

JUNE 2015

HONOLULU COMPLETE STREETS IMPLEMENTATION STUDY LOCATION REPORT

California Avenue from Kamehameha Highway to Wahiawa District Park (DRAFT II)



City & County of Honolulu
Department of Transportation Services

Prepared by
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Summary: California Avenue from Kamehameha Highway to Wahiawa District Park

Central Oahu Planning Area, Wahiawa Town Sub-Area, Council District II

NEED FOR PROJECT

This location has a strong potential to become a vibrant, walkable corridor. There are many commercial destinations at the east end of the corridor, institutions and public facilities to the west, and residences to the north and south. California Avenue also serves as the arterial spine road for all of Wahiawa.

SUMMARY OF RECOMMENDATIONS

- Implement a road diet that transitions the street from four to three vehicle lanes.
- Encourage bicycle usage by creating protected bike lanes.
- Promote bicycle-bus commuting by installing bicycle lockers at Wahiawa Transit Center.
- Convert unsignalized pedestrian crossings to “Z-crossings” and protect them with raised medians.
- Make improvements to the pedestrian environment at the intersection of California Avenue and Kamehameha Highway:
 - Remove the right-turn lane from California Avenue to Kamehameha Highway, and instead direct right turning traffic on to Maalo Street;
 - Improve the pedestrian sidewalk zone and reduce crossing distances by extending curbs and relocating utilities; and,
 - Eliminate the right-turn lane from Kamehameha Highway to California Avenue; convert one existing through-lane to a shared right/through-lane.
- Enhance walkability by closing or narrowing driveways at multiple locations.
- Install roundabouts at California Avenue and Lehua Street, and at California Avenue and North Cane Street to facilitate traffic flow while calming vehicle speeds.



COST BREAKDOWN

Total: \$7,474,292.14

Design: \$423,073.14

Construction: \$7,051,219.00

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Part One: Introduction, Study Area, & Need for Project

WHAT ARE COMPLETE STREETS?

Complete Streets is a transportation policy and design approach. It aims to create a comprehensive, integrated network of streets that are safe and convenient for all people, whether traveling by foot, bicycle, transit, or automobile, and regardless of age or ability. Complete Streets moves away from streets designed with a singular focus on automobiles towards a design approach that is context-sensitive, multi-modal, and integrated with the community's vision and sense of place. The end result is a road network that provides safe travel, promotes public health, and creates stronger communities.

Implementing Complete Streets requires integrating transportation with community planning. Changes are brought about by transforming the built environment. Engineers, planners, architects, landscape architects, and urban design professionals work along with health providers, business leaders, elected officials, community organizations, and residents to promote Complete Streets implementation. Actively engaged community members in Complete Streets are important participants and stakeholders. They help to ensure that efforts are relevant to the community's use, values, and priorities for the neighborhood.

The State of Hawaii adopted Complete Streets in 2009 and required each County to follow suit. In May 2012, the Honolulu City Council adopted a "Complete Streets" policy and passed Ordinance 12-15. The City and County of Honolulu is now taking aggressive steps to implement Complete Streets by updating policies, applying guidelines during maintenance and paving projects, and designing projects in specific locations. The City and County of Honolulu selected fourteen sites across the island of Oahu for in-depth study to illustrate how Complete Streets can be applied in specific locations. This report describes one of the selected sites and presents recommendations to implement Complete Streets at that location.

STUDY AREA

Wahiawa was founded in 1898 and is located 22 miles northwest of downtown Honolulu. It is situated on the 1,000-foot high Leilehua Plateau between the two forks of the Kaukonahua Stream. It is a commercial center for nearby communities and military installations and is home to a major transit center and park and ride. Access to the town is through one of two bridges on Kamehameha Highway (State Rte. 80). The town used to be entirely surrounded by military bases and agricultural fields, but development is making its way up from the increasingly urbanized southern portion of the central plain. The nearby military facilities include Schofield Barracks, Wheeler Army Airfield, and East Range, an Army training area. Schofield Barracks alone is larger than Wahiawa.

California Avenue is the central focus of this project. It anchors a robust urban grid stretching about 3.5 miles east to west, and at its widest point, about 2/3 miles north to south. In its core, blocks are rectangular. They average about 275 feet long east to west and about 600 feet long north to south. These block sizes, combined with many important destinations and segments of continuous building façade,

create the bones of a walkable street. Properly handled, it could return to its former status as a vibrant commercial street anchoring the community of Wahiawa Town.

This Complete Streets study project extends along the portion of California Avenue from North Cane Street to Kamehameha Highway, the heart of Wahiawa’s commercial core.

Figure 1 Study Area



NEED FOR PROJECT

This location was selected for Complete Streets treatment because of its strong potential to become a great walkable corridor. It has many commercial destinations at its east end, institutions and public facilities to the west, and is surrounded by residences to the north and south. California Avenue is also the backbone of Wahiawa’s traffic network, creating a 3.6 mile-long axis for the community. As a result, it carries a heavy traffic load. In keeping with the prevailing philosophy of the second half of the 20th century, California Avenue was incrementally converted to an auto-oriented street over time. Both vehicular speeds and pedestrian crossing distances have increased as a result, and a once high-quality walking environment, has deteriorated.



Multi-lane intersections and large corner radii create an uncomfortable pedestrian crossing environment at most California Avenue intersections.



Signalized mid-block crossing and bike lane west of North Cane Street.

EXISTING LAND USE, TRANSPORTATION FACILITIES, AND USAGE PATTERNS

Land Use, Transportation Facilities and Traffic Accidents

California Avenue is classified as a minor arterial. It interconnects with the urban arterial system. It handles both local traffic headed for the many destinations along its length, and regional traffic headed to points such as the North Shore, downtown Honolulu, Waikiki, and Ala Moana Shopping Center. It is 64 feet wide, curb to curb, generally consisting of four ten-foot wide lanes, eight-foot wide parking lanes on each side, and a four-foot wide striped bike lane between the parking and travel lanes (see Figure 2). Sidewalks are concrete and seven to eight feet wide, with utility constrictions on the north side. There are 20 driveways on the south side of California Avenue leading to private business lots. There are seven business driveways on the north side of California Avenue. The road carries approximately 18,300 cars a day and is posted with a 25 mph speed limit.

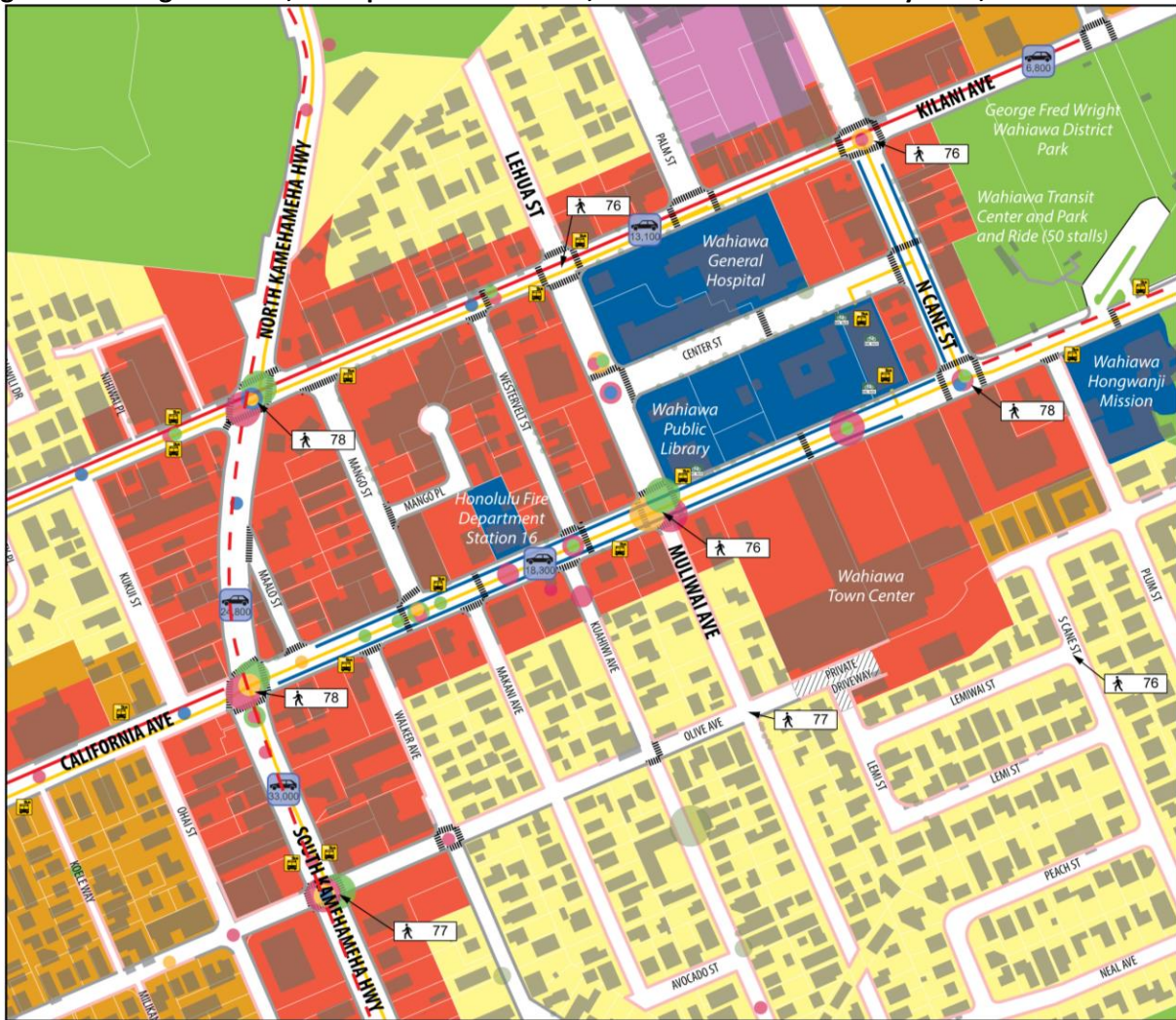
The accident history is moderate based on the records from 2007 to 2014. As might be expected, the accident rate increases near Kamehameha Highway, with almost half of the project area accidents occurring at or near its intersection with California Avenue. One quarter (20 total) of the incidents involved pedestrians; 11 involved motorcycles and mopeds. Only one involved a bicyclist, likely due to the low cycling volume. This low volume may be attributed to the fact that there are lower volume and lower speed alternate routes for biking along Olive and Kilani Avenues.

Figure 2 depicts existing land uses, transportation facilities, and traffic accident data within the study area. The land uses immediately adjacent to California Avenue are mostly commercial. Some institutional uses exist along the block east of Muliwai Avenue. Wahiawa District Park is located at the eastern terminus of the project, and the Wahiawa Hongwanji Mission and Hoala School are tucked into a corner of the park on the south side of California Avenue. The Wahiawa Transit Center is an important hub for route-to-route transfers and access to destinations across the island. Many pedestrian trips originate or end there.



Wahiawa Transit Center and Park & Ride is a major pedestrian trip generator.

Figure 2 Existing Land Use, Transportation Facilities, and Accidents in the Study Area, East End



0' 100' 200' 300' 400' NORTH

Source: City and County of Honolulu, Department of Planning & Permitting, Honolulu Land; *www.walkscore.com



California Ave from Kamehameha Hwy to N. Kane St

Bicycle Facilities

Existing=Solid, Proposed=dashed

- Lane
- Path
- Route
- Bicycle Racks

Transit Facilities

- Bus Route
- Bus Stop

Walk Scores

- Walk Score

Traffic Accidents

- 1 crash
- 2 crashes
- 3-9 crashes
- 10+ crashes

- = Car/Truck,
- = Motorcycle/Moped,
- = Bicyclist,
- = Pedestrian

Traffic Counts

- Average Daily Traffic

Street Trees

- Canopy Diameter

Existing Land Use

- Apartment
- Business
- Industrial
- Institutional
- Park/Open Space
- Residential

Pedestrian Facilities

- No Sidewalk
- Sidewalk
- Crosswalk

Usage Patterns

Table 1 describes existing usage patterns by pedestrians, bicyclists, vehicles, and transit users in the study area. Pedestrian traffic is moderate and bike traffic is minimal.

There are 13 bus stops along California Avenue in the project area, an additional five on Kamehameha Highway, and seven on Kilani Avenue. Collectively, they serve six bus routes, with destinations to downtown Honolulu, the North Shore, Pearl Harbor and Schofield Barracks. The average daily ridership in 2012 was 4,234.

Table 1 Existing Usage Patterns along California Avenue

Pedestrian Use	Moderate
Bicycle Use	Low
Transit Use: Average Daily Boardings + Alightings (Source: <i>Global Stop Summary by Trip</i> , TheBus, 2012)	<p><u>Stops</u></p> <p>Kamehameha Hwy + Avocado St: 129 Average daily riders (ADR) Kamehameha Hwy + Olive Ave: 478 ADR California Ave + Walker Ave: 73 ADR California Ave + Muliwai Ave: 140 ADR California Ave + Plum St: 17 ADR California Ave + Ihoiho PI (Eastbound): 12 ADR California Ave + Ihoiho PI (Westbound): 10.5 ADR California Ave + Wahiawa District Park: 20 ADR California Ave + Lehua St: 37 ADR California Ave + Mango St: 57.5 ADR Kamehameha Hwy + Olive Ave: 317 ADR Kamehameha Hwy + Ohai St: 70 ADR Kamehameha Hwy + Kilani Ave: 70.5 ADR California Ave + Kukui St: 7.5 ADR California Ave + Cypress Ave (Westbound): 1 ADR Kilani Ave + Mala St (Eastbound): 0.5 ADR Kilani Ave + Kamehameha Hwy (Westbound): 11 ADR Kilani Ave + Kamehameha Hwy (Eastbound): 28.5 ADR Kilani Ave + Holoku PI: 1 ADR California Ave + Koele Way: 4.5 ADR Wahiawa Transit Center East: 422 ADR Wahiawa Transit Center West: 383 ADR Kilani Ave + Mango St: 31.5 ADR Kilani Ave + Lehua St (Eastbound): 12 ADR Kilani Ave + Lehua St (Westbound): 12.5 ADR</p> <p><u>Boardings and Alightings by Route</u></p> <p>Route 52: 1,621 ADR Route 62: 1,686 ADR Route 72: 463 ADR Route 83: 422 ADR Route PH3: 27 ADR</p>

HONOLULU COMPLETE STREETS PROJECT IMPLEMENTATION STUDY

	Route 88A: 16 ADR Total: 4,234 ADR
Daily Vehicular Volumes (Source: <i>Historical Traffic Station Maps, HDOT, 2008-2013</i>)	California Ave: between Mahele St and Kamehameha Hwy (2008) - 3,100 vehicles California Ave: Lei Awapuhi Pl to Kaliponi St (2011) - 3,100 vehicles California Ave: Makani Ave to Kuahiwi Ave (2013) - 18,300 vehicles Kamehameha Hwy: between California Ave and Maalo St (2013) - 24,800 vehicles Kamehameha Hwy: between Olive St and California Ave at H Market (2010) - 33,000 vehicles Kilani Ave: between Imaka Pl and Anoni St (2008) - 700 vehicles Kilani Ave: between Kaliponi St and Kamehameha Hwy (2008) - 2,600 vehicles Kilani Ave: Koa St to Kellog St (2013) - 6,900 vehicles Kilani Ave: Lehua St to Palm St (2013) - 13,100 vehicles Wilikina Dr: between Lake View Cir and off-ramp to Kamehameha Hwy (2012) - 50,900 vehicles
Peak Periods (Source: <i>Historical Traffic Station Maps, HDOT, 2012</i>)	California Ave: between Mahele St and Kamehameha Hwy - 7:00-8:00 AM, 4:15-5:15 PM California Ave: Lei Awapuhi Pl to Kaliponi St - 7:00-8:00 AM, 3:15-4:15 PM California Ave: Makani Ave to Kuahiwi Ave - 7:30-8:30 AM, 4:15-5:15 PM Kamehameha Hwy: between California Ave and Maalo St - 5:00-6:00 AM, 4:00-5:00 PM Kamehameha Hwy: between Olive Ave and California Ave at H Market - 7:00-8:00 AM, 5:00-6:00 PM Kilani Ave: between Imaka Pl and Anoni St - 7:00-8:00 AM, 4:15-5:15 PM Kilani Ave: between Kaliponi St and Kamehameha Hwy - 7:15-8:15 AM, 4:15-5:15 PM Kilani Ave: Koa St to Kellog St - 7:15-8:15 AM, 4:15-5:15 PM Kilani Ave: Lehua St to Palm St - 7:15-8:15 AM, 3:00-4:00 PM Wilikina Dr: between Lake View Cir and off-ramp to Kamehameha Hwy - 5:15-6:15 AM, 4:45-5:45 PM
Accident History (Source: <i>State of Hawaii Motor Vehicle Accident Reports, 2011-2014</i>)	California Ave: between Lehua St/Muliwai Ave and North Cane St - seven car/truck accidents, one motorcycle/moped accident, two pedestrian accidents California Ave: between Mango St and Kuahiwi Ave - two car/truck accidents California Ave and Lehua St/Muliwai Ave: four car/truck accidents, three motorcycle/moped accidents, three pedestrian accidents California Ave and Maalo St: one motorcycle/moped accident California Ave and Mango St: three car/truck accidents, one motorcycle/moped accident, four pedestrian accidents California Ave and North Cane St: four car/truck accidents, one bicyclist accident California Ave and Walker Ave: one pedestrian accident California Ave and Westervelt St: two car/truck accidents, one pedestrian accident Kamehameha Hwy and California Ave: eight car/truck accidents, two motorcycle/moped accidents, five pedestrian accidents California Ave and Kamehameha Hwy Intersection: 17 car/truck accidents, two motorcycle/moped accident, one pedestrian accident California Ave and Plum St: four car/truck accidents, two pedestrian accidents California Ave: between Kamehameha Hwy and Walker Ave - three car/truck accidents, one motorcycle/moped accident California Ave: between Muliwai Ave and Kuahiwi Ave - two car/truck accidents California Ave: between Walker Ave and Makani Ave - five car/truck accidents, one pedestrian accident

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Part Two: Field Work and Key Findings



A walking audit brought together 24 community stakeholders and participants from the City and County of Honolulu, State agencies, and the Hawaii Bicycling League.

STAKEHOLDER INPUT

The findings of this report are comprised of input received from participants in a walking audit conducted on January 20, 2015. The walking audit took place along California Avenue within the project limits. Local stakeholder participation for the audit included Heidi Tsuneyoshi representing Honolulu City Council Member Ernest Martin, David Cho representing Senator Donovan Dela Cruz, Wahiawa resident Alesia Au, and Dan Alexander of the Highway Bicycling League. Representing SSFM International, Inc. was Alan Fujimori and Michael Motoki; consultants were Dan Burden and Samantha Thomas of Blue Zones, and Gary Toth of Gary Toth Consulting. Others participants included:

- City and County of Honolulu, Department of Transportation Services (DTS): Mark Garrity, Kelly Cruz, Layden Akasaki, Shawn Butler, Ezra Kao, Jay Egusa, Lorine Jaena, Randall Kurashige, Yamato Milner and Paul Texeira; and,
- Hawaii State Department of Health (DOH): Heidi Hansen-Smith.

Findings are discussed in the following section.

FINDINGS

This section summarizes key findings based on observations made by the consultant team with input from Department of Transportation Services staff, State agency staff, and local stakeholders.

Finding: The width and alignment of California Avenue encourages speeding.

California Avenue is a straight away with 64 feet wide curb to curb. This design encourages motorists to drive at speeds higher than the posted 25 mph speed limit. Local stakeholders verified that vehicular speeds on California Avenue are too high for the comfort of most bicyclists and pedestrians. One resident advised that speeding is particularly problematic in the westbound direction in the morning, with commuters heading towards Kamehameha Highway. It is also prevalent in the eastbound direction when motorists are heading to the many schools at the east end of Wahiawa. Another resident who drives the road frequently expressed that he didn't realize that so many people were walking along the street, since he is driving fast and his vision is focused on the road. A number of the audit participants noted how much more comfortable they felt walking along Kilani Avenue, which is more narrow and has slower vehicular speeds.



The wide and straight cross section of California Avenue induces drivers to speed and to focus on the road instead of pedestrians.

Finding: Corner radii along California Avenue are large, encouraging higher-speed turns, and creating long crossing distances for pedestrians.

Residential street crossings along California Avenue are very long due to large corner radii. Both California Avenue and North Cane Street are wide streets with wide corner radii. These features encourage speeding through the intersection and create large pedestrian crossing distances. In the photo to the right, the sweeping corner radius creates a crossing distance of 76 feet, whereas intersecting the curb at 90 degrees would reduce the crossing distance to 60 feet.



Project team member Gary Toth standing where the curb lines would intersect if the corner radius was zero.

Finding: The seating and bicycle storage at the Wahiawa Transit Center could be upgraded.

Seating at transit stations is needed to accommodate elderly and disabled passengers. This becomes particularly important when transit service is less frequent. Although the Wahiawa Transit Center is a major transit hub, some individual routes have headways of roughly an hour during non-peak hours, which results in increased passenger waiting times. As shown in the photo below, existing seating is inadequately sized and too closely spaced to allow full occupancy of seats. Partial occupancy by a person sitting or by their belongings in the next seat may preclude others from sitting even though additional people may wish to sit. Seat perches and lean bars may provide some comfort for waiting passengers in locations where full-size seating is not possible.



While seating at the Wahiawa Transit Center is ample, it requires customers to sit on closely spaced concrete ovals with no back support.

Bicycle parking at the Wahiawa Transit Center is inadequate. As a park and ride location, Wahiawa Transit Center provides more than 50 vehicle parking stalls, but only six bicycle rack spaces, and no long-term bicycle storage. Long-term bicycle storage facilities such as lockers protect bicycles from theft, vandalism, and inclement weather. Bicycle parking allows people to use their bicycle to access regional transit routes. Fees and time limits can be imposed on long-term bicycle storage.

Finding: On-street parking is underutilized on California Avenue.

On-street parking on California Avenue is underutilized during most of the day. This is likely due to the presence of ample off-street parking. The plentiful off-street parking opens up an opportunity to reallocate street space to bicycle and pedestrian use.



There are many open parking stalls along California Avenue.

Finding: Narrow bike lanes discourage bicycle use.



One of the few bicyclists observed during the field audit.

Given the narrow bike lanes coupled with high vehicle volumes and speeds along California Avenue, only experienced cyclists share the road with motorists. Many cyclists choose to use the sidewalk. As a major direct route, California Avenue should have protected bicycle facilities. Given the low usage of on-street parking, a case can be made for allocating space for this.

Finding: Many of the driveways serving the commercial businesses along California Avenue are overbuilt.

The wide driveways along California Avenue allow motorists to enter and exit quickly, but they also expose pedestrians to potential crashes for longer periods of time than narrow driveways. During the walk audit, a participant reported that she was struck by a car in the driveway of the Wahiawa Foodland parking lot, which measures 60 feet wide. Many of these driveways can be significantly narrowed to increase safety while still meeting acceptable standards.



Wide driveways increase conflicts for all users (including drivers) and cut across the sidewalk zone.

Finding: The left turns on California Avenue, whether they be into driveways or at intersections, cause queuing and lane changing, even during the off-peak hours.

The frequent left turns from the inner of the two through-lanes on California Avenue significantly erode the roadway's through capacity. The frequent lane changing, accelerating and decelerating to get in and out of driveways increases the likelihood of crashes and reduces attention paid to pedestrians.

Part Three: Recommended Application of Complete Streets Concepts

This section describes the recommended application of Complete Streets concepts for California Avenue in Wahiawa. It includes a written description of recommendations accompanied by illustrative drawings. The Complete Streets principles incorporated are:

- Encourage multiple modes of transportation, particularly walking and biking,
- Promote safety for all modes of transportation,
- Adjust the design speed of the road to match and reinforce the posted speed limit of 25 mph,
- Promote safer street crossings, and
- Strengthen the sense of arrival.

COMPLETE STREETS RECOMMENDATIONS

Conceptual Illustrations of Recommendations

The primary recommendations narrow the road with a road diet and would add 5' bike lanes in both directions. They would also reduce pedestrian crossing width. Figures 3 through 5 provide an overview of the proposed changes to California Avenue within the study area.

Drawings of the proposed changes are presented for three sections of California Avenue:

- From Kamehameha Highway to Makani Avenue (Figure 3)
- From Makani Avenue to just east of Lehua Street (Figure 4)
- From just east of Lehua Street to Plum Street (Figure 5)

These recommended changes are described in the following section and summarized in Table 2.

Description of Recommendations

The recommendations for California Avenue are described below and shown on Figures 3 through 5. Table 2 is a summary list of all recommendations, the before and after effect.

A) Implement a road diet, transitioning street from four to three vehicle lanes

- Between Walker Avenue and North Cane Street, reduce California Avenue from two through-lanes in each direction to one 10 foot wide through-lane in each direction with a 10 foot wide center-turn lane. Remaining roadway width (32 feet) should be allocated to inset on-street parking (see Recommendation F) and on-street bicycle facilities (see Recommendation B).
- Beginning at the crosswalk east of North Cane Street, reduce California Avenue from 4 to 2 lanes.

B) Improve bicycle facilities

- Create a buffered bike lane with 5 foot travelway and a 3 foot buffer on both sides of the street beginning east of Walker Avenue.
- Pigment bicycle lanes with green paint at intersections, high-conflict driveways, or for the entire length of the corridor (use green as per MUTCD).

- Paint a bike box on the westbound approach of California Avenue at its intersection with Kamehameha Highway to facilitate southbound turns on to Kamehameha Highway.
- Put sharrow markings on Maalo Street to facilitate northbound turns onto Kamehameha Highway.
- Work with the State Department of Transportation (DOT) to improve bike facilities on Kamehameha Highway.
- Connect to existing bike facilities on North Cane Street.
- Install bike lockers at Wahiawa Transit Center/Park and Ride to improve connectivity for bicycle-bus commuters.
- Install bike corrals in underutilized parking stalls and where adjacent to supportive land-uses.



Buffered bike lane.

Source: http://nacto.org/wp-content/gallery/bufferedlane_3d/buffered-bike-lane_3d_0.jpg

C) Reconfigure Kamehameha Highway and Maalo Street intersections

- Eliminate right turn lane on California Avenue westbound to Kamehameha Highway northbound. Create a “wrap-around curb extension” that starts on Maalo Street, wraps around onto California Avenue (occupying the space of the existing right-turn lane), and extends into Kamehameha Highway. This will alleviate the constricted pedestrian space on the corners of Kamehameha Highway and California Avenue.
- Install signage that directs drivers to use Maalo Street to turn right onto Kamehameha Highway.
- Reduce entrance width to Maalo Street using curb extensions to slow turning movements.
- Create curb extensions at the remaining corners of Kamehameha Highway and California Avenue as shown in Figure 3 to reduce pedestrian crossing distances and to create a more intuitive crossing point. Relocate traffic signals and utilities into the newly created furniture zone of the curb extension instead of the pedestrian zone.
- Combine the rightmost through-lane and the right-turn lane on the northbound approach of Kamehameha Highway.
- Realign the crosswalk on the northbound side of Kamehameha Highway intersection to be perpendicular.

D) Enhance pedestrian crossings

- Convert the pedestrian crossings at the intersections of California Avenue and Mango Street, Makani Avenue, Westervelt Street to a “Z-crossing.”
- Construct raised crossing islands within the center lane at unsignalized pedestrian crossings to protect pedestrians and reduce the effective crossing distances.
Remove the existing traffic signal at the midblock crossing between North Cane Street and Lehua Street, and convert to a “Z-crossing”.
- Install one ADA compliant curb ramp per crosswalk rather than a single ramp at the apex of the curve.

E) Reduce impact of driveways on walkability

- Enhance walkability by closing or narrowing driveways as shown on the concept plans (Figures 3, 4, and 5).
- Enhance walkability by closing the easternmost driveway at the strip mall just west of Mango Street (on the eastbound side of California Avenue). Create alternative access at Walker Avenue around the back of the building as show in Figure 3.

F) Inset on-street parking

- Retain on-street parking where shown on the concept plans (Figures 3, 4, and 5).
- Designate at least one ADA compliant stall per block in each direction.
- Inset on-street parking using curb extensions to increase sight distances and to enforce proper parking practices. Remove on-street parking on eastbound direction from Kamehameha Highway to Walker Avenue.

G) Install traffic calming measures

- Construct a single lane roundabout at the intersection of North Cane Street and California Avenue, and at Lehua Street and California Avenue. The concept design figures depict roundabouts with approximate inscribed diameters of 90 feet. This will necessitate moving the crosswalks about 25 to 30 feet back of the sidewalk path (currently they are 9 to 10 feet back). To better align the crosswalks, a smaller roundabout reduced in size to a mini-roundabout could be constructed; size to be determined during design to best balance influence on vehicles, as well as crosswalk alignment.
- Reduce corner radii at the Walker Avenue intersection and California Avenue and extend the curb on northeastern corner to inset parking and provide a physical buffer between vehicle traffic and the new protected bike lane.
- Convert the intersection at Muliwai and California Avenues to a single lane roundabout as shown in Figure 4. Provide bike ramps to allow bicyclists to transition to sidewalk level. Install appropriate signage and pavement markings in the sidewalk areas surrounding the intersection to delineate proper travel paths for each mode.
- Create curb extensions at the Mango Street intersection with California Avenue. Provide a break in the curb extension for the protected bike lane. Where space and sight lines permit, install rain gardens in the curb extensions.

Table 2 Proposed Design Changes to California Avenue

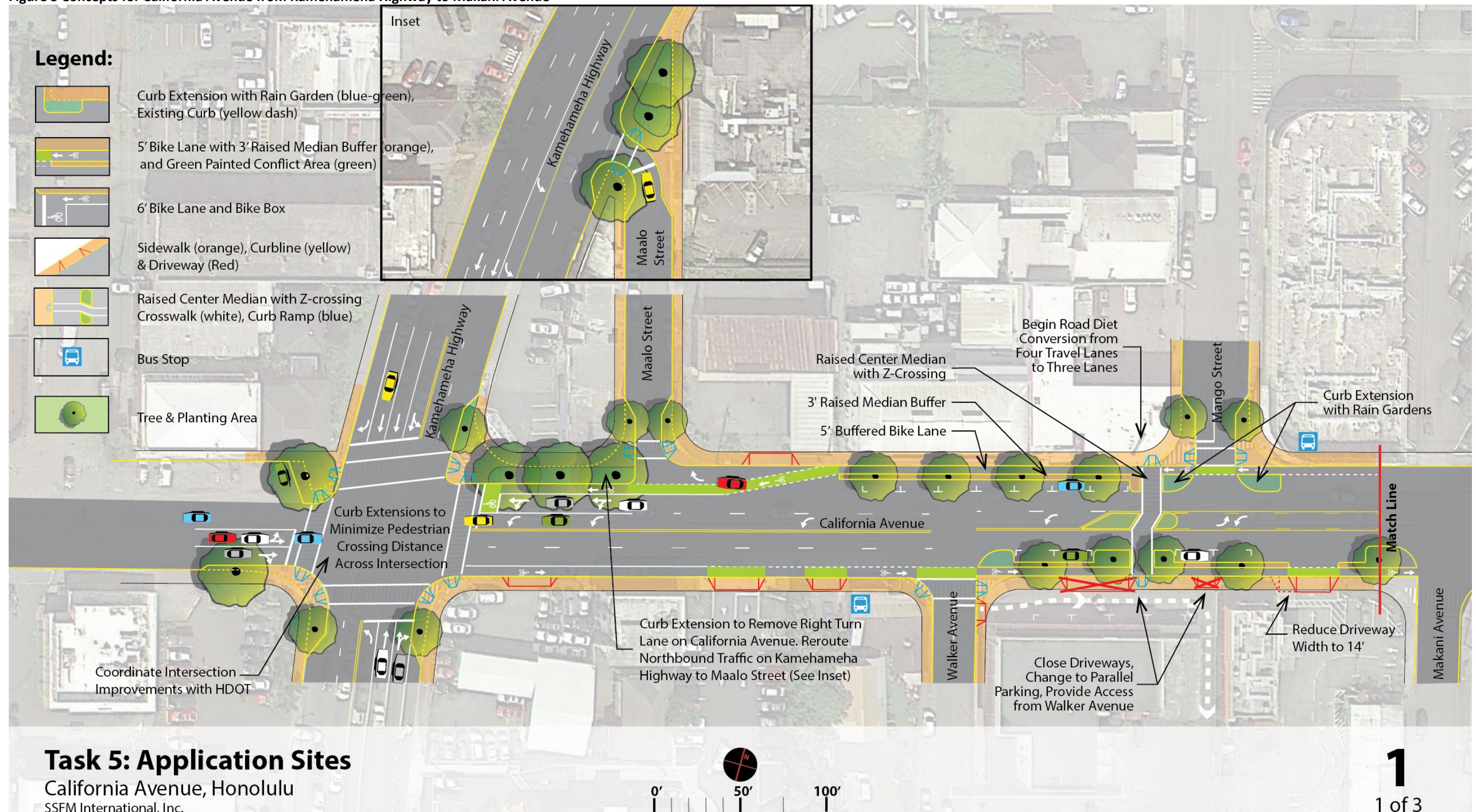
	CURRENT	AFTER RECOMMENDATIONS ARE IMPLEMENTED
Type of Facility	Urban Minor Arterial	Same.
Street Width	Kamehameha Hwy to North Cane St: ~64'	Same.
Speed Limit	25 mph on California Ave	Same.
Crosswalk Length (longest)	California Ave and Kamehameha Hwy (East Leg): 86'	California Ave and Kamehameha Hwy (North Leg): 62'.
Number of Lanes	Kamehameha Hwy to Maalo St: one 11' eastbound through-lane, one 21' eastbound through-lane, one 12' westbound right-turn lane, one 10' westbound through/left-turn lane, one 10' westbound left-turn lane. Maalo St to 130' south of North Cane St: two 10-11' eastbound through-lanes, one 4' eastbound bike lane, one 7.5-8.0' eastbound shoulder/parking lane, two 10-11' westbound through-lanes, one 4' westbound bike lane, one 7.5-8.0' westbound shoulder/parking lane. 130' south of North Cane St to North Cane St: one 11' eastbound left-turn lane, two 11' eastbound through-lanes, one 4' eastbound bike lane, one 7.5-8.0' eastbound shoulder/parking lane, two 11' westbound through lanes, one 4' westbound bike lane, one 7.5-8.0' westbound shoulder/parking lane	Kamehameha Hwy to Walker Ave: two 10' lanes in each direction, and 5' bike lanes in each direction. Walker Ave to North Cane St: one 10' through-lane in each direction with a 10' center-turn lane, 5' eastbound bike lane with 3' buffer, 5' westbound bike lane with 3' buffer, and 8' on-street parking on both sides of the street. East of North Cane St: one 10' through lane in each direction.
Distance to Side Streets	145' from Kamehameha Hwy to Maalo St, 183' from Maalo St to Walker Ave, 145' from Walker Ave to Mango St, 135' from Mango St to Makani Ave, 270' from Makani Ave to Kuahiwi Ave, 40' from Kuahiwi Ave to Westervelt St, 230' from Westervelt St to Lehua St, 830' from Lehua St to North Cane St, 245' from North Cane St to Plum St	Same.
Driveways	~20 driveways on the eastbound side of California Ave leading to business lots. 7 business driveways on the westbound side of California Ave.	Remove 4 driveways where shown in Figures 3 and 5.
Parking	1-hr on-street parking behind bike lane from Maalo St to North Cane Rd both sides of street; however, parking is prohibited in areas with bus stops, fire hydrants, and driveways.	Remove 5 on-street parking stalls in the eastbound direction from Kamehameha Highway to Walker Avenue.
Sidewalks	7-8' concrete sidewalks with multiple driveways on the eastbound side of California Ave. 7-8' on the westbound side of California Ave with utility constriction.	Same, except where curb extensions increase sidewalk width.

HONOLULU COMPLETE STREETS PROJECT IMPLEMENTATION STUDY

Transit Routes, Stops, Shelters	<p>25 bus stops in the project study area. 13 bus stops along California Ave, including two stops at the Wahiawa Transit Center. Seven stops along Kilani Ave. Five bus stops along Kamehameha Hwy.</p> <p>The Wahiawa Transit Center doubles as a Park and Ride with 50 stalls, including 3 ADA stalls, and three bike racks. The Wahiawa Transit Center is closed between 1:30 AM and 4:00 AM.</p>	Additional bike lockers at Wahiawa Transit Center.
Proximity to Future Rail	No direct access to the future rail.	Same.
Bicycle Features	<p>4' bike lanes on both sides of California Ave between Maalo St and North Cane Rd. Sharrows on California Ave south west of Kamehameha Hwy. Sharrows along Kilani Ave. One 5-stall bike rack located at the Wahiawa Public Library, and three 2-stall bike racks at the Wahiawa Transit Center.</p>	Protected bike lanes with 5' travelways and 3' buffers on both sides of the street.
Nearby Schools	Hoala School	Same.
Nearby Institutions	Wahiawa District Park and Recreation Center, Wahiawa Swimming Pool, Wahiawa Public Library, Wahiawa General Hospital, US Post Office, Honolulu Fire Department Station Number 16	Same.

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Figure 3 Concepts for California Avenue from Kamehameha Highway to Makani Avenue



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Figure 4 Concepts for California Avenue from Makani Avenue to just East of Lehua Street



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Figure 5 Concepts for California Avenue from just east of Lehua Street to Plum Street



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Part Four: Implementation

This section looks at the recommendations and sorts them according to how soon they can be implemented. Near-term actions are those that may be implemented immediately through incorporation into existing City paving, marking, or signage projects or maintenance funding. Mid-term actions are those that may require or warrant a longer planning horizon (one to five years) due to logistical, financial, or other considerations. Longer-term actions are those that may require or warrant an even longer planning horizon (five years and beyond).

Near-Term Actions (0-1 year):

A) Implement a road diet, transitioning street from four to three vehicle lanes

- Conduct a traffic study to study the traffic volumes and assess the possibility of converting the roadway to two-through lanes with one dedicated left-turn lane.
- Restripe the roadway to include one 10 foot lane per direction, a 10 foot center-turn lane, 5 foot wide bicycle lanes with 3 foot wide buffers, and 8 foot wide marked on-street parking beginning east of Walker Avenue.
- Reconfigure traffic signals to accommodate road diet at intersections.



Road diet with two ten foot wide travel lanes, a center-turn lane, two bike lanes and on-street parking in Kailua, Oahu.

B) Improve bicycle facilities

- In conjunction with Recommendation A, re-stripe the road to create a buffered bike lane with a 5 foot travelway and a 3 foot striped buffer on both sides of the street. Install appropriate bike signage and bike lane pavement markings (e.g., bike lane pavement wording and pavement symbols).
- Pigment bicycle lanes with green paint and dotted white line at intersections, high-conflict driveways, or for the entire length of the corridor (use green as per MUTCD).
- Paint a bike box on the westbound approach of California Avenue at its intersection with Kamehameha Highway to facilitate southbound turns on to Kamehameha Highway.
- Install sharrow markings on Maalo Street to facilitate northbound turns on to Kamehameha Highway.
- Install bike box on the eastbound approach of California Avenue at its intersection with North Cane Street to connect to existing bike facilities.



Bike box in Washington, DC.

C) Reconfigure Kamehameha Highway and Maalo Street intersections

- Close right-turn lane on California Avenue westbound to Kamehameha Highway northbound using bollards, planters, and striping.
- Install signage that directs drivers to use Maalo Street to make right-turns onto Kamehameha Highway.
- Reduce entrance width to Maalo Street using striping.

D) Enhance pedestrian crossings

- In conjunction with Recommendation A, restripe the pedestrian crossings at the intersections of California Avenue and Mango Street, Makani Avenue, Westervelt Street to a “Z-crossing” with advanced stop lines.
- Stripe crossing islands within the center lane at unsignalized pedestrian crossings.
- Install “Stop Here for Pedestrians State Law” signs (R1-5b and R1-9a).

E) Reduce impact of driveways on walkability

- Close or reduce width of driveways using striping and bollards where possible.

F) Inset on-street parking

- Use striping to inset on-street parking.

G) Install traffic calming measures

- Reduce corner radii at Walker Avenue intersection and California Avenue using striping and bollards.
- Reduce corner radii at the Mango Street intersection and California Avenue using striping and bollards.

Mid-Term Actions (1 to 5 years):

A) Implement a road diet, transitioning street from four to three vehicle lanes

- None.

B) Improve bicycle facilities

- Construct asphalt concrete (A/C) berms (or similar) in the 3 foot buffer space to provide physical vertical separation between bicyclist and vehicles.
- Connect to existing bike facilities on North Cane Street.
- Install bike lockers at Wahiawa Transit Center/Park and Ride to improve connectivity for bicycle-bus commuters.
- Install planters in the 3 foot buffer space.
- Install bike lockers at Wahiawa Transit Center/Park and Ride to improve connectivity for bicycle-bus commuters.
- Install bike corrals in underutilized parking stalls.

C) Reconfigure Kamehameha Highway and Maalo Street intersections

- Use A/C berms (or similar) to create a “wrap-around curb extension” that starts on Maalo Street, wraps around onto California Avenue (occupying the space of the existing right-turn lane), and extends into Kamehameha Highway.
- Reduce entrance width to Maalo Street using A/C berms (or similar) to extend the curb.
- Use A/C berms (or similar) to create curb extensions at the remaining corners of Kamehameha Highway and California Avenue as shown in Figure 3.
- Restripe the rightmost through-lane and the right-turn lane on the northbound approach of Kamehameha Highway into a combined right-through lane.
- Fill curb extensions with planters, or other street furnishings such as benches, public art, bike racks, news racks, etc.
- Realign and restripe the crosswalk on the northbound side of Kamehameha Highway intersection to be perpendicular. Provide a break in the A/C berms (or similar) to maintain ADA accessibility.

D) Enhance pedestrian crossings

- Use A/C berms (or similar) to construct raised crossing islands within the center lane at unsignalized pedestrian crossings.

E) Reduce impact of driveways on walkability

- None.

F) Inset on-street parking

- Use A/C berms (or similar) to extend curbs and inset on-street parking.

G) Install traffic calming measures

- Use A/C berms (or similar) to delineate a roundabout at the intersection of North Cane Street and California Avenue (as shown in Figure 5). Restripe roadway to accommodate new roundabout. Install bike ramps using A/C pavement to allow bicyclists to transition to sidewalk level. Install appropriate signage and pavement markings in the sidewalk areas surrounding the intersection to delineate proper travel paths for each mode.
- Use A/C berms (or similar) to delineate a roundabout at the intersection at Lehua Street and California Avenues (as shown in Figure 4). Install bike ramps using A/C pavement to allow bicyclists to transition to sidewalk level. Install appropriate signage and pavement markings in the sidewalk areas surrounding the intersection to delineate proper travel paths for each mode.
- Use A/C berms (or similar) to reduce corner radii at Walker Avenue intersection and California Avenue and extend the curb on northeastern corner to inset parking and provide a physical buffer between vehicle traffic and the new protected bike lane.
- Use A/C berms (or similar) to create curb extensions at the Mango Street intersection with California Avenue. Provide a break in the curb extension for the protected bike lane.



Single lane roundabout in Laie, Oahu.

Longer-Term Actions (5 years and beyond):

A) Implement a road diet, transitioning street from four to three vehicle lanes

- Redesign and repave roadway to accommodate roundabouts (see Recommendation G) and rain gardens (see Recommendation C and G).

B) Improve bicycle facilities

- Construct a 3 foot raised concrete median in place of the A/C berm and pavement striping. Connect to future curb extensions.



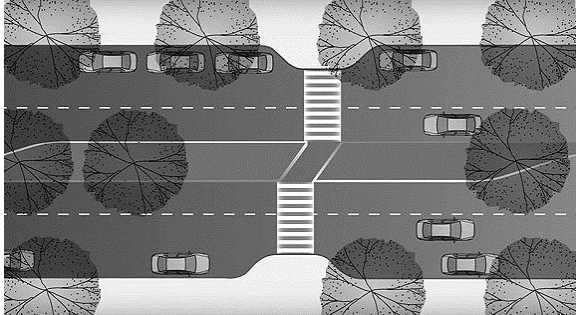
Raised median buffer with green painted pavement in conflict zones in Washington County, OR.

C) Reconfigure Kamehameha Highway and Maalo Street intersections

- Construct concrete curb extensions that are flush with the existing sidewalk at corners of the Kamehameha Highway and California Avenue intersection. Include one ADA compliant curb ramp per crosswalk (see Recommendation D).
- Relocate traffic signals and utilities into the newly created furniture zone of the curb extension instead of the pedestrian zone.
- Space permitting, install rain gardens in the new curb extensions.

D) Enhance pedestrian crossings

- Construct raised concrete crossing islands within the center lane at unsignalized pedestrian crossings. Provide space for landscaping and install additional street lighting at the crosswalk.
- Remove existing traffic signal at the midblock crossing between North Cane Street and Lehua Street, and convert to a “Z-crossing” with raised a concrete crossing island.
- Install one ADA compliant curb ramp per crosswalk rather than a single ramp at the apex of the curve at the intersection of Kamehameha Highway and California Avenue. Fill existing curb ramps so that the pedestrian area is flush.



Z-crossings force pedestrians to turn and face oncoming traffic, increasing visibility between pedestrians and motorists. Source (left): <http://www.ite.org/CSS/online/DWUT09.html>

E) Reduce impact of driveways on walkability

- Enhance walkability by closing the easternmost driveway at the strip mall just west of Mango Street (on the eastbound side of California Avenue). Create an alternative access at Walker Avenue around the back of the building as show in Figure 3.

F) Reconstruct driveway areas so that they are complete removed or appropriately sized and flush with the existing sidewalk. Inset on-street parking

- None.

G) Install traffic calming measures

- Reconstruct the roadway to accommodate roundabouts at the intersections of North Cane Street and California Avenue, and Lehua Street and California Avenue.
- Reconstruct A/C berm (or similar) curb extensions throughout the project area using concrete curb extension and including space for rain gardens.

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Part Five: Cost Sheet

<i>ITEM</i>	<i>UNIT</i>	<i>QUANTITY</i>	<i>UNIT COST</i>	<i>TOTAL COST</i>
Removals/Demo				
Remove existing traffic signal	each	2	\$ 100,000.00	\$ 200,000.00
Demolish existing sidewalk	Sq. Ft.	16675	\$ 5.00	\$ 83,375.00
Demolish existing Pavement	Sq. Ft.	28867	\$ 8.00	\$ 230,936.00
Erosion Control	L.S.	1	\$ 10,000.00	\$ 10,000.00
Site improvements				
Roadway				
Mill and Overlay existing AC pavement	Sq. Ft.	135428	\$ 6.00	\$ 812,568.00
Curb Gutter and Sidewalk	Sq. Ft.	14181	\$ 20.00	\$ 283,620.00
Drainage works		9	\$ 14,000.00	\$ 126,000.00
Raised Median	Sq. Ft.	5815	\$ 20.00	\$ 116,300.00
4" Stripe (white/Yellow)	Lin. Ft.	10231	\$ 6.00	\$ 61,386.00
12"stripe (white)	Lin. Ft.	1350	\$ 9.00	\$ 12,150.00
5' Bike lane (Green)	Sq. Ft.	5050	\$ 9.00	\$ 45,450.00
Striping Symbols	each	56	\$ 300.00	\$ 16,800.00
Intersection				
Full Single Lane Roundabout	each	2	\$ 1,300,000.00	\$ 2,600,000.00
includes sidewalk, roadway, striping and lighting				\$ -
Traffic Signal Modification	each	1	\$ 350,000.00	\$ 350,000.00
Landscaping				
Trees	each	88	\$ 1,000.00	\$ 88,000.00
Misc.				
Traffic Control	L.S.	1	5%	\$ 251,829.25
Mobilization	L.S.	1	10%	\$ 503,658.50
Contingency - 25%			25%	\$ 1,259,146.25
Design				
Design Cost			6%	\$ 423,073.14
TOTAL CONSTRUCTION				\$ 7,051,219.00
TOTAL COST				\$ 7,474,292.14