

## **AIRPORT LANDSIDE AND OFF-AIRPORT INTERACTION**

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Traditionally, airport planning efforts have been directed toward developing operational and economic efficiency within the airport landside and airside. Recently, these efforts have recognized the importance of maintaining equilibrium between the airside and the landside. This paper expands the scope of airport planning by focusing attention on off-airport activities that interact with the airport landside. The material presented assesses the relations between landside functions and off-airport activities. The activities relevant to the landside and off-airport interaction are identified, and the demand for and supply of off-airport activities are reviewed with emphasis on consumption and production. Findings and recommendations for alternative approaches for balancing the airport landside and off-airport capabilities are presented.

### **OFF-AIRPORT ACTIVITIES**

Off-airport activities that influence airport landside functions are airport access, remote vehicle parking, and off-airport passenger processing.

#### Airport Access

The term "airport access" refers to that portion of the overall airport trip that is accomplished on the local and regional transportation system outside of the airport boundary. This access is predominantly on surface transport facilities; few major airports offer access by air.

Airport access is important for several reasons. All other things remaining the same, the level of accessibility measured by both time and distance is a critical determinant of how much an

airport is used. The higher the level of access offered by an airport is, the stronger will be its attracting power to travelers. Most airport operators try to improve access to their airport. Each incremental improvement in access facilities provides the airport with a comparative advantage, which strengthens the basis for soliciting new passenger patronage, airline service, and airport-related industries.

Another reason why access is important is its impact on the traveler's decision process in selecting a mode of travel for the main portion of the journey. Although access is not a major factor in selecting medium- and long-haul travel modes, it is a significant consideration in short-haul markets where substitute transportation is available. In the short-haul market [less than 500 miles (805 km)], the traveler is acutely aware of total trip time and the time required for airport access and egress. Increases in access and egress travel times, due to either congestion or remoteness of distant airports, negate the speed benefit of air transportation and cause travelers to shift to surface transportation modes.

Perhaps the most widely publicized reason for the importance of airport accessibility is its effect on airline operations and passenger convenience. An example of the interdependence of off-airport and landside activities is the experience at San Francisco (International) Airport during the pre-Christmas days of 1974. The demand on access and parking facilities during this peak period exceeded the capacity to such an extent that freeway congestion and parking delays resulted in many 100 percent booked flights leaving the airport with near 50 percent loads. The situation was then further complicated by the stranded passengers in a congested terminal facility.

### Remote Vehicle Parking

The storage of private automobiles at metropolitan airports after capacity limitations have been reached is a problem to the operators. Those seeking a parking place are forced to recirculate or double park along airport terminal frontage. Recirculation reduces the roadway capacity and results in delay.

Off-airport parking is one solution to such congestion, but usually has mixed results. Drivers hesitate to use off-airport parking facilities in the hope of securing close-in parking. If they cannot find close-in parking, they will return to the off-airport facility and in the process consume valuable internal roadway capacity (both inbound and outbound).

The parking capacity of airports has a direct effect on air quality in metropolitan areas. For example, vehicles entering and leaving Los Angeles (International) Airport emitted 11,280 tons (10 233 Mg) of air pollutants in 1970, an estimated 25 percent of the 44,530 tons (40 397 Mg) emitted by all sources within the airport boundary, including aircraft (2). Repeated circling and searching for parking have a significant effect on automobile emission pollution levels.

The interrelation between parking facilities and air quality may be further defined in the desire of the Environmental Protection Agency to establish parking control plans at large parking facilities. If current (1975) plans are implemented, further expansion of landside parking facilities by airport operators will be constrained, thus reducing the airport's overall landside capacity.

### Off-Airport Passenger Processing

Off-airport passenger processing is the process in which ticketing and baggage checking are completed at a remote terminal and the passenger is delivered to an airport for direct boarding of the aircraft. The downtown terminal concept relies on the concentration of predominantly business air travelers in the central business district (CBD) to generate sufficient demand for this service.

The issue of off-airport passenger processing was considered by the Aviation Advisory Committee in its 1973 report (3), but was not conclusively endorsed except for the recommendation that existing large multipurpose airports be evaluated to determine

the benefits resulting from remote terminal operations. The Regional Airport System Plan adopted by the Southern California Association of Governments (4) acknowledged 2 forms of remote passenger processing as capable of partially alleviating ground access capacity problems. One form requires the establishment of remote terminals in peripheral parking lots that are served by a vehicular intra-airport circulation system. The second requires remote terminals at key points in the region where passenger origins and destinations are concentrated. An adopted policy of the plan is that "phased development of remote terminals should be implemented throughout the region, coinciding with incremental increases in the number of passengers at major airline airports." Although this policy statement sets forth the nature of remote terminal development, the impact of such development on landside and airside activities and procedures remains to be fully understood.

## DEMAND AND SUPPLY OF OFF-AIRPORT SERVICES

### Airport Access

The airport population may be categorized into 4 groups:

1. Air passengers who make trips into and out of the airport;
2. Visitors who are friends and relatives of air travelers and accompany them to and from the airport;
3. Airport employees who commute daily to airport-related employment; and
4. Casual visitors who come to the airport for business, trip information, shopping, or sightseeing.

The proportion each group is of the total airport population on a typical weekday is significant because the demand for airport access and certain landside facilities (parking, curb space) is a function of these proportions. The relative mix of user groups for San Francisco (International), Oakland (International), and San Jose (Municipal) airports is given in Table 1; air passengers account for nearly 50 percent of the airport population.

The demand for airport accessibility can be evaluated by the number of trips each group makes, vehicle occupancy factors, peaking patterns, and other exogenous factors. For example, many air passengers make only 1 person trip to or from the airport for each flight, but air-passenger-related visitors make a minimum of 2 person trips.

Table 1 also gives the distribution of person trips for the user groups for each airport. Although air passengers account for almost 50 percent of the airport population, they generate only 25 percent of the person trips. Data given in Table 1 compare well with those from a 1969 survey of 13 domestic airports (5) wherein air passengers made 26 percent of the daily person trips, all visitors made 45 percent, and employees made 29 percent.

Of the 4 user groups, airport employees and air-passenger-related visitors generate

**Table 1. Estimated airport population and daily person trips to and from airports by group.**

Group	Airport Population (percent)			Daily Person Trips to and From Airports (percent)		
	San Francisco	Oakland	San Jose	San Francisco	Oakland	San Jose
Air passenger	40	41	42	25	26	26
Air-passenger-related visitor	24	45	46	31	56	58
Employee	26	11	10	32	14	13
Casual visitor	10	3	2	12	2	3

the greatest demand as measured by vehicle trips to and from the airport. Future efforts to improve airport access conditions should therefore focus on redirecting the demand by these user groups.

The supply of off-airport access facilities is a "complex multi-jurisdictional arrangement with wide variations from airport to airport" (6). The institutional complexities are given in Table 2 (6). The complexity of federal participation in capital funding programs relating to airport and off-airport access facilities is shown in Figure 1 and given in Table 3 (6). Capital improvement programs sponsored by FAA are limited to on-airport roadways, guideways, and walkways. Beyond the airport boundary, UMTA or FHWA or both assume responsibility for funding capital improvement projects designed to facilitate airport accessibility.

### Remote Vehicle Parking

The demand for off-airport remote parking is sometimes thought of as a spillover demand resulting from insufficient landside capacity. This premise was verified during a study for the San Francisco (International) Airport (7), where the most frequently voiced criticism of existing parking facilities is the nonavailability of short-term, conveniently located parking in the terminal area.

The demand for remote off-airport parking by employees is a function of exhausted landside capacity. Employees, however, are more willing to accept remote parking facilities for several reasons:

1. Uncertainty of shuttle bus schedules is less critical to most employees,
2. Adaptation required to successfully use remote parking quickly becomes routine to employees,
3. No feeling exists among employees of "second best" or lost opportunity due to nonavailability of close-in terminal area parking, and
4. Employees are not frustrated by luggage handling in automobile-to-shuttle bus transfer.

Vehicle storage is a third demander of off-airport parking facilities. Use of remote parking areas for this purpose differs from the previously described off-airport parking accommodations in that these facilities serve as a storage area or holding lot for rental cars that will subsequently be transferred to on-airport parking facilities. When these off-airport storage facilities are used as customer pickup and drop points, they are not normally perceived as remote off-airport parking.

**Table 2. Government entities involved in supplying airport access.**

Government	Technical Studies and Planning	Policy and Project Review	Capital Funding
<b>Federal</b>			
Congress	x	x	x
Department of Transportation	x	x	x
Federal Aviation Administration	x	x	x
Urban Mass Transportation Administration	x	x	x
Federal Highway Administration	x	x	x
Federal Railroad Administration	x	?	?
Environmental Protection Agency	x	x	
<b>State</b>			
Legislatures	x	x	x
Departments of transportation	x	x	x
Departments of the environment	x	x	
<b>Regional</b>			
Regional transportation planning commissions	x	x	
Areawide planning commissions	x	x	
Transit operators or districts	x	x	x
<b>Local</b>			
Cities or counties	x	x	x
Airport operators	x	x	x

Figure 1. Federal capital funding of airport and related facilities.

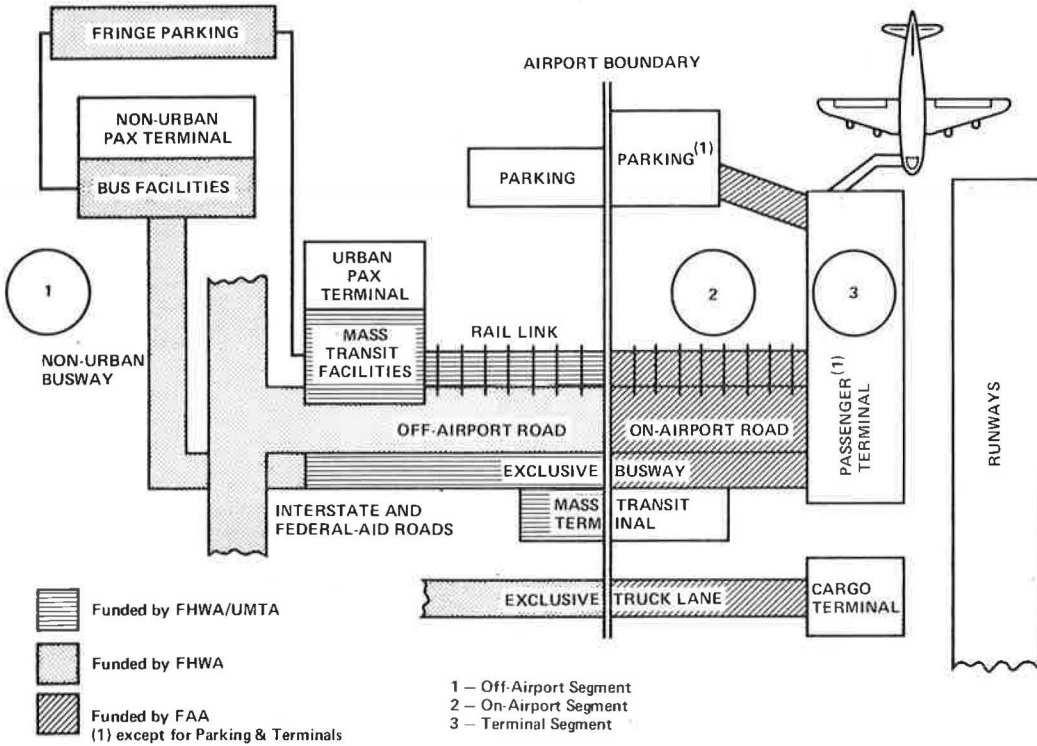


Table 3. Federal capital funding of specific elements by sponsor and program.

Element	Federal Aviation Administration		Urban Mass Transportation Administration*		Federal Highway Administration*				Federal Railroad Administration	
	ADAP, 50 percent	PGP, 66 2/3 percent	Capital Grant, 80 percent	Technical Studies, 100 percent	Public Transportation, 70 to 90 percent	Fringe and Corridor, 70 percent	Urban System	Exclusive Truck Lane	Special Urban High-Density Program	High Speed Ground
Automobile parking		x <sup>b</sup>		x	x	x <sup>b</sup>				
Pedestrian walkways	x <sup>c</sup>	x <sup>c</sup>		x <sup>c</sup>						
Road links between parking and modal and intermodal terminal	x <sup>c</sup>	x <sup>b</sup>	x	x	x	x	x	?	?	
Bus terminal										
Ramps, shelters	x <sup>c</sup>	x	x	x	x	x	x			
Building		x <sup>b</sup>	x	x	x	x	x			
Rapid rail	x <sup>c</sup>	x	x	x			x <sup>d</sup>			x
Air terminal land	x	x								
Air terminal building		x								
Entrance roads	x <sup>c</sup>	x		x	x		x		x	
Exclusive truck lanes	?	x						x		
Joint use access roads		x <sup>b</sup>	x	x	x		x		x	
Internal circulation										
Roads	x	x							x	
People movers	?	?	?	?						
Intraterminal		x <sup>b</sup>								
Satellite terminal (pax collection)			x <sup>f</sup>	x <sup>f</sup>	x	x	x	x		?

\*Funds not earmarked for airport access, but access projects may be eligible.

<sup>b</sup>Limited scope.

<sup>c</sup>On airport.

\*Special restrictions in fiscal years 1974 and 1975.

<sup>d</sup>On airport plus links.

<sup>f</sup>Public transit.

The supply of off-airport parking facilities evolves from policy decisions by airport managers and airport tenants who provide parking on leased or owned grounds. Increases in the supply of off-airport parking by airport managers and tenants represent an effort to substitute off-airport capacity for exhausted landside capacity. In addition, the supply of off-airport parking may be influenced by entrepreneurial decisions that originate in the private sector.

Table 4 gives the results of a survey conducted to identify present levels of off-airport parking and plans for future development of off-airport parking facilities (1). Policies favorable to off-airport facilities do not dominate the airport industry. The lack of plans for implementing this option raises doubt as to its applicability for existing or future landside capacity constraints.

The interpretation of the data given in Table 4 is more revealing when analyzed in conjunction with Figure 2 (1), which shows equilibrium conditions for parking demand and supply by the dotted line (as recommended by FAA parking design criteria). Airports registering parking capacity deficiencies include Chicago, Atlanta, and New York (La Guardia). Those airports do not offer off-airport parking.

### Off-Airport Passenger Processing

The demand for off-airport passenger processing remains weak and relatively unproven and is confined to the CBD of large metropolitan areas. Such processing accommodates only a small percentage of air travelers, e.g., business travelers with origins or destinations in the CBD. Table 4 gives the findings of an inventory (1) of existing and planned off-airport terminals and suggests that off-airport terminals have not gained wide acceptance by airport operators even when landside capacity constraints exist.

## FINDINGS AND RECOMMENDATIONS FOR BALANCING OFF-AIRPORT AND LANDSIDE CAPABILITIES

### Findings

1. No common or accepted measure of subsystem service levels or capacities exists for evaluating off-airport activities and landside functions.
2. The concept of balanced airport subsystems requires an understanding of what level of production is optimum for a given level of physical plant.
3. Off-airport accessibility exhibits a powerful effect on landside capabilities.
4. Improvements occurring from incremental changes in either landside functions or off-airport functions have not received careful analysis to determine how such changes affect total system performance.

### Recommendations

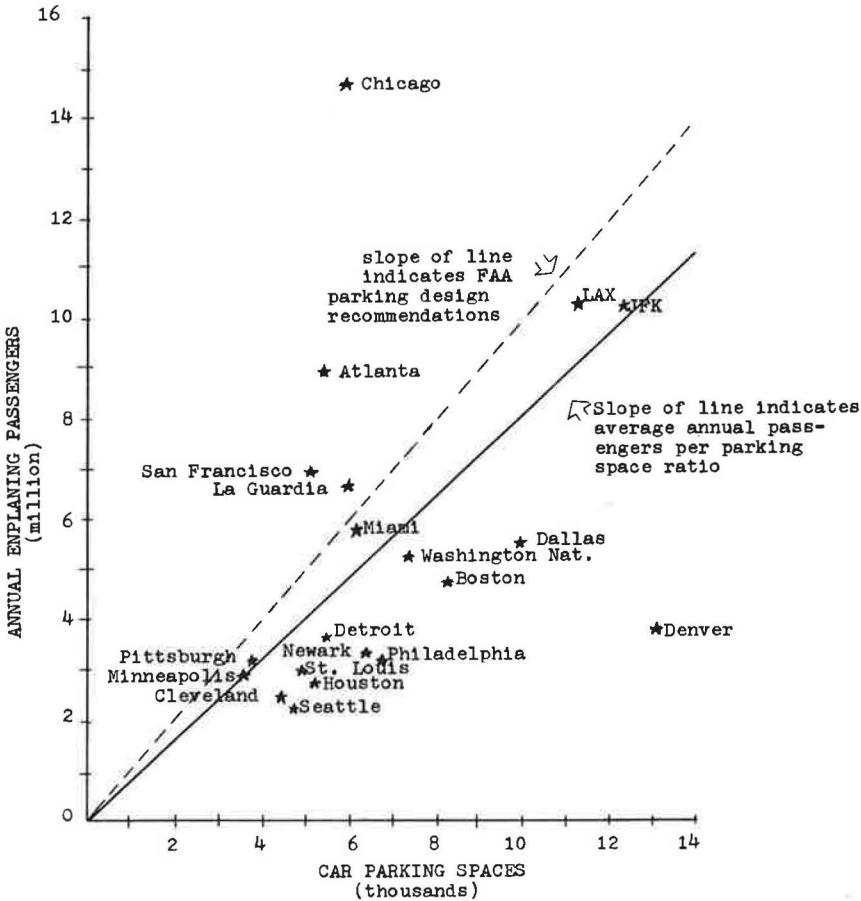
1. Research should be carried out to develop methodologies capable of identifying airport landside and off-airport conflicts. Simplified procedures should be developed for use by field personnel.
2. The impact of remote terminals should be evaluated to quantify the marginal utility of expanding existing facilities in this manner.
3. Detailed technical studies should be done to determine the demand characteristics associated with off-airport parking.
4. Airport access studies should be accomplished, oriented toward reducing the number of vehicle trips of employees and air-passenger-related visitors in and around the airport.
5. Research should be done to examine the potential for substituting off-airport facilities for landside functions. Consideration should be given to airport size, location,

**Table 4. Supply of off-airport parking and airport terminals.**

Airport	1974 Annual Passengers	Public Off-Airport Parking	Plans for Off-Airport Parking	Number of Off-Airport Terminals	Plans for Off-Airport Terminals
Chicago (O'Hare)	38,000,000	None	None	0	None
Los Angeles	23,600,000	1,637 <sup>a</sup>	Yes <sup>a</sup>	0	?
New York (Kennedy)	20,200,000	None	None	0	Under study
Atlanta	25,500,000	None	None	1 <sup>b</sup>	None
San Francisco	17,400,000	Yes <sup>c</sup>	None	0	None
New York (La Guardia)	13,700,000	None	None	0	Under study
Dallas-Fort Worth	6,800,000	None	None	0	None
Miami	13,000,000	None	None	0	None
Washington (National)	11,800,000	None	None	1 <sup>d</sup>	None
Boston (Logan)	10,700,000	None	None	0	None
Detroit (Wayne)	7,700,000	Yes <sup>c</sup>	None	0	None
Denver (Stapleton)	11,000,000	None	None	0	None
Philadelphia	8,000,000	None	None	0	None
Newark	6,500,000	None	None	0	Under study
St. Louis (Lambert)	6,300,000	None	None	0	None

<sup>a</sup>For Van Nuys Airport. <sup>b</sup>Private ownership.  
<sup>c</sup>Not operated by airport department. <sup>d</sup>Downtown terminal, used primarily for Dulles.

**Figure 2. Air passengers and airport parking spaces at various airports.**



user characteristics, and access facilities.

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