALUATION MEASURES

Measures	No-Build	TSM	Refined LPA
CAPITAL AND O&M COSTS			
Total Capital Cost (FY 2003-2025) (Millions of 2002 $)	$404.4	$540.8	$954.9-$1,038.2*
Annual Operating and Maintenance Cost at Full System Operation (Millions of 2002 $)	$120.7	$139.8	$151.2
Impact on City Budget (Average Annual Costs for Debt Service and O&M Net of Fare Revenue) FY 2003-2016 (YOE)	$120.7 million	$133.0 million	$151.9 million
MOBILITY			
Daily Transit Trips Within the Primary Transportation Corridor (2025) (Daily Linked Trips)	261,130	279,400	312,570
Increase in Transit Trips Over the No-Build Within the Primary Transportation Corridor (2025)	N.A.	18,270	51,440
Daily Transit Mode Share Within the Primary Transportation Corridor (2025) (Work Trips)	19.2%	19.5%	22.6%
Daily Revenue Bus Miles (2025)	62,560	77,790	84,450
Comfort Level (Passengers Per Transit Seat) (2025)	1.31	1.01	0.90
Daily Reduction in Vehicle Miles of Travel (Compared to No-Build) (2025)	N.A.	27,340	718,530
Daily Reduction in Vehicle Hours of Delay (2025) (Compared to No-Build)	N.A.	13,285	78,080
Projected Transit Travel Time Between Downtown and Kapolei (2025)	83.1 minutes	78.0 minutes	58.2 minutes
Projected Transit Travel Time between Downtown and Waikiki (2025)	25.0 minutes	25.0 minutes	23.1 minutes
Projected Transit Travel Time between Downtown and UH-Manoa (2025)	24.4 minutes	23.3 minutes	22.6 minutes
Projected Transit Travel Time between Downtown and Kalihi (2025)	17.6 minutes	16.3 minutes	13.3 minutes
Typical Levels of Service on In-Town Roads (Transit)	E/F	E/F	B/C
Typical Levels of Service on In-Town Roads (Autos)	E/F	E/F	E/F
New Parking Spaces Provided at Transit Centers/Park-and-Rides	0	600	1,520
On-Street Parking Spaces Removed (Unrestricted/Restricted) (U/R)	0	166 (U)	IOS: 22 (U) Middle St. to Iwilei: 27 (U) Iwilei to Waikiki: 124 (R) Kakaako Mauka: 69 (U) / 66(R) UH-Manoa: 199 (U) / 343 (R)
Number of Loading Zones to be Mitigated	0	14	26
LAND USE DEVELOPMENT			
Support of transit-oriented development	Not supportive	Somewhat supportive	Most supportive
ECONOMIC IMPACT			
Employment (direct and indirect person-years jobs)	704	1,797	9,418

TABLE 6.2-1 (CONTINUED)
SUMMARY OF KEY EVALUATION MEASURES

Measures	No-Build	TSM	Refined LPA
QUALITY OF LIFE AND LIVABILITY			
In-Town Transit Technology	Diesel Buses	Diesel Buses	Hybrid diesel/electric or EPT for In-Town BRT
Visual Character	No Changes	Development of transit centers provide opportunities to improve the visual environment	Development of transit centers and In-Town BRT stops provide opportunities to improve the visual environment. Sound barrier near future Aloha Stadium Transit Center will cause visual impact.
Noise/Vibration (In-Town)	No or very little perceptible difference from existing conditions	Similar to the No-Build Alternative	Moderate noise impacts at residences from In-Town BRT operations on Dillingham Boulevard, using the hybrid-diesel vehicle. Use of hybrid diesel/electric or electric In-Town BRT vehicles generally less noisy than diesel buses.
Noise/Vibration (Regional)	No Impacts	No Impacts	Moderate noise impacts to nearby residences from increase in bus operations at future Aloha Stadium Transit Center and associated Luapele Ramp.
ENVIRONMENTAL IMPACTS			
Number of Business and Residential Displacements	Loss of four acres of agricultural land.	Loss of four acres of agricultural land.	Removal of two parking spaces at an apartment complex. Displacement of parking stalls, landscaping, and/or driveway effects on 22 businesses. Loss of four acres of agricultural land.

TABLE 6.2-1 (CONTINUED)
SUMMARY OF KEY EVALUATION MEASURES

Measures	No-Build	TSM	Refined LPA
Street Trees	No Impact	No Impact	Some tree trimming will be required. 32 "notable" and 68 non-notable trees will be relocated near their original locations. Roughly 50 other trees will be replaced. No designated exceptional trees will be affected.
Change in Energy Consumption Compared to No-Build (in thousands of barrels of oil)	N/A	35	-215
Historical Resources	No Impacts	No Impacts	Construction of an EPT system may uncover archaeological resources or native-Hawaiian ancestral burial sites along certain segments. In-Town BRT stops located within or near historic districts or properties with high visual integrity have the potential to affect historic characteristics.
Parkland Impacts	Joint-use of Aloha Stadium Kamehameha Highway parking lot as a transit center/park-and-ride	Same as No-Build Alternative	Same as No-Build Alternative
COST-EFFECTIVENESS			
Incremental Cost Per New Rider (compared to No-Build Alternative)	N/A	$6.25	$5.01
EQUITY			
Impacts/benefits to minority or low-income populations	No adverse impacts/ No increased benefits	No adverse impacts/ Some improvement in transit service	No adverse impacts/ Substantial improvement in transit service

Source: Parsons Brinckerhoff, Inc., November 2002.
Note: *If hybrid diesel/electric vehicles are used, the estimated cost is $954.9 million. If EPT vehicles are used, the estimated cost is $1,038.2 million.

6.2.1 Comparison of Alternatives Against Project Purposes and Needs

The purposes and needs to be addressed by a major transportation investment in the primary transportation corridor are listed below (from Chapter 1):

1. Increase the people-carrying capacity of the transportation system in the primary transportation corridor by providing attractive alternatives to the private automobile;
2. Support desired development patterns;
3. Improve the transportation linkage between Kapolei and Honolulu's Urban Core; and
4. Improve the transportation linkages between communities in the Primary Urban Center (PUC).

Increase The People-Carrying Capacity Of The Transportation System In The Primary Transportation Corridor by Providing Attractive Alternatives to the Private Automobile

Detailed mobility analyses are presented in Chapter 4. The following enhanced mobility measures are used to compare the alternatives:

1. Person-carrying capacity of the roadway system;
2. Increased transit usage islandwide;
3. Reduced traffic congestion; and
4. Improvement to other level of service indicators.

1) Person-Carrying Capacity of the Existing Roadway System

The TSM Alternative and Refined LPA would increase person-carrying capacity by enhancing the level of transit service. Additionally, roadway lanes would become more efficient by reallocating them from general-purpose use to transit or ride-share use. The Refined LPA would provide substantially more person-carrying capacity within the Urban Core than the TSM Alternative, because of its superior level of transit priority.

Table 6.2-2 compares the A.M. peak hour person throughput for selected screenlines within the Urban Core for each of the alternatives. Table 6.2-2 shows that the Refined LPA would improve person-carrying ability within key corridors within the Urban Core by a range of 8 to 18 percent over the No-Build Alternative. To get an equivalent increase in person-carrying capacity through road construction alone, the roadway lanes in the Urban Core would need to be increased by almost two lanes in each direction (four lanes total). This is not feasible without major displacement of existing land uses and the accompanying adverse social and environmental impacts.

The TSM Alternative would not improve person-carrying capacity over the Refined LPA.

Transit systems have the additional advantage of being able to provide still further person-carrying capacity and expansion potential. Each In-Town BRT vehicle has an assumed capacity of 120 persons, corresponding to a 60-foot articulated vehicle with a single articulation joint. Using higher capacity vehicles (i.e. bi-articulated buses) or a further increase in the BRT frequency of service would add more person-carrying capacity, without the need for additional roadway construction. Therefore, the Refined LPA has the potential to further increases the person-carrying capacity beyond that provided by the No-Build and TSM Alternatives. The Regional and In-Town BRT systems are investments that would efficiently serve growth in travel demand well into the future, beyond the 2025 planning horizon.

TABLE 6.2-2
PROJECTED 2025 A.M. PEAK HOUR PERSON-CARRYING CAPACITY
AT SELECTED SCREENLINE LOCATIONS
(PERSONS/HOUR)

Screenline Location	Alternative		
	No-Build	**TSM**	**Refined LPA**
Ewa-bound at Ward Avenue	21,120	20,600	24,940
Ewa-bound at Punchbowl Street	21,105	20,520	22,865
Koko Head-bound at Liliha Street	24,310	22,825	28,760
Koko Head-bound at Bishop Street	24,665	23,765	27,920

Source: Parsons Brinckerhoff, Inc., October 2002.
Note: Capacity can be increased through using larger vehicles or providing more frequent service.

2) Increased Transit Usage Islandwide

Transit ridership reflects trips taken on transit (not counting transfers). The measure "ridership" addresses key goals of increasing the number of people using transit, decreasing the number using individually driven automobiles, and increasing the patrons paying fares. Higher ridership indicates increased attractiveness of a transit system, otherwise transit patrons would choose another mode. Increased transit ridership amplifies the secondary benefits already enumerated for transit, such as reduced energy consumption, enhanced air quality, and support for desired land use development patterns.

Table 6.2-3 compares total daily transit ridership among the alternatives. The Refined LPA, with the highest level of transit service, is forecast to attract the most transit ridership.

TABLE 6.2-3
RIDERSHIP FORECASTS ISLANDWIDE
(FORECAST YEAR 2025)

	No-Build	**TSM**	**Refined LPA**
Total Transit Trips (Daily Linked Trips)	261,130	279,400	312,570
New Transit Trips compared with No-Build	Not Applicable	18,270	51,440
New Transit Trips compared with TSM	Not Applicable	Not Applicable	33,170
Transit Mode Share:			
All Trip Purposes	6.6%	6.9%	7.9%
Work Trips	14.7%	15.7%	18.4%

Source: Parsons Brinckerhoff, Inc., October 2002.

Transit mode share is the proportion of total trips taken on the transit system, indicating the contribution of the transit system towards satisfying total travel demand. The higher the transit mode share, the fewer the automobiles that will be on the roads. The Refined LPA would result in increased transit mode share, compared to the other alternatives. As shown in Table 6.2-4, the advantages of improved transit service with the Refined LPA are even more pronounced within the primary transportation corridor, as evidenced by the even higher transit mode split within the corridor compared to islandwide.

TABLE 6.2-4
TRANSIT RIDERSHIP WITHIN THE PRIMARY TRANSPORTATION CORRIDOR
(DAILY LINKED TRIPS IN 2025)

	No-Build	TSM	Refined LPA
Total Transit Trips	202,000	216,130	234,390
Transit Mode Share:			
All Trip Purposes	8.5%	8.7%	10.0%
Work Trips	19.2%	19.5%	22.6%

Source: Parsons Brinckerhoff, Inc., October 2002.

3) Reduced Traffic Congestion

Restoring a balance between automobile, transit, pedestrian and bicycle modes is a prime objective within the primary transportation corridor. Transit improvements would encourage some people to modify their travel behavior by switching from private automobiles to transit, thereby decreasing traffic congestion. Vehicle Miles of Travel (VMT) is a measure of roadway congestion. Higher VMT reflects more vehicle trips made (higher roadway demand and more congestion), and more circuitous travel as drivers “hunt” for less congested routes. The search for less congested routes affects neighborhoods, as streets meant to accommodate local traffic become through traffic routes as drivers seek ways to avoid congestion on major arterial roadways. Table 6.2-5 shows that in 2025, the Refined LPA (which would provide the highest level of transit service) is projected to have the lowest peak period VMT compared to the other alternatives.

TABLE 6.2-5
PROJECTED YEAR 2025 PEAK PERIOD VMT AND VHD

Measure	Time Period	Alternative		
		No-Build	TSM	Refined LPA
VMT	A.M.	5,145,570	5,133,800	4,893,630
	P.M.	5,596,345	5,587,195	5,361,660
	Total Peak	10,741,915	10,720,995	10,255,290
VHD	A.M.	177,750	173,015	145,470
	P.M.	192,890	184,155	156,020
	Total Peak	370,640	357,140	301,760
Vehicle Trips Assigned	A.M.	555,140	554,970	535,040
	P.M.	660,150	660,250	641,125
	Total Peak	1,215,290	1,215,220	1,176,165

Source: Parsons Brinckerhoff, Inc. October 2002.
Notes: VMT = vehicle miles of travel
VHD = vehicle hours of delay

Lower peak period VMT for the Refined LPA reflects increased use of travel modes such as transit as opposed to single-occupant vehicles (SOVs), and less congestion on roadways. This finding is consistent with the fewer vehicle trips projected to occur with the Refined LPA (because there are more transit trips) than with the TSM or No-Build Alternatives.

Another indicator of regional roadway performance is Vehicle Hours of Delay (VHD), which is the difference in hours of travel between that associated with free-flow traffic conditions, and that associated with projected roadway congestion levels (see Table 6.2-5). Lower VHD indicates that the roadway network is handling travel demand more efficiently, with less aggravation and frustration for travelers. The Refined LPA and TSM

Alternative are projected to have lower daily VHD than the No-Build Alternative in 2025. While the Refined LPA would provide a greater person-carrying capacity than the TSM or No-Build Alternatives, it would also result in less VHD for motorists than the TSM Alternative since some general-purpose traffic lanes would be converted to provide priority for transit vehicles.

4) Improvement to Other Level of Service Indicators

The ridership forecasting results can be used to compute several other indicators of the level of service provided by each alternative. These measures are presented in Table 6.2-6 and discussed below.

TABLE 6.2-6
OTHER MEASURES OF SERVICE
(FORECAST YEAR 2025)

Measure	No-Build	TSM	Refined LPA
Boardings per Linked Trip (Transfer Rates)	1.29	1.33	1.38
Passenger per Seat at Peak Load Point (Comfort)	1.31	1.01	0.90

Source: Parsons Brinckerhoff, Inc., October 2002.

One level of service indicator is the transfers a typical rider must make to complete a trip. Riders prefer not to transfer, unless transferring produces a shorter total travel time. In Table 6.2-6, the transfers are reflected by the boardings per linked transit trip. The Refined LPA would require the greatest amount of transferring because many riders would access the BRT systems by feeder bus. In the No-Build and TSM Alternatives, more riders would have a one-seat ride from origin to destination. The additional transferring in the Refined LPA would be offset, however, by the more frequent, more comfortable, and more reliable service provided, and in many cases, by a shorter total travel time. The Refined LPA would provide the most travel time savings for transit patrons.

Since transit service in mixed traffic is subject to delays caused by traffic congestion, transit service reliability is correlated to the extent the system utilizes exclusive travel lanes (which would not be affected by the congestion in general purpose lanes). Since the Refined LPA would provide substantially more priority transit lanes, it would offer the most reliable service.

One measure of comfort is the probability of getting a seat on a transit vehicle during the peak hour. As shown in Table 6.2-6, the projected ridership in 2025 will exceed available seats by over 30 percent under the No-Build Alternative. Over 30 percent of all riders would be required to stand, sacrificing comfort and decreasing the attractiveness of travel by transit. Worse, buses would be full and pass by riders waiting at stops in some instances.

The available seats under the TSM Alternative would be about equal to the demand. On an average weekday, there would typically be a seat for every rider, even at the most heavily used parts of the system.

The available seats under the Refined LPA would be slightly greater than the demand, increasing the probability that a rider would find a seat and have a comfortable ride. The availability of surplus seats also reflects the ability of the Refined LPA to accommodate even further increases in ridership growth without having to increase the number of vehicles.

Support Desired Development Patterns

Chapter 5 provides detailed information on the growth-shaping attributes of the alternatives analyzed. The No-Build and TSM Alternatives would not encourage land use development in desired patterns or support implementation of an urban growth strategy that integrates land use and transportation elements.

The Refined LPA would substantially increase the people-carrying capacity within the corridor and help focus growth along the alignment of the In-Town BRT system. Because of the permanency of the fixed facilities that would be constructed under this Alternative, it would be highly effective in supporting implementation of an urban growth strategy that integrates land use and infrastructure planning. In combination with favorable land use policies it would help facilitate desired land use development patterns consistent with the vision for the island. Transit centers and transit stops would serve as focal points for transit-oriented development and would be designed to maintain or improve visual conditions through cohesively designed structures, street furniture, landscaping and lighting. The Refined LPA would improve the quality of urban living by enhancing transportation service within the Urban Core, and by reducing air and noise emissions in comparison to the diesel buses in the No-Build and TSM Alternatives. Because the Refined LPA would reduce automobile travel, regional air emissions would be less.

Improve the Transportation Linkage Between Kapolei and Honolulu's Urban Core

Improving connections within the primary transportation corridor, including the key linkage between Kapolei and Honolulu's Urban Core, is a principal project goal.

The Refined LPA would provide priority treatments in the H-1 Corridor, which would be used by vehicles with two or more occupants in addition to Regional BRT vehicles. This would enhance the linkage between Kapolei and the Urban Core for all higher occupancy vehicles. The benefits of the P.M. zipper lane, express lanes, and exclusive bus ramps with the Refined LPA are reflected in the reduced travel time for transit riders shown in Table 6.2-7.

TABLE 6.2-7
PROJECTED 2025 TRANSIT TRAVEL TIME FROM DOWNTOWN TO KAPOLEI

	No-Build	TSM	Refined LPA
Travel Time (minutes)	83.1	78.0	58.2

Source: Parsons Brinckerhoff, Inc., October 2002.

Improve the Transportation Linkages Between Communities in the PUC

Another project goal is to improve mobility within the PUC through enhanced transit service. The Refined LPA would attract additional transit riders by improving mobility within the PUC and strengthening the connections between the PUC and the rest of Oahu. This ridership increase reflects the service benefits – particularly reduced travel time – that such a system would provide in the primary transportation corridor. While the TSM Alternative would achieve some benefits, the benefits of a high capacity BRT system would be substantially greater, especially for travel within the PUC.

As shown by the travel times in Table 6.2-8, due to the provision of exclusive transit lanes, the Refined LPA would provide faster transit travel times (and more reliable service) within the PUC than either the TSM or No-Build Alternatives.

TABLE 6.2-8
PROJECTED 2025 TRANSIT TRAVEL TIME WITHIN THE PRIMARY URBAN CENTER

	No-Build Travel Time (minutes)	TSM Travel Time (minutes)	Refined LPA Travel Time (minutes)
Downtown - Waikiki	25.0	25.0	23.1
Downtown - UH-Manoa	24.4	23.3	22.6
Downtown - Kalihi	17.6	16.3	13.3

Source: Parsons Brinckerhoff, Inc., October 2002.

6.2.2 Impacts of Alternatives

This section summarizes the environmental consequences associated with the alternatives analyzed. Chapter 3 describes the existing environmental conditions and Chapter 5 provides more detailed information on the environmental impacts of the alternatives.

No-Build Alternative

The No-Build Alternative would rely on conventional diesel buses, at least for the immediate future, and continue the present focus on automobiles for transportation. Consequently, congestion would be the worst of any of the alternatives and regional air pollutant emissions would increase about 15-30 percent by 2025. Out of 23 intersections, localized air quality (worst-case 1-hour microscale concentrations) would deteriorate at ten locations studied in the a.m. and eleven locations studied in the p.m. Noise levels along streets would remain similar to present levels, even with an increase in the number of diesel buses and vehicles, because the vehicles would be moving more slowly ("passby" noise increases with speed).

The No-Build Alternative would not adequately support the purposes and needs of the project. It would not provide a transportation system that would effectively handle present or future levels of travel demand. It would not even maintain current mobility levels. It would not develop attractive travel alternatives to the private automobile, encourage land use development in desired patterns, support implementation of an urban growth strategy that integrates land use and infrastructure planning, nor maintain the existing quality of life. It would only minimally increase the linkage between Kapolei and the Urban Core, and would not improve mobility within the Urban Core. Impacts to ecosystems and visual, historic, water and park resources would generally be limited to localized impacts associated with the construction of roadway and other transportation improvements anticipated over the next 23 years. The No-Build Alternative would not require any business or residential displacements, although it would entail the displacement of four acres of farmland.

Because there would be no new federal construction funds beyond those already expected to be received through formula programs, the No-Build Alternative would produce no additional jobs.

TSM Alternative

Compared to the No-Build Alternative, the TSM Alternative, with its emphasis on enhancing and restructuring bus service, would provide some support to the project's purposes and needs in terms of enhancing people-carrying capacity within the corridor. However, this alternative would not go far in providing an attractive alternative to the private automobile, nor in enhancing desired land use development patterns or the City's urban growth strategy that integrates land use and infrastructure planning. There would be some improvement in the linkage between Kapolei and the Urban Core, but it would not significantly improve mobility within the Urban Core.

Without the implementation of significant transit-oriented infrastructures, transit operation under the TSM Alternative would not be able to maintain current mobility levels. Travel delays would be lengthy, and air pollution emissions would increase about 20 percent as a result of the increased diesel buses and private vehicle congestion associated with the TSM Alternative.

Impacts to neighborhoods, historic resources, ecosystems, noise levels, water resources, and parklands would be similar to those under the No-Build Alternative. The TSM Alternative would entail the displacement of up to four acres of agricultural land. Under the TSM Alternative, approximately 166 unrestricted parking spaces that are currently available during peak and off-peak hours would be eliminated. The TSM Alternative would not affect on-street restricted parking spaces. Fourteen (14) loading zones would be adversely affected.

Since there would be no FTA discretionary (New Starts) funding available for use with the TSM Alternative, there would be no additional jobs created beyond those that would occur with the normal in-flow of federal formula funds to the State.

Refined LPA

The Refined LPA would do the most to better serve existing transit riders and attract people out of their autos. Because the Refined LPA would reduce automobile travel, congestion and regional air emissions would be less. Also, the electric buses that will be used on the In-Town BRT would generally be quieter than conventional diesel buses. The Refined LPA represents a major improvement over the No-Build and TSM Alternatives in meeting the project purposes and needs. It would substantially increase people-carrying capacity within the corridor and help focus growth along the alignment of the In-Town BRT. Higher density redevelopment in a transit-supportive manner, particularly at transit centers and transit stops, would be encouraged. This alternative would be more effective than the TSM and No-Build Alternatives in supporting implementation of an urban growth strategy that integrates land use and infrastructure planning. It would help facilitate desired land use development patterns consistent with the vision for the island.

This alternative would establish transit as an attractive, viable alternative to the automobile. Transit patrons would reap travel time savings. The Refined LPA would cause less motorist delay than either the TSM or No-Build Alternative. The Refined LPA would establish an attractive, high capacity linkage between Kapolei and the Urban Core. It would improve mobility within the Urban Core by improving linkages between key destinations such as Downtown, Kakaako, Kalihi, UH-Manoa, and Waikiki, and would decrease transit travel times between these key destinations.

There would be no relocations of businesses or residents with the Refined LPA, though some partial displacements of driveways, parking, and/or landscaping will be necessary. Parking provided at transit centers and park-and-ride lots would be greater than with the TSM Alternative, as would the loss of on-street parking spaces and loading zones. Impacts on historic resources would be minor.

As part of the Refined LPA, transit centers, transit stops, and other project elements would be designed to maintain or improve visual conditions through cohesively designed structures, street furniture, landscaping and lighting. The quality of urban living would improve. Impacts to ecosystems, and water resources would be similar to that attributable to the No-Build and TSM Alternatives. Some trees will need to be relocated or replaced, but no exceptional trees will be affected.

The construction-phase impacts of the Refined LPA would be greater than those of the TSM Alternative because of the larger scale of construction.   Construction impacts would be temporary and detailed mitigation plans will be developed, including a maintenance of traffic plan during the final design phase. The additional federal discretionary funds that would be provided under this alternative would create an estimated 2,787 person-years of new jobs during construction of which 1,106 would be for construction workers.

6.2.3 Cost-Effectiveness and Equity of Alternatives

Capital and operating/maintenance costs are addressed in Chapter 2 and earlier in this chapter. Cost-effectiveness, the measure used by FTA to compare the cost of a transit investment in relation to its ability to attract new riders to transit, is discussed in this section. This section also addresses equity, which is the distribution of costs, impacts and benefits.

Cost-Effectiveness Analysis

Cost-effectiveness relates the ability of an alternative to attract new riders to its costs. The FTA has established a cost-effectiveness index (CEI) for evaluating the relative merits of fixed guideway or transit lane alternatives within a corridor. The FTA also uses the index as input into its rating system, which compares projects across the country, and identifies those most worthy of federal funding. The CEI analysis is used by FTA for comparative purposes. It is not an absolute indicator of costs and benefits because of its narrow focus on projected new ridership. The index measures the additional cost of proposed transit investments, using the cost per additional rider projected under the No-Build and TSM Alternatives as the measure against which the Refined LPA is compared.

The cost-effectiveness analysis translates the capital costs of the alternatives into equivalent uniform annual costs. These uniform annual capital costs reflect assumptions about the economic life of the capital components of each alternative (based on federal guidelines) and the cost of capital (i.e., the discount rate). Uniform annual capital costs are combined with annual O&M expenses and then compared to additional transit patronage to arrive at a CEI for the alternatives.

Because all costs used in the analysis are in constant dollars, the effects of inflation are already taken into account; the discount rate used in the analysis is a "real" discount rate that reflects prevailing interest rates net of the effect of inflation. A real discount rate of 7 percent was used, which is FTA recommended practice.

Assumptions about the effective useful lives of major cost components correspond to the economic lives of the major categories of capital cost. The economic life of heavy construction items, for instance, is assumed to be 50 years, while buses and BRT vehicles are assumed to have a service life of 12 years before needing replacement.

When alternatives are compared using the CEI parameter, the one with the lower cost per new rider represents the more cost-effective alternative. As shown in Tables 6.2-9A and 6.2-9B, compared to the transit ridership that would be achieved with the No-Build Alternative, the incremental cost per new rider for the TSM Alternative is $6.25, which is greater than the cost per new rider for the Refined LPA of $5.01, also compared to the No-Build Alternative. Therefore, the Refined LPA is more cost-effective than the TSM Alternative in increasing transit ridership over the No-Build Alternative. Compared to the transit ridership that would be achieved with the TSM Alternative, the CEI of further boosting transit ridership to the level forecast to occur with the Refined LPA would be $4.52.

Equity/Environmental Justice

Equity is defined as the fairness of the distribution of costs, benefits, and impacts across various population subgroups. Fairness is determined by the extent to which the costs and impacts are distributed in a way that is consistent with regional goals.

TABLE 6.2-9A
FACTORS USED TO DEVELOP FTA COST-EFFECTIVENESS INDEX

Factor	Alternative		
	No-Build	**TSM**	**Refined LPA**
Annualized Capital Cost (2002 dollars)	$ 28,760,000	$ 37,910,000	$ 78,400,000
Total Systemwide Annual Operating and Maintenance Cost (2002 dollars)	$ 120,700,000	$ 139,800,000	$ 151,200,000
Total Annualized Cost in Forecast Year (2002 dollars)	$149,460,000	$ 177,710,000	$ 229,600,000
Total Annual Ridership (forecast year)	80,428,040	86,055,200	96,271,560

Source: Parsons Brinckerhoff, Inc., October 2002.

TABLE 6.2-9B
FTA COST-EFFECTIVENESS INDEX

Factor	Comparison		
	TSM vs. No-Build	**Refined LPA vs. No-Build**	**Refined LPA vs. TSM**
Incremental Annualized Cost	$ 28,000,000	$80,000,000	$ 52,000,000
Incremental Annual Ridership	6,000,000	16,000,000	10,000,000
Cost-Effectiveness (incremental cost per new rider)	$ 6.25	$ 5.01	$ 4.52

Source: Parsons Brinckerhoff, Inc., October 2002.

1) Impact on Low Income Areas

Certain areas within the primary transportation corridor contain concentrations of minority and low-income populations (see Section 5.3 which discusses the project's Environmental Justice compliance in more detail). Input from community residents and business owners serving the minority and low-income populations has been actively solicited throughout project planning through the community based planning program (see Appendix A). None of the alternatives would cause a disproportionately high and adverse health or environmental effect on any population group, including minority and low-income populations. Benefits to these groups would be substantial.

2) Environmental/Socioeconomic Equity and Benefit

An analysis of equity and benefit from an environmental and socioeconomic perspective was developed based on the relative balance between environmental and/or socioeconomic impacts and change in transit accessibility. The Refined LPA would result in improved transit accessibility islandwide relative to the No-Build and TSM Alternatives. The Refined LPA would increase daily transit trips by 19.7 percent over the No-Build Alternative. The Refined LPA is projected to produce a 10.6 percent increase in daily transit trips over the TSM Alternative.

The Refined LPA would provide greater support for desired land use development patterns in comparison to the No-Build and TSM Alternatives.

3) Local Financing Options Equity and Burden

Earlier in this chapter the financing plans for the alternatives were discussed. No new local revenue sources or tax increases would be required for any alternative. The City would provide its portion of the local funding with existing City funding lines and General Obligation (GO) bonds. FTA formula and discretionary grants also would be used. Transit related components on State highway facilities would be funded with federal highway funds and a local city match.

No geographic or socioeconomic group would pay a disproportionate share of the project's costs.

6.3 REQUIRED PERMITS AND APPROVALS

Table 6.3-1 lists the permits or approvals that may be required by alternative. At this point in project planning, the permit applications have not been completed or submitted to the appropriate agencies. Permit applications will be completed during the project's final design phase.

TABLE 6.3-1
PERMITS POTENTIALLY REQUIRED

PERMIT	ALTERNATIVE		
	No-Build	**TSM**	**Refined LPA**
Federal			
U.S. Coast Guard – Bridge Permit			X
U.S. Department of Transportation Notice of Proposed Construction Near Airports			X
U.S. Department of Transportation FHWA Approval of Modifications Within Limits of Interstate Highways			X
U.S. Army Corps of Engineers – Clean Water Act Section 404 permit (Nationwide)			X
State			
State Department of Transportation Permit to Perform Work Upon a State Highway			X
State Department of Health Clean Water Act Section 401 Water Quality Certification			X
State Department of Health Noise Permit/Variance	X	X	X
National Pollutant Discharge Elimination System (NPDES) Permit - Stormwater Associated with Construction Activity	X	X	X
Commission on Water Resource Management – Stream Channel Alteration Permit			X
Disability and Communication Access Board Approval		X	X
County			
Special Design District Permit			X
Zoning Waivers for Public Uses, Public Utilities and Walls			X
Building Permit		X	X
Development Application in Flood Hazard Districts			X
Special Management Area Use Permit			X
Construction Dewatering Permit (Temporary)	X	X	X
Grubbing, Grading, Excavation, and Stockpiling Permit		X	X
Street Tree Review	X	X	X
Permit to Excavate on Public Right-of-Way (Trenching)		X	X
Street Usage Permit	X	X	X

Source: Parsons Brinckerhoff, Inc., April 2003.