ACRP

REPORT 4

AIRPORT COOPERATIVE RESEARCH PROGRAM

Sponsored by the Federal Aviation Administration

Ground Access to Major Airports by Public Transportation

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AIRPORT COOPERATIVE RESEARCH PROGRAM

ACRP REPORT 4

Ground Access to Major Airports by Public Transportation

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IN ASSOCIATION WITH

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AIRPORT COOPERATIVE RESEARCH PROGRAM

Airports are vital national resources. They serve a key role in transportation of people and goods and in regional, national, and international commerce. They are where the nation's aviation system connects with other modes of transportation and where federal responsibility for managing and regulating air traffic operations intersects with the role of state and local governments that own and operate most airports. Research is necessary to solve common operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the airport industry. The Airport Cooperative Research Program (ACRP) serves as one of the principal means by which the airport industry can develop innovative near-term solutions to meet demands placed on it.

The need for ACRP was identified in *TRB Special Report 272: Airport Research Needs: Cooperative Solutions* in 2003, based on a study sponsored by the Federal Aviation Administration (FAA). The ACRP carries out applied research on problems that are shared by airport operating agencies and are not being adequately addressed by existing federal research programs. It is modeled after the successful National Cooperative Highway Research Program and Transit Cooperative Research Program. The ACRP undertakes research and other technical activities in a variety of airport subject areas, including design, construction, maintenance, operations, safety, security, policy, planning, human resources, and administration. The ACRP provides a forum where airport operators can cooperatively address common operational problems.

The ACRP was authorized in December 2003 as part of the Vision 100-Century of Aviation Reauthorization Act. The primary participants in the ACRP are (1) an independent governing board, the ACRP Oversight Committee (AOC), appointed by the Secretary of the U.S. Department of Transportation with representation from airport operating agencies, other stakeholders, and relevant industry organizations such as the Airports Council International-North America (ACI-NA), the American Association of Airport Executives (AAAE), the National Association of State Aviation Officials (NASAO), and the Air Transport Association (ATA) as vital links to the airport community; (2) the TRB as program manager and secretariat for the governing board; and (3) the FAA as program sponsor. In October 2005, the FAA executed a contract with the National Academies formally initiating the program.

The ACRP benefits from the cooperation and participation of airport professionals, air carriers, shippers, state and local government officials, equipment and service suppliers, other airport users, and research organizations. Each of these participants has different interests and responsibilities, and each is an integral part of this cooperative research effort.

Research problem statements for the ACRP are solicited periodically but may be submitted to the TRB by anyone at any time. It is the responsibility of the AOC to formulate the research program by identifying the highest priority projects and defining funding levels and expected products.

Once selected, each ACRP project is assigned to an expert panel, appointed by the TRB. Panels include experienced practitioners and research specialists; heavy emphasis is placed on including airport professionals, the intended users of the research products. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, ACRP project panels serve voluntarily without compensation.

Primary emphasis is placed on disseminating ACRP results to the intended end-users of the research: airport operating agencies, service providers, and suppliers. The ACRP produces a series of research reports for use by airport operators, local agencies, the FAA, and other interested parties, and industry associations may arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by airport-industry practitioners.

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FOREWORD

By Dianne S. Schwager
Staff Officer
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ACRP Report 4: Ground Access to Major Airports by Public Transportation provides tools and information to assist airport managers in improving ground access to large airports. The dramatic increases in air travel, congestion near airports, and interest in improving access to airports make this research report very timely. This research project builds upon and updates the results of two previous research projects undertaken within the Transit Cooperative Research Program, which produced *TCRP Report 62: Improving Public Transportation Access to Large Airports* (2000) and *TCRP Report 83*: *Strategies for Improving Public Transportation Access to Large Airports* (2002).

ACRP Report 4: Ground Access to Major Airports by Public Transportation provides a wealth of information about the current status of public transportation services and their use at large airports in the United States and around the world. Chapter 1 summarizes for airport managers the key elements in the creation of a six-step market-based strategy for improving the quality of public mode services at U.S. airports. This strategy focuses on the needs of the air traveler who uses airport ground access services. This traveler makes decisions that are affected by the amount of baggage being carried, the sense of apprehension about the reliability of the trip and arriving on time, the total trip costs, and a lack of knowledge about the non-home end of the trip. The market-based strategy was designed to support the development of public transportation services unique to the needs of the airport and to the users of the airport.

The balance of the report addresses the context for public transportation to major airports; explores the attributes of successful airport ground access systems; presents an airport-by-airport summary of air traveler ground access mode share by public transportation services (i.e., rail, bus, and shared-ride vans) for major U.S., European, and Asian airports (modes excluded from this review include hotel and rental car vans, limousines, and charter buses); discusses integrated baggage and airline ticketing strategies; applies market research to planning public transportation services to airports; reviews strategies for improving airport landside ground transportation services, including addressing institutional challenges for implementing these strategies and identifying potential funding sources; describes ways to improve the public transportation mode share for airport employees; examines new and evolving information technology to bring airport ground access information and ticketing options to the traveler; and identifies opportunities for further research that tie back to the six-step process described in Chapter 1.

CONTENTS

SUMMARY

Ground Access to Major Airports by Public Transportation

The objective of this ACRP project was to build upon previous research undertaken within the Transit Cooperative Research Program to provide an updated summary of the role of public transportation services in providing improved ground access services to America's airports. The ACRP project was designed to build upon and update the results of *TCRP Report 62: Improving Public Transportation Access to Large Airports* (2000) and *TCRP Report 83: Strategies for Improving Public Transportation Access to Large Airports* (2002).

Six Steps in a Market-Based Strategy for Improving Airport Ground Access

Chapter 1 presents a shortened summary of the key elements in the creation of a market-based strategy for improving the quality of public mode services at U.S. airports. The airport manager faces a wide variety of challenges in the creation of a successful ground transportation strategy, which almost certainly will comprise several separate services to respond to the needs of several separate market segments. This introductory chapter reviews the key steps for improving public transportation access to airports and presents some information that is further developed in later chapters. The chapter is intended to point the reader to best U.S. practices that can be explored for additional information contained in later chapters.

There are six steps in the process outlined in Chapter 1:

1. Establish the public policy goals for airport ground access (a theme that is further developed in Chapter 2).
   - *Form the collaborative effort that will be needed for implementation.*
   - *Understand the travel behavior of the longer distance traveler.*
2. Undertake the program for data gathering and system monitoring (a theme that is further developed in Chapter 6).
   - *Design the survey to reveal key market characteristics.*
   - *Emphasize accurate geography and market segmentation for both air passengers and airport employees.*
3. Understand the markets revealed and their relationship to candidate solutions (a theme that is further developed in Chapter 6).
   - *Understand the composition of the overall airport market.*
   - *Establish the target markets at several levels of trip-end density.*
   - *Understand the precedents for market support of various modes and services.*
4. Design a program of services and strategies for airport ground access (a theme that is further developed in Chapters 3 and 4).
   - *Understand the quality attributes achieved by successful services.*

- *Match modes with markets.*
- *Acknowledge the role for dedicated, higher cost services.*

5. Manage the airport to encourage rather than discourage higher occupancy use (a theme that is further developed in Chapter 7).
   - *Examine priorities and implications of curbside allocation and pricing.*
   - *Evaluate the level of amenity experienced by the public mode user.*
6. Present the ground access services to the traveler (a theme that is further developed in Chapter 9).
   - *Provide basic service description to the users.*
   - *Develop programs for integrated passenger information and ticketing.*

Chapter 1 proposes a planning process based on the needs of the consumer of ground access services. The chapter notes that it is important to apply the tools of analysis to understand the particular travel demand behavior of the individual taking a longer distance, multimodal, multisegment trip. ***The long-distance traveler makes logical and rational economic decisions, and those decisions are different from those made in daily commuting.*** The longer distance traveler is making a different set of decisions from those of the metropolitan-scale traveler. These decisions are different in terms of uncertainty and lack of knowledge about the non-home end of the trip. The decisions are different because of the amount of baggage being carried by the traveler, the traveler's sense of apprehension about the reliability of the trip and arriving on time, and the total trip costs. The six-step planning process is designed to support planning and implementation decisions based on the needs of the traveler.

From the outset, the analysts need to see the problem in terms of the full trip of the traveler. The choice of a mode to or from an airport is part of a larger set of decisions made in the process of going from the door of origin to the door of destination of the full trip. It is critically important to establish early in the process that the needs of the long-distance traveler most probably ***will require solutions that are not simply extensions and elaborations on service concepts already provided for the metropolitan context.*** The operation of traditional, low-fare, multistop street bus service to major airports may be a critically important element of a program to get workers to jobs, but such services only rarely have the ability to attract air travelers.

The process has been designed to support the development of services unique to the needs of the airport and to the users of the airport.

The Context for Public Transportation to Major Airports

Chapter 2 presents the context within which the airport manager must form policies toward airport ground access and summarizes the reasons for a policy interest in the subject in the United States. It reviews the present state of the airline system, including a review of variations in air traffic over the period before and after the events of September 11, 2001. It presents a brief update of the major recommendations presented in the previous TCRP reports, which called for a planning process based on the revealed characteristics of the several submarkets within each large airport's overall ground access market. As it has evolved, this approach to airport ground access planning focuses more on the understanding of market segments than on the inherent characteristic of any particular mode or technology. The chapter reviews the extent to which concern about the quality of airport ground access has become an integral part of the process of environmental and political approval of airport expansion and efficient utilization of key national assets.

Understanding the Scale of Airport Ground Access

The scale of public transportation markets varies by the size of the airport and by the propensity of the airport region to support public transportation. This ACRP project has ranked 27 U.S. airports in order of their use of public transportation—defined as rail, bus, and shared-ride vans, but excluding single-party limousines, courtesy shuttles, and charter operations. These 27 airports have public mode shares of 6% or more. Table S-1 reveals the scale of each airport in terms of the absolute number of passengers who are transported *to* the airport by a public mode. Importantly, these calculations are based on the number of originating passengers rather than on total enplanements, i.e., passengers who are changing from plane to plane are excluded.

What Has Happened over the Last Decade?

Much of the data presented in the original TCRP report were based on 1998 statistics from the FAA, and from Airports Council International–North America. There has been a 21%

Table S-1. Volume of transit use at 27 U.S. airports.

Rank by transit volume	Airport	Public transport users to airport (in millions)	Market share to public modes	Originating enplanements
1	New York JFK	2.2	19%	11,602,440
2	Los Angeles	2.1	13%	16,441,180
3	San Francisco	2.1	23%	8,938,170
4	Las Vegas	2.0	12%	16,339,950
5	Atlanta	1.9	14%	13,696,770
6	Boston	1.9	18%	10,428,620
7	Chicago O'Hare	1.8	12%	14,923,320
8	Orlando	1.5	11%	13,792,840
9	Newark	1.5	14%	10,375,220
10	Denver	1.4	14%	9,817,970
11	Reagan National	1.2	17%	7,003,410
12	Seattle	1.1	11%	9,898,290
13	Phoenix	1.0	9%	11,491,890
14	Oakland	0.9	15%	6,273,490
15	Baltimore/Washington	0.9	12%	7,637,130
16	New York LaGuardia	0.9	8%	11,291,970
17	San Diego	0.7	9%	7,833,280
18	Dallas/Fort Worth	0.6	6%	10,683,750
19	Philadelphia	0.6	7%	9,123,560
20	Tampa	0.6	7%	8,116,390
21	Portland (Oregon)	0.5	10%	5,373,750
22	Chicago Midway	0.5	9%	5,933,190
23	New Orleans	0.5	15%	3,472,780
24	Washington Dulles	0.5	8%	6,505,480
25	Indianapolis	0.3	9%	3,628,540
26	St. Louis	0.3	6%	4,845,770
27	Cleveland	0.2	6%	3,789,610

growth in enplanements at all U.S. airports in the time period from 1998 to 2005. Most of the gains of the first 3 years were lost by 2002; however, the growth in volume in the airline system from the nadir of 2002 to the present has been strong, with a 21% increase in the most recent 4-year period.

Over the past decade, changes in the management of the airline industry have had profound effects on the ground transportation patterns to major airports. These changes fall into two general categories. First, the non-legacy airlines have not sought to mimic the hub-and-spoke system that often results in the potential connection of all airports of origin with all airports of destination in a time-sensitive manner. In other words, lower cost airlines go to those airports they choose to serve, and only those airports they choose to serve. The result of this initial pattern by the low-priced carriers was a significant increase in the length of ground access travel that airline passengers would be willing to undertake to travel on the lower cost airline. Second, a new wave of low-priced carriers has incorporated a business strategy that does indeed serve existing major airports, such as New York's JFK airport.

How Have the Transit-Oriented Airports "Bounced Back" from the Decrease in Air Traffic?

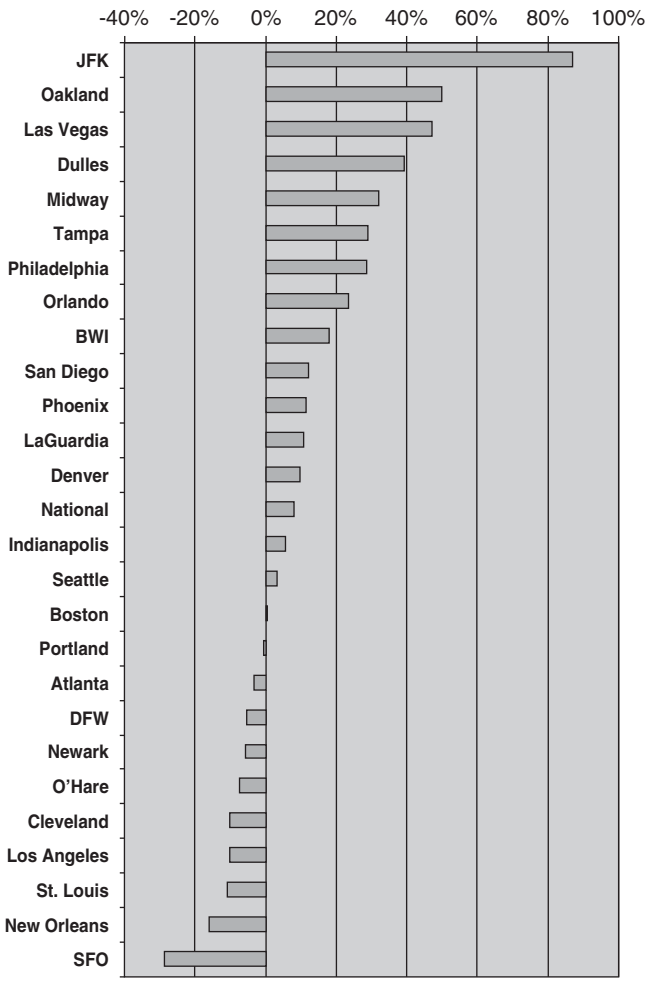
For the nation as a whole, enplanements grew by about 20% between 1998 and 2005; but, at the 27 most transit-oriented airports, total enplanements increased by only 13%. Logically, this statistic suggests that the *growth in total enplanements has been considerably stronger in the airports outside of the sample;* these other airports tend, with few exceptions, to be smaller and more difficult to serve with public transportation.

Turning our attention to the number of origin–destination trips being made through the 27 airports, *only an 8% increase has occurred* overall, with 10 of the major airports having *fewer* originating passengers than in 1998. Clearly, *part* of the 13% increase in total enplanements in the sample is associated with an increase in the number of transferring passengers. The airport-by-airport changes in originating passengers for the 27 airports are presented in Figure S-1.

Chapter 2 presents a set of calculations from which peak-hour volumes of public mode users can be estimated. Virtually all of the transit-oriented airports have total peak-hour volumes for all public modes combined (rail plus bus plus van) of less than 1,000 passengers per hour. Clearly, the transit infrastructure must be able to accommodate volumes in the range of 500 to 1,000 passengers per hour to an airport. However, it is important to note that *capacity alone* should never be the sole justification for rail investment; in many corridors in the United States, buses regularly carry more people than they would need to carry to serve all airline passengers at an entire airport. For example, through the Lincoln Tunnel in New York City, buses carry more than 40,000 passengers per hour in the peak direction. There are many powerful reasons to select rail services to airports, based mainly on the existence of a grade-separated right-of-way not subject to the daily congestion plaguing such airports as New York's JFK and Chicago's O'Hare; but, in theory, the capacity constraints of rubber-tired services should not be used as a justification for such a selection.

Attributes of Successful Ground Access Systems

Chapter 3 explores the question of what makes a public transportation access system to a major airport successful. The breadth of travel patterns detailed in Chapter 4 will document the wide variety of experience around the world in the design and implementation of public transportation strategies to major airports. Those patterns range from the remarkable



SOURCE: U.S. Department of Transportation/Federal Aviation Administration, Origin-Destination Survey of Airline Passenger Traffic, Domestic.

Figure S-1. Change in originating passengers for the 27 U.S. airports, 1998 to 2005.

public transportation share in Europe to the more specialized role played by public transportation to most U.S. airports. Chapter 3 interprets best practices and attempts to draw out lessons learned from this wide variety of experience.

Chapter 3 examines the implications of certain attributes of successful services, whether those services are in operation in the United States, Europe, or Asia. One lesson is clear at the outset—there is no particular modal solution that is optimal everywhere: a simple focus on line-haul speed of the vehicle does not produce a high mode share to public transportation, as revealed in Shanghai; the adoption of high-cost, high-quality rail design does not convince more Hong Kong travelers to ride the train than the bus; direct on-airport rail connections to an advanced regional rail system do not attract a higher share of travelers to choose the rail transit to San Francisco airport than the less direct connections in operation at nearby Oakland Airport attract.

This chapter looks at *service attributes of successful systems*, without regard to the dominant mode that resulted in those high mode shares to public transportation. As discussed in the final section of this chapter, capital investment decisions about new rail systems are being made in

Chicago, New York, Paris, and Berlin. But, other than these, planning for new capital-intensive rail systems is slowing, with a growing emphasis on management of existing rights-of-way.

Chapter 3 reaches the following conclusions:

- *In general, while airports need a certain size to support public transportation services, size alone does not explain high ridership. Distance traveled to the airport is worthy of more attention.*
- *In general, the longer the ground access trip, the less competitive is the taxi, and the less attractive is the casual kiss-ride drop-off trip.*
- *In general, directness of the connections on the airport cannot explain the wide variation in mode shares reported in Chapter 2, although there is strong anecdotal data to support the idea that fewer transfers are better than more transfers.*
- *In general, the speed of the public transportation service alone cannot explain the variation in mode share.*

Chapter 3 makes it clear that no single attribute—such as the speed of the vehicle, the directness of the on-airport connections, or the connectivity to the rest of the public transportation system—can *by itself* explain the propensity for high market shares. Rather, it becomes evident that a successful ground access system will need to combine various attributes from separate services designed to meet the needs of the separate market segments. Most U.S. airports have at least three market areas: a dense downtown/inner market area; a distant set of dispersed origins, for which dedicated express buses can carry travelers collected by other modes; and a mid-suburban area, where door-to-door shuttle services can be supported.

Public Transportation Market Share by Airport

Chapter 4 presents an airport-by-airport summary of airline passenger ground access mode share by public transportation services.

Part 1: Best Practices at U.S. Airports

In Part 1 of the chapter, the public transportation mode share data for 27 U.S. airports are presented, along with a discussion of trends and patterns for each of the modes. Five categories are used to summarize each U.S. airport:

- **The airport:** Each U.S. airport is summarized in terms of its location, its traffic in terms of annual enplanements in 2005, and the number of those enplanements representing originating passengers. Automobile travel times to downtown are presented, along with a reasonable approximation of the taxi fares, which will vary by the actual destination of the trip.
- **Connections at the airport:** The discussion of this category examines the nature of the airport configuration and design, which influence the ability of both bus and rail services to serve the airport efficiently.
- **Rail:** Rail services to the U.S. airports are described when they exist.
- **Bus:** Bus services that are specific to the airport market (i.e., "airporters") and more traditional public transportation services by bus are summarized. In the case of Boston, bus rapid transit is discussed as a separate mode.
- **Shared-ride vans:** Shared-ride vans are included in the analysis, but services such as limousines and "black cars" designed to transport single parties are excluded whenever the original data will allow.

The rail and bus/van market shares of the 13 U.S. airports with a public mode market share of 12% or more are shown in Figure S-2. The rail and bus/van market shares of the 14 U.S. airports with a public mode market share from 6% to 11% are shown in Figure S-3.

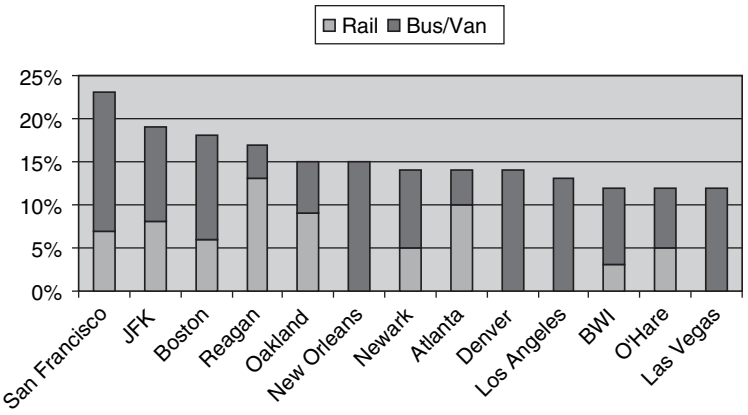


Figure S-2. Market shares to rail and bus in the 13 most transit-oriented U.S. airports.

Part 2: Best Practices at European and Asian Airports

The second part of Chapter 4 briefly summarizes the salient characteristics of 19 of the most successful airport access systems in the world. For each of these systems, the combination of rail and bus services attracts more than 20% of airline passenger market share (Figure S-4). Certain information is provided for the European/Asian airports, such as their baggage-handling strategies and the relationship of ground access services to national transportation services, which is not provided for the U.S. airports because of a lack of relevance.

Six categories are used to summarize each European/Asian airport:

- **The airport:** Data are presented that describe each European or Asian airport's size and location, and give a general estimate of taxi fares to the downtown area. Uniform data on originating passengers are presented.
- **Connections at the airport:** The discussion of this category examines the quality of the connection between the rail services and the airport check-in or baggage claim areas. Physical and architectural details are reviewed as relevant, and the physical quality of the transfer from the airline passenger terminal to the rail system is described. Also noted is the nature of the configuration of the airport itself. The difference between centralized and decentralized airport layouts is examined.

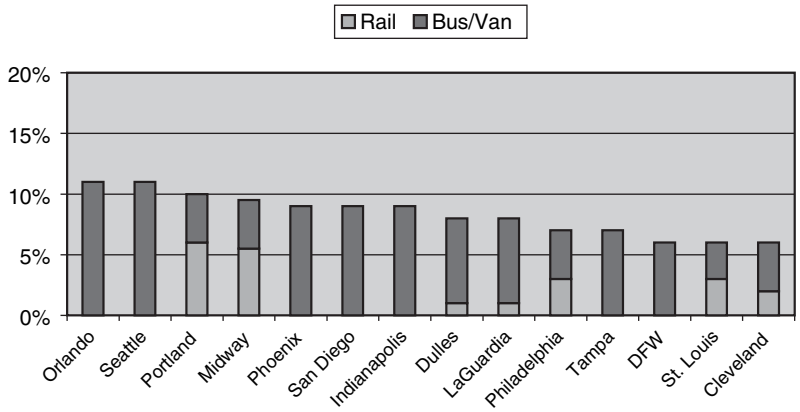


Figure S-3. Rail and bus shares for the 14th through 27th most transit-oriented U.S. airports.

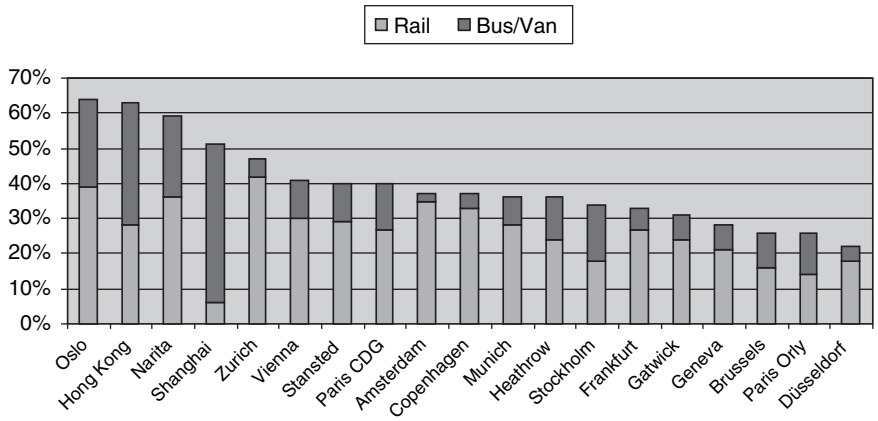


Figure S-4. Public transportation mode shares at European and Asian airports.

- **Rail:** Most European airports rely on some form of rail service for ground access. This category includes a brief description of the nature of the rail service provided and whether the service is dedicated or shared. Fares are presented. When service is provided beyond the traditional downtown, the nature of the regional services is noted.
- **Baggage-handling strategy:** In the discussion for this category, each airport access system is reviewed in terms of the strategies employed to deal with the baggage of the air traveler. Specific examples are presented for off-site check-in strategies, ranging from full-service downtown terminals to integration with other mechanisms for off-site check-in. When relevant, the status of such systems is summarized.
- **Bus:** Although their *relative* importance in Europe and Asia is less important than in the United States, key services are provided by bus. Small buses (i.e., vans) are included in the overall mode shares for bus.
- **Relevant market characteristics:** This descriptive information is reviewed in the context of any known market data for each of the systems. Market characteristics include the extent to which the market is oriented to the downtown or to other areas well served by the regional rail system.

Integrated Baggage and Ticketing Strategies

The goal of the airport ground access planner is to make full journey as "seamless" as possible, often with separate services appealing to separate market segments. Chapter 5 deals with the integration of baggage and ticketing strategies. Around the world, a wide variety of strategies have been developed to create seamless trip experiences: providing airport-type baggage check-in at local off-airport locations and providing integrated ticketing between ground and airline services.

In theory, a fully integrated national transportation system would have through ticketing and through baggage-handling services between ground and air. In practice however, these goals have proven elusive in major projects all over the world and are being re-assessed. In fact, the empirical data assembled for this report *suggest that airline passengers are increasingly reticent to separate themselves from their bags,* consistent with what seems to be an evolution in the nature of what the passenger hopes for, and expects from, the travel experience.

Part 1 of Chapter 5 reviews recent developments, both successful and unsuccessful, in off-site baggage check-in services for passengers within the metropolitan area. Part 2 reviews the concept of integrating baggage and ticketing for passengers traveling longer

distances on the ground access system, noting the results of a recent national study on the subject by the Government Accountability Office. Part 3 examines present trends in the application of various levels of integrated ticketing, and integrated baggage, noting the lessons learned from the first two parts; this examination includes a case study of the ambitious programs in operation at the Newark Liberty International Airport Rail Station.

A tabular summary is presented of major programs to unify air and rail through various baggage and ticketing strategies. Four categories of projects are presented:

- *Service from a downtown terminal to the local airport, with baggage*
- *Service from a downtown terminal to an airport in another city, with baggage*
- *Service to the local airport, no baggage*
- *Baggage check-in at points adjacent to the airport*

Chapter 5 includes an analysis of the ridership impact that resulted from the abandonment of the elaborate downtown check-in facility at London's Paddington rail station, serving the Heathrow Express. The market data show that there has been no visible negative impact on rail ridership on the Heathrow Express attributable to the abandonment of the check-in services at Paddington. In fact, between 2001, when the first airlines began to abandon the check-in services, and 2004, when the process was over, mode share increased by about one-tenth. After the events of September 11, the airline industry went through major reorganization and major shifts occurred in travel patterns worldwide. These changes (more reliance on discount airlines, for example) may be expected to cause changes in ground access patterns in some parallel way. The market data in Chapter 5 show that, in the case of the high-priced premium Heathrow Express, such parallel change simply did not happen.

Applying Market Research to Airport Ground Access

Chapter 6 focuses on the role of market research in planning public transportation services to airports. After an overview of market research techniques, a two-step approach is presented, using geographic and demographic information to better understand potential ground access markets.

The previous airport studies (*TCRP Report 62* and *TCRP Report 83*) concluded that *there is no one market for airport ground transportation services: there are a series of clearly definable submarkets, or market segments, each of which requires specific services based on the analysis of need*. This report advocates the creation of a planning process based on the needs of the traveler without regard to initial assumptions about the desirability of any given mode. In such a process, the needs of each market segment (a concept that includes both geographic location and demographic composition) have to be analyzed separately, with an appropriate service created for each segment.

The attributes of good airport connections, good line-haul connections to downtown, good coverage beyond the downtown, and the need to accommodate baggage are all characteristics of services that could be supplied with bus or rail. It is a central theme of this report that a new planning process should be encouraged—*one that does not focus on the applicability of any one mode, or even debates the relative characteristics of modes, but a process wherein the service attributes would be developed from an understanding of the separate needs of the separate submarkets existing at all airports*.

Developing a Market Research Study

Before undertaking a market research study, the airport manager should develop a clear and unambiguous problem statement. The problem statement defines the purpose of the

market research effort. For example, the following statement describes the basic information needed to begin a study of alternative modes of access: "What is the geographical distribution of this airport's ground access market and the current modes of access used by the various market segments?"

The principles of a market research–based planning process are examined in detail in Chapter 6, which documents five steps:

- Step 1: Decide What Information to Collect
- Step 2: Select the Data Collection Method
- Step 3: Determine the Sampling Frame and Sampling Method
- Step 4: Develop the Questionnaire
- Step 5: Summarize and Analyze the Results

This project advocates the application of a two-phase market research process based on first geographical segmentation, followed by demographic segmentation.

Observing Geographic Market Characteristics First

This report examines the nature of airport market segments and documents the characteristics of markets that support various forms of successful airport ground access transportation. This documentation is largely, but not totally, based on the careful examination of geographic trip-end density. The analyst is encouraged to create definitions of submarkets that are meaningful for the markets revealed by the initial exploration of the data. In the United States, the analyst is likely to find:

- **A densely clustered market** of airport trip origins, potentially supportive of fixed-route and -schedule services, possibly ranging from simple hotel loops to regional rapid transit; this area is the downtown market, but there may be several "downtowns" in a given airport market area.
- **An exurban market** of highly dispersed trip origins that can be intercepted in regional points of collection where the operation of high-density shared-ride door-to-door service is extremely challenging; these points of collection can include large parking lots or small hotel lobbies.
- **A "middle market,"** where clustering of trip origins is not dense enough to support the classic forms of fixed-route and -schedule service, where shorter trip lengths are not conducive to long-headway park-and-ride solutions, and where shared-ride door-to-door services can succeed in attaining high levels of vehicle occupancy.

Along the way the analyst, supported by the market research data, will often find other markets—perhaps dominated by a center of education or a center of medical activity—and examine strategies to deal with each of the submarkets identified in the analysis.

Adding Demographic Market Characteristics

Categories of Trip Purpose

The survey must be designed to support geographic segmentation and demographic segmentation. The point of origin must be defined with enough clarity that it can be integrated with geographic information systems. The origin of the ground access trip can be determined by either the zip code of origin or an address specific enough to support geocoding in the data entry process. The designer of the survey must deal with a basic trade-off between the amount of data desired and the need to keep the survey short. Specific trip purposes such as medical, personal business, school, or vacation, are not needed

for airport access analyses. For the survey, the most important trip purpose differentiation is simply "business" versus "non-business."

Categories of Residential Status

The second element of the demographic segmentation concerns the residential status of the traveler. As documented in Chapter 2, the mode choice decision of the traveler at the non-home end of the full trip is fundamentally different than the mode choice decision in the geographic area in which the traveler resides. The level of automobile availability (whether for the drop-off mode or the drive–park mode) is substantially higher at the home end than at the non-home end of the trip. In addition, the level of familiarity with the details of the public transportation system is usually much lower at the non-home end of the trip. For these reasons, the survey must be designed to properly differentiate between the traveler commencing the ground access trip in his/her own residential area and the traveler commencing the trip in the non-home end of the journey.

Market segmentation by geographic area, and then by demographic characteristics, is a powerful tool that allows the analyst to understand market conditions on a more disaggregate basis. It allows the comparison of "apples to apples," which in turn can reveal pronounced differences in market behavior by parallel market groups in different cities, and on different continents. It allows many variables to be held constant, while highlighting legitimate differences between target groups. Most important, the application of the two levels of market segmentation allows the transportation manager to carefully design services that will attract more people into efficient, higher occupancy modes for airport ground access.

The Role of Market Research

Market research is used in all sectors of today's economy to identify and target selected markets, to gain a competitive edge, to classify and retain customers, and even to determine the lifetime value of selected customer groups. With an ever-increasing number of products and services, the consumer market has become highly fragmented. Increasingly, identifying and targeting selected groups of customers has become important rather than trying to serve the entire market.

In the same way, classifying air travelers according to factors known to affect ground access decisions can help airport managers understand how different types of public transportation service will appeal to targeted travel groups. By providing a detailed understanding about the access needs of air travelers, market research can help airport managers plan successful public transportation services. Chapter 6 outlines a method for identifying, classifying, and understanding the air traveler on the basis of his or her ground access trip to and from the airport.

Managing the Airport Landside System

Chapter 7 reviews strategies for managing ground transportation services, including measures to enhance public transportation services. The chapter further examines the operational and institutional challenges for implementing these strategies and identifies potential funding sources.

Airport Ground Transportation Management Strategies

Most airport managers require all operators of commercial ground transportation services doing business at the airport to enter into a formal business relationship with the airport

authority or operating agency. (In most communities, any vehicle is allowed to drop off passengers at the airport, but only authorized or permitted vehicles are allowed to pick up customers.) Typically, commercial vehicle operators are required to obtain an airport permit in order to do business at the airport. By obtaining and signing the airport permit, the commercial vehicle operator indicates its willingness to abide by the rules and regulations established by airport management and to pay certain specified fees. Airport rules typically regulate (1) the use of airport roadways and other facilities; (2) the age, condition, and minimum insurance coverage for the vehicles used to transport customers; and (3) the behavior and appearance of the drivers or representatives of the commercial vehicle operators.

Sources of Funding

FAA grant assurances require major airports in the United States to be financially self-sustaining. Accordingly, rentals, fees, and charges must cover all operating and capital costs, including retirement of debt. The capital requirements of airports are significant today and are expected to increase in the future. The main sources of funds to build airport-oriented projects are reviewed in Chapter 7.

Improving Public Transportation Mode Share for Employees

Airport employees represent a large potential market for public transportation. The average number of daily employees at major U.S. airports can exceed 40,000. There are a number of challenges, however, to implementing successful public transportation services for airport employees. First, airports are usually located in suburban locations that can be difficult to serve with traditional transit services. Second, airports are in operation 24 hours a day, and many work shifts do not coincide with typical transit schedules. Third, airports have multiple employers each of whom has a variety of constraints and regulations regarding shift timing, parking reimbursement, overtime, etc. Taken together, these challenges can affect employee mode choice.

Chapter 8 discusses factors that influence employee use of public transportation, summarizes the results of a survey of the employee commuting patterns at representative airports, and presents key considerations for improving employee public transportation mode share at airports.

Getting Ground Access Information to the Traveler

Over the past 5 years, there has been a revolution in the way that airports can present ground transportation options to their passengers. Tools and media that would have been unimaginable just a decade ago are now readily available to the airport manager interested in creating better public mode ground transportation strategies to the airport. Chapter 9 examines those tools and those media in the context of the central theme of the report: that planning and implementation of ground access services must be undertaken to meet the needs of the user as defined and refined in a program of market research and segmentation.

Chapter 9 examines the development of new and evolving information technology to bring airport ground access information and ticketing options to the traveler. The presentation of service options to the traveler is the last phase of an integrated program of market-based improvements to airport ground access public modes, as summarized in Chapter 1.

Information about Ground Access at the Time of Trip Planning

To an increasing extent, airline trip planning is either (1) accomplished by the traveler using the Internet or (2) accomplished by a travel advisor to the traveler using the Internet. Thus, Chapter 9 focuses on the manner in which airport websites are or are not providing high-quality information to the traveler (or advisor) about ground access services to/from the specific airport.

Ultimately, information about local airport services will be interconnected with other media and tools used in the trip planning process. If each airport website can accurately describe the ground transportation services available at that airport, integration of that information with other media used by the traveler (such as airline websites, Expedia, Travelocity, Google, etc.) will logically occur over time.

Airport managers will need to provide to the traveler several different kinds of ground transportation information, not only information about airport-managed, -regulated, and -monitored ground services that are operated specifically for the airport market—taxis, airport limousines, airport vans, and airport coach bus services (sometimes called "airporters")—but also information about the regional public transportation system in general, including service details that are far beyond the responsibility of airport management.

Thus, one of the challenges in the design of the airport-based website on the subject of ground access services is the need to provide direct, quick access both to those services that are well documented by airport management and to those services that are best organized and described by others in the region.

Ground Access Information on Airport Websites

Amsterdam

At Schiphol Airport in Amsterdam, a new ground access information program now provides for a seamless integration of trip planning for ground access services managed by the airport with those services not managed by the airport. In concept, the new website is remarkably similar to the experimental airport ground access module being developed for the Baltimore/Washington International Airport.

When the website user specifies a destination and a date, a sketch-level summary of all the travel options to that destination is presented. The user selects a mode for more information and then can proceed linearly to the process of buying/reserving the service. The Schiphol Airport trip planner is integrated in terms of all modal options and in terms of supporting reservations and sales.

Narita

At about the same time that Amsterdam Schiphol Airport was taking the lead in integrating all ground access information, a new approach was launched by the ambitious *e*-airport program described in *TCRP Report 83*. Under the *e*-airport program, Narita Airport has developed the first ground access trip planning system that is tied to specific airline flights.

Through a series of queries, the Narita Airport website user is offered a long list of hotels and rail stations in the area. With the ground access departure time established by the scheduled arrival/departure time of the plane (via an Official Airline Guide static schedule), the user informs the system of his/her willingness to use bus, rail, or premium rail, and a set of recommended ground access trips are offered timed to the specific airplane flight.

London Heathrow

The ground transportation section of the Heathrow Airport website offers a link to the United Kingdom's national program of traveler information called "Transport Direct." The program provides both public transportation and automobile trip planning from every point in the UK to every point in the UK through a remarkable assembly and integration of national and local trip planning systems and databases. The program reviews all possible combinations of modal segments. The British program has the ability to include air as well as ground segments, although this is not relevant to the discussion of trip planning from the airport. Importantly, the program also includes travel times for automobile trips, which serves as a surrogate for taxi travel times in this context. Transport Direct can offer ground transportation advice between all airports in the UK and any point in the UK.

Baltimore/Washington

The Baltimore/Washington International Airport passenger information project seeks to use map-based interactions to simplify the airport ground access trip itinerary planning process, while at the same allowing for text-based data entry for those who prefer it. The project, which has been under development for several years, provides the traveler with immediate access to readily accessible information, followed by additional screens and hyperlinks to external sources only when needed and selected by the user. Thus, the airport-based website provides the user with an immediate summary of all modal options from the airport to the specified destination—including airport-based vans, as well as rail service provided by Amtrak, MARC, and the Washington Metropolitan Area Transit Authority MetroRail.

In many cases, the potential users of public mode services simply do not know that high-quality alternatives to the automobile and taxi exist. The U.S. transit industry is now in the process of adopting highly effective origin–destination trip itinerary planning systems that show how any given trip, such as one to or from the airport, can be accomplished by public transportation. In Europe, these programs have been applied on a nationwide and even international scale. As yet, the full integration of ground transportation information with aviation-based passenger information has yet to be implemented anywhere. Planners implementing information systems should consider the needs of later systems that truly integrate information for all modes and provide for immediate ticket sales for all segments of the longer distance trip.

Further Research

The recommendations for further research presented in Chapter 10 are categorized by the six-step process described in Chapter 1.

CHAPTER 1

Six Steps in a Market-Based Strategy for Improving Airport Ground Access

The airport manager faces a wide variety of challenges in the creation of a successful ground transportation strategy, which almost certainly will comprise several separate services to respond to the needs of several separate market segments. This chapter reviews the key steps for improving public transportation access to U.S. airports and presents some information that is further developed in later chapters.

Six steps are in the process outlined in this chapter:

1. Establish the public policy goals for airport ground access (a theme that is further developed in Chapter 2).
   - Form the collaborative effort that will be needed for implementation.
   - Understand the travel behavior of the longer distance traveler.
2. Undertake the program for data gathering and system monitoring (a theme that is further developed in Chapter 6).
   - Design the survey to reveal key market characteristics.
   - Emphasize accurate geography and market segmentation for both air passengers and airport employees.
3. Understand the markets revealed and their relationship to candidate solutions (a theme that is further developed in Chapter 6).
   - Understand the composition of the overall airport market.
   - Establish the target markets at several levels of trip-end density.
   - Understand the precedents for market support of various modes and services.
4. Design a program of services and strategies for airport ground access (a theme that is further developed in Chapters 3 and 4).
   - Understand the quality attributes achieved by successful services.
   - Match modes with markets.
   - Acknowledge the role for dedicated, higher cost services.
5. Manage the airport to encourage rather than discourage higher occupancy use (a theme that is further developed in Chapter 7).
   - Examine priorities and implications of curbside allocation and pricing.
   - Evaluate the level of amenity experienced by the public mode user.
6. Present the ground access services to the traveler (a theme that is further developed in Chapter 9).
   - Provide basic service description to the users.
   - Develop programs for integrated passenger information and ticketing.

Key Challenges in Step 1

- *Identify the key stakeholders and get them to the table*
- *Determine the extent to which the problem requires a regional solution*
- *Directly involve the managers of the regional transportation planning process*
- *Undertake early planning activities to allow for later incorporation into environmental documentation*
- *Understand the travel demand behavior of the longer distance traveler*

Step 1: Establish the Public Policy Goals for Airport Ground Access

Define the Stakeholders and Get Them to the Table

In the first step of this six-step process, it is essential to establish a collaborative initiative to implement improved public transportation services for airport access. Such establishment will require locating the key players, bringing them to the table, gaining agreement on the public policy goals of the proposed policies, and establishing a basic understanding of the nature of the problem being faced. This step establishes a regional context for decision making.

Preparing to address airport ground access involves many stakeholders including managers of airports, operators of public transportation, operators of private transportation, managers of the roadway system, and managers of the regional transportation planning process. In addition to the transportation agencies, other organizations are critical to the improvement of public transportation access to airports. These agencies—including those with environmental approval powers, the power to change taxi regulations, and the ability to subsidize transit services designed to link workers with jobs—all have a role to play in a coordinated strategy to improve airport ground access. The early involvement of the agencies with environmental review power cannot be overstated, as results from the planning process are often integrated into key environmental documents.

One transportation leader recently told Congress: ". . . we have begun to realize that no institution 'owns' the congestion or safety problem at the local level or state level, and no institution has the right players around the table such that they could be accountable for the daily performance of the system."

This observation is particularly true for the subject of improved airport ground access; yet, someone has to get the right players around the table, and someone has to be accountable for the performance of the system. In some cases, leadership can be provided by a strong regional planning agency, such as the Metropolitan Transportation Commission (MTC) in the San Francisco Bay Area or the Metropolitan Washington Council of Governments (MWCOG) in Washington, D.C., both of which have strong roles in airport planning. In most cases, leadership must come from the managers of the airports themselves.

Coordinate with the Regional Planning Process

The parties need to define the extent to which the ground access issues are regional in nature, as this will affect the number of stakeholders needed at the table. Many on-airport improvements can be managed at a very local level, but others will require a broader based coalition to deal with the issues that are clearly regional in nature. For those issues that require a multiagency response, it is critical to involve the managers of the regional planning process, usually the regional metropolitan planning organization (MPO). Failure to do this will result in serious problems in obtaining funding and needed environmental clearances.

The Role of the Congestion Management System

Within the established metropolitan transportation planning process, there are several procedures that are critical for the successful integration between the project-specific activities and the regional requirements. Many metropolitan areas, particularly those with air pollution issues of non-attainment, require the creation of a Congestion Management System (CMS) by the region's MPO. The role of the CMS is to document significant sources of congestion and low system performance and to examine a wide variety of strategic solutions to the problem, only the

last of which is the addition of roadway capacity. Indeed, in areas of non-attainment, federal funding can only be used for roadway capacity increases that result from the completion of the CMS. At the very least, the managers of the airport access improvement strategy should be working closely with regional managers of the CMS.

At this point, the regional planning must focus on the unique demands that will be placed on the data collection and analysis process for improving public transportation access to an airport. Usually, the travel demand forecasting process used in the metropolitan planning organization is focused on the needs of the peak-hour commuting period. The existing databases may or may not be structured to deal with the needs of the longer distance traveler. Traditional forms of U.S. Census journey-to-work data will be of only limited value to the analysis of airport access. MPOs may or may not be prepared to analyze the transportation behavior patterns of the longer distance traveler, in this case the air traveler.

Preparation for Major Investments

In the event that the planning process may result in a major capital investment, the early planning should be undertaken in a manner consistent with the requirements of the later creation of either an Environmental Impact Statement or a Finding of No Significant Impact. In either case, the rules for formal scoping and for the public participatory process must be established in the earliest phase of the planning process. In particular, the early examination and narrowing of alternatives must be undertaken consistent with the requirements of the National Environmental Policy Act, as part of a publicly visible process; lack of attention to the legal requirements of process at this point risks the invalidation of later results from court challenges.

For the reasons discussed in the preceding paragraphs, clearly any major attempt at applying regional resources to improving public mode services to airports must be either initiated by the regional planning body or closely coordinated with others in the region having the statutory authority for transportation planning. The planning effort to improve public transportation services to the airport should be included in the Unified Planning Work Program approved by the MPO, regardless of whether federal funds are proposed in the planning or implementation efforts. Indeed, recent funding legislation requires that the operators of airports be members of the MPO.

Design Analysis Tools for the Longer Distance Trip

The tools of analysis must be applied to understand the particular travel demand behavior of the traveler taking a longer distance, multimodal, multisegment trip. From the outset, the analysts need to see the problem in terms of the full trip of the traveler. The choice of a mode to or from an airport is part of a larger set of decisions made in the process of going from the door of origin to the door of destination of the full trip. It is critically important to establish early in the process that the needs of the long-distance traveler most probably will require solutions that are not simply extensions and elaborations on service concepts already provided for the metropolitan context. The operation of traditional, low-fare, multistop street bus service to major airports may be a critically important element of a program to get workers to jobs, but such services only rarely have the ability to attract air travelers.

The long-distance traveler makes logical and rational economic decisions, and those decisions are different from those made in daily commuting. The longer distance traveler is making a different set of decisions from those of the metropolitan-scale traveler. These decisions are different in terms of uncertainty and lack of knowledge about the non-home end of the trip. The decisions are different because of the amount of baggage being carried by the traveler, the traveler's sense of apprehension about the reliability of the trip and arriving on time, and the total trip costs.

To the extent possible, those crafting new strategies to divert air travelers away from low-occupancy vehicle strategies should familiarize themselves with the experience of others around the world who have created successful airport ground access services. Chapters 2, 3, and 4 were created to help transfer the lessons learned from major airport ground access systems around the world for application by the U.S. airport manager.

Best Practices in the United States: Establishing the Process

The following practices are some of the many good examples of coordination with the regional transportation planning organizations that exist in the United States:

- The role of the San Francisco Bay MTC in the planning of airport access improvements in the Bay Area and in continued management of the ground access surveying process.
- The role of the Denver Regional Council of Governments in undertaking a comprehensive examination of ground access issues for Denver's new airport.
- The role of the MWCOG in the analysis of the implications of continued and expected airport growth, expressed in terms of projected ground access flows.
- The role of the Southern California Association of Governments (SCAG) in the formulation of aviation policy in the Los Angeles region.

Key Challenges in Step 2

- *Develop the data-gathering instrument*
- *Document the geographic segmentation for the ground access trips*
- *Document the demographic segmentation for the ground access trips*
- *Commit to an ongoing program to monitor the performance of the system*
- *Develop measures of performance for the airport ground access system*

Step 2: Undertake the Program of Data Gathering and System Monitoring

In Step 2, the airport manager must create a database upon which to plan and monitor the services and facilities for improved airport access. This step is critical because the improvements to airport access must be based on a clear understanding of the market behavior of the several submarkets for airport ground access services. The airport ground access survey is the primary tool used to gain the information needed for a market-driven, traveler-oriented process. Decisions can then be made on a modally unbiased basis stemming from the analysis of the needs of the traveler. This process cannot be commenced without high-quality data describing just who those travelers are and where they are coming from.

The evaluation of a given service should be examined in terms of its performance in its own logical catchment area, not in terms of mode share for an entire airport. As described in Chapter 6, it is important to establish a market description of that subset of travelers for whom the proposed service is relevant. Targeted market segments should be defined and services designed for their particular needs; success or failure of those services should be established in terms of the capture rate within the targeted market group. A specialized van service from a hospital complex to an airport, for example, should be evaluated on the basis of how well it attracts riders from its specified market area, not on its performance in the entire airport ground access market. For any given service under evaluation, there will be a geographic area where that service makes sense as a logical choice and a geographic area where that service makes no sense at all.

The airport ground access survey is the essential backbone of the market-driven planning process. Such a survey can be expected to cost between $100,000 and $300,000. Without this information, the process of matching services to market needs cannot be undertaken.

Data Collection for the Airport Ground Access Survey

The application of market research methods to airport ground access, including survey procedures, is presented in detail in Chapter 6. Key issues for data collection include the exact

geographic origin of the ground access trip, time of day, the trip purpose, and the residency status of the traveler. *TCRP Report 62* (*16*) describes the use of additional market research techniques, including focus groups. A comprehensive process of market research can include both survey methods that rely on "stated preference" and methods that rely on "revealed preference."

Demographic Elements

Categories of Trip Purpose. The survey must be designed to support geographic segmentation and demographic segmentation. The point of origin must be defined with enough clarity that it can be integrated with geographic information systems. The origin of the ground access trip can be determined by either the zip code of origin or an address specific enough to support geocoding in the data entry process. The designer of the survey must deal with a basic trade-off between the amount of data desired and the need to keep the survey short. Specific trip purposes such as medical, personal business, school, or vacation are not needed for analyses of airport access. For the airport access survey, the most important trip purpose differentiation is simply "business" versus "non-business."

Categories of Residential Status. The second element of the demographic segmentation concerns the residential status of the traveler. As documented in Chapter 2, the mode choice decision of the traveler at the non-home end of the full trip is fundamentally different than the mode choice decision in the geographic area in which the traveler resides. The level of automobile availability (whether for the drop-off mode or the drive–park mode) is substantially higher at the home end than at the non-home end of the trip. In addition, the level of familiarity with the details of the public transportation system is usually much lower at the non-home end of the trip. For these reasons, the survey must be designed to properly differentiate between the traveler commencing the ground access trip in his/her own residential area and the traveler commencing the trip in the non-home end of the journey.

With these two elements of information, all travelers can be easily categorized into four clearly defined market segments, sometimes referred to as "the four-cell matrix." The market research process recommended in this project requires the creation of these demographic market segments:

- Resident business
- Resident non-business
- Non-resident business
- Non-resident non-business

Why Look at Separate Market Segments?

These four separate market segments can be applied to a wide cross section of U.S. and European/Asian airport ground access markets. Importantly, none of these categories can be applied as a "cookie cutter" approach to predicting behavior. The four market segments allow several subsets of the market to be observed separately. Successful strategies offer a variety of public mode services, at a variety of prices. At a given airport, a multistop bus service at less than $2 will appeal to a different market than a door-to-door shared-ride service for $15. At Baltimore/Washington International Airport during peak hours, travelers are offered multistop MARC commuter rail services to Union Station for $5 or Amtrak Acela service for more than $30. Some travelers will choose the first train out (at the higher cost), while others will wait for the lower priced rail service. Their choice is influenced by their demographic market segment.

Danger Areas in Data Collection

The designers of the survey should be aware of the particular data collection pitfalls that exist for airport access. For the analysis of traffic flow, a category called "bus/limousine/van" may be

a reasonable definition. However, for the analysis of public transportation patterns, it is critical to separate publicly available buses and vans from limousine service not available for shared-ride purposes. Similarly, the question "What mode do you usually take to the airport?" gets a different response from that of the preferred formation, "On your last trip to the airport—and only that trip—what mode did you take?" A survey bias towards socially desired behavior patterns occurs on the first question.

Data Collection to Monitor the Performance of the System

The measurement of performance of the system is a very important output from the data collection process. A classic example of a commitment to measurement exists in the contractual relationship between the Massachusetts Port Authority (Massport) and the Conservation Law Foundation, a non-profit environmental organization. The simplest, and most basic, commitment is to the continual monitoring and measurement of mode share to the airport and to the volume of vehicle miles traveled (VMT) associated with airport access. For such a program, it is critical to monitor the actual vehicle volumes throughout the airport roadway system; the accurate calculation of VMT will require both traffic counts by vehicle classification and the kind of origin-destination information only made available by the Ground Access Survey.

A very basic example of a system of performance measurement was developed by Massport in the mid-1980s. Table 1-1 shows the number of vehicle trips on the roadway created by one air traveler gaining access to the Boston airport on the ground system by various modes. Each of the values was calculated empirically from observed occupancy and load factors for each of the modes. In the evaluation of the performance of the system, a given strategy was considered to be beneficial if it moved the traveler to a more efficient mode (i.e., down the rows of the table) rather than to a less efficient mode (i.e., up the rows of the table).

The implications of some changes in travel behavior are intuitively obvious; a new express bus service that diverts a traveler away from his/her former drive–park mode is a more efficient mode and is evaluated positively. But not all implications of mode changes are intuitively obvious. If, for example, on-airport parking rates are set extremely high to discourage the use of drive–park, the implications of the resulting mode change are not so clear. If that trip is diverted to pick-up/drop-off mode, the implications for vehicle miles traveled are highly negative, and the candidate practice is evaluated negatively. The program of monitoring performance must be designed to record such subtle changes in travel behavior.

Table 1-1. Measures of effectiveness in Massport program: ground access vehicle trips per air traveler trip.

Mode	Vehicle trips per air traveler trips
Pick-up/Drop-off	1.29
Taxi	1.09
Drive–park	0.74
Rental car	0.69
Door-to-door van	0.33
Scheduled bus	0.10
Rapid transit	0.00

SOURCE: Massachusetts Port Authority, "Logan International Airport, Ground Access Non-Pricing Study, Second Report to the Conservation Law Foundation," 1991.

Best Practices in the United States: Continuing Survey Programs

Some of the most comprehensive survey programs in operation at the world's airports are located in the United States. The following programs are good examples of commitments to monitoring the performance of the system through surveys:

- The Air Passenger Survey Program of the Port Authority of New York and New Jersey, which operates the largest and most comprehensive data-gathering program for airport ground access in the country.
- The historic role of Massport, the Executive Office of Environmental Affairs, and the Conservation Law Foundation to establish a commitment to continuous monitoring of the performance of the ground access system to the Boston airport.
- The airport passenger survey program of the MWCOG, which integrates air survey data into the regional transportation planning process in Washington, D.C., and parts of Maryland and Virginia.

Step 3: Interpret the Markets and their Relationship to Candidate Modes

The most basic question in market research for airport ground access is "Where are they coming from?". Different airports have different fingerprints that identify their ground characteristics. Some have highly dispersed origins. Some have highly dense ground access origins. Forming an understanding of those patterns is a critical step in the development of solutions for airport ground access.

Geographic information systems now allow analysts to interact with the data and create locally derived categories of trip-end density. With these tools, each analyst can develop methods of revealing natural market patterns appropriate to the needs of the analysis. Logically, analysts examining distribution patterns in Manhattan would select different breaking points for data categorization than analysts examining Denver.

Geographic Scale of the Airport Ground Access Markets

Some airports attract most of their patrons from a relatively compact geographic area, while others draw their patrons from vast geographic areas. The geographic scale of the airport's catchment area provides an early indication of the nature of the density patterns to be dealt with in the development of successful ground access services. This report defines the primary market area for the airport as a whole as that area composed of zones with more than 5 airport trips per square mile, by all modes. This definition has proven to be an effective way of focusing attention on those areas where empirically some 70% of the airport's ground transportation customers originate. In the densely developed area served by Reagan Washington National Airport, the geographic area composed of zones with at least 5 trip ends per square mile covers only 484 square miles. In the highly suburbanized geography of Los Angeles International Airport, the area composed of zones with at least 5 trip ends per square mile spreads over 1,500 square miles.

These highly aggregated observations about the overall nature of the ground transportation market can be made early in the process and reveal much about the nature of the challenge of pairing airport access services to market segments. However, to understand the ability of markets to support specific services, the total airport market must be disaggregated into at least three categories of trip-end density.

Key Challenges in Step 3

- *Determine the density characteristics of the overall ground access market*
- *Define a geographic area with more than 50 trip ends per square mile and understand the nature of the market within this area*
- *Define a geographic area with less than 5 trip ends per square mile and understand the nature of the market within this area*
- *Define a geographic area with between 5 and 50 trip ends and understand the nature of the market within this area*
- *Analyze how each of the three market areas may require different kinds of services*

Three Categories of Trip-End Density

For the purpose of this research project, three basic categories of trip-end density have been created:

- Less than 5 airport trip ends per square mile
- Between 5 and 50 airport trip ends per square mile
- More than 50 airport trip ends per square mile

Each of the three categories has its own challenges. As will be discussed in Step 4, the empirical data suggest that providing services from door to door at trip-end densities of less than 5 trip ends per square mile is extremely difficult and may result in shared-ride services producing basically low-occupancy taxi services under a different name.

The examination of geographic areas composed of zones with at least 50 airport trip ends per square mile provides a point of departure for further analysis concerning possible markets for traditional fixed-route and -schedule service. The existence of geographic areas with more than 50 trip ends per square mile is *necessary but not sufficient to support these services*. Having defined the geographic area of more than 50 trip ends per square mile, the analyst can further explore the characteristics of density within this geographic area, which vary considerably among U.S. airports. Table 1-2 ranks 10 of the 27 most transit-oriented U.S. airports in order of the portion of their ground transportation markets originating in zones with densities greater than 50 trip ends per square mile.

Airports Ranked by Orientation to Areas of High Trip-End Density

Fixed-route and -schedule service requires a certain density of trip ends to operate at reasonable headways. Table 1-2 shows that, of U.S. airports, only San Francisco International Airport and Reagan Washington National Airport have a majority of trip origins coming from the densest category, those areas with more than 50 trip ends per square mile.

The use of the category "more than 50 trip ends per square mile" is a surrogate to describe the market areas most susceptible to higher occupancy public mode solutions. It is a first step in the process of identifying specific service proposals, ranging from scheduled hotel loop service (appropriate to most large airports) to full-scale regional rail transit coverage (applicable to a small number of airports), such as Washington Metropolitan Area Transit Authority (WMATA).

Whereas the first data column of Table 1-2 summarizes the extent to which an airport is oriented to the highest category of trip density, the second column provides more information about the trip-end density within that geographic area. This information is needed to assess the ability of the market to support fixed-route and -schedule services and can be used as an indicator of the potential for high-capacity service to be successful. By far the airports with the greatest concentration of trip ends are in New York with more than 400 trip ends per square mile for this analysis area. At the other extreme, the low trip-end densities for analysis areas in Los Angeles are particularly cautionary in the context of markets to support fixed-route and -schedule services throughout the defined area.

Density and Market Support Associated with Specific Modes

Next, the analyst should review the existing data concerning the trip-end densities that are supportive of various forms of airport ground access services. Looking at the existing services and market support conditions, what do we know about the correlation between trip-end density and specific modal service? What mode shares can be expected within specifically targeted geographic areas? While many factors contribute, clearly volume (and density) of trip ends are critical elements in understanding the ability of specific markets to support specific modal services.

Table 1-2. U.S. airports ranked by orientation to dense urban market.

Airport	Percentage of airport ground origins from zones with more than 50 trip ends per square mile	Trip-end density from these zones, as trip ends per square mile	Daily air travelers from these zones
San Francisco	**57%**	225	18,000
Reagan National	**52%**	216	9,840
New York LaGuardia	**49%**	409	11,700
New York JFK	**44%**	310	10,450
Boston	**35%**	210	9,300
Los Angeles	**33%**	77	12,970
Washington Dulles	**30%**	110	4,280
Denver	**29%**	100	8,600
Seattle	**28%**	126	4,700
Tampa	**25%**	126	3,025

SOURCE: *TCRP Report 83*, MarketSense.

A key conclusion of *TCRP Report 62* (*16*) and *TCRP Report 83* (*47*) is that the overall mode share for an entire airport does not reveal the extent to which a given strategy may or may not be working; it does not provide the basis on which to analyze the performance of specific services. Rather, *each candidate service needs to be examined in terms of a catchment area in which the service is a logical choice for the traveler*. Using this market research technique, Chapter 6 reviews a set of specific services in the Washington, D.C., area in the context of their logical catchment area.

Air Traveler Markets Supportive of Rail Services

TCRP Report 83 calculated that the primary geographic market for rail services for air travelers to Boston's airport is characterized by a density of 150 total airport trip ends per square mile. Within this logical catchment area, the Massachusetts Bay Transportation Authority (MBTA) rail services attain a mode share of 16% of the air travelers to Boston's airport. The same analysis process has determined that the prime geographic market for rail services to Reagan Washington National Airport is characterized by a density of 125 total airport trip ends per square mile. Within this logical catchment area, WMATA rail services attain a mode share of 13% of air travelers to Reagan Washington National Airport.

Air Traveler Markets Supportive of Regional Collection Points

Primary geographic markets were calculated for airport express bus services from regional collection points serving airports in Boston, San Francisco, and Los Angeles. Support for these dedicated airport bus services was found in geographic market areas with less than 5 trip ends per square mile. The Van Nuys FlyAway bus service to Los Angeles International Airport was supported by a market area with 8 trip ends per square mile. Express bus services from regional collection points to Boston's airport attained more than 20% mode share in their markets, while the Marin Airporter (San Francisco) captured more than 30% of its primary market area. Similar strong markets are reported from other data sources for longer distance bus and van services serving New York John F. Kennedy (JFK) and Boston airports.

Air Traveler Markets Supportive of Door-to-Door Services

In both Seattle and Oakland, the logical catchment areas for door-to-door van services were characterized by airport trip-end densities averaging about 15 trip ends per square mile. A market area

south of the San Francisco International Airport supported door-to-door van service with a trip-end density of 24 trips per square mile, while the Los Angeles primary market supported door-to-door services with an average of 27 trips ends per square mile. Door-to-door vans capture a variety of mode shares from their respective logical catchment areas. Mode shares of less than 10% are attained in Los Angeles, Boston, Seattle, and the market area south of San Francisco International Airport. Mode shares of about 20% are attained in the City of San Francisco, and in the Oakland market. While there are clearly densities below which door-to-door van services cannot be supported, they are able to serve in areas of high density. Van services operate with strong market performance in the City of San Francisco in a market area with more than 300 trip ends per square mile.

Markets Supporting Exclusive Airport Buses to Downtown

Examples of airport-oriented bus services from downtown hotel and major activity centers have existed in most major U.S. airports, serving a wide variety of downtown trip-end densities. While these buses serve central business district (CBD) densities as high as 500 trip ends per square mile in Boston or New York, they also serve the smallest of downtowns. As buses have considerable flexibility in their operating patterns, this research effort has not established a lower level support threshold under which services cannot operate. Advanced downtown bus services, such as the Airport Express in New Orleans, have shown exceptionally strong market capture rates.

The Need for a Composite Approach

The market analysis process examines the strength of specific markets to support airport ground access services and provides hints as to the modes best matched to those markets. While the details of effective market segmentation will vary from airport to airport, it is fair to say that a comprehensive strategy to deal with U.S. airport ground access must deal with *at least three* geographic submarkets.

- **A Dense Urban Market.** Clearly, there is a geographic area of highest trip-end density, some portions of which may support fixed-route and -schedule services. There is no empirical evidence that zones with less than 50 trip ends per square mile can support such services on their own. Successful rail services have been observed in market areas of far more than 100 trip ends per square mile. Hotel loop buses serve small geographic areas, with highly compact markets: Seattle's Gray Line Express serves a hotel-oriented concentration of more than 400 trip ends per square mile. Boston's CBD generates more than 500 trip ends per square mile, supporting both rail and hotel loop services.
- **An Exurban Market.** Clearly, significant portions of the overall airport market come from large geographic areas where collection services need to be provided by means other than the vehicle providing line-haul services to the airport. Express services dedicated to the needs of the air traveler are supported by immediate market areas with trip-end densities less than 10 trip ends per square mile and provide park-and-ride availability to those coming from areas of very low trip-end density.
- **A Middle Market.** Finally, there is a category for which upper and lower boundaries are less clear. It is the largest of the three categories for U.S. airport ground access: zones of origin generally more than 5 and less than 50 trip ends per square mile. As discussed in Step 4, this market may be the most difficult to serve.

Best Practices in the United States: Examples of Market Types at U.S. Airports

The wide variety of market types in the United States serves to illustrate the importance of designing a cross section of services. In the United States, airport markets cannot be characterized

as either all exurban in nature or all urban in nature. The following airports are good illustrative examples of three types of markets:

- **An Airport Oriented to a Dense Urban Market.** To San Francisco International Airport, the majority of trips come from areas in which airport trip ends are densely concentrated: about 18,000 air travelers come from zones with more than 50 trip ends per square mile; this area has an overall average of about 225 trip ends per square mile. San Francisco has the nation's single largest market for airport trips from the kind of highly concentrated trip ends that can be served by a variety of fixed-route and -schedule modes, including rail.
- **An Airport Oriented to an Exurban Market.** To Denver International Airport, more than 9,000 air travelers come from zones that have trip densities of less than 5 trips per square mile. Of the 27 most transit-oriented U.S. airports, Denver's airport had the highest volume of "exurban" trip ends, which come from highly dispersed zones of origin.
- **An Airport Oriented to a Middle Market.** To Los Angeles International Airport, the majority of airport trips come from market areas that are neither dense nor exurban in nature: about 21,000 air travelers originate in areas with less than 50 trip ends per square mile but more than 5 trip ends per square mile; this area has an overall average of about 15 trip ends per square mile. This area represents the United States' largest market for medium-density modes, such as door-to-door vans.

Step 4: Design a Program of Services and Strategies for Airport Ground Access

Having established an understanding of the nature of the markets for airport access services, a ground access strategy can be developed to include a set of services appropriate to the submarkets revealed. During this step, a set of candidate modal services must be selected, determined by the needs of the travelers and by the ability of the markets to support specific services. At this point, decisions must be made between investment in rail versus bus systems.

The decision about whether to build a rail system to a U.S. airport may be driven more by the overall public transportation strategy of the region rather than by airport access needs in isolation. When a region, such as San Francisco, has invested heavily in downtown rail distribution services and other regional connections through the system, extension of that system to cover the airport can be seen as part of a regional transportation strategy. By contrast, when the rail services do not currently serve a major role in a bigger network of collection and distribution, the investment in a stand-alone rail system to the airport may not make sense.

In this phase of the process of improving public modes to major airports, services must be designed to achieve certain service quality attributes revealed in the analysis of successful systems around the world. Chapter 3 summarizes a set of attributes that are important for services. Those attributes are not specifically tied to the choice of bus versus rail but rather describe the needs of the traveler without regard to mode or technology.

Lessons Learned from Successful Systems

The key lessons from the analysis of international systems presented in Chapter 3 do not form an argument for or against rail solutions in the United States. The key issue is to understand the *attributes* of service from the European experience and to design services that deal with those attributes. Each of the four attribute areas defined in that chapter can be reviewed for the implications for a choice of mode in the United States.

Key Challenges in Step 4

- *Design a set of services for*
  - *a dense urban market*
  - *an exurban market*
  - *a middle market*
- *Incorporate the attributes of the successful systems, including quality of*
  - *Line-haul service to CBD*
  - *connection at the airport*
  - *service beyond the CBD*
  - *appropriate baggage strategy*
- *Design a set of services to appeal to four market segments:*
  - *Resident business*
  - *Resident non-business*
  - *Non-resident business*
  - *Non-resident non-business*

Quality of the Line-Haul Connection to the CBD

Finding an available right-of-way is a problem for the designer of a bus access system and for the designer of a rail system. Finding an available express track has been determined to be a problem throughout Europe. Multistop rail transit service in London was perceived to be so slow that new, non-stop rail was created. Planners at Munich's airport are looking at magnetic levitation (maglev) alternatives to deal with the historically slow rail travel times there. Universally, buses stalled in general-purpose traffic cannot provide a competitive advantage over the automobile. By contrast, volumes on the Braintree Logan Express bus service (Boston) increased by 50% when a bus lane was added to the system. If the metropolitan system can provide free-flowing bus lanes, total travel times may well be lower by bus. Simply extending multistop local service to include the airport is a formula doomed to failure.

Quality of Connection at the Airport

The selection of the rail mode does not ensure a good quality connection from the baggage pick-up location, nor does the selection of bus preclude a good connection. In Europe, some rail stations are located immediately adjacent to a common baggage pick-up location, while other rail stations require clumsy, uncomfortable connections by bus shuttle vehicles. In the United States, connecting charter buses leave from the Las Vegas airport from within a unified terminal complex adjacent to a common baggage pick-up area, while many U.S. rail services operate from locations far from major baggage pick-up areas. This issue of the high-quality connection between airline operations and the ground access vehicle needs to be solved for whatever ground mode is selected.

On the other hand, the new data from Oakland challenges the assumption that directness of connection is more important than underlying market conditions. Certain market segments, such as resident non-business, may be willing to put up with lower levels of service amenity in a trade-off with more important trip-making objectives.

Quality of the Connecting Service Beyond the Terminal

Providing high-quality services to areas beyond the traditional downtown is a problem for both rail and bus systems. Connections between the major rail terminals in downtown London are difficult, and the mode share for Heathrow air travelers to connecting national rail service is low. By contrast, trains from Zurich Airport rail station are totally integrated into the national rail system, and mode share to national destinations is extremely high. The Newark Liberty International Airport rail station provides a case study of the appeal of longer distance rail services as a mode of airport ground access; at the present time, the market patterns are not showing the expected growth in ridership there.

The Existence of a Strategy for Baggage

While the designers of airport ground access systems must deal with the impediment of baggage and its negative impact on the choice of public modes, this report has created a comprehensive discussion of the failure—through much of the world—of downtown airport check-in terminals operated by airline personnel. Chapter 5 documents problems at downtown terminals serving London Heathrow, London Gatwick, Munich, Newark, and Madrid airports, while reporting more positive market experiences in Hong Kong, Vienna, Moscow, and Kuala Lumpur. Systems operating national, longer distance rail equipment, such as that in use in Copenhagen, can allow for the use of existing baggage storage areas. For rail systems operating standard commuter and rapid transit equipment, the problem is only rarely solved in a manner satisfactory to the traveler with large baggage.

Generically, the accommodation of baggage is not an issue between bus and rail, but rather is an attribute to be sought by the service designer. *Dealing with the baggage issue tends to argue for*

the adoption of dedicated services (by whatever mode) rather than shared service of traditional multistop transit (by whatever mode). Whether a dedicated train or a dedicated airport bus service is being considered, baggage handling can be designed in from the outset.

Summary: Designing to Deal with Revealed Attributes

For each of the four design areas specified previously in "Lessons Learned from Successful Systems," U.S. designers can strive to attain the attributes revealed in the successful international systems not by mimicking the choice of mode but rather through careful regional systems design that finds solutions for the issues defined by the four attribute areas.

Design Airport Ground Access Services for the Three Geographic Areas

At this point in the planning process, candidate markets for services can be defined. Within the contour for the market area of more than 50 trip ends per square mile, submarkets can be sought at significantly higher market concentration. With knowledge of the location of these strong market segments, rail and other services can be considered. The market research method in this report advocates defining a targeted geographic area for a given candidate service and understanding the airport trip-end density (all modes) from that geographic area to better understand the contribution that service can play.

At least three geographic areas should be examined for the service most likely to meet the needs of the customer:

- **Services for the Dense Urban Market.** High-quality line-haul service to the highest trip-end density should be developed, whether by rail or by dedicated airport bus. Examples of high-quality rail services include Washington, D.C.'s Metrorail system and Metropolitan Atlanta Rapid Transit Authority (MARTA) service to Hartsfield-Jackson Atlanta International Airport. Examples of high-quality bus service to the CBD include the specialized airport bus service from New Orleans International Airport, as well as those in Denver and downtown Seattle.
- **Services for the Exurban Market.** Dedicated airport bus service from specially designed regional parking facilities should be examined to offer services to those areas where airport trip-end densities cannot justify or make feasible collection services. Both the Los Angeles International Airport FlyAway program and the (Boston) Logan Express programs are adding additional lines and services.
- **Services for the Middle Market.** A variety of strategies should be explored for the majority of U.S. airport travelers who come from outside of the densest downtown areas, but within the principal market area of the airport, defined here as the area with more than 5 airport trip ends per square mile. Within this area, a wide variety of combinations of door-to-door, fixed-route, and, most importantly, combinations thereof, can be considered.

Understanding Demographic Segments Within Each Geographic Market

In the design of candidate services for each of the geographic areas, the market research–based planning process requires information beyond the density of trip ends. This report strongly recommends that each geographic area be examined in terms of the four demographic segments: resident business, resident non-business, non-resident business, and non-resident non-business. In many cases, the support of a high-fare, high-quality premium service (such as the Heathrow Express) is dependent upon the strength of the business market. In other cases, the support of multistop transit service (such as the Blue Line in Boston) is dependent on a strong non-business market, including students and vacationers. In many cases, airport buses from regional collection points are very attractive to the resident market (who find lower parking charges) and

not at all attractive to the non-resident market (who find it more convenient to get rental cars on the airport than in outlying areas).

The knowledge of demographic characteristics gained from the ground access survey will also become critical at the time of marketing and pricing the services. For example, to increase ridership on days of low business travel, a marketing strategy might offer low fares for families via local newspapers only. The incoming businessperson would not be aware of the existence of these fares and would continue to pay the higher basic fares. Such a marketing strategy would be designed to lower fares for that portion of the market that is elastic to fare change and not to lower fares for that portion of the market that is inelastic in relation to price.

Best Practices in the United States: Service Based on Markets

Examples of best practices can be found for all three of the submarkets, ranging from dense urban conditions to areas of dispersed origins.

Best Practices for the Dense Urban Market

- A good example of best case practices for service to areas with a high density of airport trip ends is the Airport Express bus service in New Orleans, which captured about 15% of the entire airport market before Hurricane Katrina. Its mode share rate for its primary market area (downtown) may be the highest of any U.S. airport.
- The high-frequency AirBART bus operated by Oakland International Airport to the BART rail station captures about 9% mode share. It can be argued that this service is well matched with the needs of this airport dominated by a low-cost carrier.
- To Reagan Washington National Airport, the Metrorail service covers the geographic area where most airport trips originate. This match between the origins of the riders and the location of the rail service in that area results in an airport-wide mode share of more than 12%.
- An unusual best practice is the extension of the FlyAway express bus service concept to a new terminal within the Los Angeles Union Station, providing an exceptional level of urban intermodal connections.

Best Practices for the Exurban Market

- The Logan Express system serving Boston airport continues to grow as more services are added. These services capture an estimated 20% of their catchment areas. At the time of data collection, airport buses from three parking lots attracted more airport riders than the entire fixed-route and -schedule public transportation system.
- The Marin Airporter is a privately owned service noted for its understanding of the market needs of its customers. The Marin Airporter has captured 30% of the travelers in its market area of San Francisco.
- The Van Nuys FlyAway is a mature dedicated airport bus operation, capturing an estimated 17% of the travelers from its catchment area.

Best Practices for the Middle Market

While the dedicated express bus and the longer distance specialized van service are characterized by line-haul trips of more than 10 miles, the middle market is marked by shorter trip lengths. Service operated in middle markets experiences competition from the pick-up/drop-off mode and the taxi mode.

- In Oakland, door-to-door vans capture nearly 20% of their logical catchment area in a middle market of less than 20 airport trip ends per square mile. Door-to-door services in an area immediately south of San Francisco International Airport, with much shorter trip distances, attract about 7% of their logical catchment area.

- Chapter 4 documents similar markets in Las Vegas and Orlando, in which door-to-door vans capture more than 10% of the airport-wide ground access market.
- In Seattle and Los Angeles, door-to-door vans capture more than 5% of their respective market areas in areas of middle market density.

The middle market, described in this analysis as the zones of more than 5 and less than 50 airport trip ends per square mile, is the largest of the three and the most difficult to serve. With low reported market capture rates and with occupancy levels approaching those of single-party taxis, this market segment needs the most research.

Step 5: Manage the Airport to Encourage Higher Occupancy Vehicle Use

Several elements of a comprehensive strategy to improve public mode airport ground access can be implemented within the boundaries of the airport itself. The manner in which the airport is managed can have a significant effect on the quality of the experience for those travelers who have chosen to access the airport by more efficient, higher occupancy modes.

The various strategies for improving public transportation access to airports are set against the context that most U.S. airports are not managed to encourage the use of higher occupancy modes; in many cases, the opposite is the case. Airports are primarily seen as transfer facilities between various forms of automobile use and the air services operated at the airport. In many cases, the motivation for the creation of new strategies for managing ground transportation vehicles (such as peripherally located Ground Transportation Centers) is to remove the larger vehicles from the primary roadway, which is freed up to devote more capacity to private automobile pick-up and drop-off.

Encouraging the Use of High-Occupancy Service

In the United States, currently only one airport has rail transportation that carries more air travelers for ground access than do the bus and van options: Reagan Washington National Airport. Even at airports with new rail services, such as Portland, Oregon, more passengers depend upon bus and van services than upon the rail option to the downtown. And yet, in sharp contrast to the recent advances in design for the airport/rail interface, there has been very little coordinated attempt to determine the potential of improving the connection between the bus and the airport activities.

Ironically, the modes most successful at most U.S. airports—buses and vans—have received the least amount of attention in terms of functional priority at key airport transfer points. In the allocation of curb space, the lanes closest to the terminals (those with the shortest walking distance) can be allocated to the most efficient modes, rather than a traditional pattern of allocating these lanes to private vehicles.

All too frequently, the traveler who chooses more efficient, higher occupancy modes from the airport is sent to an outer curb, unprotected from weather, with little in the way of accurate information or services. In many airports, the task of choosing a van operator, for example, occurs outside with no protection from rain or snow, or heat. In many cases, critical connections with long-headway regional services are made from an isolated curb, with no accurate real-time information informing the traveler that the bus is on time, is late, or has already departed. Often, travelers waiting at the curb for a shuttle bus to a regional rail system are not given information about the arrival time of the bus or the rail system it is serving.

Key Challenges in Step 5

- *Manage the airport to encourage transit first*
- *Allocate curb space to give priority to those arriving by higher occupancy mode*
- *Improve the architectural standards experience of the public mode traveler*
- *Build transfer facilities for bus and van modes to the design standards attained for rail projects*
- *Modify regulations that make it difficult for the traveler to purchase public mode services at the airport curb*
- *Modify regulations that make it difficult to use higher occupancy services to the airport without prior reservation*

Learning from Recent U.S. Airport Designs

Recent U.S. design experience at key rail projects can point the way towards the adoption of higher standards for transfer facilities for bus and van. The traveler inside the Newark airport terminals is offered real-time information screens that show the next departures from Newark airport rail station for both Amtrak and New Jersey Transit. The departure schedules of the two rail operators are displayed in chronological order on one screen, consistent with the needs of the traveler. Armed with this connecting mode information, the rail user can proceed upstairs to the Newark AirTrain people mover. All connections to the people mover are made within the interior spaces of the airport terminal. Accessing the AirTrain platform is simpler and quicker than getting to the major parking facilities. At the Newark airport rail station, the pedestrian paths are clear and the information about connecting services is abundant.

For major transit investments in Washington, D.C., and San Francisco, high-quality architectural solutions have been designed for the transferring public mode traveler. At the reconstructed Reagan Washington National Airport, the MetroRail station is located closer to the terminal than is the major parking garage facility; travelers walk through the rail station lobby to get to the parking garage. The public transportation terminals built by WMATA in Washington and BART in San Francisco can be used as case studies in the improvement of the condition of the arriving passenger connecting on public modes. In Washington, D.C., the walkway bridges are heated and air conditioned and brightly lit. In San Francisco, the arriving traveler on ground transportation at the new International Terminal disembarks from the BART train at the same level as the airport check-in function: no bridges, no elevators, and no escalators will impede traveler flow from the three-track station.

The operation of both a Delta Air Lines and an AirTran Airways check-in facility at the MARTA station within the Atlanta landside terminal is another example of high-quality architectural integration. That rail station is located immediately adjacent to the common baggage claim facility for the entire airport, allowing the seamless connection from baggage pick-up to the rail platform overhead.

Standards for the Ground Transportation Transfer Experience

The architectural treatment at recently constructed rail stations establishes that the transfer experience to public modes at an airport can be positive. The question is then raised about the quality of transfer to buses and vans. It is not a question that can be solved quickly, or with only one solution. In some airports, a shared Ground Transportation Center is the optimum solution, and in others it is not. Clearly, if there is a guiding public policy to encourage the use of higher occupancy modes, *the level of amenity offered to the connecting public transportation traveler should be as good as or better than that offered to the traveler connecting onward by private mode.*

Some of the strategies required by a comprehensive public policy are best carried out by the public sector, and some of the strategies are best implemented by the private sector. In theory at least, it is immaterial whether the onward connecting service is operated by the public or private sector; *the public mode traveler should experience the same level of architectural amenity in the transfer act as comparable portions of the airport.* At several large airports, bus and van passengers often board their vehicles at parking lots, dead end locations, outer curbs and other facilities with no traveler support services.

Designs to Integrate Bus Systems into Airports

Baltimore/Washington International Airport has adopted a managed strategy for authorized van service, with specific companies authorized for specific geographic areas. In design terms, this strategy makes possible the creation of a single departure point for all door-to-door services, located inside the airport terminal at the center of the terminal complex. The multiparty groups are formed inside this area with all waiting occurring inside with access to information.

Similar advances in quality of terminal design have been incorporated into the centrally located Ground Transportation Center at Minneapolis–St. Paul International Airport, which is accessed by underground walkways from the main baggage claim areas. The act of finding, purchasing, and accessing public modes of transportation occurs in a heated/air-conditioned interior space integrated into the airport terminal complex. Similar high-quality pedestrian connections are offered in the underground connections to the departure area at Portland International Airport's redesigned terminal complex, where ground transportation information and ticketing is provided within the underground walkway system.

All taxi, bus, and van departures from the Atlanta airport occur from a compact departure area located at the western edge of the terminal immediately adjacent to the common baggage claim area for the airport. At Chicago O'Hare International Airport, a City Bus Center has been built to improve the quality of transfer to the bus modes, located within the central structure with enclosed walkways from the domestic terminals.

Considering Regulations to Encourage Higher Occupancy Mode Strategies

Many local policies concerning the potential encouragement of higher occupancy patterns are determined by pre-existing regulations concerning the management of taxis. In some airports, a traveler standing at the curb seeking to purchase a shared-ride service is often not allowed to enter the vehicle unless he/she leaves the curb, goes back inside the terminal, calls a reservations line, and then comes back to the curb to wait for a subsequent dispatched vehicle.

Going to the airport, similar inefficiencies exist in the system, especially for the traveler who would like to board a shared-ride vehicle to the airport but has not formally "pre-arranged" the trip. The public policy goal of getting greater levels of vehicle occupancy is often undercut by regulations designed for general-purpose management of taxis. Public policies should be explored that would serve to maximize the occupancy levels of public mode vehicles to the airport.

Best Practices in the United States: Management and Amenity

U.S. best practices in this category tend to include examples of good architectural treatment of amenities for transferring travelers, rather than any airport-wide strategy to encourage higher occupancy. Examples of such details include:

- The revised Ground Transportation Center in the center of Minneapolis–St. Paul International Airport is a rare example of improved amenity for the traveler on buses and vans.
- The City Bus Center at Chicago O'Hare International Airport provides deplaning passengers a comfortable waiting area with seating, where they can purchase food, beverages, and newspapers/magazines, which is linked directly via an underground walkway to each terminal.
- The location of the MARTA station in the Atlanta terminal and the location of the Delta Air Lines and AirTran Airways check-in at the MARTA station.

Key Challenges in Step 6

- *Include ground transportation itinerary trip planning capability on airport websites*
- *Include ground transportation timetables in printed documents describing airport services*
- *Work in coordination with local efforts to develop the national 511 traveler information system*
- *Integrate the ticketing reservation process between aviation and ground systems*

Step 6: Present Information about Ground Access Services to the Traveler

Assuming the markets have been analyzed and services have been established, the last step in the process requires the creation of a program to make the traveler aware of the public trans-

portation services offered and to facilitate the purchase of these services. Fortunately, the technology to improve the quality of information sent to the traveler is being developed and implemented at a rapid pace.

Building a Ground Transportation Information Strategy

The traveler needs to be aware that public transportation options exist. Airport websites should include some form of automated trip planning for ground trips to and from the airport. For each city and town of destination, an airport information system should describe the services available, based on the actual schedules of each component segment of the trip for that particular hour of that particular day. These systems can now tie directly into the reservations systems of the ground transportation operators.

A website managed, or at least approved, by the local airport should include automated itinerary trip planning encompassing all public modes available to and from the airport, including public modes traditionally used in the public transportation system and public modes available only for airport services. Such a program would logically include estimated taxi fares and travel times, accurate by time of day. No currently available regional trip planning program includes a full description of all vans, limousines, and buses approved for airport use. Only the 2007 trip planning system in Amsterdam's Schiphol Airport integrates both airport-specific and regional services on one screen. The BWI Ground Access Information Module currently under beta testing will also provide these integrated information services.

Until automated services are ubiquitously and easily available at airports, printed material from simple brochures to elaborate ground transportation guides will continue to be the backbone of traveler information strategies at airports. Good examples of such materials can be found at Baltimore/Washington International Airport and many other U.S. airports.

Best Practices: Traveler Information

While the Amsterdam Schiphol Airport operates the only website that fully integrates airport-specific modes and general regional services, other more limited examples of best practice can be noted:

- The Transport Direct website in the United Kingdom describes all public transportation ground access options (and private automobile) from all airports in the UK to all destinations in the UK.
- The 511.org website provides all general public transportation services by combinations of carriers in the San Francisco Bay Area.
- The Trips123 website provides all general public transportation services from all New York City airports to all areas in the tri-state region.
- The real-time Amtrak and New Jersey Transit train departure screens in key locations at Newark airport are a good example of the kind of traveler information that has to be developed in the United States. Real-time airline departure information is presented within the train station mezzanine level.

Conclusion

A major theme that emerges from Chapters 1 and 2 is the need for some party to take leadership, and very often that happens at the level of the airport management. The professional ground access staffs at leading airports such as San Francisco and Baltimore/Washington take a proactive role in examining the extent of coverage and providing incentives (such as the grant-

ing of exclusive rights to serve a given area). In each of these cases, it is understood that there are costs associated with the establishment of high-quality services; these costs are often associated with the continued subsidy of these services. In nearly all of the best practices, such as the terminal changes at Reagan Washington National Airport or the early development of the Logan Express, there have been financial costs to bear. There is no working assumption that the solution(s) to these problems will occur without significant costs.

CHAPTER 2

The Context for Public Transportation to Major Airports

This chapter presents the context within which the airport manager must form policies towards airport ground access and summarizes the reasons for a policy interest in the subject in the United States. It reviews the present state of the airline system including a review of variations in air traffic over the period before and after the events of September 11, 2001. The chapter reviews the extent to which concern about the quality of airport ground access has become an integral part of the process of environmental and political approval of airport expansion and efficient utilization of key national assets.

Over the past decade, the way people use the aviation system has changed considerably. In the past, major airlines (now called "legacy carriers") actively competed with one another in terms of amenities that were offered to attract the user. An almost unstated assumption was that each major national carrier would provide service from any point to any point using some combination of large trunk routes between hubs and smaller commuter airplanes to get to those hubs.

Since the publication of *TCRP Report 62* (2000) and *TCRP Report 83* (2002), much of that has changed. Some major airlines have taken the approach that they will fly between airports that are cost effective at each end of the trip. The net result is that the airport ground access trip length is becoming longer and the difficulty of capturing those trips in high-occupancy vehicles such as trains, buses, and vans is getting greater. This chapter reviews what is known about the changes that have occurred in the field over the past decade.

Increasingly, transportation managers in the United States are dealing with close interrelationships between modal services that have historically been seen, and managed, as separate entities. The scale of trip generation at major airports is of concern to the regional transportation and environmental manager; the airport manager finds that strategies for higher occupancy ground access solutions have become an accepted pre-condition to the expansion and better utilization of the airport assets. Across the country, MPOs are becoming involved in problem solving for the difficult issue of public mode airport ground access. To begin this review of the policy interest behind improving airport ground access, it is important to establish a sense of scale for the amount of travel to airports and to other points of intermodal transfer in the United States.

Understanding the Scale of Airport Ground Access

TCRP Report 62 presented an analysis of the U.S. airports and their orientation to public transportation ground access modes, based largely on data collected by the FAA and the Airports Council International (ACI)–North America in the year 1998. In addition, a survey undertaken for *TCRP Report 62* drew responses from 33 airports, each of which provided a summary of the

latest ground access market share. This chapter now presents a summary of how aviation patterns have changed between the analysis years 1998 and 2005.

This report includes all U.S. airports with public mode share of 6% or more, which creates a sample of 27 of the most public mode–oriented airports in the United States. For Minneapolis–St. Paul International Airport, the research team was informed that no new survey information had been collected since the opening of the Hiawatha Light Rail. If this information had been available, the research team estimates that a rail mode share of somewhere less than 5% would be augmented by bus/van shares, making a combined public mode share of more than 6%. For the sake of brevity, the sample will be referred to as the 27 most transit-oriented airports in the United States—technically the sample should be called 27 out of 28 of the most transit-oriented airports.

U.S. Airports and Their Public Mode Share

In the study of airport ground access, focus on the originating passengers, i.e., those who are not changing from one airplane to another, is critical. However, the scale of the total operations for the 27 airports is also important and is introduced in Table 2-1, which shows the variation in *total enplanement*: this category includes all aircraft boardings for revenue purposes. The largest airport in the sample, Atlanta, has more than 10 times the total volume of the smallest airport in the sample, New Orleans. And yet volume alone cannot explain the market share gained by public modes of ground transportation, as New Orleans's well-managed downtown shuttle bus system gains about the same market share (15%) as the combination of rail and bus/van services in Atlanta. The relationship between public mode share and a wide range of geographic factors is discussed in Chapter 3.

The wide variation in the growth or shrinkage of total airline passengers for each airport will be discussed in the following section. For clarification, the number in the first row in the sixth column means that the total enplanements at San Francisco International Airport have *decreased* and are now 83.4% of those in 1998. The number in the second row of the sixth column means that the total enplanements at JFK Airport have *increased*, and are now 134.5% of those in 1998.

The Scale of the Public Mode Volumes at These Airports

The scale of public transportation markets varies by the size of the airport and by the propensity of the airport region to support public transportation. Table 2-2 reviews the 27 airports ranked by the volumes of airline passengers actually using public transportation, here defined as rail, bus, and shared-ride vans, but excluding single-party limousines, courtesy shuttles, and charter operations. Table 2-2 focuses on the scale of an airport in terms of the absolute number of passengers who are transported *to* the airport by a public mode. Importantly, these calculations are applied to the number of originating passengers, i.e., excluding those who are changing from plane to plane.

The 27 airports included in the sample generate about 60 million public mode trips when counting trips both to and from the airport. Table 2-2 shows that, at present, more travelers are using the public mode ground access services in New York's JFK airport than at any other U.S. airport, with an estimated 2.2 million annual travelers going *to* the airport on JFK's new combination of people mover to subway/commuter rail, express buses, and shared-ride vans.

After JFK airport, the next highest public mode volume occurs at an airport that does not rely on fixed-guideway investment, whether by rail or people mover. (A rail station near Los Angeles International Airport does not attract any significant number of airline passengers.) Table 2-2

Table 2-1. U.S. airports ranked by market share to public modes.

Rank by mode share	Airport	Market share to public modes	Annual airport traffic 2005 (a)	Annual airport traffic 1998 (b)	2005 enplanements as percentage of 1998
1	San Francisco	23%	32,802,363	39,317,252	83.4%
2	New York JFK	19%	41,885,104	31,109,286	134.6%
3	Boston	18%	27,087,905	26,501,508	102.2%
4	Reagan National	17%	17,843,772	15,790,288	113.0%
5	Oakland	15%	14,417,575	9,225,2228	156.3%
6	New Orleans	15%	7,800,000	8,953,224	87.1%
7	Newark	14%	33,999,990	32,659,606	104.1%
8	Atlanta	14%	85,907,423	73,513,332	116.9%
9	Denver	14%	43,387,513	36,889,080	117.6%
10	Los Angeles	13%	61,489,398	61,653,718	99.7%
11	Baltimore/Washington	12%	20,187,741	15,008,228	134.5%
12	Chicago O'Hare	12%	76,510,003	71,683,102	106.7%
13	Las Vegas	12%	43,989,982	30,264,440	145.4%
14	Orlando	11%	34,128,048	27,584,414	123.7%
15	Seattle	11%	29,289,026	25,735,660	113.8%
16	Portland	10%	13,879,701	12,974,452	107.0%
17	Chicago Midway	9%	17,650,462	10,837,660	162.9%
18	Phoenix	9%	41,213,754	31,969,240	128.9%
19	San Diego	9%	17,372,521	14,906,372	116.5%
20	Indianapolis	9%	8,524,442	7,303,054	116.7%
21	Washington Dulles	8%	26,842,922	15,607,924	172.0%
22	New York LaGuardia	8%	26,671,787	22,845,520	116.7%
23	Philadelphia	7%	31,495,385	24,152,358	130.4%
24	Tampa	7%	19,045,390	13,911,610	136.9%
25	Dallas/Fort Worth	6%	59,176,265	60,243,046	98.2%
26	St. Louis	6%	14,697,263	28,669,688	51.3%
27	Cleveland	6%	11,463,391	12,273,770	93.4%

SOURCES: (a) Airports Council International–North America, 2005 North America Final Traffic Report;
(b) Airports Council International, *The World's Airports in 1998,* "Airport Ranking by Total Passengers," 1999.

shows that San Francisco has the third largest volume of public mode users, followed by Las Vegas, which relies on a wide variety of vans and buses, as documented in Chapter 4. Atlanta, Boston, and Chicago O'Hare airports each attract from 1.8 to 2.0 million public transportation travelers per year. More than 1 million travelers per year use public transportation to get to Orlando, Newark, Denver, Reagan Washington National, and Seattle airports.

What Has Happened over the Last Decade?

Figure 2-1 reflects early growth rate in total enplanements at all U.S. airports between 1998 and the summer of 2001, followed by the sudden drop in airline traffic following the events of September 11. Figure 2-1 also shows the powerful recovery of the industry over the last 4 years of the graph. The figure shows a roughly 21% growth in enplanements at these U.S. airports in

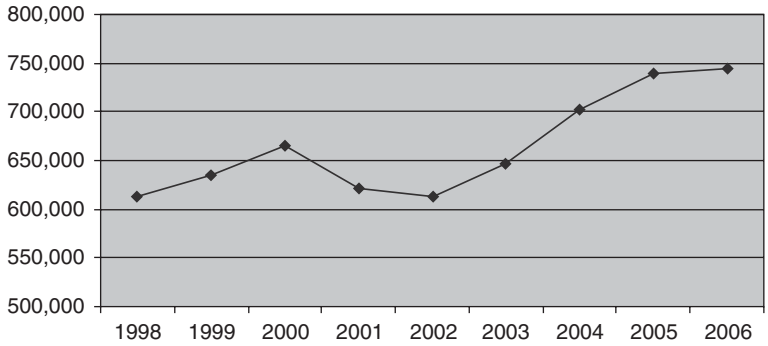
Table 2-2. Volume of transit use at 27 U.S. airports.

Rank by transit volume	Airport	Public transport users to airport (in millions)	Market share to public modes	Originating enplanements (a)
1	New York JFK	2.2	19%	11,602,440
2	Los Angeles	2.1	13%	16,441,180
3	San Francisco	2.1	23%	8,938,170
4	Las Vegas	2.0	12%	16,339,950
5	Atlanta	1.9	14%	13,696,770
6	Boston	1.9	18%	10,428,620
7	Chicago O'Hare	1.8	12%	14,923,320
8	Orlando	1.5	11%	13,792,840
9	Newark	1.5	14%	10,375,220
10	Denver	1.4	14%	9,817,970
11	Reagan National	1.2	17%	7,003,410
12	Seattle	1.1	11%	9,898,290
13	Phoenix	1.0	9%	11,491,890
14	Oakland	0.9	15%	6,273,490
15	Baltimore/Washington	0.9	12%	7,637,130
16	New York LaGuardia	0.9	8%	11,291,970
17	San Diego	0.7	9%	7,833,280
18	Dallas/Fort Worth	0.6	6%	10,683,750
19	Philadelphia	0.6	7%	9,123,560
20	Tampa	0.6	7%	8,116,390
21	Portland	0.5	10%	5,373,750
22	Chicago Midway	0.5	9%	5,933,190
23	New Orleans	0.5	15%	3,472,780
24	Washington Dulles	0.5	8%	6,505,480
25	Indianapolis	0.3	9%	3,628,540
26	St. Louis	0.3	6%	4,845,770
27	Cleveland	0.2	6%	3,789,610

SOURCE: (a) U.S. Department of Transportation/Federal Aviation Administration, *Origin-Destination Survey of Airline Passenger Traffic, Domestic 2005.*

the time period from 1998 to 2005. Perhaps most relevant to this project is the growth between the nadir of 2002 to the present volumes in the airline system, which, again, shows a 21% growth in the most recent 4-year period. The question is raised as to whether there have been major changes in travel during this period and how such an environmental change might (or might not) affect the patterns of ground access.

A key problem for the aviation market analyst is the coincidence of the timing of the depression in traffic after September 11 and the timing of the rapid growth of "non-legacy" low-cost carriers. Given the profound changes that were occurring, it is sometimes difficult to distinguish changes associated with more draconian security, for example, from changes in assumptions about free peanuts once on the plane. The net emotional result as experienced by the passenger is a more stressful total travel experience than existed 20 years before.



SOURCE: Calculated from Bureau of Transportation Statistics, based on "Origin and Destination Survey of Airline Passenger Traffic - Table 1," a publication of the U.S. Civil Aeronautics Board, based upon a 10% sample.

Figure 2-1. All U.S. airport enplanements between 1998 and 2006 (in 1000's).

In interviews with airport managers affected by the sudden growth of the low-cost carriers, virtually all of them responded that the arrival of Southwest Airlines had made a major impact on demand on their parking supply and on the trip distance of those coming to the low-cost airline airport. In general, these longer distance automobile trips are more difficult to capture by higher occupancy modes (such as van or express bus) than are trips from areas closer to the airport.

A series of surveys were undertaken for the New England Regional Aviation System Plan, a highly innovative study of the integrated air system operating in six states, which was completed in 2006. All the airports in New England were surveyed in 2004, before the upturn in air traffic had significantly begun in that region. When asked why the traveler chose his/her airport, a standard response was that it was simply the closest. However, for both Manchester, New Hampshire, and Providence, Rhode Island, a trade-off of longer ground access trips for lower airplane fares was apparent. The study managers wrote:

> "When passengers choose among alternative airports, airport proximity is the single largest decision factor. However, airports with an advantage over competing airports in terms of service levels and/or fares will attract *a higher share of traffic than they would based on drive times alone*." (*1,* emphasis added)

At the time of that survey, Southwest Airlines served only Manchester, New Hampshire, and Providence, Rhode Island. The study created a natural catchment area based on minimum time path by automobile and noted the extent to which each airport attracted originating passengers from outside of that area; the highest rate of capture from a longer distance than necessary came from Manchester airport at 47%, with Providence showing that 40% of passengers came from a geographic area closest to a different airport. Thus, some evidence exists that ground access distances tended to increase as a result of the first wave of low-cost carriers.

Over the past decade, changes in the management of the airline industry have had profound effects on the ground transportation patterns to major airports. These changes fall into two general categories. First, the non-legacy airlines have not sought to mimic the hub-and-spoke system that results (often) in the potential connection of all airports of origin with all airports of destination in a time-sensitive manner. In other words, lower cost airlines go to those airports they choose to serve, and only those airports they choose to serve. The result of this initial pattern by the low-priced carriers was a large increase in the length of ground access travel that airline passengers would be willing to undertake to travel on the lower cost airline. Second, a new wave

of low-priced carriers has incorporated a business strategy that does indeed serve existing major airports, such as Boston's Logan International Airport.

Turning to the question of the impacts of the events of September 11, survey research during the period of lowest levels of airline patronage during 2002 reported that fundamental attitudes *toward air travel options* had not changed significantly because of September 11. The study by Resource Systems Group (RSG) based on a 2002 survey concluded:

> "Comparing the results described in the previous sections to the results from previous years' surveys, it is clear that the events of 9/11 and subsequent changes to the air security system have not dramatically changed the way that air travelers evaluate alternative air travel options. However, additional questions that were asked in this year's survey make it clear that there have been some changes in how travelers evaluate air versus other travel options and in the way that they use the system. *Almost one-quarter say that they make fewer air trips now than they did before 9/11 and, of those, almost two-thirds drive a car to substitute for air travel, 20% use a train and 40% forgo trips (multiple response were allowed so the total is greater than 100%).*
>
> "*More than 40% of all travelers say that they allow more time for air travel now than they did before 9/11; the median additional amount of time is over 50 minutes.* Over 20% say that they feel less safe and secure when traveling; this is partially offset by the 4% who say that they feel more safe/secure now. Only small numbers (approximately 3% each) say that they use different airports or different airlines as a result of 9/11. And, over 37% say that 9/11 has not had any continuing effect on their air travel (*2,* emphasis added)

It seems clear that Americans now routinely allow more time at the air terminal than in previous decades, consistent with the RSG finding at the time. The study also noted that travelers place a different value of time on different modal segments of the full trip. While the business traveler places a value of time of $37 per hour on the scheduled in-air time of the trip, the same business traveler places a value of time of only $24 per hour on the ground access portion of the trip. This value assessment is consistent with the concept that the traveler will indeed spend more time in his/her automobile in order to gain whatever advantage is offered by the airport selected.

The survey concluded that only 3% of travelers say they would use a different airport *as a result of September 11,* but this attitude still allows for a change in selected airport in reaction to lower fares or other service dimension. It is implicit from Figure 2-1 that many of those who, in 2002, had reported a mode change to train or car subsequently returned to the air system over the following 3 years.

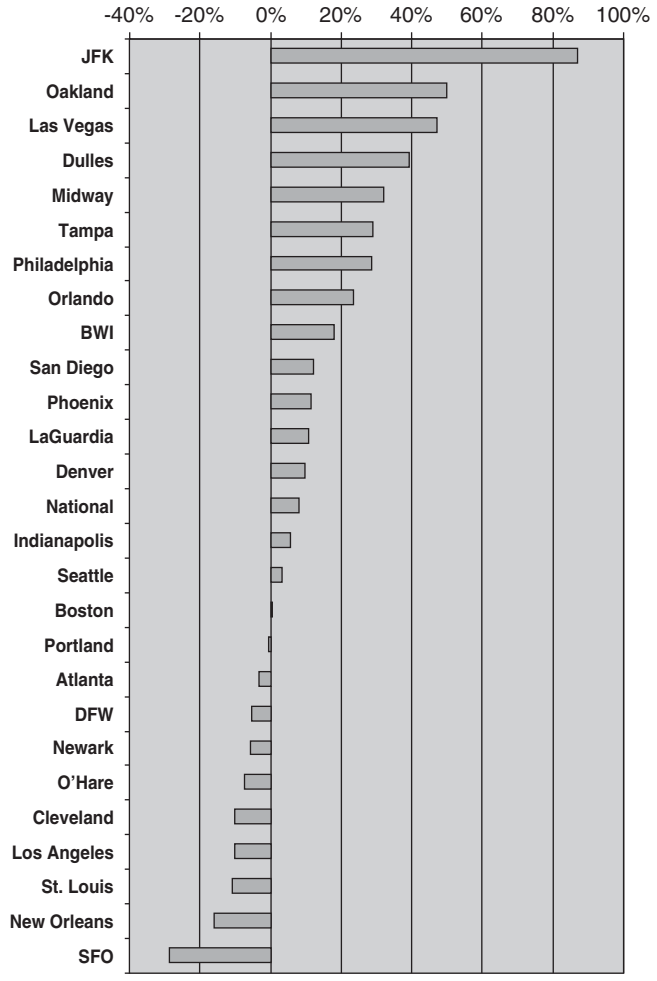
How Have the Transit-Oriented Airports "Bounced Back" from the Decrease in Air Traffic?

The focus of this project is on the U.S. airports with the highest use of public transportation services and specifically on the 27 airports in the sample. For the nation as a whole, the data behind Figure 2-1 shows enplanements grew by about 20% between 1998 and 2005; at the transit-oriented airports, total enplanements increased by 13%. Logically, this statistic suggests that the *growth in total enplanements has been considerably stronger in the airports outside of our sample*; these other airports tend, with few exceptions, to be smaller and more difficult to serve with public transportation.

The research team has focused on the changes in originating passengers (thereby avoiding the double counting of travelers who have to make several segments to accomplish one trip). The results are somewhat more complicated than the simple rebounding trend in total enplanements revealed in Figure 2-1. Turning to the number of origin–destination trips being made through the 27 airports, *only an 8% increase has occurred* overall, with 10 of the major airports having *fewer* originating travelers than in 1998. It is clear that *part* of the 13% increase in total enplanements in the sample is associated with an increase in the number of transferring passengers.

As shown in Figure 2-2, between 1998 and 2005, the use of JFK airport by originating passengers grew by a remarkable 80%, largely attributable to the additional services provided by JetBlue Airlines. The number of originating passengers in Oakland grew by about 50% over the same time period, associated with a growth in service by Southwest Airlines. In the middle of the spectrum, airports in Boston and Portland, Oregon, had not fully gained back their mid-period losses as of the 2005 data. Volumes of originations decreased by a factor of 10% in airports in Cleveland and Los Angeles. While the New Orleans decline was somewhat expected, the loss of more than 20% in San Francisco is a sharp change for an airport that has invested heavily in infrastructure to improve ground access services

In some cases, the changes occur largely within a metropolitan area with decreases at San Francisco International Airport correlated with increases at Oakland and San Jose airports and decreases at Chicago O'Hare correlated with increases at Chicago Midway. The two New York City airports seem to have simply attracted more people (over longer distances) as increases during the time period at JFK airport are not associated with any decrease at LaGuardia airport.



SOURCE: U.S. Department of Transportation/Federal Aviation Administration, Origin-Destination Survey of Airline Passenger Traffic, Domestic.

Figure 2-2. Change in originating passengers for the 27 U.S. airports, 1998 to 2005.

Will the Pattern of Air Travel Continue to Grow?

While the extent of growth for major U.S. airports was clouded by the market reaction to the events of September 11 and while any precise forecasts are clearly beyond the scope of this project, there has been considerable consensus on the scale of growth expected over time. The International Air Transport Association (IATA) based in Geneva has used a growth rate of 3.9% for U.S. air traffic for its forecasting (*3*). In a worldwide forecast released in January of 2007, the ACI Global Traffic Forecast 2006-2025 predicts a "doubling of current passenger numbers within the next 20 years. Passenger volumes are predicted to grow by an average of 4% annually over the 20-year period, leading passenger volumes to top 9 billion passengers a year by 2025, up from 4.2 billion in 2005." (*4*)

Some U.S. airports concur in these aggressive forecasts. SCAG, the MPO for the Los Angeles area, forecasts a regional increase at an annual rate of 4%, dealing as it does with a growing market of services between Asia and the Americas. All of this growth is set in the context of a projected increase in the role of the other airports in the region from their original share of 12% of the region's demand to 33% in the target year (*5*).

The recent New England Regional Aviation System Plan undertook both high and low forecasts. With 49.6 million New England passengers in the base year of 2000, the Plan produced a high-demand 2020 forecast of 90 million air passengers and a low-demand forecast of 67.5 million air passengers (*1*). The high-demand forecast reflects a compounded growth rate of approximately 3%, while the low-demand forecast translates to about a 2% growth rate. The consensus forecast averages to about 2.3% growth per year, showing the difference in assumptions in the mature Northeast and the developing Southwest (e.g., 4% annual growth in Los Angeles).

In the Washington, D.C., metropolitan area, a 30-year forecast was adopted at a rate of approximately 2.8% per year compounded (*6*). As shown in Figure 2-3, this overall regional growth must be distributed over three airports, some of which are more physically constrained than others, as assumed in the transportation planning process now underway at the MWCOG. Figure 2-3 shows the expected growth in three airports expressed in terms of ground transportation impacts. In a 25-year planning horizon, between 2005 and 2030, originating enplanements at Baltimore/Washington International Airport are expected to double, with an overall growth factor of 2.1. Turning to Dulles International Airport (from the same study), originating enplanements are expected to triple, with an overall growth factor of 3.2. Close-in Reagan Washington National Airport is even more constrained than Baltimore/Washington International Airport, with originating enplanements expected to increase only by somewhat more than one-third, with an overall growth factor of 1.38. Importantly for the study of ground transportation, these MPO-predicted growths in air travel demand are expressed as flows by mode, which can be immediately integrated into the planning of the ground access system, as shown in Figure 2-3.

Understanding the Trips that Use Airports

Trip Purpose: Why Do Airline Passengers Travel?

Airline passengers are more likely to be traveling for business purposes than are long-distance travelers as a whole. On board the commercial airplane an average of 41% of passengers are traveling on business, compared with a national average of only 22% of overall travel for this purpose. Pleasure trips, such as vacations, have a high propensity to occur by car rather than by airplane, as shown in Figure 2-4. Phrased differently, 64% of our national long-distance trip making is for pleasure, while only 49% of airline passenger trips are for pleasure.

Average Weekday Air Passenger Ground Access Trips by Mode 2000 - 2030 BWI Airport

Year	Arrival Mode					
	Auto Driver	Auto Passenger	Transit	Airport Transit	Other	Total
2000	12,438	8,004	445	3,074	460	24,421
2005	13,869	8,916	484	3,363	485	27,117
2010	19,195	12,318	675	4,566	666	37,420
2015	23,044	14,792	816	5,445	804	44,901
2020	25,920	16,634	922	6,131	877	50,484
2025	27,611	17,724	974	6,546	920	53,775
2030	29,354	18,857	1,022	6,884	962	57,079

Average Weekday Air Passenger Ground Access Trips by Mode 2000 - 2030 DCA Airport

Year	Arrival Mode					
	Auto Driver	Auto Passenger	Transit	Airport Transit	Other	Total
2000	9,584	5,805	2,881	2,119	256	20,645
2005	9,426	5,719	2,798	1,936	256	20,135
2010	10,756	6,507	3,182	2,313	296	23,054
2015	11,224	6,808	3,397	2,506	304	24,239
2020	11,785	7,128	3,562	2,626	324	25,425
2025	12,328	7,458	3,710	2,758	347	26,601
2030	12,885	7,784	3,871	2,885	369	27,794

Average Weekday Air Passenger Ground Access Trips by Mode 2000 - 2030 IAD Airport

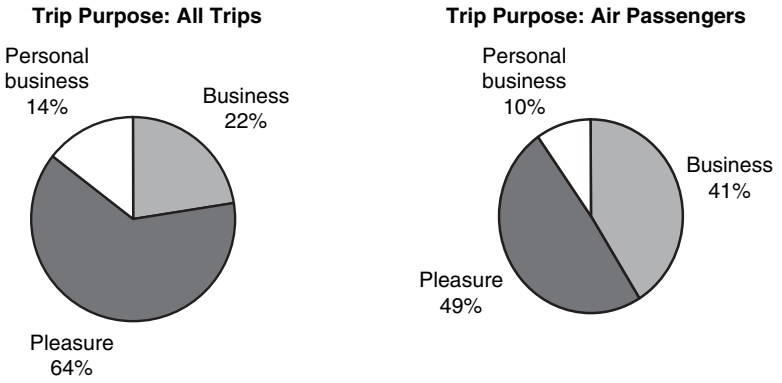
Year	Arrival Mode					
	Auto Driver	Auto Passenger	Transit	Airport Transit	Other	Total
2000	8,975	4,987	7	2,166	410	16,545
2005	9,264	5,099	7	2,196	422	16,988
2010	14,246	7,789	9	3,379	644	26,067
2015	18,337	10,128	3,344	3,412	845	36,066
2020	22,188	12,301	4,005	4,145	1,026	43,665
2025	24,448	13,605	4,448	4,619	1,132	48,252
2030	27,423	15,288	4,903	5,276	1,278	54,168

SOURCE: Metropolitan Washington Council of Governments, *Washington-Baltimore Regional Airport System Plan Ground Access Update, 2007*

Figure 2-3. Airport growth forecasts and growth in ground access volumes for Washington metropolitan area.

How Trip Purpose Varies by Airport

In *TCRP Report 62*, airline passenger trip purpose data were reviewed for 25 airports (not all of which are included in this report's sample of the 27 most transit-oriented airports). The 25 airports are grouped in Table 2-3 according to the trip purpose of originating passengers (business versus leisure). The trip purpose will usually affect a passenger's decision to use public transportation to the airport because of several factors, such as frequency of trips, duration of trips, and sensitivity of passengers to time. For example, airline passengers traveling on busi-



SOURCE: American Travel Survey, 1995.

Figure 2-4. Trip purpose for air passengers vs. all trips over 100 miles.

ness may have more information available on access options at specific airports because they tend to make more trips by air than airline passengers traveling on leisure. Certain business travel arrangements may also require the use of particular airport access modes.

Five airports appear to be dominated by business travelers. The two airports with the largest proportion of business travelers (Atlanta and Reagan Washington National) also attract significant rail ridership (as discussed in Chapter 4), in part because of the business travelers. At nine airports, between 45% and 55% of all airline passengers are making business-related trips. It is anticipated that the category of airports dominated by business travelers would include most U.S. airports if trip purpose data were available. At seven airports, 35% to 44% of all airline passengers are on business-related trips. Many of these airports (e.g., San Francisco, San Diego, Tampa, and Salt Lake City airports) serve a combination of business and resort/leisure markets. Airports with fewer than 35% business travelers primarily serve leisure markets (e.g., Las Vegas, Fort Lauderdale, and Orlando).

Airports Serving Residents and Airports Serving Visitors

Data describing airline passenger place of residence were available from 23 airports in *TCRP Report 62*. These data suggest four groupings of airports, shown in Table 2-4. Local residents represented in Table 2-4 are airline passengers who are considered part of the airport's local market

Table 2-3. Percentage of air travelers who are on business.

More than 55%	45% to 55%	35% to 44%	Less than 35%
Atlanta (66%)	Boston (54%)	San Francisco (41%)	Los Angeles (32%)
Reagan National (64%)	Baltimore/Washington (54%)	San Diego (40%)	Las Vegas (30%)
Dallas/Ft. Worth (57%)	Seattle (54%)	Tampa (37%)	Orlando (23%)
Kansas City (57%)	Washington Dulles (52%)	Chicago Midway (37%)	Ft. Lauderdale (23%)
New Orleans (56%)	Chicago O'Hare (50%)	Phoenix (36%)	
	Oakland (50%)	Portland (36%)	
	San Jose (48%)	Salt Lake City (36%)	
	Denver (47%)		
	Sacramento (46%)		

SOURCE: *TCRP Report 62*, Jacobs Consultancy.

Table 2-4. Percentage of air travelers who are local residents.

More than 55%	50% to 55%	40% to 49%	Less than 40%
Sacramento (69%)	Dallas/Ft. Worth (54%)	San Jose (49%)	Phoenix (38%)
Boston (59%)	Chicago O'Hare (54%)	Baltimore/Washington (47%)	Tampa (38%)
Seattle (57%)	Oakland (52%)	Salt Lake City (45%)	Washington Dulles (33%)
	Atlanta (50%)	San Francisco (43%)	New Orleans (28%)
		Los Angeles (42%)	Reagan National (29%)
		Fort Lauderdale (41%)	Orlando (27%)
		Denver (41%)	Las Vegas (17%)
		Portland (40%)	
		San Diego (40%)	

SOURCE: *TCRP Report 62*, Jacobs Consultancy.

area and who live close enough to access the airport using ground transportation. Airline passengers who are not local residents are visitors who do not live within the market area of the airport they are using. Resident airline passengers are more likely to have (1) a private vehicle, (2) more information on airport access, and (3) more familiarity with regional traffic patterns and transportation options.

More than 50% of the airline passengers at seven airports surveyed are local residents. These airports include those that serve as large airline connecting hubs (Dallas/Fort Worth, Chicago O'Hare, and Atlanta), plus airports located on the East and West Coasts (Boston, Oakland, and Seattle). The proximity to leisure markets or vacation destinations influences the passenger profile at airports serving fewer than 50% residents (e.g., San Francisco, Los Angeles, Ft. Lauderdale, Tampa, Las Vegas, and Orlando).

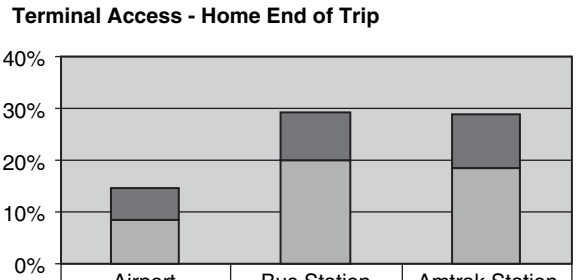
National Patterns of Access to Airports and Terminals

Most of the airport ground access data presented in this report were collected by the airports themselves (or regional planning agencies associated with those airports). However, a nationwide view of access patterns to terminals can be obtained from the American Travel Survey (ATS), which described about 365 million annual total ground access trips to and from U.S. airports in the survey year of 1995. In the ATS, these trips are categorized by whether they occur in the traveler's area of residence or in the non-home portion of the longer distance trip. In this report, travelers in the first category are described as the "resident" market and those in the second category are described as the "non-resident" market for purchase of ground transportation services.

Terminal Access at the Home End of the Trip

Getting airline passengers to access the airport with public modes seems to be more difficult than getting passengers on intercity bus and intercity rail to access their terminals with public modes. Looking at the mode of ground access selected from a national aggregate perspective, ground access modes to all three kinds of terminals (i.e., bus, train, air) are dominated by the private automobile. In this resident market, those accessing a bus or a train have a significantly higher propensity to select a mode other than the private automobile to get to the bus or train terminal, with combined mode shares for taxi, limousine, and public mode at nearly 30% market share.

Figure 2-5 reveals that bus, van, limousine, and rail capture about 20% of the market to long-distance bus and rail terminals, but capture only 8% of national travel to airports, excluding taxis.



	Airport	Bus Station	Amtrak Station
Taxi share	6%	9%	10%
Public (Includes limo)	8%	20%	19%

SOURCE: American Travel Survey, 1995.

Figure 2-5. Ground access mode to terminals by the residential market.

Unfortunately, the ATS does not allow private limousines to be examined separately from higher occupancy vans in this national overview. The rest of this report will present airport-specific data that allows this important distinction to be made in the analysis.

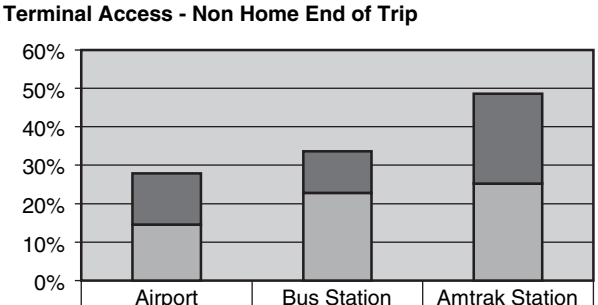
Terminal Access at the Non-Home End of the Trip

From a nationwide data perspective, the long-distance traveler has a greater propensity to purchase a ground access service *while in the non-home end* of the long-distance trip than while in their home area. Figure 2-6 shows behavior of the non-resident market: in the non-home area, the public mode share to the airport is nearly twice as high as in the home area. Non-home area public mode shares to long-distance bus and rail terminals also are greater than those in the home area.

Daily Public Mode Volumes to Airports

Most airports describe their scale in terms of total annual passenger movement, which includes both enplanements and deplanements. As shown in Table 2-1, airports in Chicago and Atlanta are generally described as airports with more than 70 million annual passengers (MAP).

The scale of airport ground access markets is often easiest to interpret in terms of a *daily* volume from points origin to the airport and, if possible, an hourly volume number. This section refers to



	Airport	Bus Station	Amtrak Station
Taxi Share	13%	11%	23%
Public (Includes Limo)	15%	23%	25%

SOURCE: American Travel Survey, 1995.

Figure 2-6. Ground access mode to terminals by the non-resident market.

ground access flows *to* the major airports for the simple reason that the vast majority of airport ground access surveys are collected in the airline departure areas, for a variety of reasons of survey accuracy and reliability. The relationship between annual passenger activity figures and hourly flows of persons on public modes is illustrated in the following steps.

"Typical" Public Mode Volumes for Large U.S. Airports

A "typical" public mode volume for a large U.S. airport can be estimated from the available data. The steps to calculate an average daily ground access public mode volume are straightforward.

1. **From passengers to enplaning passengers.** The scale of an airport is generally categorized in terms of total annual airport activity. For example, in 2005, Boston is usually described as an airport of roughly 26 MAP. For the analysis of ground access, it is more useful to examine movements in one direction: Boston could be just as well described as an airport of 13 million *enplanements*.
2. **From total enplanements to originating passengers.** The most important step in observing the overall scale of the ground access market is to subtract the airplane-to-airplane connecting movements from the total enplanements. When these movements are subtracted, Boston airport in 2005 can be observed to have 10.4 million *originating* passengers, making it the ninth largest ground access market in the United States. As such, it can be used as a "typical" larger airport in the top 20 U.S. airports.
3. **From annual to daily originating passengers.** By dividing Boston's 10.4 million originating passengers per year by 365, somewhat less than 29,000 airline passengers arrive at the airport on an "average" day.
4. **From daily to hourly volume.** Approximately 10% to 15% of the 24-hour passenger volume have been observed to arrive in a single peak hour, creating a peak-hour volume of between 2,900 and 4,200 airline passengers arriving by all ground access modes.
5. **Peak-hour public transit volumes.** In Boston, about 18% of arriving airline passengers arrive by some form of public transportation; thus, between 500 and 750 airline passengers arrive in the peak hour by rail, bus, and van combined.

Public Mode Volumes for 27 U.S. Airports

Table 2-5 presents the estimated scale of use of public mode ground transportation at selected U.S. airports. The steps taken to create the "typical" public mode volume into the airport can be applied to each U.S. airport for which the data are available. Thus, using the assumptions in this section, JFK airport is estimated to attract about 7,000 public mode ground access users per day. The airports in this group of transit-oriented airports vary widely: five U.S. airports attract 6,000 or more public mode users per day and eight airports attract less than 2,000 public mode users per day.

Dealing with peaking characteristics at airports is difficult, because different airports have different distributions of traffic over the day. A range of 10% to 15% of daily volume in the peak hour can be used as a default. From this assumption, total hourly volumes to U.S. airports are estimated to be far less than 1,000 passengers per hour by all public modes combined (with JFK as the possible exception, from Table 2-5).

Implications for Choice of Ground Access Mode

The scale of public transportation volumes to major airports must be examined with some caution. Clearly, the transit infrastructure must be able to accommodate volumes in the range

Table 2-5. Daily ground access volumes.

Airport	Estimated daily inbound public mode volume (air travelers only)	Market share to public modes	Annual originating passengers (a)
New York JFK	7,000	19%	11,602,440
Los Angeles	6,900	13%	16,441,180
Las Vegas	6,300	12%	16,339,950
Atlanta	6,200	14%	13,696,770
Boston	6,000	18%	10,428,620
Chicago O'Hare	5,800	12%	14,923,320
San Francisco	5,600	23%	8,938,170
Orlando	4,900	11%	13,792,840
Newark	4,700	14%	10,375,220
Denver	4,400	14%	9,817,970
Reagan National	3,800	17%	7,003,410
Seattle	3,500	11%	9,898,290
Phoenix	3,300	9%	11,491,890
Baltimore/Washington	3,000	12%	7,637,130
New York LaGuardia	2,900	8%	11,291,970
Oakland	2,600	15%	6,273,490
San Diego	2,300	9%	7,833,280
Dallas/Fort Worth	2,100	6%	10,683,750
Philadelphia	2,100	7%	9,123,560
Tampa	1,800	7%	8,116,390
Portland	1,700	10%	5,373,750
Chicago Midway	1,700	9%	5,933,190
New Orleans	1,700	15%	3,472,780
Washington Dulles	1,700	8%	6,505,480
Indianapolis	1,000	9%	3,628,540
St. Louis	900	6%	4,845,770
Cleveland	700	6%	3,789,610

SOURCE: (a) U.S. Department of Transportation/Federal Aviation Administration, *Origin-Destination Survey of Airline Passenger Traffic, Domestic 2005.*

of 500 to 1,000 passengers per hour into an airport. However, *capacity alone* should never be the sole justification of rail investment; buses in many corridors in the United States regularly carry more people than they would need to carry to serve airline passengers at an entire airport. For example, through the Lincoln Tunnel in New York City, buses carry more than 40,000 persons per hour in the peak direction. There are many powerful reasons to select rail services to airports, based mainly on the existence of a grade separated right-of-way not subject to the daily congestion plaguing such airports as JFK and O'Hare; but, in theory, the capacity constraints of rubber-tired services should not be used as a justification for such a selection.

For most metropolitan areas, a comprehensive program to improve public mode airport ground access services, and to raise the overall vehicle occupancy levels, will require a variety of

modes and a variety of operational strategies. Modal technologies from multiparty taxi sharing to regional rapid transit have all been found to be relevant to the U.S. experience. For each of these services, the transportation planner must match the characteristics of the supporting market with the characteristics of the candidate mode. In many cases, the capacity of a given mode, such as express bus service, has been described as a limiting factor in a long-term role of airport ground transportation. However, in virtually all cases under consideration, the capacity of bus, light rail, rapid transit, or commuter rail service is vastly higher than that required for airport-related services. Finding an exclusive dependable right-of-way—such as the high-occupancy vehicle (HOV) lane between the Braintree Logan Express terminal and Boston airport—is a key issue in providing high-quality public mode access. Thus, *the choice of airport access mode has more to do with policy decisions made for the rest of the regional transportation system than with any capacity limitations inherent to any given mode.*

In the United States, the market for public transportation (rail, bus, and shared-ride vans) at airports appears to be finite. Chapter 4 presents descriptions of 27 airport ground access systems in the United States and 19 ground access systems in Europe and Asia. Simply summarized, all of the reported international systems attract a public mode share of more 20%, while none of the U.S. systems attract a public mode share of more than 20%. The question then turns to the most effective way to raise higher occupancy vehicle shares at U.S. airports.

Why are Airports Concerned with Ground Access by Public Modes?

Seen from the vantage point of the airport manager, key decisions to utilize existing airport assets, and expand upon those assets, are often interrelated with approvals through the environmental and the local political processes. Airport managers in Los Angeles, San Francisco, and Boston, like managers in London, Zurich, or Amsterdam, understand that key environmental and political approval processes for more airport airside capacity require a planning process that specifically addresses the impacts of airport ground access.

Seen from the vantage point of the regional transportation manager, travel demand management strategies are being implemented to deal with VMT from major activity centers. A large airport, of greater than 45 MAP, can be associated with the generation of 5 million vehicle miles of ground access travel per day, while a smaller airport of 5 MAP can be associated with 500,000 VMT per day. A public official charged with the creation of a CMS or an air quality control strategy cannot help but note the rate of traffic growth of major airports and their role in the regional growth of VMT.

Ground Access Issues and the Regional Planning Process

The need to acknowledge, and deal with, the problems of ground access have become an accepted part of the process of gaining environmental approvals for major growth in airports. Environmental regulations deal with the air quality implications of transportation facilities, both on and off of the airport. Issues that at one point seemed separate are now seen in an integrated intermodal systems perspective. Throughout the United States, the provision of improved ground transportation strategies is seen as an integral component of plans to increase capacity and efficiency at major airports. Over the last few years, ground access strategies have been advanced at San Francisco; Los Angeles; Miami; Portland, Oregon; Minneapolis–St. Paul; Newark; and New York JFK airports. New combinations of services are being explored in Chicago (both O'Hare and Midway), Dallas/Fort Worth, Baltimore/Washington, Seattle, and Dulles airports.

Metropolitan Washington Council of Governments

A good example of the coordination that should exist between airport managers and the metropolitan transportation planning process is the Continuous Airport System Planning program of the MWCOG. MWCOG notes:

> "The transportation linkage between airports and local activities is a critical and often overlooked component of the airport system. Choice of airport and even the decision to fly are clearly linked to the quality, cost and travel time associated with the ground journey to the airport. The goal of the Continuous Airport System Planning (CASP) program is to provide a process and products that support the planning, development and operation of airport and airport-serving facilities in a systematic framework for the Washington-Baltimore region." (*6*)

Keeping the aviation system supported by the ground transportation system is a stated goal of the long-range plan of the metropolitan Washington region.

> "Goal 8 of the [Transportation Planning Board's] Vision reads: The Washington metropolitan region will support options for international and inter-regional travel and commerce. Goal 8 has three objectives:
>
> (1) The Washington region will be among the most accessible in the nation for international and inter-regional passenger and goods movements.
> (2) Continued growth in passenger and goods movement between the Washington region and other nearby regions in the mid-Atlantic area.
> (3) Connectivity to and between Washington Dulles International, National, and Baltimore/Washington International Airports." (*6*)

The New England Regional Aviation System Plan

The concept of a continuous regional planning process for three airports together, in the MWCOG program, has been taken one step further in an ambitious plan encouraged and sponsored by the FAA in New England, where the interaction between all commercial airports in six states was examined in the New England Regional Aviation System Plan (NERASP), which concluded in October 2006.

According to its managers, the main objective of the study was to identify strategies for optimizing New England's regional airport system:

> "The objectives of the forecast task are to assess how future air travel demand may be distributed across the region's network of commercial service airports and how that distribution might vary depending on the level of regional demand or changes in key parameters s*uch as airport access times or airline service development decision*." (*1,* emphasis added)

The technical forecasting process was unique in that forecasts were developed from a regional perspective first, "rather than from the perspective of an individual airport or a state system of airports. Thus the NERASP forecasts for individual airports in the regional system reflect the fact that many of the region's passengers have multiple airport options and often choose from among several airports when making travel plans."

Applying the process described in this report, the NERASP study was widened to include a free-standing ground access report, which was unique in its simultaneous examination of many airports and their competition—in many cases—for a common and overlapping market.

Los Angeles: Cooperation with the Regional Planning Organization

In Los Angeles, work is continuing to ensure the coordination of aviation planning with the other components of the region's transportation strategy. At SCAG, a professional staff dedicated to aviation issues works closely with other modal specialists in the development of the Regional Transportation Plan. According to SCAG:

> "The adopted Regional Aviation Plan needs to be supported by complementary ground access programs and projects at existing and proposed regional commercial airports. The aviation plan is a component of the Regional Transportation Plan (RTP), a federally mandated long-range transportation plan . . . ." (*5*)

To accommodate the projected air travel demand, the Los Angeles aviation planning process focused attention on two areas: (1) the possible use of high-speed ground transportation services in redistributing the demand away from Los Angeles International Airport toward other regional airports such as Ontario International, Palmdale Regional, Bob Hope, John Wayne/Orange County, Long Beach, and San Bernardino International and (2) the actions that the airport agency itself can take to deal with ground access issues.

The development of all alternatives in the Los Angeles International Airport (LAX) Master Plan took place within a heightened policy awareness of the importance of higher occupancy strategies, and connection with regional transit. Los Angeles World Airports (LAWA), the airport oversight and operations department for Los Angeles, establishes the following three goals of the Master Plan:

- "Maximizing access to and from regional transportation systems,
- Providing opportunities for people to connect to mass transit systems, and
- Protecting neighborhoods by minimizing or mitigating any impacts on local streets." (*7*)

The plan states that "In order to relieve traffic impacts on area residents and ease congestion on surface streets and freeways around LAX, LAWA is committed to a Master Plan that improves access to and circulation around the airport and *develops alternatives to the increased use of single occupancy vehicles.*" (*7*, emphasis added)

The development of the LAX Master Plan entered a new phase in early 2007 with a new mayor and Stipulated Settlement Agreement with petitioners that allowed certain elements of the plan to proceed, while other design elements were put on hold. An earlier terminal scheme, which moved most of the landside access facilities to an intermodal center at an adjacent transit station, has not gained the support of the present mayor. At this time, a planning process is under way to develop a revised design for various components of the LAX Master Plan including reconfiguration of the North Airfield and the Central Terminal Area.

Environmental Approvals in Europe

The need for explicit action to deal with the environmental impacts of airport growth has been explicitly spelled out in environmental approvals recently issued in other areas, including London and Zurich. In London, the approval process for the new Terminal 5 at Heathrow was made contingent upon the airport agency bringing about a set of rail improvements in the region, including the Heathrow Express. In fact, the environmental and political approval of the massive terminal expansion project was, at least in part, the result of years of commitment by the airport management to deal with off-airport environmental impacts including the investment of more than $600 million in the Heathrow Express rail system. An airport access program, called "Free Flow Heathrow," includes the design and subsidization of new local bus routes for employees working at the airport.

In Switzerland, the approval for a new airport expansion project was made conditional upon the commitment of the airport authority to make a significant improvement in the overall public mode share, for both passengers and employees. Until March 2000, Zurich Airport was owned by the local government (called a "Canton"), where every expenditure had to be approved in a town meeting–like process. At the time of the referendum to approve the airport expansion project, the airport had an overall public mode share of 34%. As part of the political approval of the

expansion project, the airport committed itself to raising that mode share to 42% by the end of the period covered by the capital investment. Since that time, the airport has undertaken programs aimed at both airline passengers and employees, including a decision to build a tramway through adjacent neighborhoods, which is expected to appeal to airport employees. In 2006, the responsible authorities approved the results of the mode share study and completed the approval process required by the terms of the capital expansion agreement.

What's Next?

The base of the proposed ground access planning process, as summarized in Chapter 1, is a combination of the characteristics of supply (public mode services) and the characteristics of demand, as disaggregated by market segment. Chapters 3 and 4 will present an updated description of major airport ground access systems in the United States, Europe, and Asia, with an emphasis on understanding the attributes of successful services.

CHAPTER 3

Attributes of Successful Ground Access Systems

What makes a public transportation access system to a major airport successful? The breadth of travel patterns to specific airports (detailed in Chapter 4) shows the wide variety of experience around the world in the design and implementation of public transportation strategies to major airports. Those patterns range from the remarkable public transportation share in Oslo to the specialized role played by public transportation to most U.S. airports. This chapter interprets best practice and attempts to draw out lessons learned from this wide variety of experience.

This chapter will examine the implications of certain attributes of successful services, whether those services are in operation in the United States, Europe, or Asia. One lesson is clear at the outset—no particular modal solution is optimal everywhere: a simple focus on line-haul speed of the vehicle does not produce a high mode share to public transportation, as revealed in Shanghai; the adoption of high-cost, high-quality rail design does not convince more Hong Kong travelers to ride the train rather than the bus; direct on-airport rail connections to an advanced regional rail system do not attract more travelers to choose the rail transit to the San Francisco International Airport than the less direct connections in operation at nearby Oakland International Airport.

It is a central theme of this report that the services offered must be based on an analysis of the needs of the traveler, not the adoption of one particular mode (usually rail) as the "world class" standard. However, most of the highest mode shares to transit reported in this study do come from European and Asian systems that use rail services as a major and dominant strategic component. This chapter seeks to look at *service attributes attained in successful systems* without regard to the dominant mode that resulted in those high mode shares to public transportation.

After this examination of service attributes, Chapter 5 will explore the question of the integration of ground access services into larger national systems, and the role of integration of baggage and ticketing systems. Then, Chapter 6 will present a discussion of the application of market research techniques to a planning process based on the needs of the traveler, including of the roles of geographic and demographic market segmentation.

Understanding Successful Airport Ground Access Systems

This section will focus on the attributes associated with the success of the rail projects that form the principal mode of most of the successful systems to be detailed on an airport-by-airport basis in Chapter 4. It will quickly become clear that no single attribute—such as the speed of the vehicle, the directness of the on-airport connections, or the connectivity to the rest of the public transportation system—can *by itself* explain the propensity for high market shares. Rather, it

is clear that a successful ground access system will need to combine various attributes from separate services designed to meet the needs of the separate market segments. As noted in previous chapters, most U.S. airports have at least three market areas: a dense downtown/inner market area; a distant set of dispersed origins, for which dedicated express buses can carry travelers collected by other modes; and a mid-suburban area, where door-to-door shuttle services can be supported.

A quick summary of possible explanations of high mode share is presented in the following sections.

Does Airport Size Explain Ridership?

Does an airport have to be extremely large to justify and support an exemplary ground access system? As shown in Tables 2-1 and 3-1, the ranking of public transportation use cannot be explained by the location or the size of the airport. MAP is not a good predictor of total public mode market share: the largest airports, Heathrow and Frankfurt, rank in the middle of the sample in terms of ground access market share; the smaller airports rank both higher and lower than the largest.

The sheer size of an airport does not explain the mode share to public transportation services. Table 3-1 shows that London Stansted (smaller) has a higher mode share to public transportation than does London Heathrow (larger). Oslo and Zurich are relatively smaller airports but have high mode shares. Oakland (smaller) has a higher mode share than Dallas/Fort Worth (larger). On the other hand, Paris de Gaulle (larger) has a higher mode share than does Paris Orly (smaller) and New York JFK (larger) has a higher mode share than New York LaGuardia

Table 3-1. Market share by size and location.

Rank	Airport	Public transport market share	Size of airport	Distance to CBD
1	Oslo	64%	16 MAP	30
2	Hong Kong	63%	44 MAP	21
3	Narita	59%	31 MAP	40
4	Shanghai	51%	21 MAP	18
5	Zurich	47%	19 MAP	7
6	Vienna	41%	17 MAP	12
7	London Stansted	40%	21 MAP	35
8	Paris Charles de Gaulle	40%	56 MAP	15
9	Amsterdam	37%	44 MAP	12
10	Copenhagen	37%	20 MAP	7
11	Munich	36%	31 MAP	17
12	London Heathrow	36%	67 MAP	15
13	Stockholm	34%	15 MAP	25
14	Frankfurt	33%	52 MAP	6
15	London Gatwick	31%	34 MAP	30
16	Geneva	28%	9 MAP	3
17	Brussels	26%	16 MAP	7
18	Paris Orly	26%	25 MAP	9
19	Düsseldorf	22%	15 MAP	5

SOURCE: M. A. Coogan, based on airport information.

(smaller). *In general, while airports need a certain size to support public transportation services, size alone does not explain high ridership. Distance traveled to the airport is worthy of more attention.*

Does Distance from Downtown Explain Ridership?

Most airports serve one dominant downtown (e.g., Boston), or at least a set of dominant downtowns (San Francisco and Oakland/Berkeley). What is the influence of line-haul distance to the downtown mode share? Some trades-offs are clear: with close-in service, the taxi provides a cost-effective alternative to the public transportation trip, whereas with a distant airport it does not. For example, the sheer distance involved in a trip to Narita airport (located approximately 37 miles from downtown Tokyo) or Oslo airport (located approximately 30 miles outside Oslo) makes the taxi a weak competitor. Thus, airports that are relatively close to downtown, such as Reagan Washington National, tend to have a high taxi share to the airport. At the same time, the close-in airport can offer many destinations by public transportation with only a moderate amount of transferring (e.g., in Washington, D.C.).

However there are some complexities to consider. High rail mode shares exist when the distance is long, the taxi fare is high, and travel time can be gained on the line-haul segment to compensate for the non-directness of access at the non-airport end of the trip. At first glance, the high rail mode shares for Zurich and Copenhagen may seem to be an exception to this rule, as they are relatively close to the downtown. In fact, each of these airports is tied into an unusual nationwide (and sometimes multi-country) feeder system. For example, the mode share to distant Swiss regions is very high, while that to the center of Zurich is low, because the taxi is a feasible alternative. But such programs as that in Copenhagen, with its new tunnel/bridge directly from Copenhagen airport to Sweden, are a part of a longer distance national feeder system, not just a local one. *As a general rule, the longer the ground access trip, the less competitive is the taxi, and the less attractive is the casual kiss-ride drop-off trip.*

Does the Quality of the Airport Connection Explain Ridership?

Looking at the connections *on the airport*, most of the public transportation services included in the sample of European/Asian airports have direct rail service to the airline terminals on the airport grounds. A major exception to this is Paris Orly airport, which operates a people mover over a 3-mile guideway to transfer travelers to the regional rail line that also serves Paris de Gaulle airport to the north. Thus, with both the quality of the line-haul service and the connectivity with the rest of the system constant, the Paris airport with the direct connection can be seen to have a higher market share to rail than the airport without the direct connection.

At face value, a service with no change of vehicle at the airport *should* be expected to capture a higher market share than a service with a transfer at/near the airport, all other things being equal. For example, a traveler using rail from either downtown Dallas or Fort Worth would have to transfer once at the rail station, and a second time at a remote parking lot before getting a bus to any one of the five airline terminals. A low market share would be expected when compared with a bus or van that goes directly from major hotels in those two downtowns to the airports.

However, in the United States, airports with direct rail service to the terminal area do not necessarily attain a higher share to public modes than those that do not. Of the ten U.S. airports with the highest mode shares to public transportation shown in Table 2-1, only two airports (Atlanta and Reagan Washington National) have rail service direct to the terminal complex; seven airports do not have rail service direct to the terminal; and San Francisco has direct rail service only to one terminal. In the latter category, the exceptionally high mode share attained by the 3-mile bus connection at Oakland International Airport needs some explanation other than minimization of

transfer! The Bay Area case study is similar to the Paris case study in that both airports connect to the same regional rail system. With the quality of the rail system held constant, the 9% mode share in Oakland, compared with 7% from San Francisco, cannot be explained simply in terms of the ease of airport transfer.

In the same vein, the 8% mode share to rail at New York JFK airport (no direct rail) compares favorably with direct on-airport rail connections in Chicago (Midway and O'Hare); Portland, Oregon; St. Louis; Minneapolis–St. Paul (determined from interviews with airport personnel); Philadelphia; Cleveland; and Baltimore. Düsseldorf airport provides another case study: it offers both a direct on-airport rail connection and an indirect connection via people mover to a nearby station; travelers choose the *indirect* connection over the direct connection by two to one.

In short, directness of the connections on the airport cannot explain the wide variation in mode shares reported, although there is strong anecdotal data to support the idea that fewer transfers are better than more transfers.

Does Line-Haul Speed Explain High Ridership?

Without question, the speed of the line-haul vehicle between the airport and the downtown area is important. Table 3-2 shows the relationship between overall speed of the train and the mode share attained. Average speeds of more than 40 mph are attained in Zurich, Oslo, Narita,

Table 3-2. Market share by time and speed.

Airport		Market share by rail	Rail travel time (min)	Distance from CBD (miles)	Implied rail speed to CBD (mph)
Zurich		42%	10	7	42
Oslo		39%	19	30	95
Narita		36%	55	40	44
Amsterdam		35%	17	12	42
Copenhagen		33%	13	7	32
Munich		31%	40	17	26
Vienna		30%	16	12	45
London Stansted		29%	40	35	53
Paris Charles de Gaulle		28%	35	15	26
Hong Kong		28%	23	21	55
Frankfurt		27%	12	6	30
London Heathrow (23%)	Express	9%	15	15	60
	Tube	14%	45	15	20
Geneva		21%	10	3	18
London Gatwick		20%	30	30	60
Stockholm		18%	20	25	75
Düsseldorf		18%	12	5	25
Brussels		16%	14	7	30
Paris Orly via People Mover		14%	35	9	15
Shanghai Maglev		6%	8	18	135

SOURCE: M. A. Coogan.

and Hong Kong and contribute to strong rail mode shares in those cities. But, Table 3-2 shows that line-haul speed alone does not explain the propensity to attain high market share.

High-Speed Service and High Market Share: Oslo Airport Express

The Oslo Airport Express train (Figure 3-1), which has the second highest mode share to rail in the sample, is an example of a strategy based on a determination to attain high running speeds and low terminal-to-terminal travel times. From the beginning, the running time of the train to the new airport was to be no longer than the running time of the bus from the existing airport—19 minutes. For this investment, the government set the following policy goal: the airport rail system would attract 50% of the market, a mode share considerably higher than any system had attained to date. Of this desired share, 42% was set as the goal for the Oslo Airport Express service, with an 8% goal established for the traditional national train service. In Oslo, the strategy to provide high-speed service to the downtown and additional direct service beyond has resulted in a 39% market share for the dedicated Airport Express train and another 13% mode share to the slower, lower priced Norwegian Railway.

High-Speed Service and Low Market Share: Shanghai Maglev

A dramatic example of a strategy to build a market based on the speed of the line-haul vehicle comes from the Shanghai maglev project (*8*). On first look, the service characteristics of the maglev are impressive. While the bus takes about 60 minutes and the taxi takes 50 minutes, the maglev makes the line-haul segment of the trip in just 8 minutes. The headway of the super high-speed train is 15 minutes. A good connection is available at the airport: the maglev station is connected by a pedestrian bridge (see Figure 3-2); no people mover or shuttle bus is needed to access the service. However, it was not possible to get a maglev directly into the center of the city, so a terminal was built on the edge of the downtown next to an existing metro stop.

PHOTO: M. A. Coogan.

Figure 3-1. The Oslo Airport Express train was specifically designed for high speeds on this service.

PHOTO: http://home.wangjianshuo.com/archives/20030809_pudong_airport_maglev_in_depth.htm.

Figure 3-2. The Shanghai Airport maglev station (left) is directly connected to the air terminal (right) by this pedestrian bridge.

From Shanghai Airport, the exclusive airport bus follows a strategy of serving several areas directly. Seven separate airport bus lines are operated to such destinations as the main train station and the City Air Terminal. Headways for the separate bus services range from 15 to 30 minutes.

At a cost of around $7, the maglev service is roughly twice the cost of the airport bus, while still somewhat cheaper than a taxi for one. However, with a party of two, the taxi becomes cheaper than the maglev and directly competitive with the airport bus.

The faster maglev attracts only about 6% of the market, compared to 43% for the more direct (and cheaper) airport buses. Market research undertaken in Shanghai shows that people traveling on business had a lower than average use of the maglev, while their use of taxi (25%) was the highest of any market segment. Indeed, the business travelers also had the highest use of the airport bus of any market segment, at 48% mode share. Retired persons had no recorded use of the maglev, presumably because of the price differential. Highest use of the maglev came from "tours" and "visiting friends." About half of the trips by arriving air travelers involved only one mode; about an equal number involved two modes, the most popular being airport bus and taxi (about 15% of all trips).

Without question the low market share gained by the high-speed maglev is surprising. The analysts noted that the higher income markets, like those traveling on business, chose the taxi in spite of the obviously longer travel time to the city edge, at 60 minutes versus 8 minutes. Clearly, the lower income travelers selected the cheaper buses, while the business travelers went for the no-transfer service offered by the taxi. The lack of selection of the maglev-plus-taxi option is puzzling.

The implications are clear: the analyst and service designer must be concerned with the door-to-door travel times and the directness of public mode services rather than with the highest speed of the vehicle (reported at 450 km [~280 mph] per hour for the Shanghai maglev). These conclusions are consistent with the Hong Kong experience of the market response to one high-speed rail line compared to a wide variety of more direct bus lines, as discussed below. In both cases, the resident (who is aware of the local options) has a greater propensity to choose the directly routed bus than does the visitor (who is less aware of local options).

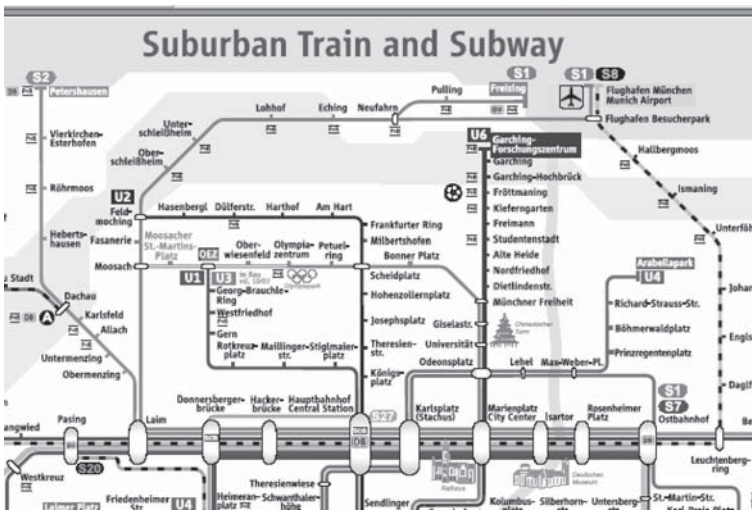
Is Higher Speed or Directness of Service More Important?

In the case studies of successful rail services to downtown, two strategies for service design emerge: (1) focus on the line speed to the terminal or on the quality of distribution services, and (2) minimize the headway that comes from joint operation with regularly scheduled services. Both strategies seek to produce a door-to-door travel time that is competitive with the taxi and the private vehicle. In the comparison of the two strategies, the Oslo Airport Express can be used as a prototype of the high-speed dedicated-service strategy (in which services are designed specifically for air travelers) and Munich's standard S-Bahn can be a prototype of the lower speed shared-service strategy (in which air travelers share public transportation services designed for commuters and others). In the evolutions of these systems, service was improved in Oslo by decreasing the line time, while service in Munich was improved by doubling the number of trains, thus lowering the waiting time by 50%.

An Example of Low-Speed, Shared Service: Munich

Although several cities have chosen to create dedicated express airport services, most of the airports in the sample are served by rail lines that are also used by daily commuters. Munich can be used as an example of a local strategy, because, as shown in Figure 3-3, the airport station is served by only conventional metropolitan railway equipment, with no direct national service. In the 1990s, the Munich S-Bahn system made a major improvement to airport service with the addition of a second local rail line, making no change in the basic strategy to serve the airport with the existing metropolitan rail system.

In 1998, the Munich system doubled the amount of service to the airport with standard local equipment providing service that is shared with the other users of the system. A new line was extended for 4 miles from an existing route, the S-1 (shown at the left end of the dotted line on Figure 3-3), at a cost of DM 220 million (US $121 million). In the first months of the new service, ridership from the airport station increased by 7%, with air traveler mode share rising from 28% to 31%. This increase in ridership is notable because the actual travel time by either of the two lines to downtown remains about 40 minutes. This travel time is similar to that of the London Underground from Heathrow airport but worse than that of most other local airport services.



SOURCE: Copyright Münchner Verkehrs- und Tarifverbund GmbH (MVV) Munich.

Figure 3-3. Munich Airport (upper right) is served by two local train lines, with good network coverage.

The Role of Distribution and Connectivity

With shared services, the line-haul travel speeds from the airport to the CBD are slow, but the service is well integrated with local distribution systems. At both London Heathrow and Munich airports, the local rail service, with its shared services, captures more of the market than does any other service. An example can be observed in London: dedicated service on the Heathrow Express takes about 17 minutes to Paddington Station (central London), leaving every 15 minutes. The Underground's Piccadilly Line to central London takes about 40 minutes, leaving every 4 minutes. The Express traveler waits an average of 7.5 minutes and travels 17 minutes, for a total travel time to Paddington Station of about 25 minutes. The walk from the express rail platform, through the Paddington Station complex to the specific underground platform takes about 7 minutes. The headway of the connecting service may add another 5 minutes of waiting time. Examination of total trip times shows that there are only a small number of Underground stations (the immediately adjacent stations on lines connecting from Paddington) at which the total travel times for the Heathrow Express plus Underground are superior to the Underground plus other Underground travel times.

Shared services make the traveler endure whatever level of overcrowding exists on the rail vehicle during rush hour, which, in London, can be a serious problem. Dedicated services provide guaranteed quality of service on the line-haul segment, leaving the traveler with the need to find adequate distribution from the rail terminal.

Case Study: Fast Service versus Slower, More Direct Service

Planners at the Hong Kong Mass Transit Railway Corporation (MTRC) have been examining the competitive market position of the fast rail and the slower bus services available to the air traveler. High-quality air-conditioned buses, often double-decked, provide direct service to many urban destinations.

Looking only at travel from the airport to downtown (Central Station), the fast train provides service in 23 minutes, at a fare of more than $10 US; the Airbus A route takes 48 minutes and charges about half as much; while the standard city bus takes 53 minutes and charges much less. At the time of the analysis reported here (1998), the rail gained 21% of the market; the Airbus, 16%; and the city bus, 20%.

The factors that result in this high mode share to bus seem to include more than price minimization, because MTRC also provides good lower priced rail service to the airport complex. From the beginning, planners designed the rail system to operate with two price points. While the Airport Express Line train to downtown operates directly from the airport terminal, a second standard train, reached by shuttle bus, operates from a nearby station. The entire trip (shuttle plus train) on the standard train is about one third the cost of the express, making the shuttle plus train option directly comparable with the cost of the city buses. In fact, the air traveler who uses this lower priced rail connection can get to Central Station in only 39 minutes, compared with 53 minutes on the city bus. But for this price-sensitive market, the shuttle bus–to–rail connection is capturing only 3% of air travelers; the direct city bus captures 20%. The bus system serves many area destinations directly, with no change of mode required for the trip. For the air traveler, *directness of service may be more important than price minimization or line-haul speed* to the terminal point.

To understand the motivation for mode choice—and to explore the attribute of directness of service—MTRC managers conducted market research. Of those travelers on the direct bus routes, an expected 55% said that the lower fare was a reason for choosing the bus; importantly, 51% stated that directness of service (i.e., no need to transfer) was a reason for their choice of mode. Directness of service was considered a factor by only 18% of rail travelers, presumably those with destinations convenient to the terminals.

Of all travelers on the Airport Express, an expected 63% stated that speed was the reason for choosing the rail. Some 13% mentioned the fare as the reason, which is lower than the fare for either taxi or airport door-to-door bus service.

In an important conclusion, one of the original architects of the Hong Kong Airport Express writes:

> "It is apparent that even with a good design and well-integrated railway service, the Airport Express does not have inherent advantages over more direct single-mode bus travel. In other words, *the speed advantage of rail versus single-mode road competitors when traveling over distances of only up to 34 km [21 mi] do not result in significant enough time savings to compensate for the necessary transfer*." (*9*, emphasis added)

Lessons Learned: The Importance of Line-Haul Speed and Directness of Service

The examination of relative line-haul speeds in the database of successful European/Asian airport rail operations has several key implications for the U.S. practitioner. The first implication, and by far the most important, is the difference that exists in the basic travel-time conditions, largely associated with the existence of fast highway connections in the United States. Four of the airports in the sample offer service to downtown that is twice as fast as automobile service. Table 3-3 shows that automobile travel times in Oslo are more than twice as long as the rail line-haul time. Table 3-3 shows many examples in which the automobile travel times are significantly

Table 3-3. Market share by comparative times.

Airport	Market share by rail	Auto travel time (min)	Rail travel time (min)	Ratio of auto time to rail time	Distance from CBD (miles)	Dedicated service?
Zurich	42%	20	10	2.0	7	No
Oslo	39%	50	19	2.6	30	Yes
Narita	36%	90	55	1.6	40	Yes
Amsterdam	35%	30	17	1.8	12	No
Copenhagen	33%	13	13	1.0	7	No
Munich	31%	35	40	1.1	17	No
Vienna	30%	17	16	1.0	12	Yes
London Stansted	29%	70	40	1.7	35	Yes
Paris Charles de Gaulle	28%	45	35	1.3	15	No
Hong Kong	28%	35	23	1.5	21	Yes
Frankfurt	27%	20	12	1.7	6	No
London Heathrow	Express 9%	45	15	3.0	15	Yes
	Tube 14%	45	45	1.0	15	No
Geneva	21%	10	10	1.0	3	No
London Gatwick	20%	80	30	2.7	30	Yes
Stockholm	18%	41	20	2.0	25	Yes
Düsseldorf	18%	12	12	1.0	5	No
Brussels	16%	20	14	1.4	7	No
Paris Orly via People Mover	14%	25	35	0.7	9	No
Shanghai Maglev	6%	50	8	6.2	18	Yes

SOURCE: M. A. Coogan, based on airport and rail information.

higher than the rail travel times. Given the extent of roadway investment in the United States, attaining similar relative travel-time advantages for rail services will be difficult in most U.S. applications.

The second implication is that the rankings of services by relative travel times to downtown do not correlate linearly with the rankings by mode share performance. The data reveal that it is the comparative travel time on a door-to-door basis that seems to influence choice. The data presented in Table 3-3 show that the focus on travel time to one location may be unproductive. For example, there are many points in central London where the slower mode (i.e., the Underground) gets the traveler to the destination without the negative experience of the transfer. Likewise, there are many points in Hong Kong where the slower mode (i.e., the direct bus) serves the traveler more directly than the faster mode.

The third implication is that the travel-time characteristics to downtown may not be a good surrogate for the travel-time characteristics to the actual destinations of the users. The travel time to downtown Geneva is an interesting piece of information, but 75% of those leaving the Geneva airport are not going to the city of Geneva. The ratios of comparative travel times to Lausanne or to Bern are considerably more favorable to rail. The service must be designed based on the understanding of the needs of the travelers and must reflect the actual spatial distribution of trip-end destinations.

The Implications of Dedicated Premium Service

Dedicated versus Shared Service

Public transportation services to airports can be categorized as either a *dedicated* service or a *shared* service. In the United States, there are no examples of rail service dedicated only to air travelers, but the Logan Express (Boston), the Van Nuys FlyAway (Los Angeles), and other airporter buses in major U.S. airports are all examples of service designed specifically for the air traveler. In Scandinavia, cities such as Helsinki and Gothenburg that have dedicated bus services attract higher levels of market share than do many cities with rail connections. Under the dedicated concept, services and vehicles designed specifically for the needs of the air traveler are provided. With shared service, air travelers use the same vehicles as other public transportation passengers in the corridor of service.

European and Asian airports have many examples of rail services operated for air travelers only. Of the nineteen European/Asian airports in the sample, nine have dedicated rail services (shown in the last column of Table 3-3). In London, both the Gatwick Express and the Heathrow Express rail services are examples of dedicated service, with vehicles designed for the air traveler. Service to Heathrow Airport on the London Underground's Piccadilly Line and other commuter rail services stopping at Gatwick Airport are examples of shared service.

Many dedicated services market their high-quality line-haul times with fast service to only one downtown terminal. Most shared services, such as the Piccadilly Line to Heathrow, provide relatively slow speeds into the city, but with distribution to many points in downtown. In many cases, the dedicated service (e.g., Gatwick Express, Heathrow Express) utilizes a vehicle (originally) designed to accommodate checked baggage. In most shared services, such as Munich's S-Bahn service, no specialized vehicle is used, resulting in vehicles that may not serve travelers' need for extra baggage space. The ten airports without dedicated service have chosen to provide public transportation that is designed primarily for commuters and the rest of the system. A characteristic of the dedicated-service strategy is the ability to provide minimized travel times between the airport and the downtown. However, the most successful overall mode share is gained by airports that offer a variety of strategies.

Table 3-3 shows that, in general, providing dedicated service does not itself guarantee high market share to rail. Looking at the 14 airports with rail mode share of 20% or higher, seven do provide dedicated service and seven do not.

Increase in Mode Share Due to Dedicated Premium Service

Given that every airport needs lower priced shared ground access services, the following question is raised: how much increase in rail market share would result from the addition of dedicated service to the existing shared service? This question is currently being examined by ground access planners in Chicago, New York City, and Paris. As summarized below, planners are designing higher priced rail services to O'Hare, Midway, JFK, and de Gaulle airports to serve *in addition to* existing lower quality rail services to those airports.

Ridership data that document the experience of Heathrow airport can help answer this question. Longitudinal data have been created that describe the change in overall rail market share between Heathrow and central London resulting from the addition of highly specialized dedicated services to a system that already offered one-seat, non-dedicated services shared with all other rail system travelers. Data from before and after the addition of Heathrow dedicated services have been examined and, from these data, an expansion factor for each of the four market segments has been calculated to represent the growth in market share attributable to the addition of dedicated rail service. Importantly, the market segment most impacted by the premium service is the resident business segment, which experienced a 60% growth in market share. By contrast, resident non-business, more concerned about cost minimization, grew only by 13%. Non-resident market share to rail grew by about 40%. All in all, the addition of premium rail service to the existing shared rail service resulted in a 33% growth in rail mode share to Heathrow.

Service Attributes of Proposed Projects

In four cities around the world, major capital investments to improve rail services to major airports are being considered. In the case of Berlin, the decision was made in connection with the decision to focus all airport activity on one new regional airport, phasing out older closer-in facilities. In the other three cities—Paris, Chicago, and New York, planning is underway to provide high-quality service that is dedicated to the needs of the air traveler. In addition, there have been plans for several years to build a maglev train between Munich Airport and the downtown Main rail station (Figure 3-4); the political future of that project is not clear after a tragic accident on the maglev test facility in Northern Germany.

It is important to note that in each of these four examples, local decision makers are considering *dedicated, premium service* concepts at this time. The actual form of the two U.S. projects, however, is still under active debate.

Berlin Brandenburg Airport

In 1999, German Railways announced its decision to develop a dedicated train to operate express service to the new Berlin Brandenburg International Airport, which will consolidate and replace the existing airports in Berlin. An S-Bahn suburban rail line already serves the site for the new airport, currently known as Schonefeld Airport, with a 25-minute service to downtown.

The S-Bahn division of German Railways will develop a new dedicated express line that will connect with Berlin's new central rail station, called "Berlin-Lehrter Bahnhof," with only two intermediate stations. The specially designed trains will be capable of 100 mph service and will reduce the running time to downtown to 18 minutes.

PHOTO: M. A. Coogan.

Figure 3-4. The future of the proposed Maglev from Munich Airport (shown here in a demonstration mock up at Terminal Two) is unclear.

Paris Charles de Gaulle Airport

For years, the access strategy between Charles de Gaulle airport and downtown Paris has been based on the use of standard regional rail services, which are shared with commuters. No specialized service to the downtown was planned. Over the past decade, the French National Railways (SNCF) and Aéroports de Paris (ADP) worked to develop a new dedicated high-speed service to the Gare de l'Est. Responsibility for leading the planning for the new service has recently shifted entirely to the national railway system. Thus, the French authorities are planning for Charles de Gaulle airport to have two services available at two separate price points: a shared commuter service along the RER-B with distribution services through downtown Paris and the suburbs to the south, and a second, non-stop dedicated train service to a terminal at Gare de l'Est, where a transfer to taxi or other mode would be needed to continue the onward journey. In one routing option, an expensive new tunnel was proposed between the airport and the city; more recently the rail authorities are examining more efficient use of the existing rail right-of-way currently used by the RER trains. At present, no downtown baggage check-in services are planned for the new dedicated rail service. While funding commitment for the project has been lacking, the ADP website reports that the French government is now committed to the project.

Chicago Midway and O'Hare Airports

The Chicago Transit Authority developed an ambitious plan to operate a dedicated airport train service from O'Hare International Airport to downtown and continuing on to Midway International Airport. A central feature of the plan was the creation of bypass tracks at key stations along the Kennedy Expressway, which would allow for an elaborate skip-stop operation that would reduce travel time from about 45 minutes to perhaps 25 minutes. The plan proposes the creation of a new station at a downtown location (called "Block 37" on State Street) where a connector could be built from the present tunnel of the Blue Line (serving O'Hare) to that of the Orange Line (serving Midway.) At this point a single station would be dedicated to the Blue/Orange train, with the

possibility of a baggage check-in station. New train equipment would be purchased that could accommodate both the air travelers and their baggage.

A 2006 consultant report examined a less costly proposal, in which a dedicated service would be provided, but the investment in the bypass tracks postponed (*10*). This service would run "closed door" on the existing rails, in effect waiting as the preceding train stopped at each station but not serving those stations itself. This concept was developed in the original "Train to the Plane" service operated to JFK in New York for several years. Over time, bypass tracks could be added incrementally to allow the dedicated train to overtake local trains at key locations. Operational details for the new Chicago dedicated service will be developed over time.

New York JFK Airport

The concept of a new dedicated rail service for air travelers between the general site of the World Trade Center and JFK airport was proposed in the aftermath of the September 11 attack on Lower Manhattan. For this project, a major engineering study recommended the creation of an entirely new tunnel between Brooklyn and Lower Manhattan, whether for commuter rail service to a new terminal or for extension of rapid transit north into Manhattan. In either case, a new air traveler terminal with full airline baggage check-in was proposed near the World Trade Center site. In the proposed concept, a hybrid form of the existing JFK AirTrain people mover would operate counter-clockwise around the existing air terminal loop and proceed to Jamaica Station. There the vehicle would switch from the existing linear induction propulsion system to a third-rail propulsion system. The vehicle would then reverse direction, traveling from the Jamaica Station to a new connection to the existing Long Island Railroad (LIRR) Atlantic Branch elevated system to a point in downtown Brooklyn. In the preferred plan a new tunnel would be built from there to the World Trade Center site. In an alternative, the new service would be connected to the existing Montague rapid transit tunnel, allowing stops at Broad Street, Fulton Street Transit Center, and Chambers Street, according to the project press release of May 5, 2004.

Since the conclusion of that 2004 feasibility study, the prime proponent of the project, the Lower Manhattan Development Corporation, has ceased operations. A planning study has since been undertaken that "will evaluate all reasonable rail and non-rail alternatives which potentially address the project's goal and objectives" (*11*). The project created a list of 47 options for study. No funding commitment has been made to the project, which is being reviewed by the new Governor of New York, particularly in the context of competing transportation proposals.

Summing It Up

This chapter has reviewed a series of attributes associated with successful airport ground access systems. It has established that no single attribute or characteristic can be used alone to predict the level of market share attained by public transportation services to airports. Rather, the total travel time—which includes the efficiency of the connection on the airport, the speed of the vehicle to the terminal, the quality of distribution services experienced after the line-haul trip, and the provision of services meeting the unique needs of the air traveler—all interact in determining the marketability of the trip.

No mode emerges as perfectly matched to all trips. The experience of fast express time can be marred by the lack of a taxi at the arrival terminal. The experience of a van trip operating directly to a hotel can be damaged by long in-vehicle times serving the needs of three or four other passengers and by long waits to assemble the trip at the airport curb.

Desired Attributes of Rail Service to U.S. Airports

The two previous TCRP studies reviewed a wide variety of factors associated with the success or lack of success of airport rail services around the world. The following key factors have been shown to affect the use of rail service:

- **Proportion of air travelers with trip ends in downtown or the transit-rich core areas.** For example, at Reagan Washington National airport about 33% of all air travelers have trip ends in the downtown area. Other airports where large proportions of travelers have downtown trip ends include those serving Boston, Chicago, New York, and San Francisco. At most airports, fewer than 15% of all travelers have trip ends in the downtown area. Thus, in most communities, the geographic service area directly served by a downtown rail service represents a relatively small percentage of the total air traveler market.
- **Characteristics of air traveler market.** Air travelers with few or no checked bags are more likely to use rail service. Large family groups are less likely to use rail. Thus, airports serving a high proportion of business trips (e.g., Atlanta and Reagan Washington National airports where more than 40% of the travelers are making business-related trips) are more likely to attract rail users than those serving tourist destinations (e.g., Las Vegas and Orlando where less than 30% of the travelers are making business-related trips). The proportion of passengers familiar with regional transit systems (i.e., who understand the schedules and how to purchase a ticket) is also important.
- **Regional travel time.** The availability of direct service between the airport and downtown (or major activity centers) allowing travelers to avoid transfers or multiple stops is important. Travelers going between the airport and downtown encounter 6 to 9 station stops at Reagan Washington National airport versus 15 or more stops on less successful rail systems. As evidenced by the data, travelers tend to use rail service when they are concerned about (1) unreliable travel times on access roadways or encountering traffic delays en route to the airport and (2) the lack of convenient parking at the airport and the need to search for an available space.
- **Ability to walk between station and destination.** Air travelers may find using rail service more attractive if their final destination is within walking distance of the station, and less attractive (and less convenient) if they must transfer to a second mode (e.g., a bus or taxicab) to travel to/from the station. The need for travelers using rail service to wait for and transfer to a second mode may provide a travel time advantage for door-to-door services.
- **Extent of regional coverage.** A comprehensive rail network, serving a large catchment area, will serve a larger potential market and provide travelers with more travel opportunities (e.g., those who may wish to leave from their place of work and return to their home) than does a rail system consisting of a single line between downtown and the airport.
- **On-airport travel time.** The time (and distance) airline passengers are required to travel between the station and their gate is also important. Convenient rail service is easier to provide at airports that have a single terminal (e.g., Atlanta or Chicago Midway airports) than those that have multiple terminal buildings (e.g., New York JFK, Boston, or Paris de Gaulle airports) where travelers must use intermediate shuttle buses or people movers to get to the rail station.
- **Frequency of service**. Waiting times of 10 minutes or less are preferred. The rail service at one U.S. airport operates on 30-minute headways, while a taxi ride downtown at the same airport requires a wait of only 15 to 30 minutes. The availability of late-night and weekend service is also important.

Desired Attributes of Van and Bus Service to U.S. Airports

The TCRP studies documented that air travelers represent a unique market that differs from traditional daily commuters. Compared to daily commuters, air travelers are typically more time sensitive and less cost sensitive, have more baggage, use the transit system less often, and are more

likely to use the system outside of normal commute hours. Often designing a special bus or van service to respond to this market is easier than trying to adapt a commuter-oriented, multistop bus (or rail) service to meet the needs of both daily commuters and air travelers. Door-to-door van and express bus services are examples of airport access modes that respond to the desire of air travelers for greater convenience and faster travel times than are typically offered by multistop bus services. Many operators of rail service prefer not to have airport-dedicated vehicles (e.g., with special baggage racks), because these special vehicles reduce their flexibility in the use of equipment.

In the United States, specialized services have been developed to respond to specific markets not well served by traditional transit services. These services include the express bus services operated at the airports serving Boston (Logan Express), Denver (employee-oriented SkyRide), Los Angeles (Van Nuys FlyAway), and San Francisco (Marin Airporter). None of these services rely upon the general-purpose transit configuration of the metropolitan area. In each case, the specific needs of the target market segment were defined and provided for. In general, each of the transit services was able to attract about 20% market share in its immediate service area. Market conditions improved for the Logan Express's Braintree service when both a new express bus lane and a new tunnel serving the airport were opened. Braintree Logan Express's average daily ridership increased 50% as a result of the new radial bus lane, the commercial-vehicle-only tunnel, coordinated HOV policy, and other factors.

As with rail systems, numerous studies have documented the requirements for a successful bus and van transportation service. At an airport, the following key factors affect the use of bus and van services:

- **Door-to-door transportation.** Many air travelers are willing to pay additional fares for the convenience offered by door-to-door services because they value travel time (particularly reliable travel time) more highly than travel costs. Such services also allow travelers to avoid transferring between airport access modes.
- **Express bus service.** Express bus services, particularly those that offer travel time savings and service from intercept lots near regional access roads, have proven attractive to specific air traveler market segments.
- **On-airport travel time.** The time (and distance) airline passengers are required to travel between the terminal and the boarding area is an important consideration. As with rail systems, an airport with a single terminal building allows better levels of service (i.e., fewer stops and faster travel time) than does an airport with multiple terminals or bus stops.
- **Pick-up/drop-off locations.** To best serve the needs of travelers, drop-off locations should be located immediately adjacent to ticket counters and pick-up should occur next to baggage claim areas, preferably in areas reserved for buses, vans, and other commercial vehicles.
- **Frequency of service**. The availability of off-peak, late-night, and weekend service is also important as many airline passengers travel during non-commuter hours (e.g., the peak hours at many airports are 11 a.m. to 1 p.m. on weekdays).
- **Regional travel time.** The availability of HOV lanes on airport access routes can allow bus and van services to offer a travel time savings compared to private vehicles. The ability to stop at major activity centers, thereby allowing the traveler to avoid the need to use a second, connecting travel mode at the non-airport end of the trip, is an advantage.
- **Form of competition.** The measures used to control competition between bus, van, and other rubber-tired services (e.g., taxis and limousines) are important. In an open market, a legitimate operator offering high-quality service will find it difficult to compete financially with an operator who (1) uses vehicles that are improperly maintained and lack proper insurance and (2) uses owner-operator drivers who lack proper training and are encouraged or required to improperly solicit business.

- **Regional coverage/traveler characteristics.** The proportion of air travelers whose trip end is near the bus stops/stations is important. The degree of population density and automobile ownership may also influence the use of door-to-door service. For example, the proportion of travelers using shared-ride vans at San Francisco International Airport is much higher than the proportions at Oakland or San Jose airports, perhaps because of the greater population densities and lower automobile ownership rate in San Francisco.

What's Next?

Understanding the logic of high market shares requires a case-by-case examination of both systems that are performing well and systems that are performing poorly. Using the most basic measure of performance—market share to public transportation, 46 airports around the world are examined in detail in Chapter 4. Chapter 5 then reviews known ridership impacts of strategies to integrate baggage check-in/handling and ticketing across modes.

Documentation of the desired attributes of good service is clearly important. However, once documented, the service attributes *per se* clearly cannot explain the variations in the public transportation market, particularly when examined on the basis of the total airport market. A process to document both the geographic distribution of market segments and the demographic distribution of market segments is needed to understand the extent to which a given service is succeeding or failing in terms of the market for which it was designed. This task will be addressed in Chapter 6.

CHAPTER 4

Public Transportation Market Share by Airport

This chapter presents an airport-by-airport summary of air traveler ground access mode share by public transportation services. The modes included in this summary are rail, bus, and shared-ride vans; modes excluded from this summary are hotel and rental car vans, limousines, and charter buses. In Part 1, the public transportation mode share data for 27 U.S. airports are presented, along with a discussion of trends and patterns for each of the modes. In Part 2, the public transportation mode shares for 19 European/Asian airports are presented with a brief description of the salient characteristics of the services provided. Certain information is provided for the European and Asian airports, such as their baggage-handling strategies and the relationship of ground services to national services, which is not provided for the U.S. airports because of a lack of relevance.

The available mode choice (i.e., market share) data for originating airline passengers at large U.S. airports are discussed below. (Unless otherwise noted in the following sections, "passengers" refers to originating airline passengers.)

Part 1: Best Practices at U.S. Airports

This section presents brief, factual overviews of the 27 U.S. airports covered in this report in terms of the characteristics of the airport itself, the nature of its configuration relative to ground transportation services, and the role played by rail and bus services. Finally, observations are presented about the market characteristics of the airport ground access services when they are relevant to the emphasis areas of this report. The factors that contribute to the success of the ground access systems are examined in five categories:

- **The airport:** Each U.S. airport is summarized in terms of its location, its traffic in terms of annual enplanements in 2005, and the number of those enplanements representing originating passengers. Automobile travel times to downtown are presented, along with a reasonable approximation of the taxi fares, which will vary by the actual destination of the trip.
- **Connections at the airport:** The discussion of this category examines the nature of the airport configuration and design, which influence the ability of both bus and rail services to serve the airport efficiently.
- **Rail:** Rail services to the U.S. airports are described when they exist.
- **Bus:** Bus services that are specific to the airport market (i.e., "airporters") and more traditional public transportation services by bus are summarized. In the case of Boston, bus rapid transit is discussed as a separate mode.
- **Shared-ride vans:** Shared-ride vans are included in the analysis, but services such as limousines and "black cars" designed to transport single parties are excluded whenever the original data will allow.

Table 4-1. Public transportation mode shares to U.S. airports.

		Market Share		
Rank	Airport	Total	Rail	Bus/Van
1	San Francisco	23%	7%	16%
2	New York JFK	19%	8%	11%
3	Boston	18%	6%	12%
4	Reagan National	17%	13%	4%
5	Oakland	15%	9%	6%
6	New Orleans	15%	0%	15%
7	Newark	14%	5%	9%
8	Atlanta	14%	10%	4%
9	Denver	14%	0%	14%
10	Los Angeles	13%	0%	13%
11	Baltimore/Washington	12%	3%	9%
12	Chicago O'Hare	12%	5%	7%
13	Las Vegas	12%	0%	12%
14	Orlando	11%	0%	11%
15	Seattle	11%	0%	11%
16	Portland	10%	6%	4%
17	Chicago Midway	9%	5.5%	4%
18	Phoenix	9%	0%	9%
19	San Diego	9%	0%	9%
20	Indianapolis	9%	0%	9%
21	Washington Dulles	8%	1%	7%
22	New York LaGuardia	8%	1%	7%
23	Philadelphia	7%	3%	4%
24	Tampa	7%	0%	7%
25	Dallas/Fort Worth	6%	0%	6%
26	St. Louis	6%	3%	3%
27	Cleveland	6%	2%	4%

The public transportation mode shares for all 27 U.S. airports are shown combined and by share to rail and bus/van services in Table 4-1.

Tier 1

Figure 4-1 presents the first tier of U.S. airports—the 13 U.S. airports with a public transportation mode market share of more than 11%—ranked in order according to their performance.

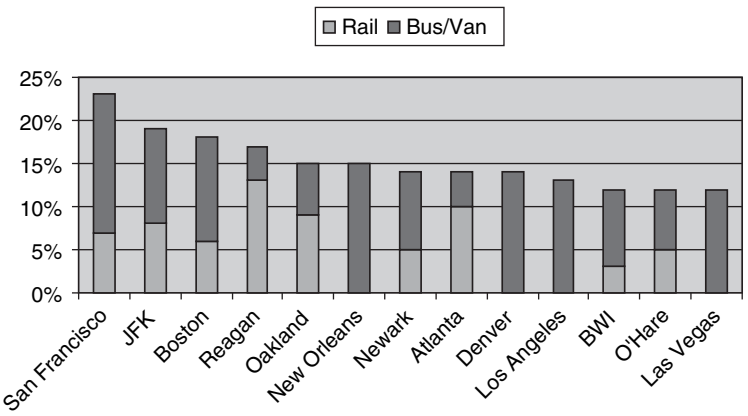


Figure 4-1. Market shares to rail and bus in the first tier U.S. airports.

San Francisco (23% Market Share)

U.S. Rank	Airport	Market Share		
		Total	Rail	Bus/Van
1	San Francisco International Airport	23%	7%	16%

SOURCE: Surveys (*12*)

The Airport. San Francisco International Airport is located about 14 miles from Union Square in downtown San Francisco, with a driving time of 18 minutes possible with no traffic. The airport served nearly 33 MAP in 2005; of these, nearly 9 million were originating passengers. San Francisco International Airport remains one of the strongest markets in the United States for publicly available modes of transportation.

Connections at the Airport. The airport has two major terminal buildings: a traditional horseshoe configuration to the east and a new international terminal to the west. The Bay Area Rapid Transit (BART) station is located within the structure of the international terminal, but requires a transfer to the automated people mover for most connections to the original airport terminals.

Rail. In June 2003, the long-planned extension of the BART system into San Francisco was opened. Airport managers report a 7% market share for the new BART service in 2006.

Bus. San Francisco International Airport also has a strong tradition of regional bus operations with direct service to the airport, designed for airport users. In the North Bay, three companies operate service; in the East Bay, one company operates service; and there are two operators to the South. The long-operated dedicated bus to downtown, which made or connected to a hotel loop, was abandoned after the opening of the direct BART service to the airport. Together, buses directly serving the airport capture about 5% of the ground transportation market.

The Marin Airporter express bus service was developed by private entrepreneurs, who have successfully operated the service between Marin County (located across the Golden Gate Bridge, north of San Francisco) and San Francisco International Airport. Consistent with other successful long-distance bus routes, the Marin Airporter operates from the airport every half hour from 4:30 a.m. to midnight.

Shared-Ride Van. Shared-ride vans continue to dominate the public transportation market to San Francisco International Airport, capturing about 11% of the market in 2006. San Francisco International Airport advertises two distinct kinds of van services. For "door-to-door vans," the members of the public can walk up to the service operator at the airport and purchase a ride without reservation. In the return direction, some form of reservation is required. For "pre-arranged" vans, reservations are required for all services, to or from the airport.

Over time, the airport management has analyzed a variety of methods to limit the number of shuttle operators carving up the same geographic market. At the present time, however, multiple operators go after the same shared-ride market, which degrades the services. For example, to the city of San Francisco, the San Francisco International Airport website lists 11 service providers offering services to the same area. To the East Bay, three companies provide service, with two companies providing service to the south, to Santa Clara and San Mateo counties.

New York JFK (19% Market Share)

U.S. Rank	Airport	Market Share		
		Total	Rail	Bus/Van
2	John F. Kennedy International Airport	19%	8%	11%

SOURCE: Ground Access Surveys (*13*)

The Airport. John F. Kennedy International Airport is located about 16 miles from the center of Midtown Manhattan. The airport served about 42 MAP in 2005; of these, some 11.6 million were originating passengers. In theory, driving time between Manhattan and JFK can be as short as 25 minutes, with several hours experienced in the worst cases of congestion. Taxi fares are about $45.

Connections at the Airport. JFK has long been known as a difficult airport to serve with public transportation services, as its terminal structure in highly decentralized. To deal with this geographic challenge, the Port Authority of New York and New Jersey examined a wide variety of solutions for public transportation access, including a proposed master plan that called for all public transportation facilities to be located in the center of the airport, with people mover shuttles from the central check-in terminal (only for public transportation travelers) to each of the currently existing air terminals. After that plan was rejected, the Port Authority developed the AirTrain concept, which opened in 2003. According to the most recently available data, the airport ground access system serving JFK has experienced a major increase in its public transportation mode share. The overall public mode share of 19% is a major increase over the 7% reported in 1997.

The automated AirTrain system operates three services over one right-of-way. One line travels on a counter-clockwise loop from Jamaica Station through the airport, stopping at five stations serving the nine terminals, and back to Jamaica Station. A second line travels through the counter-clockwise loop of airline terminals from Howard Beach Station and back. The system operates a continuous loop with the ability to travel in either direction within the terminal area only, which is used for intra-airport connections. The multibillion dollar project, coupled with a parallel increase in van usage, has resulted in a significant increase in public transportation use since the publication of the two TCRP airport access studies.

Rail. The traveler has the option of two separate rail systems for the continuing journey to Manhattan or other regional destinations. The greatest number of rail connections exists at Jamaica Station, which serves the Long Island Railroad and several subway lines. Although it varies significantly by hour of the day, the Long Island Railroad has many non-stop or one-stop trains directly to Midtown Manhattan, terminating in Penn Station. However, the strongest ridership is via Howard Beach Station, which is served only by the A-line, which enters Manhattan near the site of the former World Trade Center.

Bus. Dedicated airport-only bus service is offered to a Midtown terminal near Grand Central Station, at which point connections are offered to major hotels and the Port Authority bus terminal.

Shared-Ride Van. More than a dozen firms are operating shared-ride services from JFK, in addition to the airport bus service to Manhattan.

Boston (18% Market Share)

U.S. Rank	Airport	Market Share		
		Total	Rail	Bus/Van
3	General Edward Lawrence Logan International Airport	18%	6%	12%

SOURCE: Massachusetts Port Authority Surveys (*14*)

The Airport. Boston's Logan International Airport is located about 3 to 4 miles from the center of the business district, with highly dependable automobile travel times now established with the new Ted Williams Tunnel. The trip takes less than 15 minutes, depending on the traffic near the downtown destination. The airport served about 27 MAP in 2005; of these, some 10.4 million were originating passengers.

Connections at the Airport. The airport has four major air terminal buildings, which are now connected by moving sidewalk facilities through the central parking garage structures. All buses and ground transportation services pick up and drop off at all four of the terminals. Although the recently relocated Blue Line rail station is only about 1 mile from the farthest terminals, an indirect ramping system makes the connecting ride longer than it was before the reconstruction of the roadway system. An additional water shuttle system serves the downtown and has traditionally captured less than 1% mode share for airline passengers.

Rail. The rapid transit station at Boston's airport attracts more than 4,000 travelers daily, approximately one-third of whom are air travelers. In 2005, the airport's rapid transit station attracted 6% of airline passengers to the system operated by the MBTA. That rail ridership has declined since the inauguration of the Silver Line Bus Rapid Transit (BRT) to South Station.

Bus. The tripling of market share by scheduled services is the result of many years of public agency participation, considerable operator investment, and public subsidy. Of the nearly 2 million travelers per year who use scheduled services to the airport, the majority of them use the Logan Express bus service, which offers non-stop airport connections to three regional terminals located on or beyond Route 128.

Over a 25-year period, policy makers in Massachusetts have been trying—with a remarkable level of success—to decrease the use of private transportation and to increase the use of public transit modes to Logan airport. In 1970, 84% of airline passengers arrived at the airport in either a private or rented car; by 1996, that percentage had decreased to 48%. In 1970, fewer than 2% of airline passengers arrived at the airport by scheduled bus. In 1996, 12% arrived by scheduled services, and 10% was recorded in 2006.

Five bus companies provide standard coach services directly to the airport, in addition to the Logan Express, which serves Braintree, Framingham, and Woburn with new services to Peabody.

Bus Rapid Transit. Since the data was collected, the MBTA has inaugurated a major bus rapid transit project that has dual-propulsion vehicles capable of operating on electric power within the new downtown bus tunnel and on other sources outside of the bus tunnel. The new bus tunnel serves the rapidly developing Seaport area of the city with connections to the new Ted Williams Tunnel (Interstate 90), a stop for a major new convention center, and direct service to the South Station Transportation Center.

Travelers going to South Station and the Red Line are encouraged to take the new BRT service; travelers going to Government Center, the Orange Line, or the Green Line are encouraged to take the airport bus (free) to the newly relocated Blue Line rapid transit center. Since the opening of the BRT service to South Station, boardings at the Blue Line station (both air travelers and others) have fallen considerably, suggesting a roughly 50-50 split between the two services.

Shared-Ride Van. For some reason, shared-ride van services have not become as successful in Boston as they have in other airports. A major carrier went bankrupt after a series of operating problems, and no single operator dominates the market. The researchers estimate that less than 3% of the Logan ground access market chooses high-occupancy vans, as distinct

from single-occupancy limousines. The airport website lists about 12 companies that provide shared-ride services to and from the airport.

Reagan Washington National (17% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
4	Ronald Reagan Washington National Airport	17%	13%	4%

SOURCE: *2005 Washington-Baltimore Regional Air Passenger Survey* (*15*)

The Airport. Reagan Washington National Airport is located less than 4 miles from the White House in downtown Washington, D.C., and is accessible with a 10-minute drive under perfect traffic conditions. While traffic conditions do vary, the trip is reliable by the standards of many U.S. airports. The airport served almost 18 MAP in 2005; of these, some 7 million were originating passengers.

Connections at the Airport. Reagan Washington National Airport has been rebuilt to be primarily centered around the previously existing Metrorail station. Quite literally, the airport was reconfigured to be closer to the rail station, rather than the other way around. With the 1997 opening of the new integrated air–rail terminal at Reagan Washington National, the airport has one of the shortest walking distances of any air–rail facility. Served by two rapid transit lines from one station, the Metrorail service offers excellent downtown distribution. The market for services from Reagan Washington National is focused on downtown Washington, D.C., and the close-in suburbs, most of which are directly served by the MetroRail network.

Rail. Reagan Washington National has the highest rail mode share in the United States at 13%. The rail service is provided by the Washington Metropolitan Area Transit Authority (WMATA).

Provided by WMATA, the rail service to Reagan Washington National Airport has the highest rail mode share in the United States at 13%. Construction of the Metrorail station at the airport in the 1970s led to one of the largest increases in public transportation share ever recorded, from 2.5% (bus) before the new service to 16% (rail and bus) after the opening of the new station.

Shared-Ride Van. Reagan Washington National operates as a franchised facility and all shared-ride services are provided by Super Shuttle, Inc. Thus, there are no traditional bus services serving the airport.

Oakland (15% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
5	Oakland International Airport	15%	9%	6%

SOURCE: Surveys (*12*)

The Airport. Oakland International Airport is located about 18 miles from downtown San Francisco, which is about a 30-minute drive assuming no traffic problems. It is about 9 miles from downtown Oakland; driving time is less than 20 minutes. The airport served more than 14 MAP in 2005; of these, some 6.3 million were originating passengers.

Connections at the Airport. Oakland International Airport has an unusually high mode share to rail for an airport not directly served by rail. The Coliseum Station of BART is about

3 miles from the airline passenger terminal area of the airport and is served by a dedicated bus line, called "AirBART." The fare for the AirBART bus is $3. Plans for an automated people mover from the rail station to the airport have been under development for some time.

Rail. Oakland airport managers have calculated that the bus connection to the BART system attracts about 9% of the ground transportation market. The airport managers report that, in 2006, bus ridership gained almost 6% over the previous year. From Coliseum Station, BART trains serve an extensive network on the East Bay area of the San Francisco peninsula itself with service between 4 a.m. and midnight. For many hours of the day, the BART connection to downtown San Francisco is actually faster than the taxi alternative. Service from Coliseum Station to the Union Square area takes about 21 minutes, at a rail fare of less than $3.50.

Bus. Given the very high utilization of AirBART, scheduled bus services to Oakland airport play a smaller role than in many U.S. airports. In a 2002 survey, scheduled buses attracted about 3% of the market.

Shared-Ride Van. In that same survey, shared-ride vans attracted about 3% of the market, which is lower than other recent experiences in the Bay Area. The airport website lists more than 100 service providers under the category "limo" but only two under the category "scheduled vans and buses."

New Orleans (15% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
6	Louis Armstrong New Orleans International Airport	15%	0%	15%

SOURCE: *TCRP Report 62* (*16*)

The Airport. Louis Armstrong New Orleans International Airport is located about 15 miles from downtown New Orleans, which is about a 25-minute drive under conditions of no congestion. The airport served about 7.8 MAP in 2005, of which about 3.5 million were originating passengers. Note that passenger volumes in 2005 were about 20% lower than in 2004. Similar volumes were down 36% in 2006, again compared against 2004.

Connections at the Airport. The New Orleans airport is smaller than many in this sample and operates out of a single, compact terminal. Within this terminal, the proximity of the baggage pick-up area to the franchised van departure area is nearly optimal, from the point of view of maximizing public mode use. The Shuttle Express departure locations are closer than private automobile pick-up areas, and ticket sales are located on the immediate path between baggage carousels and the curb serving the vans.

Bus/Van. According to the TCRP reports, New Orleans had one of the highest mode shares to bus of any U.S. airport, with a reported 15% of airline passengers using the direct, dedicated hotel loop services to downtown and New Orleans East. From the airport, vehicles are dispatched with varying levels of directness. The highly successful scheduled van system does not require a reservation from the airport, but does require that reservations be made 24 hours in advance of the trip to the airport.

No new ground access data are available; however, shifts in mode share are to be expected over the post-Katrina period, as the relative portion of air travelers going downtown to the convention-oriented hotels might have decreased. Nevertheless, the New Orleans example—where a series of small buses run a fixed route and schedule service from the airport, which varies by time

of day—may remain as one of the highest public mode shares recorded in the United States from any single mode.

Newark (14% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
7	Newark Liberty International Airport	14%	5%	9%

SOURCE: Surveys (*13*)

The Airport. Newark Liberty International Airport is located about 18 miles from Midtown Manhattan. The drive can be made in about 30 minutes, but the travel time varies vastly according to local congestion on route. The airport served about 34 MAP in 2005; of these, some 10.4 million were originating passengers.

Connections at the Airport. Newark airport is a comparatively centralized airport, with only three major terminal departure areas. The Newark AirTrain connects these three terminals with a rental car area, a transfer point for hotel courtesy vehicles, and the Newark Liberty International Airport Rail Station, which is served by New Jersey Transit and Amtrak. The airport rail station is the only direct connection between an airport people mover and the national rail system.

Rail. At Newark Liberty International Airport Rail Station, New Jersey Transit offers frequent service both toward Manhattan and in the opposite direction toward Trenton, New Jersey, and Philadelphia. Amtrak offers less frequent service, with many regional trains stopping, but with no connection to the high-speed Acela service.

Bus. A wide variety of bus services are offered at the passenger terminal area. A major express bus service serves midtown, and a separate line serves Lower Manhattan. About 5% of Newark's non-connecting airline passengers choose this bus service. Another 2% use the local bus systems.

Shared-Ride Van. Around 10 companies provide services beyond the major express bus services to Manhattan, with direct services in all directions.

Atlanta (14% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
8	Hartsfield-Jackson Atlanta Airport	14%	10%	4%

SOURCE: Atlanta Airport (*17*)

The Airport. The Hartsfield-Jackson Atlanta International Airport is located about 10 miles from downtown Atlanta (Peachtree Center), which is a less than 20-minute drive under good traffic conditions. This airport is the largest in the United States, and one of the largest in the world, with nearly 86 MAP served in 2005; of these, about 13.7 million are originating passengers.

Connections at the Airport. The Atlanta airport has recently opened a new ground transportation center that is located in the arrivals lobby, next to the Hertz rental car desks. This common location provides information, and allows immediate reservations, for all kinds of publicly available ground services, including both shared and single-party limousines. Because

of the highly centralized landside configuration of the airport, all buses, vans, and hotel shuttles leave from a single fixed-slot loading point: they are each assigned a parking place and, thus, do not circle around the airport, as is common at most U.S. airports. The reconstruction and improvement of this transfer area is continuing in 2007.

Rail. The Atlanta airport was constructed with a rapid transit station for MARTA in the arrival area of the airport's landside terminal. The entrance to the rail station is closer to baggage claim than are the taxi, limousine, and bus services at the airport. The Atlanta transfer point is part of a highly centralized baggage pickup area, with an escalator connection to the transit station above. In a 1997 airport survey, about 8% of originating airline passengers arrived at the airport on the MARTA rapid transit service. At present about 10% of airline passengers choose rail.

MARTA's market share is consistent with the high quality of connections that the system offers. The connections seem to be valued by travelers more than cost savings: in 1990, 54% of those surveyed said they chose MARTA for reasons of convenience; 24% said they chose MARTA because of cost savings. About 6% of those surveyed reported that they chose MARTA because they had no other options. Importantly, the survey showed that MARTA was capturing the business traveler, with 82% of the weekday airline passengers on the train traveling for business or convention purposes. Only 16% of airline passengers on the train were taking a personal or vacation trip. About 27% of airline passengers leaving the airport were going to CBD stations; 32% would walk from the train to their destination, while 28% are picked up. Of airline passengers who used rail, 9% carried three or more pieces of baggage (*18*). Had the rail service not been available, 46% would have accessed the airport by car, and 36% would have accessed the airport by taxi or limousine.

Bus. A system of shuttles within the metropolitan area operates every 15 minutes, while a system of shuttles to destinations outside of the metropolitan area departs every 30 minutes. A wide variety of privately owned companies provide the shuttle services, in addition to companies providing only limousine services.

Denver (14% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
9	Denver International Airport	14%	0%	14%

SOURCE: *TCRP Report 62* (*16*)

The Airport. Denver International Airport is located about 27 miles from the center of Denver. The airport served about 43.4 MAP in 2005; of these, some 9.8 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 31 minutes. The airport currently attracts about 1.4 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. The new Denver International Airport has a unique multilevel landside terminal structure, in which the baggage claim level (Terminal Level 5) is used by a wide variety of ground access services. Passengers being picked up by private automobile must take their bags to a different level to find the automobile pick-up area. There are two public mode transfer spaces: one on the east side of the concourse and one on the west side. The immediate curb is for public passenger drop-off; Island 1 is for limousines; Island 2 is for Mountain Carriers, shuttles to mountain resorts; Island 3 is for hotel shuttles; and Island 4 is for rental car shuttles. All public transportation services and scheduled bus services are located on Island 5, located farthest from the terminal area.

Bus. In Denver, the Regional Transportation District (RTD) has adopted an aggressive program of providing bus service to Denver airport. This service currently captures a 3.5% market share of airline passengers. The Denver RTD SkyRide Service is unique because it provides direct service to several major activity centers, not just to the CBD. The transit agency currently operates five routes providing transit access to the new airport. The SkyRide Service is operated to serve the work schedule of airport employees, with early-morning and late-night service. Toward the airport, service is operated from 3:20 a.m. to various hours ranging from 8:20 p.m. to midnight, depending on the route. From the airport, the service leaves generally between 6 a.m. and 1 a.m. The full fare for a one-way ticket is $8. The service attracts about 3,900 travelers per day.

Los Angeles (13% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
10	Los Angeles International Airport	13%	0%	13%

SOURCE: MarketSense (*19*)

The Airport. Los Angeles International Airport is located about 19 miles from the center of Los Angeles. The airport served about 61.5 MAP in 2005; of these, some 16.4 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 22 minutes. The airport currently attracts about 2.1 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. Four public transportation agencies serve the airport. Los Angeles International Airport is designed as a series of terminals on a loop road around a central parking garage facility. All public transportation services must collect or distribute their passengers on this loop road.

Rail. A free shuttle connects to the Aviation Metro Rail Station. The mode share to the adjacent rail service is less than ½ of 1%.

Bus. To Los Angeles International Airport, LAWA operates an express bus route, called the Van Nuys FlyAway. In 1998, the Van Nuys FlyAway attracted 717,900 airline passengers. The Van Nuys terminal is about 21 miles from the airport, and service takes about 1 hour. Service is similar in scope to the Logan Express service in Boston, with 30-minute headways all day, except in the morning peak period, when headways are 15 minutes. The Los Angeles service offers 1-hour headways after 1:30 a.m. The service operates more than 2,000 spaces at the Van Nuys terminal location.

LAWA attempted a second operation, considerably closer to the airport, in West Los Angeles. After a 3-year trial, the facility was closed because of low ridership. Airport staff has suggested that the facility was too close to the airport to attract private-automobile users to the service.

Since March 2006, the Los Angeles airport has been operating a new FlyAway service between the airport and the Union Station in downtown Los Angeles. This service operates every half hour between 5 a.m. and 1 a.m., and every hour during the late night. At Union Station, the traveler can connect to regional transit services, downtown shuttle buses, and intercity Amtrak services.

Both the original Van Nuys FlyAway location and the new Union Station location now offer baggage check-in services provided by Baggage Airline Guest Services, Inc. The charge is $5 per

person (two bags), and bags must be checked in 3 hours before scheduled flight time. About six major airlines are currently cooperating in the program.

Shared-Ride Van. Use of shared-ride vans at the airport increased from about 2% in 1987 to 5% in 1993 (*16*). As part of a commitment to improve customer service and respond to regional efforts to comply with air quality standards, LAWA has limited the number of shared-ride van concession agreements. This program has significantly reduced the number of shared-ride companies allowed to pick up on-demand passengers at the airport and is expected to increase the occupancies in the shared-ride vans. At present, shared-ride services are provided by Prime Time Shuttle and Super Shuttle.

Baltimore/Washington (12% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
11	Baltimore/Washington International Thurgood Marshall Airport	12%	3% MARC 2% Metro 1%	9%

SOURCE: *2005 Washington-Baltimore Regional Air Passenger Survey* (*15*)

The Airport. The Baltimore/Washington airport is located about 11 miles from downtown Baltimore and 32 miles from the center of Washington, D.C. The airport served about 20.2 MAP in 2005; of these, some 7.6 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 42 minutes. The airport currently attracts about 0.9 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. Baltimore/Washington airport has a wide variety of connecting services. For those traveling north to Baltimore, the light rail services connect directly to the international terminal. For those traveling south to the Washington, D.C. area, a shuttle bus operates from the airport to the Greenbelt station on the Green Line. A shuttle bus connects the airport terminal area with the BWI Rail Station, served by MARC and Amtrak. The airport runs a taxi service of owner-operators from the airport, but all taxis are allowed to carry passengers to the airport. Only two shuttle van operators are allowed on the controlled inner curb area; others operate more informally from an outer curb area near the parking garage. The combined rental car facility is several miles from the airport, with a single multiuser bus operation connecting with the airport. Individual rental companies are not allowed to serve the inner curb area.

Rail. The combination of Amtrak and MARC services are currently capturing about 2% of the market, with somewhat less than 1% attracted to the Metro shuttle bus to Greenbelt. The market share of airline passengers attracted to the light rail is well under 1%.

Bus/Van. Much of the marketing strategy at Baltimore/Washington airport is directed toward capturing metropolitan Washington air travelers. Looking only at that market, the consumers' response to new ground transportation services has been encouraging. Ridership on the new Washington, D.C., door-to-door van services increased 125% in 1996 over 1995 ridership, and ridership in 1997 was about 80% above 1996 levels. Door-to-door van service to Prince George's and Montgomery Counties increased 38% in 1996, and early 1997 volumes were about 36% ahead of 1996 rates.

The combination of bus and limousine attracts about 10% of the market share; thus, the market share for shared-ride services is somewhat less than 9% (excluding single-party limousines

from the calculation). One traditional public transportation bus is operated to Columbia, Maryland.

Chicago O'Hare (12% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
12	O'Hare International Airport	12%	5%	7%

SOURCE: Chicago Origin-Destination Survey Report (*20*)

The Airport. O'Hare International Airport is located about 18.5 miles from the center of Chicago. The airport served about 76.5 MAP in 2005; of these, some 14.9 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 23 minutes. The airport currently attracts about 1.8 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. O'Hare airport is served directly by the Chicago Transit Authority (CTA) Blue Line, with a terminal located within the central parking garage, about 1000 feet from Terminals 1, 2, and 3. To access Terminal 5, the international terminal, an automated people mover must be used. In addition, a free shuttle bus connects the terminals with the Metra commuter rail system. A consolidated bus/shuttle center is located immediately above the rail station, on the first level. The major bus/van system to downtown, the Airport Express, operates from curb locations near each of the major terminal baggage collection areas.

Rail. The train station at O'Hare airport has the highest use rates of any U.S. on-airport transit station, with more than 7,000 transit boardings per day. Of these boardings, surveys show that fewer than 20% are air travelers, with most of the others working at the airport. Although rail service has somewhat longer travel times than taxi service in off-peak hours, rail benefits from greater travel-time reliability during peak hours.

According to the most recent data, between 4% and 5% of O'Hare ground access air travelers choose the CTA train service, while 5% choose airport van and less than 3% choose other forms of buses. In the most recent survey efforts, a logical catchment area was defined, including a central Chicago area, with both a northern and a southern market area. For the prime market area for existing services (and for an express concept now under examination), 12% of travelers take the existing Blue Line train, with an additional 15% taking buses and van services.

Bus. Continental Airport Express operates both the downtown hotel shuttle loops and door-to-door service throughout the region. Suburban bus service is operated by PACE to downtown Evanston, Illinois. Six private bus/van companies run direct service to locations in Wisconsin, Indiana, and Iowa and several destinations in Illinois.

According to earlier CTA surveys, about 5% of airline passengers used the CTA rail services to or from the airport. There is little variation in rail ridership by air travel purpose: business travelers choose rail at about the same rate as non-business travelers. Rail was slightly more attractive to travelers going to the airport than from the airport. CTA analysts note that almost two-thirds of those arriving at the airport had local origins outside of the CTA service area; within the transit agency's service area, airline passenger rail market share was estimated at 15% (*21*).

In a 1990 survey, CTA services were found to be used more to the airport (5.8%) than from the airport (4.9%). The service is more often used by residents than non-residents, with 21% of departing residents choosing rail. Although about 60% of airline passengers are non-residents, fewer than 20% of airline passengers who use the train are non-residents.

Las Vegas (12% Market Share)

U.S. Rank	Airport	Market Share		
		Total	Rail	Bus/Van
13	McCarran International Airport	12%	0%	12%

SOURCE: *TCRP Report 62* (*16*)

The Airport. McCarran International Airport is located about 9.4 miles from the center of Las Vegas. The airport served about 44.0 MAP in 2005; of these, some 16.3 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 12 minutes. The airport currently attracts about 2.0 MAP per year who use public, high-occupancy modes to the airport.

Connections at the Airport. Terminal One has an unusual configuration, with several drop-off points for the airline departure function, but only one terminal for arrivals and baggage claim for all domestic flights. All shared-ride shuttle services depart from the "west side" curb of the main arrivals hall. Private automobiles pick up travelers on the first floor of the parking garage above the arrivals hall. The airport is unique in that six Las Vegas hotels provide hotel check-in and room key pick-up within the airport arrivals hall.

Bus. The Las Vegas airport is now served by six separate shuttle companies with service between the airport and the Strip hotels. With the six companies all serving the same area, the vans compete directly with taxis for service to the hotel area. Four additional companies provide regional service beyond Las Vegas. Traditional public transportation buses also serve the airport.

Tier 2

Figure 4-2 presents, in order of performance, the second tier of 14 U.S. airports that have public mode market shares between 5% and 11%.

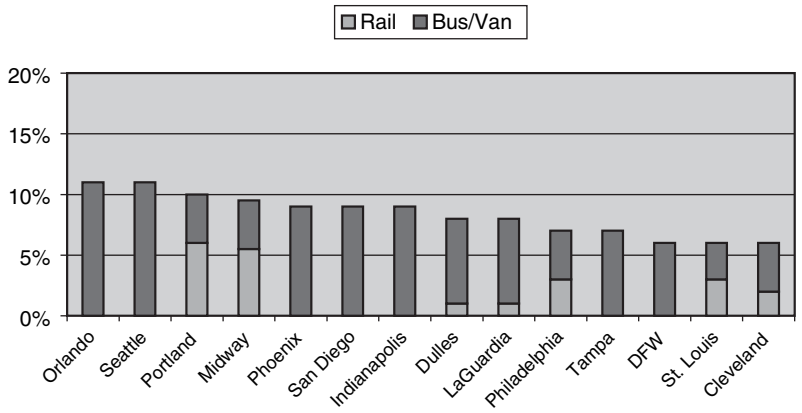


Figure 4-2. Market share to rail and bus in the second tier of U.S. airports.

Orlando (11% Market Share)

U.S. Rank	Airport	Market Share		
		Total	Rail	Bus/Van
14	Orlando International Airport	11%	0%	11%

SOURCE: *TCRP Report 62* (*16*)

The Airport. Orlando International Airport is located about 13 miles from the center of Orlando. The airport served about 34.1 MAP in 2005; of these, some 13.8 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 18 minutes. The airport currently attracts about 1.5 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. Orlando International Airport has a highly centralized configuration, with all landside services in one central structure and air-side services (gates) connected only by automated people movers. Local buses operate from only one departure point (A-side), while shuttle vans depart from both sides of the terminal.

Bus/Van. Traditional public transportation bus services are operated by Lynx to downtown Orlando, International Drive, and the city of Apopka. Shuttle vans are provided only by one company. At $17 per trip, the vans provide a cost-effective alternative to taxis for parties of one traveling to hotels on International Drive. A taxi costs about $34, which makes it competitive for any party of two or more. About seven van operators provide regional service to areas outside of the metropolitan area.

In operation at Orlando International Airport is one of the world's few through-baggage check-out services; the Swiss Railways operates one, and another such service is planned for Kuala Lumpur later in 2007. In this system, travelers with reservations at a Disney Hotel are sent baggage tags by mail with the hotel vouchers. These tags are placed by the traveler on the bags (in addition to the airline tags); then the bags are separated at the airport and sent directly to the individual hotel room. A reverse service is sometimes offered at the resort hotel, but not for all flights.

Seattle (11% Market Share)

U.S. Rank	Airport	Market Share		
		Total	Rail	Bus/Van
15	Seattle-Tacoma International Airport	11%	0%	11%

SOURCE: SEATAC Airport Surveys (*22*)

The Airport. Seattle–Tacoma International Airport is located about 14 miles from the center of Seattle. The airport served about 29.3 MAP in 2005; of these, some 9.9 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 17 minutes. The airport currently attracts about 1.1 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. The Seattle airport has a traditional horseshoe layout, centered around a large parking structure. Within that parking structure, managed areas have been created for taxis, vans, and courtesy vehicles. An "island" serves as the location for courtesy vehicles and vans, while an inner drive (deeper into the garage structure) serves taxis and the Shuttle Express services. A ground information center is also located in the garage structure. Separate from the garage complex, a departure area is located for charter buses (to cruises, for

example) at the southernmost end of the air terminal complex. Airporter buses also depart from this point. Public transportation buses use the arrivals level roadway at a point south of the terminal area.

Bus/Van. Traditional public transportation bus services are offered by both King County Metro and Sound Transit. Included in these services are unique dual-powered buses that operate on gas in the express bus lane on Interstate 5 and then convert to electric propulsion in the downtown bus tunnel. This tunnel will become a shared tunnel serving both buses and light rail upon completion of construction. The Gray Line runs an airporter service to a downtown hotel loop. Ten other companies offer bus and van services around the region. Together, all the scheduled services attract about 4% mode share. All shared-ride van service to the airport is provided by Shuttle Express, which attracts more than 6% of market share.

Portland (10% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
16	Portland International Airport	10%	6%	4%

SOURCE: Terminal Access Study (*23*)

The Airport. Portland International Airport is located about 12 miles from the center of Portland. The airport served about 13.9 MAP in 2005; of these, some 5.4 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 16 minutes. The airport currently attracts about 0.5 million travelers who use public, high-occupancy modes to the airport.

Connections at the Airport. The Portland airport has a centralized configuration, with all baggage claim in one location. Across from the baggage claim area, a ground transportation center has been built within the central garage structure. In various island locations, rental cars, shuttle vans, and courtesy vehicles all depart from a relatively small area. The light rail station has been built on the same level as baggage claim, which makes for a very convenient connection for travelers with baggage.

Rail. Light rail service has been inaugurated to downtown, with good regional connections to other transit centers. The train trip takes about 35 minutes to downtown, which is competitive with automobile times during peak periods, and costs $2. At present, rail attracts more than 5% of market share.

There are six longer distance shuttle operators. Sixteen companies are listed as providing door-to-door shared-ride services. Buses and vans capture more than 4% of airline passenger market share.

Chicago Midway (9% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
17	Midway International Airport	9%	5.5%	4%

SOURCE: Chicago Origin-Destination Survey Report (*20*)

The Airport. Chicago's Midway International Airport is located about 11.8 miles from the center of Chicago. The airport served about 17.7 MAP in 2005; of these, some 5.9 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 19 minutes. The airport currently attracts about 0.5 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. In an unusual terminal expansion, the landside terminal functions of Midway airport were moved closer to the existing Orange Line station, which is connected to the terminal by a series of walkways through the new parking garage.

Rail. CTA provides the rail service, and the airport is the terminus of the service's Orange Line. Nearly 6% of air travelers choose the rail system at Midway airport. Similar to many higher market share services, transit at Midway serves specific market segments well. Specifically, more than 20% of air travelers from the Loop choose the Orange Line service.

Bus. Continental Airport Express operates both the downtown hotel shuttle loop and door-to-door services throughout the region. There are five bus and van companies offering regional ground access services to Midway, with connections to Iowa, Wisconsin, Indiana, and several locations in Illinois. One bus company provides several connections in the Chicago Metro area, including O'Hare International Airport. About 4% of air travelers use buses and airport vans to get to the airport.

Phoenix (9% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
18	Phoenix Sky Harbor International Airport	9%	0%	9%

SOURCE: *TCRP Report 62* (*16*)

The Airport. Phoenix Sky Harbor International Airport is located about 7 miles from the center of Phoenix. The airport served about 41.2 MAP in 2005; of these, some 11.5 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 11 minutes. The airport currently attracts about 1.0 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. Phoenix has a dominant terminal (Terminal 4 with seven concourses) and two smaller terminals (Terminal 2 with two concourses and Terminal 3 with one concourse). (Terminal 1 does not exist.) Terminals 3 and 4 are characterized by a somewhat unusual clockwise-loop roadway (vehicles drive on the left rather than the right). This clockwise-loop roadway allows the landside terminal buildings to be located in the middle of the loops and serve concourses on both sides of the loop. Thus, in total, the buses have three pick-up areas to serve 10 separate airside concourses.

Bus/Van. There are two traditional transit bus services serving the airport. All shared-ride shuttle services throughout the region are operated by one company, Super Shuttle. Services depart every 15 minutes until 9 p.m., after which headways become longer. More than a dozen companies are authorized to serve other cities and towns within the state.

San Diego (9% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
19	San Diego International Airport	9%	0%	9%

SOURCE: *TCRP Report 62* (*16*)

The Airport. San Diego International Airport is located about 3 miles from the center of San Diego. The airport served about 17.4 MAP in 2005; of these, some 7.8 million were

originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 5 minutes. The airport currently attracts about 0.7 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. San Diego airport has two general-purpose terminals, which have a one-level curb serving both arrivals and departures. Each terminal has a ground transportation plaza for taxis, buses, and vans. In each case, passengers are offered a "skybridge" to access the check-in areas.

Bus/Van. A specialized public transportation service has been created between the airport and the primary convention/hotel area of downtown San Diego, with service every 12 minutes. Many buses are elaborately painted with airport themes, and baggage space is provided. The fare is more than $2.

The van services are presented in a novel way: a Transportation Coordinator places the traveler with the first available shuttle, unless the traveler specifies a particular shuttle company. This service may be a small step toward joint or centralized dispatching over several companies. Ten companies are listed as service providers on the airport's website. Overall, all bus/van services together attract about 9% of the ground access market.

Indianapolis (9% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
20	Indianapolis International Airport	9%	0%	9%

SOURCE: *TCRP Report 62* (*16*)

The Airport. Indianapolis International Airport is located about 15.1 miles from the center of Indianapolis. The airport served about 8.5 MAP in 2005; of these, some 3.6 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 28 minutes. The airport currently attracts about 0.3 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. Indianapolis International Airport was one of the first U.S. airports to construct a separate ground transportation center, located on the first floor of its main parking garage. From this point, all buses, limousines, and courtesy vehicles depart.

Bus/Limousine. Traditional transit bus service is offered to downtown. Three operators provide shuttle van service from Indianapolis International Airport, with one service going to Champaign/Urbana, Illinois; one to Indiana University; and one to Purdue University. The absence of a shared-ride van service to downtown is interesting. However, the airport website describes seven limousine operators as "shared-ride service." This difference in definitions may have resulted in a "shared-ride" mode share being reported that is not consistent with other market shares reported in this chapter.

Washington Dulles (8% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
21	Washington Dulles International Airport	8%	1%	7%

SOURCE: *2005 Washington-Baltimore Regional Air Passenger Survey* (*15*)

The Airport. Washington Dulles International Airport is located about 33 miles from the center of Washington, D.C. The airport served about 26.8 MAP in 2005; of these, some 6.5 million were originating passengers. The average driving time to DC was calculated by MWCOG at 51 minutes. The airport currently attracts about 0.5 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. Dulles airport is one of the most highly centralized airport configurations in the United States, with all landside functions occurring in one structure. The curb system at the arrivals level allows for a single point of departure for public mode services.

Rail. Travelers from Dulles airport can access the Washington MetroRail system via a scheduled bus service between Dulles and West Falls Church station. The service operates every half hour, for a fare of $9, and takes about 30 minutes. Line time to downtown is then under 25 minutes. This service attracts somewhat less than 1% of the ground access market.

Bus/Van. All shared-ride services from Dulles airport are provided under a franchise agreement with Super Shuttle, Inc. The use of traditional coach bus services has evolved considerably over the past decade. For years, the Washington Flyer coach served a fixed route between Dulles and a terminal area at or near the Capital Hilton, near K Street in Washington, D.C. Now the larger coach service is offered only to the Falls Church station of the Metrorail system. The shared-ride van system at Dulles captures a market share of about 7% of airline passengers.

As noted in *TCRP Report 62*, the market share for the Dulles express bus service had been decreasing for two decades, from 15% in 1978 to 9% in 1982, 5% in 1994, and 4% in 1997. During this time, the market area served by Dulles airport shifted from primarily downtown Washington to Northern Virginia, influenced by the increasing airline service available at the airport.

New York LaGuardia (8% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
22	LaGuardia Airport	8%	1%	7%

SOURCE: Metropolitan Transportation Authority New York (*11*)

The Airport. LaGuardia Airport is located about 9 miles from the center of Manhattan. The airport served about 26.7 MAP in 2005; of these, some 11.3 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 17 minutes. The airport currently attracts about 0.9 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. LaGuardia has traditionally been a difficult airport for ground transportation services because of its four decentralized terminals. With two stops in the central terminal area, and one each at the US Airways and Delta terminals, bus service must also provide access to the Marine Air Terminal, currently the location of the Delta Shuttle, located some distance from the central terminal area. In some years, the bus service from Grand Central Station operated a separate bus for the Marine Air Terminal, but currently all buses must serve all five stops in the LaGuardia facility.

Rail. Local bus service is available to several New York City subway stations, including Jackson Heights and Astoria Boulevard stations. These two rail transfer points are actually closer to LaGuardia than Coliseum Station is to Oakland airport; nevertheless, rail service has accounted for less than 1% of the LaGuardia access market.

Bus/Van. Bus service designed for and dedicated to airline passengers has been a major public transit mode at the three New York City area airports. At LaGuardia, privately owned buses captured 7% of the market in 1992 and 5% of the market in 1997 (*24*). New York Airport Service Express Company offers scheduled service, with full-size coaches, to its Grand Central station facility and connecting services to hotels and the Port Authority Bus Terminal. At present, two companies offer shared-ride van services to New York City, and about five more provide services to the distant suburbs and adjacent states. At present, the combination of scheduled airport bus service and shared-ride services together account for about 7% of the market.

Philadelphia (7% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
23	Philadelphia International Airport	7%	3%	4%

SOURCE: Philadelphia International Airport Ground Access Survey (*25*)

The Airport. Philadelphia International Airport is located about 9 miles from the center of Philadelphia. The airport served about 31.5 MAP in 2005; of these, some 9.1 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 14 minutes. The airport currently attracts about 0.6 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. At Philadelphia International Airport, ground transportation services depart from a series of arrival terminals, where baggage claim occurs immediately adjacent to rail departure points. Although the train is required to stop in five places, the overall walking distances between baggage carousels and train boardings are quite short.

Rail. Philadelphia International Airport's layout was designed for good connections to the commuter rail platforms, with baggage pick-up areas adjacent to the three rail stops. Walking distances from each of the baggage claim areas to the adjacent platform of the commuter rail are among the shortest in the world. The 30-minute travel time to a series of distribution stations in downtown Philadelphia can be competitive during congested-roadway periods but not during off-peak conditions. The rail line goes to the center of downtown, serving the Market Street East complex.

In 1986, about 4.5% of originating passengers chose the commuter rail service, a market share that has decreased to about 2%. At the time of the 1986 survey, rail captured about 16% of the air traveler market from the center of the city (*26*).

The 30-minute headway of the service is problematic: the traveler can spend more time waiting for the vehicle than on board the vehicle. As a result, Philadelphia's rail service attracts only about 2% of airline passengers. Although the airport commuter rail station attracts about 2,600 travelers a day, only 14% of them are estimated to be airline passengers. Because of a reported growth in rail ridership on the line, the researchers have estimated the rail mode share at about 3%. The Southeastern Pennsylvania Transportation Authority (SEPTA) reports an increase in rail ridership on the line, for all trip purposes, of about 66% between 1990 and 2005.

Bus/Van. A wide variety of shared-ride services are offered from the airport, with connections southward to Delaware and north to New Jersey. Based on the last available data, bus and vans together gained about a 4% market share.

Tampa (7% Market Share)

U.S. Rank	Airport	Market Share		
		Total	Rail	Bus/Van
24	Tampa International Airport	7%	0%	7%

SOURCE: *TCRP Report 62* (*16*)

The Airport. Tampa International Airport is located about 6 miles from the center of Tampa. The airport served about 19.0 MAP in 2005; of these, some 8.1 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 12 minutes. The airport currently attracts about 0.6 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. Like the nearby Orlando airport, Tampa airport operates with one consolidated landside air terminal. However, the design of the terminal calls for publicly available transportation services to depart from four separate "Commercial Ground Transportation Quadrants."

Bus/Van. Shared-ride van service to Hillsborough County is provided by Bay Shuttle, while service to Pinellas, Pasco, and Hernando Counties is provided by Super Shuttle. In the most recent survey data available, they attract about 6% of the air traveler market. Traditional public transit buses are provided to Tampa and to Sarasota; the Tampa service stops at one curb location, while the Sarasota bus stops at two of the four quadrants.

Dallas/Fort Worth (6% Market Share)

U.S. Rank	Airport	Market Share		
		Total	Rail	Bus/Van
25	Dallas/Fort Worth International Airport	6%	0%	6%

SOURCE: *TCRP Report 62* (*16*)

The Airport. Dallas/Fort Worth International Airport is located about 21 miles from the center of Dallas. The airport served about 59.2 MAP in 2005; of these, some 10.7 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 24 minutes. The airport currently attracts about 0.6 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. Dallas/Fort Worth airport is one of the most decentralized airports in the world, which is a challenge to the designer of shared ground transportation services. Currently there are five terminals, each with two clearly definable baggage claim locations. The airport roadway system connecting these terminals is itself a series of loops, and the task of assembling a shared-ride group of passengers for an outbound vehicle trip can take a considerable amount of time.

Rail. The Centre Point/DFW station has been built on the new Trinity Railway Express that operates between Dallas to the east and Fort Worth to the west of the airport. The station is located about 6.5 miles from the center of the airport. Service is operated Monday through Saturday, but not on Sundays. From the rail station, airline passengers are expected to take a shuttle bus, with service every 15 minutes and an 11-minute travel time, to the airport's Remote South Parking Lot. There the airport runs three shuttle buses: one to Terminals A and C, one to Terminals B and E, and one to Terminal D.

Bus. Transit services are provided from two transfer points at two remote lots. An airporter service links the airport with a downtown hotel loop. A variety of shuttle van companies serve the airport.

St. Louis (6% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
26	Lambert-St. Louis International Airport	6%	3%	3%

SOURCE: *TCRP Report 62* (*16*)

The Airport. Lambert–St. Louis International Airport is located about 16 miles from the center of St. Louis. The airport served about 14.7 MAP in 2005; of these, some 4.8 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 21 minutes. The airport currently attracts about 0.3 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. The St. Louis light rail has been integrated into the interior spaces of the airport's Main Terminal; the traveler does not need to leave the terminal to access the rail system. A second station has been built to serve the East Terminal currently used by Southwest Airlines.

Rail. The light rail at St. Louis airport attracts about 3% of airline passengers, as determined from calculations, not surveys. About 2,400 transit riders board at the airport station daily, but no market survey has been undertaken concerning the split between airline passengers and employees. Both airport and transit officials, however, suggest that about one-third of the riders are airline passengers, with most of the rest airport employees. These airport and transit officials have reported that nearby park-and-ride facilities have been filling up with airport employees anxious to avoid an airport parking charge recently established for most airport employees.

Bus/Van. Service to a downtown hotel loop is provided by Gem Shuttle/Trans Express Transportation. Two bus companies provide traditional coach service to the airport, and three companies provide additional van services.

Cleveland (6% Market Share)

		Market Share		
U.S. Rank	Airport	Total	Rail	Bus/Van
27	Cleveland Hopkins International Airport	6%	2%	4%

SOURCE: *TCRP Report 62* (*16*)

The Airport. Cleveland Hopkins International Airport is located about 15 miles from the center of Cleveland. The airport served about 11.5 MAP in 2005; of these, some 3.8 million were originating passengers. Under conditions of no highway congestion, the driving time from the airport to downtown is 20 minutes. The airport currently attracts about 0.2 million travelers per year who use public, high-occupancy modes to the airport.

Connections at the Airport. Rail service at Cleveland airport benefits from a well-designed passenger connection to the terminal, with short walking distances from baggage claim.

Rail. With a 30-minute ride to downtown (the Tower City Center), the "Rapid" offers travel times that are directly comparable to taxi times. With 15-minute headways for most of the day,

the service is one of the most frequent of rail services at airports located this distance from the CBD. The major difference between the two modes is price—$1.75 for rail versus more than $20 for taxis (which capture about 5% mode share)—reinforcing the concept that most air travelers perceive convenience to be more important than cost.

Ridership has declined sharply over time, for reasons that have more to do with the perception of the service than the actual times and costs relative to competing modes. A 1970 airport access survey reported a rail market share of 19%, with the downtown's largest destination zone showing a 33% market share. However, average airport station volumes (all trip purposes) decreased 36% between 1970 and 1975. In 1988, the rail market share was estimated to be 2.8%.

Bus/Van. Public transportation bus services are offered to Elyria and Oberlin, Ohio, by Lorain County Transit. No van service to the Cleveland area is documented by the airport, although any state-licensed limousine company is authorized to provide pre-arranged trips to and from the airport.

Other Airports of Interest

Airports serving Minneapolis–St. Paul and Milwaukee have begun to offer new public mode services since the publication of *TCRP Report 62* and *TCRP Report 83*, but no survey-based data were found to support any quantitative summaries of market share for this chapter. Officials in Minnesota reported that no new airport-based survey has been conducted since the opening of the light rail service to downtown Minneapolis and the Mall of America. Their estimate was that the service was attracting less than 5% of the ground access market.

Similarly, no survey-based data have been found for the ridership on the new rail station at Milwaukee's General Mitchell International Airport on the new Amtrak Hiawatha Line. Unofficial reports suggest that airline passengers who take the train to that station, and connect to the terminal by the shuttle bus, would comprise less than 1% of the total airline passenger volumes at General Mitchell International Airport.

Part 2: Best Practices at European and Asian Airports

This section presents brief, factual overviews of 19 of the most successful airport ground access systems in Europe and Asia case studies. For each of these systems shown in Figure 4-3, the combination of rail and bus services attracts more than 20% of airline passenger market share.

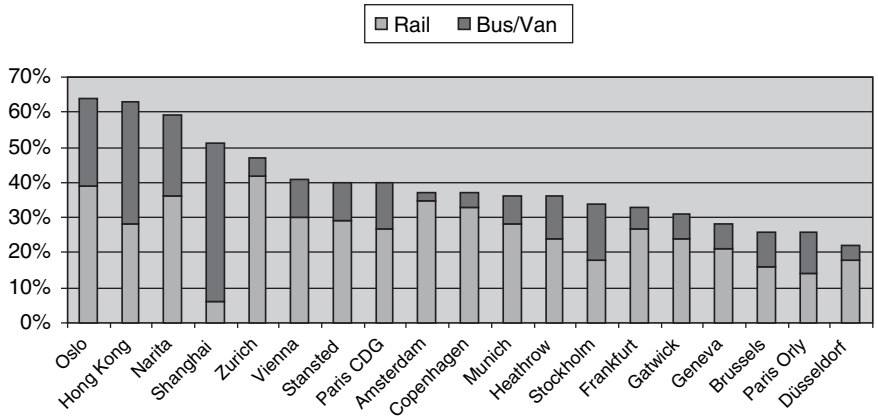


Figure 4-3. Public transportation mode shares at European and Asian airports.

In each case, key roles are played by rail and bus services. These systems are presented in order of their mode share to rail and bus services combined. Shared-ride services (such as door-to-door vans) play a very small role in European and Asian airports and have been uniformly excluded from this analysis. The public transportation mode shares for the 19 European and Asian airports are shown combined and by share to rail and bus services in Table 4-2.

Each European and Asian airport is reviewed in terms of the characteristics of the airport itself, the nature of its configuration relative to ground transportation services, and the role played by rail and bus services. Additionally, the services are reviewed in terms of their relationship to an overall baggage-handling strategy or approach. (This category was not included in the review of U.S. airports in the previous section.) Finally, observations are presented about the market characteristics of the airport ground access services when they are relevant to the emphasis areas of this report. The factors that contribute to the success of the ground access systems are examined in six categories:

- **The airport:** Data are presented that describe each European or Asian airport's size and location, and give a general estimate of taxi fares to the downtown area. Uniform data on originating passengers are presented.
- **Connections at the airport:** The discussion of this category examines the quality of the connection between the rail services and the airport check-in or baggage claim areas. Physical and architectural details are reviewed as relevant, and the physical quality of the transfer from the airline passenger terminal to the rail system is described. Also noted is the nature of the configuration of the airport itself. The difference between centralized and decentralized airport layouts is examined.
- **Rail:** Most European airports rely on some form of rail service for ground access. This category includes a brief description of the nature of the rail service provided and whether the service is dedicated or shared. Fares are presented. When service is provided beyond the traditional downtown, the nature of the regional services is noted.

Table 4-2. Public transportation mode shares to European and Asian airports.

		Market Share		
Rank	Airport	Total	Rail	Bus
1	Oslo	64%	39%	25%
2	Hong Kong	63%	28%	35%
3	Narita	59%	36%	23%
4	Shanghai	51%	6%	45%
5	Zurich	47%	42%	5%
6	Vienna	41%	30%	11%
7	London Stansted	40%	29%	11%
8	Paris Charles de Gaulle	40%	27%	13%
9	Amsterdam	37%	35%	2%
10	Copenhagen	37%	33%	4%
11	Munich	36%	28%	8%
12	London Heathrow	36%	24%	12%
13	Stockholm	34%	18%	16%
14	Frankfurt	33%	27%	6%
15	London Gatwick	31%	24%	7%
16	Geneva	28%	21%	7%
17	Brussels	26%	16%	10%
18	Paris Orly	26%	14%	12%
19	Düsseldorf	22%	18%	4%

- **Baggage-handling strategy:** In the discussion for this category, each airport access system is reviewed in terms of the strategies employed to deal with the baggage of the air traveler. Specific examples are presented for off-site check-in strategies, ranging from full-service downtown terminals to integration with other mechanisms for off-site check-in. When relevant, the status of such systems is summarized.
- **Bus:** Although their *relative* importance in Europe and Asia is less important than in the United States, key services are provided by bus. Small buses (i.e., vans) are included in the overall mode shares for bus.
- **Relevant market characteristics:** This descriptive information is reviewed in the context of any known market data for each of the systems. Market characteristics include the extent to which the market is oriented to the downtown or to other areas well served by the regional rail system.

Oslo (64% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
1	Oslo Airport	64%	39%	25%

SOURCE: *Vergleich internationaler Flughäfen* (*27*)

The Airport. Oslo's new airport at Gardermoen opened in 1998. The airport is 30 miles north of downtown Oslo and served more than 16 MAP in 2006. Travel time by taxi from Oslo to the airport is estimated to be 45 minutes.

Because the new airport is 30 miles from downtown Oslo, high-speed transit services have a market advantage over taxis and other modes of transportation. The Norwegian authorities set a policy goal of 50% market share capture for the combined rail services.

Connections at the Airport. The new Oslo airport was built from the initial concept to serve as an exemplary intermodal transfer facility. Designed from the outset to serve as part of an integrated access system, the airport is centralized, with all gates served by a single landside terminal. Because of the natural geography of the airport site, the rail facility is at grade for most of the area. The rail service is in the lower (basement) level of the air terminal building. Escalator service is provided from the train station to the check-in and ticketing area of the airport. Buses depart from a location very close to the baggage claim area.

Rail. Rail service between the airport and downtown Oslo was initiated in 1998. The airport is served both by a dedicated service (the Oslo Airport Express) and standard national railway service. In 1998, interim service was operated bypassing an incomplete tunnel section that has now been replaced by a more direct route between the airport and downtown. The Oslo Airport Express is designed for 120-mph operation, consistent with Norwegian intercity services. The train makes this 30-mile trip between the airport and downtown in 19 minutes. There are six trains per hour; of these six trains, three continue beyond Oslo's Central Station.

Baggage-Handling Strategy. The Oslo Airport Express train was designed with a proactive strategy for baggage. The operation does not currently have an off-site baggage-handling system, but it incorporates a unique seating layout, in which every seat faces a baggage storage area. All seats served by each entrance door face the baggage-storage shelves. Originally planned baggage check-in services at the Oslo downtown rail station have now been abandoned. Scandinavian Airlines System (SAS) offers a kiosk for check-in for those travelers with only hand baggage.

Bus. Airport bus service is offered to some major hotels with a 55-minute travel time every 10 minutes, for a fare that is lower than the competing rail services.

Market Characteristics. The managers of the Oslo Airport Express train estimate that some 48% of all deplaning airline passengers are destined to the city of Oslo. Another 11% are going to other towns in the southwest directly served by the rail service from the airport. The marketing strategy for the Oslo Airport Express focuses heavily on the needs of the business traveler, and extensive work has been undertaken with Norway's largest employers to sell tickets directly to these organizations. Some 58% of the airline passengers using rail were traveling on business.

Hong Kong (63% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
2	Hong Kong International Airport	63%	28%	35%

SOURCE: MTRC (*28*)

The Airport. Hong Kong International Airport serves about 44 MAP and is located 21 miles from Hong Kong Island. From the airport, a taxi ride to Hong Kong Island costs more than $50 and takes 30 minutes under optimal conditions, much longer when the downtown roads are congested. The new expressway, a part of the regional highway system built to access the airport development area, has virtually no associated congestion or travel time delay.

Connections at the Airport. Hong Kong airport was designed to achieve optimized integration between rail and air facilities. All deplaning passengers retrieve their bags in one centralized arrival hall/customs facility located on the lower level of the airport terminal. From this facility, passengers walk across the arrival hall and board the train without changing levels. Conversely, the train brings all enplaning passengers to the upper level of the airport terminal, where they proceed through ticketing without changing levels.

Rail. The Hong Kong Airport Express train departs from the airport every 8 minutes for three stations: Hong Kong (Central), Kowloon, and Tsing Yi. Travel time between the airport and Hong Kong (Central) is 23 minutes. Fares were initially established at $9 to Hong Kong, $8 to Kowloon, and $5 to Tsing Yi. The Airport Express is operated by the MTRC. The researchers estimate that 25% of airline passengers take the Airport Express and 3% take the local.

Baggage-Handling Strategy. MTRC developed the world's first downtown check-in system for use by all airlines. The system provides baggage check-in facilities at both Central Station and Kowloon Station. All check-in functions, including the issuance of boarding passes, are undertaken at the downtown facilities staffed by airline personnel, rather than rail employees. Although the service is free, it is available only to those who have purchased a rail ticket, and its operation is subsidized by the rail system. Central Station started with 28 check-in positions of 45 potential positions, while Kowloon Station opened with 33 positions of 83 potential positions.

Bus. The airport can also be reached by a bus connecting with the Tung Hung rail line, which was also built by MTRC as part of the integrated railway project serving the new development area around the airport. About 25% of airline passengers choose the more expensive Airport Express service; about 3% take the shuttle bus to the less expensive Tung Chung service. Bus service specifically designed for airline passengers serves major hotel locations in Kowloon and Hong Kong. Airbus service focusing on hotel locations was originally provided for about $5, while a major transit operator, Citybus, has created a series of new bus routes with lower fares.

Bus ridership has been estimated at 35%, although the actual share of pre-packaged charter buses is unclear.

Market Characteristics. The market for ground access services in Hong Kong is concentrated in a relatively small area. Of those passengers arriving at the previous Hong Kong airport, 40% were destined for the Kowloon Peninsula, while 33% were destined for Hong Kong Island. The rest were destined for the New Territories to the north. Of those passengers checking in, 17% had no bags checked. Another 27% had only one bag checked. Of those passengers on the new Airport Express train, 31% were resident air travelers and 39% were non-resident air travelers (*29*).

Narita (59% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
3	Narita Airport	59%	36%	23%

SOURCE: *TCRP Report 62* (*16*)

The Airport. The airport in Narita, located 40 miles east of downtown Tokyo, served more than 31 MAP in 2006. The airport has two terminals, each of which is connected by walkway to its rail station. Travel by automobile between the airport and downtown varies from 90 minutes to several hours. Taxi fare can be as much as $180 for the trip.

Connections at the Airport. Initially, Narita International Airport operated from a single air terminal, which was served by the stub end terminal of the rail lines. With construction of the new Terminal 2 complex, a second railroad station has been added at Narita. Both railroad stations are located in plazas beyond the access roadway, with walks of 500 ft. The stations are accessed via a mezzanine level under the airport roadway.

Rail. The East Japan Railway Company (JR-East) operates the Narita Express rail service every half hour. Coach, first-class, and super-first-class services are available for the 55-minute trip to downtown. Fares on the Narita Express cost around $40. A private railroad company operates Keisei Railways Skyliner service at lower prices to two downtown stations. The Narita Express captures 14% of the air traveler market; the Skyliner captures 10%. A third level of service is provided by more traditional transit trains, which offer a partial express service to downtown for under $10.The three rail systems at Narita attract about 36% of the market, while buses attract an additional 23%.

Baggage-Handling Strategy. The strategies for handling baggage vary considerably by service. The two major express rail services have baggage storage areas on each vehicle; the rapid transit vehicle has no provision for baggage. For years, a major downtown check-in terminal served the airport buses, but not the rail systems. This downtown check-in service was discontinued in 2002. Narita airport has a well-developed program for home delivery of bags that is operated by a private company.

Bus. Luxury buses operate from the Tokyo City Air Terminal, where downtown check-in was once offered.

Market Characteristics. Narita airport provides an excellent example of the principles of market segmentation by price points. Not only are three levels of service offered by rail operating companies, but on the most popular—the Narita Express—there are three classes of seating. During peak travel periods, all seats on the Narita Express are often reserved days in advance, and only standby seating is sold at the airport.

Shanghai (51% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
4	Shanghai Pudong International Airport	51%	6%	45%

SOURCE: "The Characteristic Analysis of Passengers' Selection of Ground Transport Mode Connecting Shanghai Pudong International Airport and the Downtown Area" (*8*)

The Airport. Shanghai Pudong International Airport is located 18 miles from downtown Shanghai and served more than 21 MAP in 2005. Built in 1999, it serves mainly international travel, with a second, older airport, Hongquiao, serving the domestic market. A taxi trip to downtown takes about 70 minutes, at a cost of about $10.

Connections at the Airport. The passenger terminal at Pudong International Airport is connected by a long walking bridge directly to the station for the maglev train to the downtown. The connection can be made without exposure to weather.

Rail/Maglev. The extremely high-speed maglev train makes the trip to downtown in about 8 minutes and costs about $7.

Surveys presented to the Transportation Research Board have established that the buses as a whole capture 45% of the ground access market, while the maglev captures only 6% of the market.

Bus. Costing around $3, a set of bus services offers direct services to a wide variety of city destinations. Six separate routes are offered from the airport, with headways ranging between 15 minutes (to a downtown air terminal) and 30 minutes (to a football stadium).

Market Characteristics. A discussion of the relative importance of fast line-haul speed versus directness of service is presented in Chapter 3.

Zurich (47% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
5	Zurich Airport	47%	42%	5%

SOURCE: *Vergleich internationaler Flughäfen* (*27*)

The Airport. Zurich Airport is located in the town of Kloten, about 7 miles from the center of Zurich. The drive to downtown can take about 20 minutes, with taxi fares of about $35. The airport has suffered a loss of traffic since the demise of its principal hub airline, Swissair, and the relative role of Zurich as a transferring hub has substantially decreased. The airport handled more than 19 MAP in 2006.

Connections at the Airport. Zurich Airport was one of the first to build a rail station underground beneath the major landside terminals. The compact configuration of Zurich Airport allows for direct connection from the rail station to both Terminals A and B. In fact, the two terminals have now been joined to create one common departure/waiting area for most passengers; this combined landside facility also serves a new midfield terminal. Most of the additional check-in terminals associated with the physical expansion of the terminals have been placed within the upper lobby of the rail station.

Rail. ***Service to Downtown.*** The trains from the airport to downtown Zurich leave approximately every 10 minutes, have a 10-minute travel time, and cost under $10.

Integration with Regional Transportation System. The Zurich rail system can be characterized as being part of a national system, which operates as a shared system. More than 200 trains per day arrive at the airport; in general no trains are operated solely to serve the airport, and all trains are part of a longer route. The Zurich Airport rail station is near the eastern end of the major east–west trunk railway, which offers service every hour to Geneva at the western tip of the country. The rail system attracts 42% of airline passengers, and recent statements from the airport operator suggest this share is rising.

Baggage-Handling Strategy. Zurich Airport is served by the most comprehensive off-site baggage and passenger check-in system in the world, known as the Fly-Rail Baggage program. Baggage can be checked in at 50 rail stations throughout the country for most scheduled flights, with the exception of some flights to the United States. This service costs $15 per bag. Swiss Federal Railway will accept bags as late as 3 hours before flight time in the downtown Zurich train station and requires up to 16 hours at isolated Alpine stations. The concept of a third party (neither airline nor airport) providing through-baggage service was developed in Switzerland and is discussed more thoroughly in Chapter 5.

Bus. Buses play a relatively minor role at Zurich Airport, given the coverage of the national rail network. Public transportation buses are operated primarily to serve employees. Some specialty buses are run from remote locations, including early in the morning (e.g., 1 a.m. to 4 a.m.) when train schedules are poor. Buses attract about 5% of the market.

Market Characteristics. The access system for Zurich Airport has been structured around the needs of airline passengers who use longer distance rail, and the mode shares attained for various geographic market segments support this. Of those passengers coming from non-local markets in Switzerland, more than 50% travel by rail. For example, the market share from the national capital, Bern, a city 75 miles from the airport, is about 60%. Conversely, from the immediate bedroom suburbs, only about 8% of airline passengers select the rail option to get to the airport. Of all outbound travelers at the Zurich Airport rail station, about 40% are going to the Zurich metropolitan area, with 60% traveling longer distances.

Vienna (41% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
6	Vienna International Airport	41%	30%	11%

SOURCE: "Vienna International Airport–AirRail 2007" (*48*)

The Airport. Vienna International Airport is located about 12 miles from Vienna and served nearly 17 MAP in 2006. The drive by automobile takes less than 25 minutes under uncongested roadway conditions.

Connections at the Airport. The Vienna International Airport operates as one single structure, in spite of the terminology of Terminals 1, 1a, and 2. From a common baggage pick-up area, an underground walkway leads directly to the rail station and also connects to the central parking facilities. The traveler can choose between one platform for the express, dedicated train and a second platform for shared commuter rail services. Newly redesigned luxury buses operate from the curb.

Rail. A new City Air Terminal has been created within the Vienna-Middle station. The terminal is well located relative to major tourist hotels, at the edge of the Stadtpark, and has four check-in counters and five automatic kiosk machines. From this location, the traveler has a choice of dedicated rail service, called the "CAT," or shared rail services from the regional suburban rail system. The CAT service offers non-stop connections to the airport in 16 minutes. Tickets on the dedicated service are available for about $12, with the competing services priced like commuter rail service. The dedicated rail is currently attracting about 14% of the market, while the standard rail service is attracting about 16% of the market.

Baggage-Handling Strategy. For those travelers who choose the higher priced dedicated rail service, baggage check-in is offered for 25 airlines, including Star Alliance airlines, of which Austrian Airlines is a member. Travelers to the United States can check their bags at the City Air Terminal. The downtown check-in station is unusual in that it offers totally automated baggage check-in service. About one in five airline passengers are reported to use the check-in service (37).

Bus. Bus service is offered from three downtown locations, including the South Rail Station and the West Rail Station, at a price of about $8. The airport reports that bus services capture about 11% of the ground access market for airline passengers.

London Stansted (40% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
7	London Stansted Airport	40%	29%	11%

SOURCE: *CAA Passenger Survey Report 2004* (*30*)

The Airport. Stansted Airport is located 35 miles north of London, which is about 70 minutes by automobile. Taxi fare for the journey is estimated at $100. Stansted served about 21 MAP in 2005 and is growing rapidly. About 13% of traffic is to UK destinations, and about 87% is international. Some 87% of these travelers are terminating, and not transferring to other flights.

Connections at the Airport. Stansted Airport has a centralized configuration, with a compact landside terminal serving a series of airside concourses via a people-mover link. The rail station is integrated into the basement of the terminal structure and accessed by elevator, escalators, and ramps. The escalators from the rail station are located in the departures concourse; the escalators to the rail station are located in the arrivals concourse. The bus station is across the airport roadway, in a central plaza.

Rail. Stansted Airport is served by both dedicated rail services to London and shared rail services in the region. Initially called the "Stansted Skytrain," the dedicated rail service to London operated every half hour from Liverpool Street Station, with about a 40- to 45-minute travel time to the airport. In 1999, the service was rebranded as the Stansted Express and began to offer service with 15-minute headways for much of the day. In 2007, the fare was about $30 one way. Hourly local service between the airport and London is also provided. Additional services are provided directly to the Midlands and destinations in the north of England. Rail captures 29% of the airline passenger market.

Baggage-Handling Strategy. The dedicated trains of the Stansted Express are designed with ample luggage storage areas on board. The concept of downtown check-in at Liverpool Street Station was explored by the operators of the Stansted Express along with the airlines and the owners of the rail station and was discontinued.

Bus. An aggressive program of bus operations to UK airports is now under way, with direct service from the London bus terminal near Victoria and Liverpool Street Station to Stansted, at prices lower than the rail. Over time, bus ridership has risen from 10.2% in 2003 to 11.4% in 2004.

Market Characteristics. Managers of the rail system have seen a significant rise in mode share to rail, from less than 10% to 29% in the last decade. Analysts note that, in the past, Stansted air travelers did not tend to come from the London area. Market data showed that, for the small portion of travelers who did come from central London, their mode share to rail was extremely high, at a capture rate of more than 50%. Over the past 5 years, a greater proportion of Stansted air travelers are now coming from London, resulting in a higher airport-wide mode share for rail.

Paris Charles de Gaulle (40% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
8	Paris Charles de Gaulle Airport	40%	27% RER 21% TGV 6%	13%

SOURCE: Aéroports de Paris (*31*)

The Airport. Located 15 miles north of Paris, Charles de Gaulle International Airport is the dominant airport in not only Paris, but also France. The airport's passenger volume was more than 56 million in 2006. A rail station has been built in the center of a new air terminal complex. Ground access time on the motorways from downtown Paris varies from 30 minutes to more than 1 hour in heavy congestion. Taxi fares are about $50.

Connections at the Airport. A shuttle bus connects Terminal 1 with the original Regional Express Network (RER) station, which is 1 mile away. In 1998, a second rail station incorporating both high-speed national service and the regional RER was opened in the new Terminal 2 complex. The current long-term plans for the airport call for the creation of a people-mover system; earlier attempts at building an innovative system failed. Currently, Terminal 1 is connected to the rail stations by a shuttle bus.

Rail. ***Line Haul to Downtown.*** Regional services are capturing 21% of the ground access market. The airport is served by both metropolitan and national rail services. The electrified suburban rail network, known as the RER Line B, provides service every 15 minutes to downtown, with direct service to many downtown stations that offer quick connections to the rapid transit system (Metro). The RER Line B provides a 35-minute travel time from the airport to downtown Paris, for less than $10.

Connections to the National System. Over the past decade there has been a rapid increase in the importance of the national high-speed rail system at Charles de Gaulle airport. At present, the national service attracts 6% of the ground access market. These services provide high-speed rail as far north as Brussels, and to the Mediterranean coast to the south. Aéroports de Paris is currently working with the national railroad authority to create a new express service into Paris, reportedly with an 18-minute travel time.

Bus. Buses are capturing 13% of the market. Bus service is provided by Air France and the local public transit operator, the RATP. The Air France bus costs more than $10 between the airport and downtown; the "Roissybus" to the bus station next to the opera house costs somewhat less.

Baggage-Handling Strategy. There is currently no downtown check-in facility in Paris to replace the original City Air Terminal at Invalides Station on the Left Bank. There are no dedicated areas for baggage on the RER trains, which are overcrowded during peak periods. The long-distance TGV trains have excellent baggage storage, and plans are under consideration for off-site check-in services.

Amsterdam (37% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
9	Amsterdam Schiphol Airport	37%	35%	2%

SOURCE: International AirRail Organization (*32*)

The Airport. Amsterdam Airport Schiphol, Europe's fourth largest airport, served more than 44 MAP in 2006. It is located about 12 miles from Amsterdam and 40 miles from The Hague, capital of the Netherlands. The airport serves a wide geographic feeder area; for example, travel to Rotterdam (approximately 32 miles from Amsterdam) is often made via rail connections after a flight into Schiphol. A taxi ride takes about 30 minutes from the airport to downtown Amsterdam, at a fare of approximately $30.

Connections at the Airport. Schiphol airport was reconstructed to create a common arrivals area adjacent to three baggage claim areas. The rail platforms are located directly under this common area. Even though the design evolved from the construction of separate terminal buildings, the main arrival hall functions occur near the rail and bus departure areas. With metropolitan rail service, national rail service, and an increasing amount of international high-speed rail services, Schiphol airport is served by one of the widest varieties of high-quality public transportation modes of any airport in the world.

Rail. ***Line-Haul Service.*** The combined rail system provides service every 15 minutes throughout most of the day, with a 15- to 20-minute travel time to Amsterdam Central Station. The fare between the airport and downtown is about $5.

Integration with the Regional Transportation System. Although the local rapid transit lines do not serve the airport, the national railway system operates high-frequency services throughout the country, meeting the needs of local commuters. Therefore, service to Rotterdam or The Hague is offered as frequently as many traditional airport services to the dominant CBD. This strategy, which serves destinations throughout the country, is similar to that adopted in Switzerland. Services to international destinations are provided both by traditional intercity trains and by the high-speed Thaylis train. With new high-speed rights-of-way in the Benelux countries, service at 180 mph will be available from France to Cologne, Germany.

Baggage-Handling Strategy. Currently, there are no off-site baggage check-in facilities in the Netherlands. In general, the trains that serve Schiphol airport are designed for national service and have ample space for bags.

Bus/Van. Schiphol airport is developing a wide array of van-type services. Eight-person shuttle vans depart every 10 minutes to more than 100 hotels, providing essentially a flexible shared-ride van system; the return trip on the hotel shuttle can be requested up to 2 hours in advance. Importantly, the airport also offers shared-ride taxis, which are essentially small vans, operating to any destination in the Netherlands. Taxis must be reserved 24 hours in advance, at which time the user is given an Internet confirmation, including price and pick-up time. The airport shared-ride taxi system commits to the traveler that the distance taken in the journey to the

airport will not be more than 1.5 times the distance of a non–shared-ride trip. The reservation systems are well integrated with the airport website, as discussed in Chapter 9.

Copenhagen (37% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
10	Copenhagen Airport	37%	33%	4%

SOURCE: *Vergleich internationaler Flughäfen* (*27*)

The Airport. Copenhagen Airport served nearly 20 MAP in 2005. The airport is located in Kastrup, 7 miles southwest of downtown Copenhagen. Taxi service from the airport to downtown takes about 15 minutes and costs less than $30. The layout of the airport, including the rail station connected with Terminal 3, has been designed to create "seamless" transfer. The airport is an integral part of the Oresund Crossing system, which links Denmark with Southern Sweden by a complex bridge/tunnel system that has both highway and rail facilities.

Connections at the Airport. The new Terminal 3 has been designed to include an architecturally ambitious integrated air-rail terminal complex. A new check-in facility has been opened in the rail station lobby of Terminal 3. A new baggage claim and customs clearance center for the airport has been built as part of the new Terminal 3 complex.

Rail. Rail service began in fall of 1998 and operates every 20 minutes, with a 12-minute travel time to Central Station for about $4. The service continues on to Hollinger and other cities, providing national rail access to the airport. Passengers on other national services are provided with transfers at major stations, including Central Station. In July 2000, the rail service was inaugurated through the new bridge and tunnel to southern Sweden.

Baggage-Handling Strategy. No off-site check-in services are planned in Denmark. The future of airport check-in facilities in Malmo, Sweden, is currently under discussion. New rail equipment for the cross-sound service is designed to accommodate a wide variety of objects, including bicycles. Historically, SAS provided baggage check-in services in many of their hotels, but this has been phased out.

Bus. Until 1999, airport bus service to Central Station had been provided every 15 minutes in association with SAS—the airport's dominant airline. The SAS bus charged $5 for the 20-minute ride. As a result of the introduction of rail service to downtown, the SAS bus to downtown has been eliminated. The city transit agency runs a bus to Central Station downtown, which is priced below the rail fare. Direct bus service is also operated between the airport and the south of Sweden. Before the rail service was initiated, the bus system captured 28% of the air traveler market.

Munich (36% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
11	Munich Airport	36%	28%	8%

SOURCE: Munich airport website (*33*)

The Airport. Munich Airport is located 17 miles north of downtown Munich and served nearly 31 MAP in 2006. From its opening in 1992, the airport was served by one line of the S-Bahn, the

suburban rail system. In 1998, the German Federal Railroad inaugurated a second rail service to the Munich Airport. When the airport was served by only one rail line, rail captured 28% of the airline passenger market. By January 1999, the ridership on the two lines together had increased to 31% market share. Taxi service to the downtown area can cost as much as $60 and can take about 40 minutes.

Connections at the Airport. The airport rail station was constructed as part of the new airport and, thus, benefits from architectural integration with the airport terminals. Previously, enplaning passengers arriving by rail took an escalator from the platform to a mezzanine level where a check-in facility was provided; that separate baggage check-in area has been discontinued. Although the connection brings the rail passenger directly into the terminal structure, the configuration of the terminal calls for long walking distances within the building. For most of the airline gates, the walking distances from parking and from curbside drop-off are considerably shorter than the walking distance from the rail station.

Rail. Rail currently captures about 28% of the market. The original rail service is provided every 20 minutes via the eastern downtown station (travel time of 31 minutes), through City Hall Square (37 minutes), and Main Station (40 minutes). The second service also provides 20-minute headways following the opposite route, with service via Main Station (40 minutes), through City Hall Square (43 minutes), and to the eastern downtown station (48 minutes). In the common downtown distribution section, service is provided every 10 minutes. However, travelers have to monitor train departures in two directions to catch the first train to the airport. A one-way ticket on either line costs about $11.

Extensive plans have been developed to build a high-speed maglev from Munich Airport to the main train station in downtown. The route would follow the existing service commuter rail route via the Main Station. At present, the national government has not committed to funding the project.

Baggage-Handling Strategy. A downtown check-in facility in the Main Station for Lufthansa passengers was discontinued for lack of customer use. Baggage space on the rail line varies by time of day and by level of crowding on the commuter systems.

Bus. The city bus, which goes to Main Station every 20 minutes, has a travel time of 45 minutes. The airport website describes 20 bus services to both metropolitan and longer distance destinations. Eight percent of Munich airline passengers come by bus.

London Heathrow (36% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
12	Heathrow Airport	36%	24% Tube 14% Express 9%	12%

SOURCE: *CAA Passenger Survey Report 2004* (*30*)

The Airport. London's Heathrow Airport served more than 67 MAP in 2006, making it the busiest airport in Europe. Heathrow is located 15 miles west of London, with a driving time of 45 minutes to more than 1 hour. The taxi fare is more than $80, depending on the destination in London.

Connections at the Airport. Terminals 1, 2 and 3, all located in the central terminal area, are connected with both London Underground and Heathrow Express stations by relatively long underground walkways. In a complex design to serve Heathrow's scattered terminals, the Heathrow Express uses a two-track tunnel to serve the central terminal area; a single-track tunnel continues on to

Terminal 4. A two-track tunnel to the new Terminal 5 is now under construction. The London Underground employs a one-direction loop between the central terminal area and the newer Terminal 4. Within the central terminal area, the Heathrow Bus Station is the second busiest bus station in the United Kingdom, with many transfers from bus to bus by patrons not destined to the airport.

Rail. In 1998, BAA (the airport operator) began operating the high-speed Heathrow Express, which captures more than 9% of the airline passenger market. With another 14% of airline passengers using the Underground's Piccadilly Line, rail captures almost 24% of the airline passenger market at Heathrow Airport. The Heathrow Express operates every 15 minutes on a scheduled 15-minute journey from the airport to Paddington Station in London's West End. The new service, with a top speed of 100 mph, uses rail equipment built specifically for airline passengers. The fare for the high-speed express service is about $30, slightly less expensive when purchased online and slightly more expensive when purchased on board.

The Piccadilly Line opened in 1977 and averages 20 mph, including station dwell times. This service takes 40 minutes to the closest parts of downtown London, with trip times including transfers of about 1 hour to farther downtown locations. The Piccadilly Line serves many popular destination areas directly, with excellent connections to the rest of the London Underground rail system. The Underground service costs about $10.

Recently, the managers of the Heathrow Express, which offers non-stop service to Paddington Station, have added a local train that stops at several stations. These stations allow several points of transfer with the rest of the metropolitan railway and underground systems. The new service, Heathrow Connect, is provided every half hour and the fare is significantly lower than the express service. This new service is not emphasized by the operators; the trains run from a separate part of Paddington Station and are not emphasized in the station graphics. It is too early to analyze ridership results.

Baggage-Handling Strategy. Beginning in June 1999, full off-site airline check-in service was provided at Paddington Station, the terminus for the Heathrow Express. At its peak, 27 check-in positions were in use. The baggage check-in service was gradually discontinued between 2001 and 2003 (for more discussion, see Chapter 5). When the baggage system was in operation, Heathrow Express managers attempted to market an in-bound baggage service from the airport to downtown hotels. It was not used to any extent.

There is little space to handle baggage on board the low-ceiling Piccadilly Line trains, and Underground stations are not designed for travelers with baggage. The Heathrow Express vehicles have large baggage storage areas on board.

Bus. A wide variety of bus services are operated from Heathrow Airport, which serves as the second largest bus station in the United Kingdom. Many buses connect with parts of the national rail service that are poorly accessed through downtown London. National Express runs nearly 400 bus services per day, including to downtown London.

Market Characteristics. Ridership of the London Underground service was documented as 62% airline passengers, 11% airport employees, 15% meeters and greeters, and 12% travelers with business in the airport vicinity. Only 5% of airport employees use the Underground (*34*).

Stockholm (34% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
13	Stockholm-Arlanda Airport	34%	18%	16%

SOURCE: *Vergleich internationaler Flughäfen* (*27*)

The Airport. The Stockholm–Arlanda Airport is located 25 miles from downtown Stockholm. The airport served 15 MAP in 1998. A taxi ride takes 35 minutes and costs well over $60.

Connections at the Airport. The airport configuration causes the Arlanda Express to have two stations: one for Terminals 2, 3, and 4 and one for Terminals 5 and 6. Both are located conveniently near the baggage claim area. Buses depart from a designated curb/island location.

Rail. The Arlanda Express rail line is a privately funded and privately managed venture that offers high-speed rail connections between Stockholm–Arlanda Airport and downtown Stockholm. At the airport, there are two rail stations for the Arlanda Express and a third station operated by the Swedish state railways. The closest station is about 17 minutes from downtown Stockholm, with a fare of $29. The trains are designed for the European standard of 120 mph, but initially are operating at no more than 100 mph.

Baggage-Handling Strategy. Initially, the main railway station in Stockholm offered three self-service machines and four counters for airline check-in for travelers who do not need to check baggage. These have been reported to be discontinued.

Bus. Flybus, the local airport bus service, continues to operate from the airport to downtown in competition with the two train services. Partly because of free-flowing conditions on the expressway system between the airport and the city, the bus provides extremely strong competition to the dedicated rail services, at a lower cost.

Frankfurt (33% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
14	Frankfurt Airport	33%	27%	6%

SOURCE: *Vergleich internationler Flughäfen* (*27*)

The Airport. Frankfurt Airport served more than 52 MAP in 2006, making it the second busiest airport in Europe after London's Heathrow Airport. The airport is 6 miles from downtown Frankfurt; travel time is about 20 minutes by automobile. Taxi service to downtown costs about $30 depending on the destination.

Connections at the Airport. The original rail station is located in the basement of Terminal 1 and provides direct escalator access to a large mezzanine level, where the platforms are accessed. The new high-speed station is about 1,000 feet from the existing Terminal 1. Currently, all travelers using rail must access the new Terminal 2 by entering Terminal 1 and taking a people mover. Buses depart from a centrally located area adjacent to the original Terminal 1.

Rail. Frankfurt Airport is currently served by the regional suburban railway—the S-Bahn—and national rail service on a trunk line between Frankfurt and Cologne. The regional S-Bahn provides suburban rail service to Frankfurt and Mainz, with a travel time of 10 minutes to downtown at a fare of about $5. The second rail station serves the new German high-speed rail system. This new station provides space for four separate lines of the German high-speed rail network, with significantly improved travel times in all directions. For example, rail travel time to Cologne has decreased from 2 hours to 1 hour with the construction of a totally new rail alignment to the east of the Rhine River. New rail stations at Cologne and Stuttgart have their own airline check-in facility.

Bus. Nine local bus routes serve the airport, with Lufthansa regional bus service to Heidelberg, Mannheim, and Talheim.

London Gatwick (31% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
15	Gatwick Airport	31%	24%	7%

SOURCE: *CAA Passenger Survey Report 2004* (*30*)

The Airport. Gatwick Airport is 30 miles southwest of central London; travel takes more than 1 hour by automobile. Taxi service can cost around $70, depending on the time of day and on other factors. Gatwick Airport served more than 34 MAP in 2006.

Connections at the Airport. For travelers arriving at Gatwick's South Terminal, the walk from customs clearance to the mezzanine level above the station is less than 500 feet, shorter than the walk to the automobile curb or garage. Rail and bus users arriving at the new North Terminal must use a people-mover shuttle to the original terminal complex. Gatwick Express managers have encouraged Gatwick Airport managers to allow the use of baggage carts on the people mover, which is not usually allowed at major airports. The baggage carts, however, cannot be taken beyond the mezzanine level of the rail station to the rail platforms below. A heavily used bus terminal is located adjacent to the South terminal building.

Rail. Gatwick Airport is part of one of the first integrated air-rail projects in the world. At present, rail services attract about 20% of airline passengers. The airport is served by both shared and dedicated rail services. The dedicated service, the Gatwick Express, runs to London's Victoria Station. The non-stop service to Victoria Station, which takes about 30 minutes, runs every 15 minutes from 5 a.m. to 1 a.m. In 2007, the Gatwick Express charged about $29 for a one-way ticket. In addition to the dedicated Gatwick Express service, a variety of shared services are operated. The general-purpose railway runs a near-express service (it has a 35-minute travel time) as part of a larger commuter corridor service. Five trains are operated per hour, at a lower fare than the Gatwick Express. In addition, the Thameslink railway serves destinations in London's financial district, operating to London Bridge Station and Kings Cross Station at similar running times.

Baggage-Handling Strategy. Gatwick Airport's pioneering downtown check-in service was discontinued by British Airways in 2003 (see Chapter 5 for further discussion).

Bus. Bus service is operated to Victoria Station every hour, with more than a 1-hour travel time. The fare to Victoria Station is around $14.

Market Characteristics. The dedicated Gatwick Express dominates the market to central London, capturing 60% of that market, with the shared rail getting 7%. Buses capture 15%, and taxis capture only 8%. The private automobile captures only 10%. Of those riding the train, 71% are airline passengers (*35*).

Geneva (28% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
16	Geneva International Airport	28%	21%	7%

SOURCE: *Vergleich internationaler Flughäfen* (*27*)

The Airport. Geneva International Airport at Cointrin, which served more than 9 MAP in 2005, is 3 miles northwest of downtown Geneva. A major mode transfer station has been built

adjacent to the air terminal. Taxi rides cost up to $30, and travel time is about 10 minutes to the center of the city.

Connections at the Airport. The Swiss Federal Railway airport station is located in a building immediately adjacent to, but separate from, the airline passenger terminal. Walking distance is about 500 feet.

Rail. The Swiss Federal Railway train departs every 15 minutes to the central station at Geneva-Cornavin. The train on the main east-west line to Lucerne, Bern, and Zurich leaves the airport station every hour. The airport's rail service can be characterized as part of the national system because the main national east-west line has its terminus at the airport rail station. At Geneva's central station, connections can be made to western France, including TGV service to Paris.

Baggage-Handling Strategy. The Swiss Federal Railway offers the Fly-Rail Baggage service to and from the Geneva airport, which is discussed in Chapter 5 as part of the discussion of the larger Fly-Rail Baggage operation at Zurich Airport. The rail-based baggage system at Geneva airport carries one-quarter the number of bags handled in the larger, older Zurich system.

Bus. Buses to the airport are provided by the local transit agency. The buses depart every 10 minutes to the downtown and every 30 minutes to the United Nations complex. New airport-specific services are being developed to such cities as Grenoble and Chambery, in France.

Market Characteristics. The rail station at the Geneva airport serves a distinctly national market. It is estimated that about 25% of the travelers boarding the train at the airport station are destined for the city of Geneva. Nearly 18% of the travelers are going to Lausanne, and most of the rest have destinations around the French-speaking areas of western Switzerland (*36*).

Brussels (26% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
17	Brussels Airport	26%	16%	10%

SOURCE: *TCRP Report 62* (*16*)

The Airport. Brussels Airport is located about 7 miles from the downtown and served more than 16 MAP in 2005, down from more than 21 million in 2000. About 16% of those airline passengers accessed the airport by rail. A taxi to the city from the airport costs more than $30 and takes the same amount of time as the rail service.

Connections at the Airport. The rail station is at the far end of the original airport terminal and requires a walk of more than 1,000 feet for access to the farthest air terminal building.

Rail. Brussels Airport is served by a spur of the main line of the national railway from the three downtown stations—North, Central, and Midi—every 15 minutes throughout the weekday and every 30 minutes on the weekends. Travel time is about 20 minutes to the nearest downtown terminal and 30 minutes to the farthest.

Baggage-Handling Strategy. A downtown check-in station, which carried baggage by airline coach, has been discontinued. Ample baggage space is provided on the national railway train that serves the airport.

Paris Orly (26% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
18	Paris Orly Airport	26%	14%	12%

SOURCE: Aéroports de Paris (*31*)

The Airport. Orly Airport is 9 miles south of the center of Paris and serves the southern suburbs of Paris. The airport served more than 25 MAP in 2006. Travel time between the airport and the center of Paris on a combination of motorway and local streets can be as short as 25 minutes but can fluctuate significantly. A taxi ride to the city center can cost $30.

Connections at the Airport. The OrlyVal people mover has two stops at the airport, allowing elevated pedestrian bridge connections to both passenger terminals. On the trip to the airport, passengers can transfer from the RER Line B to the people mover without changing platforms; however, on the return trip, passengers must change platforms to connect from the people mover to RER Line B. The connection to the RER Line C is via a 5-minute shuttle bus, which operates on a short reserved right-of-way segment to avoid traffic congestion.

Rail. Orly Airport is served by connecting services to two separate metropolitan rail lines. A people mover connects the two air terminals with the newer RER Line B. At the cost of about $12, a combined ticket is issued through to Paris on the OrlyVal people mover. A shuttle bus connects to the older RER Line C.

Baggage-Handling Strategy. As noted for Charles de Gaulle Airport, the RER Line B is poorly structured to handle the baggage of airline passengers. Initially, the OrlyVal people mover did not have any baggage storage space; they were redesigned to provide some space for baggage. Bus lines operated by Air France have ample baggage storage capacity under the floor of the coach; other buses have only a moderate amount of storage area in the vehicle.

Bus. A variety of bus services are offered, including an Air France bus with service through Paris's Left Bank. This service is provided every 20 minutes all day between the center of Paris and Orly.

Düsseldorf (22% Market Share)

European/Asian Rank	Airport	Market Share		
		Total	Rail	Bus
19	Düsseldorf International Airport	22%	18%	4%

SOURCE: "DUS Rail Access, History Development, Experiences" (*38*)

The Airport. Düsseldorf International Airport is the third largest airport in Germany, serving more than 15 MAP in 2005. The airport serves a distinctly polycentric region, with many smaller cities clustered relatively close together; the airport is less than 5 miles from the center of Düsseldorf, 27 miles from Cologne, and 22 miles from Essen. More than 18 million residents live within 65 miles of the airport.

Connections at the Airport. Düsseldorf airport has been served by the S-Bahn, regional commuter rail, direct to Central Station in downtown Düsseldorf since 1975. In the 1990s, an indirect service was added that consisted of an automated people mover to take airline passengers to a new

station along a major trunk of Germany's high-speed rail system. Thus, the deplaning airline passenger can go downstairs for a no-transfer service to the CBD or take the people mover to the edge of the airport where many trains offer direct service to a wide variety of destinations in the multicentered region. The decision to abandon off-site baggage check-in at the high-speed rail station is discussed in Chapter 5.

Rail. Given that the airport market is not particularly focused on the single central city (only about 17% of the market), a transfer somewhere in the system is needed by most travelers. The people mover connection (4 minutes) provides a faster connection to the main rail system than does the commuter service (12 minutes). The high-frequency commuter rail service to the airport itself (55 trains a day) combines with the cross section of services on the high-speed line (345 train departures a day) to yield 400 departures by rail a day from the airport. The people mover to the regional trunk line captures about 13% of the market, while the slower direct service to downtown captures about 5% of the total market. (*38*).

Bus. Buses capture about 4% of the market. Four bus lines serve the airport at the arrivals terminal, including a specialty service "Airport-Aixpress" from Aachen, Germany. Three regional bus services stop at the high-speed rail station, utilizing the people mover connection.

CHAPTER 5

Integrated Baggage and Ticketing Strategies

The goal of the airport ground access planner is to make the full journey as "seamless" as possible, often by creating separate services to appeal to separate market segments. Chapter 5 deals with the integration of baggage and ticketing strategies. Around the world, a wide variety of strategies have been developed to create "seamless" trip experiences: for example, providing airport-type baggage check-in at local off-airport locations and providing integrated ticketing between ground and airline services. In theory, a fully integrated national transportation system would have through-ticketing and through–baggage-handling services between ground and air. In practice however, these goals have proven elusive in major projects all over the world and are being re-assessed. In fact, the empirical data assembled for this ACRP report suggest that airline passengers are increasingly reticent to separate themselves from their bags, a finding consistent with what seems to be an evolution in the nature of what the airline passenger hopes for, and expects from, the travel experience.

Part 1 reviews recent developments, both successful and unsuccessful, in off-site baggage check-in services for airline passengers within the metropolitan area. Part 2 reviews the concept of integrating baggage and ticketing for passengers coming longer distances on the ground access system, noting the results of recent national study on the subject by the Government Accountability Office. Part 3 examines present trends in the application of various levels of integrated ticketing, and integrated baggage, noting the lessons learned from the first two parts. The lessons learned include a case study of the ambitious programs in operation at the Newark Liberty International Rail Station. The purpose of this chapter is to provide the airport manager with a quick review of major trends in these areas.

Part 1: Baggage Strategies for Local Originating Passengers

A major impediment to the choice of a public mode for ground access is the lack of baggage accommodation. This part of Chapter 5 reviews and provides updates on a wide variety of strategies to deal with the challenge of baggage, set in the context of an increased priority for the security of transportation operations. Some of these strategies assume off-site processing and others do not.

The air traveler usually has a choice of ground access modes, each of which responds differently to the needs of the traveler. At one end of the spectrum of accommodation, the private automobile, taxi, and private limousine all have the advantage of personal service and ample room to deal with baggage. At the other end of the spectrum, all shared service strategies, particularly those that rely on existing fixed-route and -schedule service designed for metropolitan commuting, must deal with the requirements of baggage without the benefit of built-in accommodations. In the

middle of the spectrum, shared-ride vans and dedicated rolling stock can be designed to accommodate baggage from the outset. A key issue in the design of a program of public mode services to airports is baggage accommodation, by one strategy or another.

The Importance of Baggage-Handling Strategies

The Duration of Air Trips

The composition of the potential market for public mode airport ground access services and the extent to which that market is constrained by the need for multiple bags are important considerations toward planning ground access services. The amount of baggage is largely influenced by the duration of the trip, and the duration of the trip is largely influenced by the purpose of the trip. U.S. aviation trips as a whole are divided evenly between those of less than 5 nights in duration and those of more than 5 nights. Specifically, 46% of all airline passenger trips are less than 4 nights, 34% of trips are between 4 and 6 nights, and 20% have duration more than 6 nights (*39*).

Trip purpose has a strong influence on trip duration, as the business trip tends to be shorter than the leisure trip. Data from the American Travel Survey show that for airline passengers traveling on business, 62% of the air trips take 3 nights or less; only 38% of business trips take 4 or more nights. For the non-business trips, fully 65% take 4 or more nights. Looking at long-duration trips, only 11% of business trips take more than a week, while 26% of non-business trips take more than a week. The non-business traveler emerges as a major problem for baggage handling.

Effect of Trip Duration on Choice of Ground Access Mode

Home End of the Long-Distance Trip. The duration of the trip affects the choice of ground access modes in a variety of ways: at the home end of the long-distance trip, longer duration lowers automobile use; at the non-home end of the trip, longer duration increases automobile use. Looking first at the home end of the trip, the propensity to choose alternatives to the automobile increases as the trip duration gets longer. This fact reflects, among other things, the cumulative costs of several nights of parking, which increases linearly with trip duration. For trips of 3 nights or less, 14% of U.S. airport ground access is by modes other than the private automobile; for trips of more than 6 nights, 18% of U.S. airport ground access is by mode other than the private automobile. Here, the factor of parking costs is becoming more pronounced with the increase in duration. (The park-at-airport mode decreases from 64% of those traveling for less than 4 nights, down to 38% of those traveling for more than 6 nights.)

Non-Home End of the Long-Distance Trip. At the non-home end of the long-distance trip, parking fees are no longer relevant, and the same pattern does not occur. For those trips of a week or less, 28% of the airline passengers use a mode other than being picked up by private automobile or renting an automobile. For trips of more than a week, only 23% of airline passengers choose such an alternative mode. The widest variation by trip duration occurs in the "pick-up" mode, which jumps from 32% for the trips of less than 4 nights, to 49% for trips of more than 1 week. Trips of long duration, which tend to be for non-business purposes, are marked by the willingness of friends, relatives, and colleagues to provide the pick-up and drop-off services. This form of ground access serves as a serious competitor to all public modes for the long-duration trip.

Conclusion. Baggage will be an issue in the selection of public mode trips. Overall, the data on trip duration suggest that fully half of the trips to and from airports are made as part of a trip of 5 nights or longer. For the shorter duration trips, public modes face serious competition from the park-at-airport mode, while for the longer duration trips the strongest competition tends to come from the pick-up/drop-off mode, particularly at the non-home end of the full trip. In the U.S. experience, the non-business trip tends to provide a stronger market for public mode services than the business trip; the bad news is that these leisure trips tend to be of longer dura-

tion and are associated with greater amounts of baggage. The issue of dealing with baggage, then, requires the review of a candidate set of strategies to deal with the problem.

A Case Study in Baggage Check-in at a Downtown Terminal

The downtown check-in terminal at the London Underground's Paddington Station has been chosen for a case study of the impact of having or not having off-site check-in services for airline passengers using rail for access to the airport. Data for other potential case studies, including the London Underground's Victoria Station, will be reviewed for relevance to the Heathrow–Paddington case study. The Paddington rail terminal facility had the highest level of check-in amenities of any check-in facility in the Western world. (The Hong Kong check-in terminals at downtown and Kowloon stations boast similar technologies, as they were designed during the same period as the Paddington facility. However, the Hong Kong transit agency, the MTRC, is now considering the phase-out of baggage check-in facilities at these terminals also.)

Unlike Victoria Station, Paddington Station offered check-in services from nearly all of the major airlines operating out of its destination airport, Heathrow. Victoria Station's check-in to Gatwick Airport offered services only for British Airways and, for most of its existence, American Airlines. The Paddington Station terminal offered a highly automated conveyor system for baggage; whereas, at Victoria Station, baggage was put on the train manually. The check-in facility was located quite visibly at the Paddington Main Line station; whereas, the British Airways check-in facility at Victoria Station was located on an upstairs mezzanine level out of view of travelers on the main level. In short, the Paddington check-in service (see Figure 5-1) was designed to represent the state of the art; it represents the ideal model for a case study.

The Heathrow–Paddington Station Check-in System

The Paddington Station check-in service was opened in June 1999. Local managers report that about one airport-bound rail passenger in five (22%) chose to utilize the downtown check-in services. Check-in services for airlines serving the vast majority of Heathrow passengers were

PHOTO: M. A. Coogan.

Figure 5-1. The check-in terminal at Paddington Station in full operation (2000).

provided, ultimately these airlines grouped as OneWorld, the Star Alliance, and the Swissair-based Qualiflyer Group. (See both *TCRP Report 62* and *TCRP Report 83* for a complete description of the operations of the baggage-handling system.)

The Qualiflyer Group was the first to pull out of providing services at Paddington Station, claiming that the airlines it represented thought the operating costs were too high; shortly after, Swissair collapsed, taking the alliance with it. After September 11, 2001, no U.S. carriers were allowed to check bags on flights to the United States from the facility, which affected services from American Airlines and United Airlines.

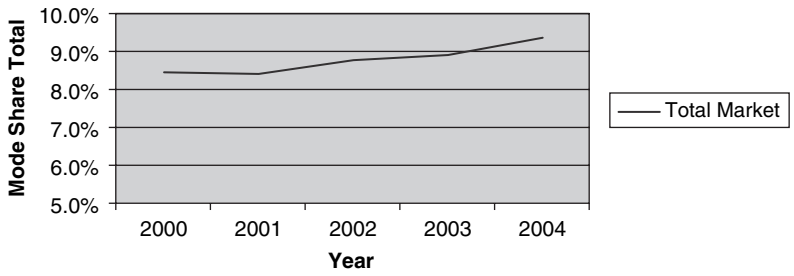
The major event in dismantlement of the system occurred in 2003 when the flagship carrier of London, British Airways, announced it would depart the system it had championed and advocated (Figure 5-2). After the collapse of services for the British-based OneWorld alliance, the remaining services of the Star Alliance were withdrawn in 2004. Today, the reconstruction of the terminal is complete, releasing thousands of square feet of prime retail space for resale on the market. The Heathrow Express trains themselves are being rebuilt to utilize the front baggage compartments for passenger use.

What Happened at Heathrow–Paddington? In cooperation with the Civil Aviation Administration, BAA (the airport operating company) has an extremely thorough process of monitoring and surveying the airport ground access system and its users. Using the original data obtained from the British organizations, the researchers analyzed the change in rail mode share by the four airport ground access market segments. The data allow the observation of the rail mode share by market group before the discontinuation of check-in service, during the discontinuation, and after the conclusion of the discontinuation. The case study mimics the characteristics of an experimental design, as the "longitudinal" data tracks the rail mode share before, during, and after a major intervention.

The Results: No Decrease in Market Share. Figure 5-3 shows there has been no visible negative impact on rail ridership on the Heathrow Express attributable to the discontinuation of the

PHOTO: M. A. Coogan.

Figure 5-2. The check-in terminal at Paddington was reduced in area in 2003 and closed in 2004.



SOURCE: Civil Aviation Authority Surveys, 2000-2004.

Figure 5-3. Heathrow Express mode share increases as baggage check-in is abandoned by U.S. airlines in 2001, British Airways in 2003, and Star Alliance in 2004.

elaborate check-in services at Paddington. In fact, during the period between 2001, when the first airlines began to discontinue check-in services, and 2004, when the process was over, mode share increased about 10%. This information, examined here for all market shares, is of interest in and of itself. After the traumatic events of September 2001, the airline industry went through major reorganization and major shifts occurred in the nature of travel patterns worldwide. With the change in the composition of the traveling public (more reliance on discount airlines, for example), ground access patterns might be expected to change in some parallel way. Figure 5-3 shows that, in the case of the high-priced premium Heathrow Express, such a change simply did not happen.

Ridership Change by Market Segment. In general, resident business travelers are assumed to be the *least* likely of the four market segments to release their bags at a downtown location. This group tends to have fewer bags in total and the least proclivity to checking them, even at the airport. Non-business travelers, on the other hand, tend to travel with more paraphernalia and benefit more from a service that would relieve them of the burden of getting the bags to the airport.

However, the resident business market segment —the travelers least likely to be impacted by the loss of baggage services—was the only segment not to experience a growth in mode share to Heathrow Express over the 4-year period covered in this analysis. Looking at the trends in mode shares, the UK-resident business segment mode share is about the same at the end of the period as at the beginning. During the year that British Airways discontinued check-in services, it tended to recapture minor losses experienced in the 2 previous years. In short, there is no indication that loss of the major carrier's check-in function had any negative impact on the resident business traveler's propensity to choose the premium rail service.

Turning to other market segments, the non-resident business segment experienced a visible increase in rail mode share immediately after the departure of British Airways in 2003, with a sharp overall increase over the 4-year period.

Non-business travelers, those with the greatest amount of baggage per party, might be seen as vulnerable to the loss of an amenity such as full baggage check-in. But, the mode share for this segment did not decrease. Rather, over the 4-year period, the non-resident non-business travelers had a visible increase in their mode share for the Heathrow Express, including an upturn after the 2003 departure by British Airways.

In sum, the disaggregate analysis by market segment does not reveal any strong patterns that would invalidate the data presented in Figure 5-3, which shows that overall mode share for the Heathrow Express did not drop in the period following the beginning of dismantling downtown check-in, but rather grew during a particularly unstable period in the long-distance travel industry.

The Gatwick–Victoria Station Check-in System

As noted previously, Paddington Station represented the true state of the art in high-quality downtown check-in facilities and services, which is why it was chosen for this case study. A quick review of change in rail mode share to Gatwick Airport from neighboring Victoria Station supports the basic observations made in the Heathrow–Paddington case study.

What Happened at Victoria Station? During the 4-year period between the first discontinuation (American Airlines in 2001) to the end of the study period (2004), the Gatwick Express experienced a 10% increase in overall mode share (for all market segments aggregated together). In short, there is no evidence in the Gatwick experience that would seem to undermine the fundamental conclusions made in the Paddington case study: neither the existence of downtown baggage check-in nor its discontinuation impacted the rail market share for the services in question.

Lessons Learned from London

To help interpret the implications of the lack of downtown baggage check-in on dedicated one-seat ride services, a series of interviews were conducted with those who had been involved in various stages of the introduction and discontinuation of downtown baggage check-in services in London.

In these interviews, several managers who created the original market strategy for the new Heathrow Express stated the belief that the service needed to be seen as something different from the directly competing (one-seat ride) Piccadilly Line services offered by the London Underground. Amenities such as a private on-board television service programmed solely for Heathrow Express and first-class coaches were all designed to differentiate the product from other options available to the traveler. These managers thought then that the provision of downtown baggage check-in was essential to differentiate the Heathrow Express, relative to other ground options.

The most revealing interview was with the manager of airport terminal strategies for British Airways, who was a long-time supporter of high-amenity rail services to London airports. In the interview, he noted that, between the latter part of 2001 and the airline decision of 2003 to give up the service, data could be obtained on whether the service was a market discriminator. In other words, for 2 years British Airways was offering a product not offered by two competitors, American Airlines and United Airlines. From these 2 years, British Airways gained the hard evidence that the addition of downtown baggage check-in services was not a market discriminator, particularly in a market obsessed with minimized price over any other factor. No significant level of complaint has been received as a result of the decision to discontinue the service.

Status of Other Downtown Check-in Terminals

In the previous decade, downtown check-in terminals supporting rail service were in operation not only in London, but also in Hong Kong and Osaka, and a check-in terminal supporting bus services was in Tokyo. More recently, additional services were commenced in Madrid, Kuala Lumpur, Moscow, and Vienna. Major operational changes have taken place not only in London, but in Tokyo and Osaka as well.

Madrid Nuevos Ministerios Check-in Facility

The Nuevos Ministerios downtown check-in facility serving Barajas International Airport in Madrid was an example of high-quality intermodal terminal design. The facility was very large: the check-in lobby covered more than 1,200 square meters, which allowed for 34 check-in stations and very spacious room for queuing (Figure 5-4). Well located on the downtown regional transit system, the facility was served by three traditional rapid transit stations (allowing one

PHOTO: M. A. Coogan.

Figure 5-4. This spacious check-in facility in Madrid was rarely used by airline passengers to check their bags.

change service from fifty transit stations), seven electrified commuter rail lines, and ten bus lines. The underground station has the capacity for 100 taxis to wait at the station and 5,000 square meters devoted to pick-up and drop-off parking. Airline check-in service was dropped in 2006.

Within the terminal area, Iberia (OneWorld), Spanair (Star Alliance), and some smaller charter operations provided check-in services. Iberia and Spanair allowed the traveler to check bags as late as 2 hours before flight time and to get a boarding card as late as 1 hour before departure. Iberia allowed baggage to be checked in up to 24 hours in advance of the flight, while Spanair allowed it from 6:30 a.m. on the day of departure.

The Transit Service. The rail service is highly unusual: a rapid transit vehicle that has very long distances between stations often associated with commuter rail service. The fare to the airport is about $1 (US). Trains leave every 5 minutes or less, and take about 12 minutes to get to the airport with only two intermediate stations. The trains have three cars operated with accordion-like "vestibule" connections, allowing the three cars to operate as one. Many of the traditional longitudinal (bench) seats have been eliminated to allow a baggage rack between virtually all of the doors. However, many passengers still place their bags immediately in front of them, ignoring the racks.

The downtown check-in area used an airport Flight Information Display (FID) board for all flights departing and arriving at the airport. Importantly, Metro de Madrid placed these FIDs at key transfer points along the new line, specifically at the Columbia transfer station.

The Baggage Transfer. Checked baggage was carried by a conveyor built to a small room on the mezzanine level, where it dropped to a platform-level location next to the front of the outbound train. The bags were then placed into containers. On board the train, the first module of the car, and the first door, was devoted to a baggage area that could store several of the containers.

At the airport transit station, the platform that serves outbound trains from the downtown was used (1) to unload the containers from downtown and (2) to load empty containers onto the train, which then continued its outbound journey to its ultimate terminal. The train would return with the empty containers already on board on the (inbound) opposite track, where there was no need for a separate inbound cargo management area.

What Happened in Madrid? Airline passengers tended not to use the elaborate, well-designed baggage check-in service, and the facility was significantly underused. Over several site visits, no more than 3 of the 34 check-in stations were seen in operation, and they were not used heavily. Local officials have stated that only about 200 bags were checked in per week, or about 30 per day. With the opening of a new airline terminal in 2006, the downtown check-in service was terminated.

Thus, although a significant number of airline passengers use the rapid transit service to the airport, most chose not to check their bags on the way. Exactly why is not known. However, given that most passengers access the direct transit line by another transit line, the passenger would have already handled any baggage on the shared-use rapid transit cars. In some cases then, the passenger may have found transferring directly to the express line easier than the alternative of getting off the transit vehicle, going upstairs to the check-in facility, and then returning to the platform area. The portion of transit users who choose to part with their bags at the Madrid downtown facility is much smaller than the one-in-five passengers who chose to use the Paddington Station check-in service.

Munich Main Station Check-in Terminal

What Happened in Munich? With the opening of the new Munich Airport in 1992, Lufthansa began to operate a small two-desk check-in service in a corner of the Main Railway Station (Figure 5-5). The baggage was carried by airport bus rather than the S-Bahn airport

PHOTO: M. A. Coogan.

Figure 5-5. This small airport check-in station in the Munich Main Railway Station was discontinued by Lufthansa in the mid-1990s.

trains. Although the check-in service operated for several years, it ceased operation in the mid-1990s because of lack of use.

Tokyo City Air Terminal

Narita Airport was unique in that its major downtown baggage check-in terminal was served by luxury bus, not by rail. The Tokyo City Air Terminal offers "limousine bus" service that has a 55-minute travel time to Narita and operates on a 10-minute headway. This service has a very high mode share for visitors and tourists to the city. For years, the Tokyo City Air Terminal offered both downtown check-in and early security screening for airline passengers who could use "express lanes" once they arrived at the airport.

What Happened in Tokyo? Check-in services for all airline passengers were discontinued at the Tokyo City Air Terminal on December 31, 2002. In 2001, only flights to the United States lost the service, but the added costs to the airlines of supporting multiple check-in locations led to the cancellation of the services the next year.

Osaka Namba City Airport Terminal

An airport check-in service was operated at the Namba City Airport Terminal in Osaka, with direct rail service to Kansai Airport. The facility was used by the largest airline in Japan, ANA; according to reports, Japan Air Lines ceased operations at the facility by 2000 because of a dispute about operating costs. The system offered baggage check-in until 130 minutes before flight departure times (*38*).

What Happened in Osaka? For reasons not determined, baggage check-in was discontinued in the Namba station complex, although shared rail service continues from there to Kansai Airport.

Hong Kong Check-in Locations

MTRC provides downtown check-in service for its Airport Express service at two locations: the downtown Central and Kowloon Stations. The operation of the baggage-handling system has been so efficient that travelers can now check bags in at the downtown Central Station only 90 minutes before flight departure (Figure 5-6)—the same time the traveler would have been required to be at the airport.

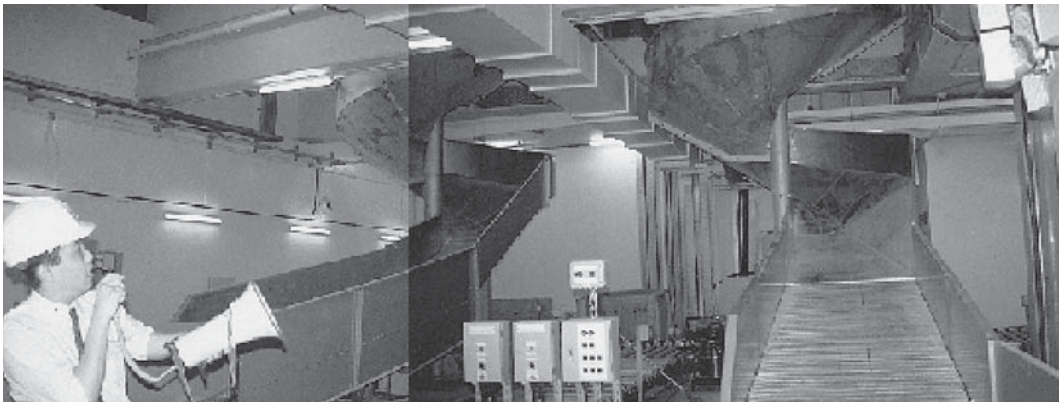


PHOTO: M. A. Coogan.

Figure 5-6. The check-in terminal in downtown Hong Kong has a massive capital investment in its automated baggage container system.

Hong Kong Airport Express officials report that 53% of those airline passengers using the trains now use the check-in service, with peak levels as high as 70%. Although these numbers are high, they are explained by most major destinations from the Hong Kong International Airport being several hours away. Thus, trip duration tends to be longer, and the percentage of travelers checking bags is very high.

What Is Happening in Hong Kong? At the present time, the management of the Hong Kong transit agency MTRC is re-examining its options for the operation of the downtown check-in service. According to agency officials, several options are being considered including offering the service for a price to travelers who have not bought a ticket on the rail line; such a move might be part of a new policy that would charge all travelers who check bags on the system. Other policy options include discontinuing the service or allowing the existing infrastructure to be used by private operators, selling their services for a fee.

Vienna City Airport Train

The dedicated City Airport Train service commenced in 2003, and ridership has grown strongly. Baggage check-in services are offered for all Star Alliance companies and for a wide variety of smaller unaffiliated airlines. According to the Vienna City Airport Train website, bags can now be checked for flights to the United States. The downtown facility includes automated, self-service baggage check-in desks, capable of reading electronically coded passports (Figure 5-7). The International Air Rail Organisation has reported that 10,000 passengers per month use the check-in services or more than 1 passenger in 5. Passengers can check-in as late as 85 minutes before flight time, or as early as 24 hours in advance (*37*).

PHOTO: M. A. Coogan

Figure 5-7. The Vienna City Airport Terminal offers attended baggage check-in (right) and automated self-service baggage check-in (left).

Moscow Domodedovo

One of Moscow's major airports, Domodedovo, offers direct rail service to a downtown station, where baggage check-in services are offered. Reportedly, 18% of the travelers who use Domodedovo airport access it from the downtown rail station (*37*).

Kuala Lumpur Sentral and Baggage Retrieval

The new service between the Kuala Lumpur International Airport and the downtown Sentral rail station is attracting nearly 1,000 passengers per day. About one in three choose to give up their bags at the downtown facility.

Of all the off-airport baggage-handling schemes being developed, only Malaysia's Kuala Lumpur International Airport is proposing off-airport baggage *claim* for its downtown terminal, located at the Kuala Lumpur City Air Terminal at KL Sentral Station. The airport has established the City Air Terminal at Sentral Station as a separate three-letter IATA code, allowing passengers to check their baggage to the city rather than to the airport. This concept was examined in depth in the development of the Hong Kong system and again for the Heathrow Express. One concern of the Hong Kong designers was the amount of space needed by a full-scale baggage claim area. Another concern was the possibility that travelers will inaccurately specify the actual destination, whether at the time of ticket purchase or at the moment of check-in.

The in-bound through-baggage system has been designed and is scheduled to open at the end of 2007. Passengers who have specified their destination correctly at the time of check-in will proceed through immigration, take the train to Sentral Station, pick up their bags from a carousel, and then proceed through customs procedures in the downtown station.

Near-Airport Check-in Locations

Another concept in baggage-handling strategy is the provision of check-in service at a point adjacent to the airport, usually at a point of transfer from one mode to another.

Düsseldorf Airport Rail Station

The Düsseldorf rail station on the high-speed system in the Rhine/Ruhr area of Germany provides an interesting case study of non-downtown locations for off-site baggage handling. Baggage check-in services were a key element of the new high-speed station in May of 2000. Check-in services were provided for 20 airlines (which served about 75% of passengers), including Lufthansa and its Star Alliance partners. Baggage was accepted up to 60 minutes before airplane departures. A futuristic suspended, automated people mover provided a quick 5-minute connection to the main terminal every 4 minutes.

The new service was widely publicized by the airport, and ridership for the rail system developed quickly.

What Happened in Düsseldorf? Faced with the choice of separating themselves from their baggage at the rail station or carrying it on the people mover to the traditional airport check-in area, passengers overwhelmingly chose to keep it to the last moment. As a result, the check-in service ceased operation in April 2004 (*38*).

Newark AirTrain Rail Station

In October 2000, the Port Authority of New York and New Jersey opened a major airport facility at the Newark Airport rail station located on the Northeast Corridor served by Amtrak and New Jersey Transit. From a legal point of view, both the AirTrain (formerly called the Airport

Monorail) and the rail station are part of Newark Liberty International Airport; the AirTrain is operated solely for airport travelers and does not carry any general-purpose traffic. Given the very significant difficulties in establishing full baggage check-in service in New York City, this strategy called for travelers to retain their baggage until arrival at this physical extension of Newark International Airport.

The baggage check-in station at the Newark Airport rail station was offered to all airlines, but used by only Continental Airlines' hub operation. Baggage was accepted at the mezzanine level on the direct path from the Northeast Corridor rail platforms to the AirTrain station itself. The baggage was sent to the ground level on a spiral ramp (Figure 5-8). From this point, the baggage was carried by the airline truck to the airport baggage make-up area.

Continental Airlines commenced its baggage check-in service on November 18, 2001. Formally, they requested that baggage be checked 2 hours before departure time, but the staff accepted bags with as little as 45 minutes remaining before departure. Continental Airlines did not charge for the service.

What Happened in Newark? Faced with the options of going directly to the people mover or parting with their bags at the rail station itself, about 80% chose to carry their bags to the traditional check-in area of the airport. Continental closed the service in 2003.

JFK AirTrain Rail Station

The new AirTrain transfer facility at Jamaica Station to the Long Island Railroad (with further connections to the New York City subways) was opened in 2004. The facility includes the

PHOTO: M. A. Coogan.

Figure 5-8. The Newark Airport rail station includes a baggage transfer system, from which Continental Airlines carried the bags by truck to the terminal.

architectural shell for a check-in facility nearly identical to that adopted by Continental Airlines in Newark. However, from the outset, Port Authority managers knew that convincing the airlines to use the check-in facility would be more difficult because of the lack of a single airline that dominates JFK in the manner that Continental dominates the Newark airport.

What Happened at JFK? No airline chose to utilize the shell of the off-airport check-in facility, and it was never opened.

Lessons Learned: Off-Airport Check-in Centers

Many U.S. cities, including St. Louis, Atlanta, Chicago, and New York, have considered the construction of major downtown check-in terminals. In many cases, these projects assumed that the airlines would provide the staffing to carry out the check-in function. Over the past decade, this assumption has become questionable, at best. In both Madrid and Kuala Lumpur, where airlines chose to staff off-airport check-in facilities, the managements for the hometown airlines have historically very strong ties with the national governments. Airport ground access strategists are now examining a wide variety of off-airport check-in concepts based on a third party providing services for a fee. Indeed, the check-in system with the widest geographic coverage is provided in Switzerland by the Federal Railway—not by the airport.

The provision of full baggage services at off-airport locations is expensive for the airlines. A British Airways official estimated that an off-airport check-in center would not make sense with fewer than 100,000 users a year. In both the Heathrow–Paddington service and the Hong Kong service, financial arrangements have been worked out to split the costs between the airline (which is providing a desired service to its passengers) and the rail company (which is charging a high fare with the intent of making a profit on the operation). When these conditions (potential profit from rail operations) do not occur, there is a major disincentive for an airline to participate. The provision of specialized baggage services by third parties, however, is growing in importance, as discussed in Part 3.

Summary

Part 1 of Chapter 5 has reviewed metropolitan strategies for off-airport processing of airline passengers in which access services to the airport from the prime market area are aided by check-in services provided in a downtown location or at a transfer point somewhat closer to the airport; *in each case, the basic assumption was that the airline itself would take the responsibility for issuing the boarding pass and accepting the baggage for the flight.*

Parts 2 and 3 of Chapter 5 will examine two additional service concepts: (1) replacement of air services by rail services for certain short-segment flights, which would require a complete integration of both ticketing and baggage systems for the multimodal trip, and (2) baggage handling and transfer for a fee by entities other than the airlines. The U.S. Government Accountability Office has recently examined U.S. implementation of various forms of integration of national air and rail services and functions, as discussed in Part 2.

Part 2: Integration of Ticketing and Baggage with Longer Distance Systems

This report has reviewed the attributes of good integration of airport-based services into the metropolitan public transportation system, which, as defined here, includes all shared-ride services immediately available to all members of the public. In many parts of the world, airports are also concerned with the quality of their connections to other, longer distance elements in the national system. For example, integration with long-distance rail systems plays a major role in public mode

services to airports in Frankfurt, Paris, Brussels, Amsterdam, and Copenhagen, but not in London, Munich, or Madrid; concerns with longer distance systems are a major policy concern in Newark and Baltimore, but not in San Francisco.

Although passengers traveling through a few U.S. airports have a strong orientation to nearby downtown origins or destinations, at most U.S. airports, dispersed trip origins or destinations are the norm and represent a significant challenge for successful rail operations.

In the United States, a small number of airports have a passenger market that is strongly linked to the nearby downtown area. As shown in Table 5-1, these airports include New York City's LaGuardia and JFK, and Washington, D.C.'s Reagan National. In Europe, several airports have markets that are heavily oriented to the downtown area, including Paris (with 60% of the airline passengers traveling through Charles de Gaulle Airport and 50% traveling through Orly Airport going to Paris itself), Oslo (with 48% of airline passengers going to the downtown), and London (with 35% of the passengers traveling through Heathrow Airport going to London).

As noted, the downtown area is typically well served by traditional transit services in the United States. Most U.S. transit systems are configured to respond to the needs of cost-sensitive, daily commuters and are thus radial systems oriented to the downtown area. However, most U.S. airline passengers have trip ends in areas located outside the downtown area and outside the area well served by transit. To travel to these areas, airline passengers often need to make one or more transfers. This need can discourage the use of transit, especially for passengers who have several pieces of baggage or who are traveling in a large family group.

An analysis of Chicago's O'Hare International Airport indicates that more than 65% of airline passengers come from beyond the regional transit service area. Thus, although the CTA serves only 4% of all airline passengers, it is used by 12% of airline passengers with trip ends in its prime market area, which includes the Loop. A similar distribution occurs in Boston, where 61% of the resident airline passengers came from the outer suburban area not served by the regional rapid transit system.

Integration with National Systems: The GAO Study

In the United States, the issue of interconnection of airports with national ground transportation systems has been raised in several forms. A major U.S. transportation advocacy

Table 5-1. Orientation to downtown.

Airport	Percentage of origination trip ends in downtown
New York LaGuardia	46%
Reagan National	33%
New York JFK	32%
Chicago Midway	20%
Newark	14%
Baltimore/Washington	14%
Chicago O'Hare	14%
Philadelphia	14%
Washington Dulles	12%
Atlanta	7%

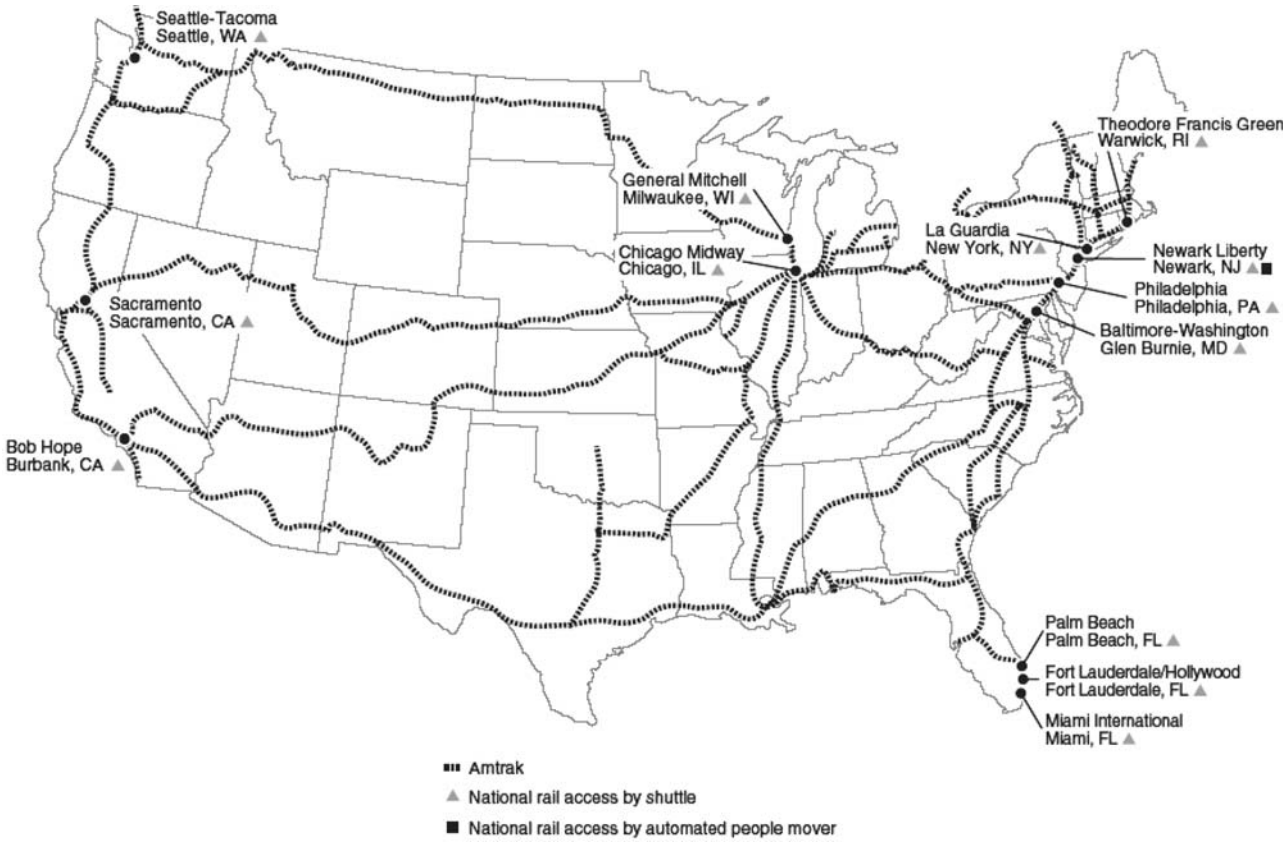
SOURCE: *TCRP Report 62*.

group, "Reconnect America," has made the case that the national decline of the airline hub–spoke system has resulted in the severe reduction of air service to smaller airports and that there is a void in terms of effective access to the remaining airports with growing air services.

A recent congressionally mandated study by the U.S. Government Accountability Office (GAO) focused on the connections to nationwide systems for several reasons:

> "Increases in the number of passengers traveling to and from airports will place greater strains on our nation's airport access roads and airport capacity, which can have a number of negative economic and social effects. U.S. transportation policy has generally addressed these negative economic and social effects from the standpoint of individual transportation modes and local government involvement. However, European transportation policy is increasingly focusing on intermodal transportation as a possible means to address congestion without sacrificing economic growth." (*40*)

The study notes that, although only one U.S. airport has a fixed guideway to an Amtrak station, no U.S. airport reported to the GAO an intention to build a connection to an Amtrak facility. Figure 5-9 shows Newark as the only example of such a national connection and 18 other airports with shuttle connections. The contrast in U.S. connectivity between major airports and the national long-distance rail system and the European connectivity strategy is noteworthy.



SOURCE: GAO (*40*).

Figure 5-9. The GAO study shows that Newark Airport has the only fixed guideway connection with national rail service in the United States.

Why Integrate an Airport with Longer Distance Ground Services?

The GAO study focuses policy attention on the possibility of greater synergy between the air system and the national ground system (rail and intercity bus). In this orientation, the concept of airport ground access services is widened to include ground access trips over longer distances. As discussed in the GAO study, the implications of this idea could be profound. For example, the managers of T.F. Green Airport, which serves Providence, Rhode Island, want to extend their geographic market area to the south toward New Haven, Connecticut, and to the north to Boston. To make this work, rail services provided by Amtrak and rail services provided by the MBTA will have to be designed to serve the needs of airline passengers. Currently, Amtrak is considering an airport stop on its regional service, but not on the high-speed Acela service. MBTA commuter connections to Boston are scheduled to begin shortly.

Transportation managers in Wisconsin have a strong interest in increasing the viability of General Mitchell International Airport in Milwaukee and supporting the hub operations of its dominant airline, Midwest Express. Thus, making it easier for travelers from the Chicago area to select Milwaukee as their airport of departure is in the managers' interest. Currently, a shuttle bus carries a small number of travelers a day between Mitchell airport and the Amtrak station built adjacent to the airport. Amtrak runs seven round-trip services a day between Milwaukee and Chicago.

The same concept is applicable to the planning of the next generation of airport investments in the United States. For example, if the existing geographically constrained airport in San Diego, California, is to be replaced, the possibility is highly probable that a site in the nearby suburbs simply could not be found; in which case, a distant airport location implies some kind of integration with high-speed ground services to gain access to that new airport location.

There are several European precedents for the integration of longer distance ground access services to airports with airline ticketing and baggage systems. The following sections discuss case studies of strategies specifically designed to replace short-distance flight segments in Germany and France and a case study of more traditional improvements to longer distance access challenges in Switzerland.

Substitution of Air Flights in Germany and France

Frankfurt Airport is developing an ambitious program to replace short-distance airline feeder services with improved rail connections. Because only a limited number of slots are available for use at the Frankfurt airport, airport officials believe that the overall productivity of the airport can be increased by reallocating these short-distance feeder slots to longer distance flights. This reallocation has resulted in the development of highly specialized joint air/rail-integrated services between Frankfurt and Stuttgart to the south and Cologne to the north.

German Railways and Lufthansa Airlines are committed to replace certain domestic airline flights with high-quality integrated rail connections. In July 1998, German Railways and Lufthansa Airlines signed a Memorandum of Understanding that states that the airline would terminate feeder flights to Frankfurt from Düsseldorf, Cologne, and Stuttgart, but only if certain standards of seamless operation have been attained. The basic attribute agreed upon is that actual travel times by rail would be no longer than the present times by feeder aircraft. The memorandum calls for "full check-in from the train station of departure through to the destination airport, and uninterrupted baggage transfer from the train station of departure to the destination airport." Figure 5-10 shows the baggage claim area in the Cologne rail station complex.

In a highly similar market strategy, Air France has ceased its flights between Brussels and Paris, because the highly successful high-speed rail (TGV) trains have erased the market for these

PHOTO: M. A. Coogan.

Figure 5-10. This off-site terminal in Cologne is one of only two locations in the world to offer full airline baggage claim service and inbound customs clearance.

flights. In their place, Air France sells tickets from the Brussels high-speed rail station to the traveler's final airport destination, substituting a fast train to Charles de Gaulle Airport in place of the deleted Brussels–Paris flight segment. Baggage check-in is allowed until 20 minutes prior to the train departure time. Bags are handed over to the airline in Brussels but are then reclaimed on the rail platform at the airport; the traveler must then re-check them at Charles de Gaulle Airport. (Perhaps importantly, an attempt to provide the reverse of this service, encouraging French travelers to access international flights through direct rail service to Brussels Airport, was not a success.)

What Is Happening in Cologne and Stuttgart? The Lufthansa terminals in both the Cologne and Stuttgart train stations have been given full-fledged IATA three-letter codes: tickets are sold to and from these terminals, and baggage is both checked in and delivered to these terminals. A single air + rail ticket is sold, in which the rail segment appears in the booking/reservation systems as a "flight."

The actual number of travelers who choose to take the train to access Frankfurt Airport from Cologne is reported to be quite high. However, the portion of those who select a joint air + rail ticket is quite low, as most travelers choose to buy a rail ticket separately form the air ticket. Similarly, the number of travelers who choose to part with their bags at either Cologne or Stuttgart stations is quite low (Figure 5-11). Some analysts believe the baggage service will be phased out.

The managers of the combined systems must contend with the fact that no one airline has a monopoly for the many origin–destination pairs. By way of example, Air France ended all flights between Brussels and Paris, and offered high-quality rail trips between Brussels and Charles de Gaulle Airport for a trip from, say, Brussels to New York. However, the free market offers alternatives; the traveler can purchase a ticket from Brussels to New York via Frankfurt or London without having to experience the rail segment.

PHOTO: M. A. Coogan.

Figure 5-11. While ridership between the Cologne rail station and Frankfurt Airport is strong, only a small portion of air travelers utilize the new check-in facility.

Thus, when Lufthansa removes flights from Cologne to Frankfurt from its system, it weakens its competitiveness with competitors' flights from Cologne to New York via Paris, Amsterdam, and London —none of which force the air traveler onto a rail trip segment.

Managers of the joint air-rail program have noted that travelers may choose the integrated air + rail ticket the first time they make the trip. Then, once they are familiar with the combinations of modes, travelers on the in-bound trip buy separate air and rail tickets, retrieve their bag at the airport, and proceed on the next departing train with the bag in hand to Cologne, to Stuttgart, or wherever. In this manner, travelers avoid connection times that are either too long (e.g., needing to wait for the pre-purchased connecting train and watching earlier trains depart) or too short (e.g., making the train connection, but the bag does not).

Integration of Air and Rail Services in Switzerland

The integration of air and rail systems in Switzerland is fundamentally different from the through-ticketing concepts in the Cologne, Stuttgart, and Brussels case studies in the preceding section. Through tickets are not included in this system; airline tickets are sold by airlines, and rail tickets are sold by rail companies. While the Swiss Railway runs a direct train from Zurich Airport to Bern, the nation's capital, a joint ticket is neither offered with any airline nor described on the reservations system.

It is estimated that 33% of Zurich Airport air travelers who use the rail system come from the city of Zurich and another 8% come from the rest of the metropolitan area. Thus, some 59% are coming from *outside the metropolitan area*. For Geneva, only about 25% of the air travelers using the rail system come from the city of Geneva, and 75% come from the rest of Switzerland and from France. Zurich Airport is served by more than 170 trains per day, and the Geneva

International Airport is served by 130 trains per day. Service is provided every hour on the main east-west line linking Zurich and Geneva. Zurich currently offers about 80 trains in its peak hour, *none of which* serve only the downtown terminal areas.

Baggage Handling by a Third Party. The Swiss concept of a national system for off-airport baggage check-in is fundamentally different from the existing downtown check-in centers currently serving Hong Kong, Madrid, Vienna, or Kuala Lumpur. Each of these downtown check-in terminals is staffed by *airline* representatives who take the responsibility for accepting baggage and issuing boarding passes. When the concept is expanded to dozens of off-site locations, it becomes impossible to expect multiple airline companies, or even one airline company, to provide the staff at each of the off-airport locations. Alternatively, a partnership with the railroads was created, in which the railroads are empowered to take certain actions in the name of the airlines. The Swiss Fly-Rail Baggage system has been in place for two decades; recent developments in Germany and France are refining the concept for wider application.

The airport baggage-handling system of the Swiss National Railways is the largest in the world, from a geographic perspective. It provided baggage processing from 116 separate railway stations, with full check-in (with boarding pass) at 50 rail stations in 2007. This service is provided by the Swiss National Railways, and no airline personnel are involved in accepting the baggage. Swiss National Railways charges about $15 per bag checked for the service. The reported usage of this program is 280,000 travelers a year (*36*). Air travelers who have only checked their bags at the rail station can use special check-in stations with shorter lines and shorter transaction times.

The system has three elements. (1) Full check-in with a printed boarding pass is available to travelers who use only a set of airlines, many of them in Star Alliance, that have agreed to all the procedures. (Some, like British Air, will allow through check-in of the bags, but not provide a boarding pass at the rail station). (2) For travelers using airlines that are not participants in the system, the rail company offers an overnight baggage service to the airport, where travelers pick up their bags and check them with the airline. This fee is also $15 per bag. (3) The system offers in-bound through-baggage service for any flight, by any airline, when the traveler pre-purchases rail system baggage tags. When bags arrive in the Swiss airport, rail company staff transfers the bags to the rail system, and travelers meet the bags at the final rail destination. (The traveler must state that no objects requiring any customs duty are included in the bags.) Again, this service is provided for $15 per bag.

What Is Happening in Switzerland? About 4% of the originating air travelers at Zurich Airport are estimated to use the off-airport baggage check-in system. Zurich officials report that the system is particularly popular with skiers and others with heavy baggage. Although most of the examples described previously involve a dominant central city check-in center, the opposite seems to be true in Switzerland. Of those bags checked through Zurich Airport, fewer than 5% came from the Zurich rail station. By contrast, 17% of the bags at the airport came from Bern, the capital city. More than 10% of the bags came from major resort areas (*36*).

Part 3: Evolving Strategies for Integrated Ticketing and Baggage

This review of various approaches taken towards integrated ticketing and baggage clearly shows that the full-scale integration of both services, managed and operated throughout by airlines as part of the ticket price, is fast becoming highly unrealistic. Such full integration *under one ticket* currently occurs for Lufthansa patrons in and out of Cologne and Stuttgart train stations, and virtually no where else. Rather, all over the world hybrid concepts that

include some, but not all, integrated features are being developed. In some cases, a key role is played by third-party baggage handlers. In other cases, air and rail services are ticketed together, but with no integration of baggage. Part 3 of Chapter 5 looks at some of the recent developments in strategies that implement some, but not all, of the elements of integration between air and ground systems.

Much of the most relevant work in the recent development of integrated systems has occurred in Las Vegas, Nevada, and is summarized in the following section. In addition, two good examples of attempts to bring separate modal services together for the benefit of the traveler are profiled. The first example is the program developed by the Los Angeles World Airports to provide a dedicated bus service designed for the needs of airline passengers traveling to Union Station in downtown Los Angeles, where the onward journey can continue on a wide range of longer distance transportation services. The second example is the program to integrate air and rail services through the Newark Liberty International Airport rail station.

Las Vegas Strategies for Integration of Modal Services

As noted in the previous section of this chapter, the largest (geographically) baggage-handling ground access system in the world is operated in Switzerland entirely by a third party, not the airlines and not the airport. The Swiss Fly Rail Baggage system provides good precedent for the idea that getting baggage to the airport can be accomplished by a private company and still efficiently integrated with the rest of the aviation system. This concept was initially being adapted for U.S. application by a highly innovative set of entrepreneurs in Las Vegas, who created the company called Certified Airline Passenger Service (CAPS), a privately owned company created by major Las Vegas resorts and a local baggage-handling company.

The Evolution of Third-Party Baggage Handling

Before September 11, 2001, passengers departing McCarran International Airport on one of 10 airlines could check-in their baggage and receive boarding passes and seat assignments at counters located at more than 12 Las Vegas area resort/casinos. These baggage check-in counters were operated by CAPS. Baggage check-in services were only available for enplaning Las Vegas passengers; no equivalent baggage service was available from the originating airport to the hotels for deplaning Las Vegas passengers.

Airline passengers using CAPS were required to check their baggage 2 to 12 hours prior to their scheduled flight departure time and pay a $6 per passenger service fee. Baggage was transported by truck from the individual hotels directly to McCarran International Airport. The international passengers including that of Virgin Atlantic were required to have their baggage re-screened and inspected at the airport. CAPS was permitted to provide off-airport baggage check-in services for scheduled and charter airlines under "Off Airport Baggage Acceptance Amendments" enacted by the FAA for McCarran International Airport. Under the terms of this amendment, CAPS personnel were subject to the same background checks and training as airline personnel, and their baggage-handing facilities were subject to FAA personnel inspection to ensure compliance with security regulations.

CAPS was growing in popularity and was being expanded to serve additional hotels and airlines before September 11, 2001. This success could be attributed to several factors; some of which were unique to Las Vegas. For example, as in many communities, hotel guests are required to check out by noon. But unlike most cities, many Las Vegas visitors, who prefer to remain at the casinos and enjoy the resorts as long as possible, depart Las Vegas on evening flights. Thus, many Las Vegas airline passengers prefer to check their bags several hours before their flight and were accustomed to paying for this service. This situation is not true in most other cities that

have more resident and fewer non-resident passengers than Las Vegas and therefore fewer passengers wishing to check their bags several hours before leaving.

By August 2001, CAPS was handling 15,000 passengers a month. But, the company was not able to survive the change in requirements that occurred immediately after September 11, 2001. "We all believed the idea was a smart one. Maybe it was a little bit ahead of its time," CAPS former vice president of marketing and sales said (*41*).

Recent Fee for Service Concepts

Since that time, a series of changes have occurred in the regulatory landscape, including the requirement for 100% of all baggage to be screened, no matter where it was checked-in. Now, there are several organizations that are intending to provide fee for service products for highly specialized markets in the United States.

An example of these providers is a company called Bags to Go, which is offering baggage check-in services for passengers of Southwest Airlines at the Las Vegas Convention Center and the Venetian and Luxor hotels. Interestingly (in terms of a previous lack of interest in multiparty services), the first airline to sign up is Southwest Airlines. Somewhat like the Swiss system, Bags to Go charges $20; however, this is per *traveler* up to the airlines free allowance, rather than per *bag*. The service is available up to 3 hours before flight departure time. According to Bags to Go, additional services are planned for Port Everglades in Broward County, Florida (*42*). Bags to Go utilizes global positioning system (GPS) navigation services from Navtrak and luggage tracking services from Air-Transport IT Services, Inc., a company owned by Fraport, the operators of the Frankfurt Airport.

Los Angeles International Airport to Union Station

At the present time, there is only one U.S. longer distance intermodal terminal that offers airport baggage check-in services: Union Station in Los Angeles. LAWA opened the check-in facility for Los Angeles International Airport at the rail station on March 15, 2006, and the first year saw about 250,000 riders. The bus service has been designed to meet the demanding needs of airline passengers, with service every half hour from 5 a.m. to 1 a.m. and hourly service through the early morning hours. The service concept was developed by LAWA based on its highly successful FlyAway bus service in Van Nuys, California, which is the only example of a regional park-ride terminal currently offering off-airport baggage check-in service.

The Union Station operation is unique in that baggage check-in services are provided by a third-party handler and the bus costs only $3. Importantly, the program has subsidized the costs of third-party airport baggage check-in, down to $5 per person, for up to two bags. (The same number of bags would cost $30 in Switzerland or $20 in a Las Vegas casino.) As of 2007, only a small number of airlines have signed onto the program. This baggage check-in service is also being offered at the original FlyAway location in Van Nuys.

Travelers can arrive at or continue their trip from Union Station on Amtrak, Metrolink, Metro Red and Metro Gold rail lines, Metro buses, and DASH downtown shuttle buses, as well as by taxi. The trip to the airport takes between 30 and 40 minutes, because the bus can use the high-occupancy lane system in the region. The agency reports that the system has saved an estimated 5 million vehicle miles and 225,000 gallons of gas. The program reportedly reduced emissions by 231,000 pounds of carbon monoxide. Based on the early success of the Union Station service, LAWA is planning to create more off-airport terminal facilities.

In January 2008, JetBlue Airways announced a program jointly developed with Bags Inc. for off-airport baggage check-in. The list of locations in the 10 cities served by the program is presented in Table 5-2.

Table 5-2. Locations for remote baggage check-in for JetBlue Airways, through Bags Inc.

Boston, MA (BOS)	**Orlando, FL (MCO)**
Boston Convention & Exhibition Center	Disney's All-Star Movies Resort
Hynes Convention Center	Disney's All-Star Music Resort
Port of Boston (Seasonal)	Disney's All-Star Sports Resort
Chicago, IL (ORD)	Disney's Animal Kingdom Lodge
McCormick Place Convention Center	Disney's Beach Club Resort & Villas
Fort Lauderdale, FL (FLL)	Disney's Boardwalk Inn
Port Everglades	Disney's Caribbean Beach Resort
Port of Miami	Disney's Contemporary Resort
Phoenix, AZ (PHX)	Disney's Coronado Springs Resort
Westin Kierland Resort	Disney's Fort Wilderness Resort & Campground
San Diego, CA (SAN)	Disney's Old Key West Resort
San Diego Convention Center	Disney's Polynesian Resort
Port of San Diego (Seasonal)	Disney's Pop Century Resort
San Francisco, CA (SFO)	Disney's Port Orleans Resort - French Quarter
SFO Long-Term Parking Garage	Disney's Port Orleans Resort - Riverside
SFO Rental Car Facility	Disney's Saratoga Springs Resort & Spa
The Moscone Convention Center	Disney's Wilderness Lodge & Villas
Port of San Francisco	Disney's Yacht Club Resort
San Juan, PR (SJU)	Disney's Grand Floridian Resort & Spa
Port of San Juan	Marriott Downtown Orlando
Seattle, WA (SEA)	Orange County Convention Center
Port of Seattle (Seasonal)	Rosen Centre Hotel
Tampa, FL (TPA)	Rosen Plaza Hotel
Port of Tampa	Rosen Shingle Creek
	Shades of Green Hotel
	Hyatt Orlando Airport
	Port Canaveral

SOURCE: JetBlue website.

Newark Liberty International Airport Rail Station: A Case Study

As noted in the GAO study, there is only one example in the United States of an airport terminal area that is physically linked with the national rail system, either directly or by people mover. Newark Liberty International Airport Rail Station stands as the best U.S. test case for the integration of long-distance ground service (Amtrak) with long-distance air service (the airlines).

In terms of physical services, the AirTrain people mover connects the Amtrak/New Jersey Transit Rail Station every 5 minutes (or better) to all three of Newark Liberty International Airport's main airline terminal buildings. The architectural integration at the air terminals is effective, as the people mover is actually on the airside of the terminal building, rather than on the other side of the airport access road, as is the case in Chicago. A simple one-story escalator connects the people mover platforms to the departure level of the air terminal. The entire system operates outside of the secure area of the terminal (i.e., before going through security check points).

The construction of the Newark Liberty International Airport Rail Station was the result of a long cooperative process undertaken primarily between the Port Authority of New York and New Jersey (who paid for it) and New Jersey Transit (who built it).

Integration of Air + Rail Ticketing

Throughout the implementation process, the plans were developed by New Jersey Transit, the Port Authority of New York and New Jersey, Amtrak, and Continental Airlines. The result was

the most concentrated attempt yet undertaken to integrate air and ground services. Continental entered into an agreement with Amtrak to code share certain rail services to Stamford and New Haven, Connecticut; Philadelphia; and Wilmington, Delaware. Therefore, Continental is able to sell a single, unified ticket from, for example, Stamford to Paris (Figure 5-12). (In fact, Continental also operates code share rail services with the French National Railway, allowing a trip from the Stamford rail station to Newark airport to Charles de Gaulle Airport in Paris and on to Marseilles by train.)

From the beginning, the new combination of people mover to *regional* rail has been a success. The Newark rail station serves about 5% of all airport ground access trips and captures about 12% of the market from Manhattan. All of this growth occurs within a pattern of greater reliance on public transportation services, which grew from 6% of the total market in 1997 to 14% in 2005. Simply stated, these figures show that the growth in rail share was not simply cannibalized from competing bus services. Currently, public transportation modes from Newark airport capture more than 25% of the trips from Manhattan.

Ticket integration between rail and airport services was accomplished on the local scale also. The purchase of one ticket from an origin on the New Jersey Transit system (e.g., Penn Station New York) to a destination at an airport air terminal includes both the fare for the New Jersey Transit train and the Port Authority's AirTrain. (There are some exceptions, such as the use of monthly tickets by New Jersey Transit riders.) A single one-way integrated ticket from Manhattan to the air terminals now costs about $14, of which $5.50 represents the fare for the AirTrain people mover on the airport. As of 2007, the station is attracting about 4,300 passengers per day, resulting in a yearly average of well over 1.5 million passengers per year (*43*). The station as a whole shows substantial market growth; total ridership is up more than 40% from its first year of operation.

Even though the traveler has purchased a unified fare, fare status must be validated at the ticket gate located between the rail platforms and the AirTrain station. Thus, a New Jersey Transit ticket once punched by a conductor on board has to be submitted again to the fare collection machines. Similarly, the paper ticket used on the Amtrak segment must be shown to the gate manager. The area is staffed 24 hours a day with airport personnel who help with the intricacies of the fare collection process.

Select Your Departing Flight for Wed., Apr. 25, 2007:

Price	Departing	Arriving	Travel Time	OnePass Miles	
Flights with stops from $403.06					
LOWEST FARE From **$403.06**	Depart: **8:24 a.m.** **Wed., Apr. 25, 2007** Stamford Rail Station, CT (ZTF)	Arrive: **9:57 a.m.** **Wed., Apr. 25, 2007** New York/Newark, NJ (EWR - Liberty)	Flight Time: 1 hr 33 mn	OnePass Miles/ Elite Qualification: **500 /50%**	Flight: **CO9434** Aircraft: **NOTE: This is Train Service** Fare Class: **Economy (S)** Meal: **None** View Seats
Select	**Change Planes.** Connect time in New York/Newark, NJ (EWR - Liberty) is 1 hour 53 minutes.				
	Depart: **11:50 a.m.** **Wed., Apr. 25, 2007** New York/Newark, NJ (EWR - Liberty)	Arrive: **2:47 p.m.** **Wed., Apr. 25, 2007** Orange County, CA (SNA)	Flight Time: 5 hr 57 mn Travel Time: **9 hr 23 mn**	OnePass Miles/ Elite Qualification: 2,433 /100% Total Miles: **2,933**	Flight: **CO387** Aircraft: **Boeing 737-700** Fare Class: **Economy (S)** Meal: **Lunch** View Seats
	Continental flight 9434 operated by Amtrak. Check in at the Amtrak Quik-Trak Self-Service Machine for Continental flight 9434 operated by Amtrak.				

SOURCE: Continental Airlines website.

Figure 5-12. An example of integrated air/rail ticketing in the United States.

What Happened at the Newark Liberty International Airport Rail Station? The goal of seamless integration between the national aviation system and the national rail system is as yet unrealized. As of 2005, about 370 daily Amtrak riders boarded or alighted at the station, while in 2006 about 350 daily riders used the station.

Clearly, the through-ticketing service between Amtrak and Continental Airlines is a pioneering first step in offering the public the option of optimizing both air and ground services in a single purchase decision. What is less clear is the extent to which the product has been aggressively marketed and promoted. However, the results of the Newark through-ticketing experiment are very much consistent with the larger pattern revealed in this chapter in which the consumer is selecting the simplest and least interconnected product options. The market pattern revealed in the Newark integration example is similar to the market pattern revealed in either the Cologne or the Stuttgart example.

Documenting the Collaboration at Newark

The experience of the Newark Liberty International Airport Rail Station can be used as a study in lessons learned in the implementation of intermodal concepts. In November 2004, the I-95 Corridor Coalition published the results of an intensive study of the intermodal coordination associated with the rail station project. At the request of the four participating organizations—the Port Authority of New York and New Jersey, New Jersey Transit, Amtrak, and Continental Airlines—a team of experts from the Coalition examined all aspects of the interagency project to create and manage the services at the Newark Liberty International Airport Rail Station. The team was given access to all levels of the operation, including a series of interviews with the team of passenger service representatives employed in the station. Through a focus group format, everyone associated with the project was invited to give their candid assessment about the strengths and weakness of the integrated project.

Some of the conclusions follow:

- Agency collaboration has the great value of acknowledging the independence and perspective of each partner in the collaboration; however, it does not have a clear locus of power to make—and *to complete*—the implementation of complex decisions.
- The two key challenges to the integration of services provided by separate institutions are (1) the integration of information, to describe the full multisegment trip, and (2) the integration of fare collection media to pay for the full multisegment trip.
- The project components most susceptible to problems in multiyear implementation are passenger information systems.
- Customer service, operations, and technical staff from all the operating agencies need to provide input into the design process.
- The customer perspective must truly be understood by all and a commitment must be made to do what is best for the customer, regardless of historical leanings and potentially conflicting policies.

The study report observes that the demands of an intermodal transfer station are unique; the passenger is different and has different expectations and needs. Therefore, the rail services themselves must be designed for the unique role; the space and amenities needed in a rail station and in the rail car are different for a long-distance traveler with luggage. Most important, the report documents the extensive coordination activities undertaken during the capital planning and construction process, and observes that such an intermodal mandate needs to be continued into the operational phase; once the service is running, the continued attention to service quality has to rise above single-agency budgets and priorities.

Making the Collaboration Work. In the collaborative model of implementation adopted in Newark, there is no one single lead agency that can mandate the others to follow its recommendations; everything must be negotiated. This model causes each agency representative to, in effect, play two separate roles: the advocate for and defender of the agency's legitimate self-interest, and the advocate of the best end-state for the customer. Rick Mariani of New Jersey Transit told a member of the research team, "each designee has to have an expansive view of the world beyond the organization's boundaries. That view must be customer centered, that the outcome must be best for the customer."

The study report concludes:

> "For many in the rail agencies, the project was 'just another station.' A major lesson to be learned from this experience is that this is not true: it is not just another station . . . It is a facility in which a higher level of service is matched with a significantly higher fare. It has been argued elsewhere that the future of the public transportation will hinge on the ability to create separate market products for separate market groups, something the publicly subsidized industry has been understandably reticent to do. Indeed, a recent study sponsored by the Transportation Research Board concluded that there is no 'market' for airport ground access services; there are a series of unique market segments." (*44*)

Lessons Learned: Integration with National Systems

In the previous examples, whether the integration is with high-speed technology (France and Germany) or slower intercity rail service (Switzerland), the airport strategy takes advantage of a capital investment decision already made for the rest of the national network. The scale of the national rail networks into which the airports have been integrated must be emphasized, because the lack of such rail networks in the United States will make similar strategies infeasible at most U.S. airports.

The travel times from the four high-speed lines serving the new Frankfurt Airport InterCity Express station will provide service that is actually competitive with the short-distance air trips that airport officials are trying to discourage. A 1-hour travel time from Frankfurt Airport to downtown Cologne is directly competitive with, and probably better than, the same trip by commuter aircraft. The traveler in western parts of Belgium may be induced to make an international trip through Charles de Gaulle Airport rather than through the Brussels Airport, because of the rail travel times created by the TGV.

Designers of U.S. strategies to integrate major airports with Amtrak services will need to understand the difference in quality of services offered to the traveling public. Within the Northeast Corridor of the Amtrak system, it is clear that intercity rail can play a role in bringing people to major airports well connected to that system. Outside of that corridor, the parallels with the international experience are weak at best.

What is clear from these examples is that the long-distance traveler is not looking for soup-to-nuts provision of integrated services. Most longer distance travelers are showing a pattern in which they want to control as many decisions about their modal options as possible. For the small subset of the market who *do* want to part with their bags (for whatever reason), third-party baggage managers may emerge as a significant market option.

Given that good public transportation options do exist to get travelers to airports—whether from near origins or from longer distance origins, a key challenge is to make the traveler aware of those services. Once that knowledge is widely available, the traveler may wish to retain control of each segment decision, rather than surrendering that control to any service. Chapter 9 will review a series of new breakthroughs in the task of getting information about those options to the traveler at the time of trip planning.

Documentation of Examples of Integrated Services

Tables 5-3 through 5-6 summarize the status of various levels of integrated services around the world:

- Service from a downtown terminal to the local airport, with baggage (Table 5-3)
- Service from a downtown terminal to an airport in another city, with baggage (Table 5-4)
- Service to the local airport, no baggage (Table 5-5)
- Baggage check-in at points adjacent to the airport (Table 5-6)

Table 5-3. Facilities with direct local airport connections—history of baggage service.

City and Terminal Identification	Airport and Airport Connection	What Was Offered as Off-Airport Terminal Service	What Happened to the Off-Airport Terminal Services?
London Victoria Rail Station	London Gatwick Airport by express dedicated rail and by shared rail	Baggage check-in for British Airways and American Airlines	Check-in service discontinued because of economic costs
London Paddington Rail Station	Heathrow Airport by express dedicated rail	Baggage check-in for most airlines serving Heathrow	Check-in service discontinued because of economic costs
Hong Kong Downtown and Kowloon Island Rail Stations	Hong Kong International Airport by dedicated rail; connections to shared rail	Baggage check-in for most airlines serving Hong Kong International Airport for holders of express rail ticket	Check-in services now being re-examined by rail company management for economic costs
Vienna Central Airlines Terminal	Dedicated and shared rail services to Vienna Airport	Baggage check-in for many airlines, and to USA; bags go in double-deck rail car	In operation
Moscow Downtown Rail Station	Dedicated train to Domodedovo Airport	Baggage check-in for selected airlines	In operation
Kuala Lumpur Sentral Station	Dedicated rail service to Kuala Lumpur Airport	Baggage check-in for many airlines; through-baggage check-out planned for 2007	Baggage check-in now operating; through check-out planned for November 2007
Madrid Nuevos Ministerios Check-in Terminal	Shared, traditional rapid transit to Barajas Airport	Baggage check-in offered for One World and Star Alliance Airlines	Check-in discontinued in 2006
Osaka Central Airlines Terminal	Several rail services connected the complex to Kansai Airport	Baggage check-in for most airlines	System discontinued for unnamed reasons
Munich Main Railway Station	Two check-in counters were built in central station for Lufthansa only	Riders could choose rail or bus. Bags were all carried by bus	Discontinued for lack of customer use
Union Station Downtown Los Angeles	Direct dedicated bus service to LAX	Third-party baggage service for $5 per rider	Commenced in 2006
Zurich Main Rail Station	No dedicated track areas–no dedicated seats on trains	Airline baggage check-in offered by railroad for $15 per bag	Some kiosks in operation
Tokyo Central Airlines Terminal	Dedicated express bus service to Narita Airport; no rail	Full baggage check-in and partial customs clearance	Discontinued in 2002 after pull-out by U.S. flights

Table 5-4. Facilities designed for the intercity access trip.

City and Terminal Identification	Airport and Airport Connection	What Was Offered as Off-Airport Terminal Service	What Happened to the Off-Airport Terminal Services?
Cologne Rail Station	High-speed intercity rail with seats dedicated to air ticket holders	Baggage check-in for Lufthansa, Star Alliance; separate three-letter code allows check-out return	Through ticketing and baggage underutilized; future uncertain
Stuttgart Rail Station	High speed intercity rail with seats dedicated to joint air rail ticket holders	Baggage check-in for Lufthansa, Star Alliance; separate three-letter code allows check-out return	Joint air/rail ticketing and baggage under-utilized; future uncertain
Air France Check-in at Brussels Main Station	High speed intercity rail with seats dedicated to joint air rail ticket holders	Baggage check-in for holder of Air France joint air/rail ticket; passengers must rejoin their bags at CDG Airport	In operation
Bern Rail Station	Shared boarding area for train direct to Zurich Airport	Airline baggage check-in offered by railroad for $15 per bag; check-in 20 minutes before train	In operation
Florence Downtown Rail Station	Allows baggage check-in for Pisa Airport	Limited baggage	In operation
Magdeburg Rail Station Germany	Shared rail connection to Leipzig/Halle Airport, baggage check-in between 6 p.m. and 9 p.m. night before flight	Bags travel by truck for $15 per person.	Ceased operation in 2007

Table 5-5. Dedicated rail service—no history of baggage handling.

City and Terminal Identification	Airport and Airport Connection	What Was Offered as Off-Airport Terminal Service	What Happened to the Off-Airport Terminal Services?
Milan Cadorna Rail Station	Dedicated train to Milan Airport	No baggage check-in	Kiosks available for those with no baggage
Stockholm Central Station	Separate boarding area for dedicated train to Arlanda Airport	No baggage check-in	Kiosks were tried for those with no baggage; now discontinued
Oslo Central Station	Separate boarding area for dedicated trains to Oslo Airport	No baggage check-in	Kiosks available for those with no baggage
Rome Central Station	Separate boarding area for dedicated train to Rome da Vinci Airport	No baggage check-in	No services

Table 5-6. Near-airport off-site facilities.

City and Terminal Identification	Airport and Airport Connection	What Was Offered as Off-Airport Terminal Service	What Happened to the Off-Airport Terminal Services?
Düsseldorf Airport High-Speed Rail Station	People mover from high-speed rail station to airline terminal area	Baggage check-in for most airlines in airport	Service discontinued because of lack of customer interest
Newark Rail Station	People mover from rail station to airport	Baggage check-in for Continental Airlines	Service discontinued because of lack of customer interest
Jamaica Station, Queens NYC	People mover to JFK airport	Shell was prepared if airlines were interested	Service never started because of lack of airline interest
Anthony Station in RER-B for Orly Airport	People mover from regional rail station to Paris Orly Airport	No facilities	No facilities

CHAPTER 6

Applying Market Research to Airport Ground Access

This chapter focuses on the role of market research in planning public transportation services to airports. After an overview of market research techniques, an approach is presented that uses geographic and demographic information to better understand potential ground access markets.

The Role of Market Research

Market research is used in all sectors of today's economy to identify and target selected markets, to gain a competitive edge, to classify and retain customers, and even to determine the lifetime value of selected customer groups. With an ever-increasing number of products and services, the consumer market has become highly fragmented. Increasingly, it has become important to identify and target selected groups of customers rather than trying to serve the entire market (*45*).

In the same way, classifying airport users according to factors known to affect ground access decisions can help airport managers understand how different types of public transportation service will appeal to targeted customer groups. By providing a detailed understanding about the access needs of airport users, market research can help airport managers plan successful public transportation services. This chapter outlines a method for identifying, classifying, and understanding the airport user on the basis of his or her ground access trip to and from the airport.

Characteristics of the Airport Ground Access Market

The previous TCRP studies established that there is no single market for ground access services to airports. Instead, there is a series of submarkets, or *market segments*, each of which has distinct and documentable characteristics. Very often, it is necessary to create distinct services for separate market segments; marketing, pricing, and promotion will usually vary by targeted market segment. For example, at Japan's Narita Airport, three rail companies offer service at three separate ticket price levels, while a limousine bus company caters to international visitors. At London's Heathrow Airport, the original combination of a good rapid transit service plus frequent buses was augmented by the addition of the higher priced Heathrow Express premium rail service. In Paris, French decision makers are now determining the best strategy to add a new premium CDG Express to the existing combination of commuter rail and specialty bus service from Paris Charles de Gaulle Airport. In New York City and in Chicago, airport ground access planners are examining the idea of adding additional, higher priced rail services to supplement the present shared rail services to their airports.

To plan such services, market researchers typically use a two-step process: first, they examine overall patterns to look for strong *geographic* markets; second, they apply a more fine-grained *demographic* segmentation for the specific market identified.

Geographic Distribution of Ground Access Trips

The first step in planning any successful public transportation service is determining the geographic distribution of the potential customers: air travelers and employees. Originating air travelers and airport employees account for the majority of person trips to and from an airport. While these are the most important groups to consider, they have very different ground access needs. Nevertheless, significant markets for ground access services can be found in the elements common to their trips.

The term *ground access traveler* will be used to describe any air traveler or airport employee who travels to or from an airport by a mode other than air. Not all air travelers are ground access travelers; air travelers transferring between two flights (and who do not leave the airport) are not candidates for ground access services at the transfer airport.

Although patterns will vary with the airport, mapping the ground access trip origins of large U.S. airports would show that the supporting market area for each airport is spread over a wide region. Several factors influence the distribution of ground access markets:

- **The physical size of the market.** The geographic size of an airport's ground access market is influenced by factors such as proximity to competing airports, the relative price of airfares at competing airports, the regional transportation networks, and the physical geography of the area.
- **The number of ground access trips originating from different locations.** The distribution of ground access trips within an airport's market area is based on development patterns of the region, population density, and demographic characteristics of the population.
- **The proportion of air traveler origins from defined market segments.** As described in the next section, these market segments usually categorize air travelers into four market segments on the basis of residency and trip purpose.

Two concepts are important for understanding the geographic distribution of air travelers. A ground transportation trip can be more precisely defined using the measure of trip ends. The definition of a *trip end* is the origin or destination point of an air traveler's ground access trip; one trip end is at the airport and the second trip end is located somewhere within the airport's market or service area. Therefore, each ground transportation trip made to or from an airport by an air traveler involves two trip ends. An additional measure, which combines the geographic and quantitative components of the airport ground transportation market, is trip-end density. For this report, *trip-end density* is defined as the number of air traveler trip ends per square mile of land area. These measures and their applications to ground transportation planning are discussed in more detail later in this chapter.

Demographic Characteristics of Air Travelers

Although air travelers can be classified in many ways, two variables—trip purpose and home residence location—are frequently used to classify air travelers for purposes of airport ground access planning. The combination of these two variables results in four market segments: resident business, resident non-business, non-resident business, and non-resident non-business (Figure 6-1). (In the figures, the four segments are sometimes shortened to res biz, res non-biz, non-res biz, and non-res non-biz.)

As mentioned earlier, one objective of market research is to identify target groups for a service or product. For air travelers, the characteristics of residence and trip purpose influence their preferences for ground access services. The different characteristics of these four market segments and the implications for ground access services are discussed in the following sections.

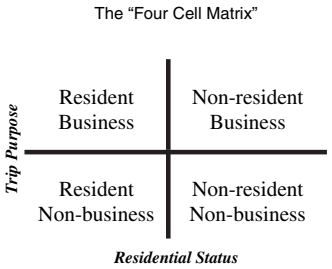


Figure 6-1. The four market segments.

Resident Business

Resident business travelers are often the largest group of air travelers. They tend to travel to and from the airport at peak arrival or departure times. Because of their frequent air travel, resident business travelers are likely to know the most efficient, reliable, and cost-effective means of accessing the airport. Typically, resident business travelers make shorter trips than non-business travelers and have less baggage. Although this characteristic makes their travel profile more suitable for public transportation, their sensitivity to access time reliability makes them cautious about using these services. Public transportation service characteristics like schedule reliability must be flawless to attract resident business travelers. This observation is especially true for the so-called "just-in-time" travelers, who arrive at the airport with barely enough time to make their flight departure and who are particularly sensitive to even minor delays. Resident business travelers tend to be the dominant users of the more convenient (close-by) and more expensive airport parking options.

Resident Non-Business

Resident non-business air travelers are almost certain to start their airport trip from home and to have a longer length of stay than resident business air travelers. They also tend to travel in larger travel parties and to have more baggage. Accordingly, they are more sensitive to access costs and may need assistance with baggage handling. Although resident non-business travelers travel less frequently than business travelers, they usually have some information available about access to their local airport and may have developed a preferred access method. They have a greater tendency to travel during off-peak times and are subject to day-of-the-week variations because of travel promotions by the airlines. Because of the characteristics of their travel, resident non-business air travelers will likely be dropped off at the airport by friends or family; if they drive, they are likely to park in reduced-rate facilities. They are candidates for public transportation if the ground mode boarding location is situated along their normal route to the airport.

Non-Resident Business

Non-resident business travelers usually begin their trips to the airport from a place of business or a hotel. These places tend to be located in city centers, near regional attractions, near the airport, or in proximity to regional highways. Depending on the nature of their trips (e.g., a business meeting at one location or multiple meetings with a series of clients), non-resident business travelers usually require the flexibility of a rental car or taxi. When their destination is the center of the city, they will use the most efficient means of reaching their destination without regard to cost. They may use public transportation, when the service is expedient and delivers them near their destination without the need for multiple stops and transfers.

Non-Resident Non-Business

Non-resident non-business travelers are usually the least informed and most unfamiliar with the access options available at any given airport. Although these travelers may make multiple

non-business trips in a given time period, they are less likely to use a specific destination airport repeatedly. Air travelers in this segment are most likely to be staying at a hotel or a place of residence. Because they may be unfamiliar with their access options, they will use the most readily available, such as taxis or shared-ride, door-to-door vans. When staying with friends or relatives, they may be dropped off or picked up at the airport. Because of their unfamiliarity with the region, these ground access travelers are less likely to use public transportation unless their local hosts assure them that it is convenient and reliable.

Airport Ground Access Market Research

There are a variety of methods for collecting data about ground access travelers, including surveys, focus groups, panels, interactive research, and observation. Each method is useful in particular situations and each has advantages and disadvantages. This discussion will concentrate on focus groups and surveys—both of which are commonly used in ground access market research.

Airport-based surveys provide the best source of information about ground access patterns and the choices of air travelers and airport employees who travel to the airport. The general procedural steps in conducting either a passenger or employee survey are similar; however, the procedural steps are implemented in different ways.

Before undertaking a market research study, the airport manager should develop a clear and unambiguous problem statement. The problem statement defines the purpose of the market research effort. For example, the following statement describes the basic information needed to begin a study of alternative modes of access: "What is the geographical distribution of this airport's ground access market and the current modes of access used by the various market segments?"

Once the problem statement has been defined, there are five steps in developing a market research study:

1. Decide what information to collect.
2. Select a data collection method.
3. Determine the sampling frame and sampling method.
4. Develop the questionnaire.
5. Summarize and analyze the results.

Airports generally solicit the help of consultants to plan and conduct a market research study. Before preparing the consultants' work plan, airport managers should review these steps to help ensure a successful research effort.

Step 1: Decide What Information to Collect

At this early stage of the research study, the kind of information the airport managers need for planning purposes must be determined. Accordingly, as many of the people and departments that will make use of the collected information should be involved as possible. It is also important to collect sufficient information to use in defining the market segments for a public transportation service but to not request such an overwhelming amount of information that the survey proves to be burdensome to the respondents. Tables 6-1 and 6-2 show the type of information generally collected from air travelers and airport employees to support ground access planning efforts.

Airport ground access market research is primarily concerned with the access mode choice (i.e., travel *to* the airport) of air travelers. To date, far less attention has been given to questions about egress mode choice for the following reasons:

- Air travelers are primarily concerned with reaching the airport in time for their flights. They are less concerned with time when leaving the airport.

Table 6-1. Information to be collected from air travelers.

- Residence location
- Trip purpose
- Destination airport
- Mode of transportation to the airport, including
  - Private vehicle (drop-off, drop-off and parked, parked for duration on airport, or parked for duration off airport)
  - Rental car
  - Courtesy vehicle
  - Taxi
  - On-demand limousines
  - Prearranged limousines
  - Chartered bus or van
  - Shared-ride door-to-door van
  - Bus (express and multistop)
  - Rail service
- Origin of access trip to the airport
- Type of origin from which the traveler departed
- Travel-party size
- Number of people who came into the terminal to see the traveler off
- Arrival time inside the terminal prior to flight departure time
- Departure time from local origin location
- Number of pieces of baggage (checked and/or carry-on) taken on flight
- Length of the air-travel trip (nights away from home)
- Number of times the traveler has flown out of this airport in the year preceding the survey
- Traveler's household income before taxes in the year preceding the survey
- Traveler's gender
- Traveler's age
- Number of people in the traveler's household
- Traveler's highest level of education
- Airline, flight number, and departure time and date

SOURCE: *TCRP Report 62*, MarketSense.

- It is difficult to get accurate answers to a question about egress mode from air travelers when surveying them prior to their air trips, which is when many airport surveys are conducted. The choice of egress mode involves a number of factors, and many air travelers do not make a decision until they return to the origin airport. Therefore, responses given prior to travelers' air trips do not necessarily represent actual choices. Non-residents could be asked this question because they have already made egress trips from the airport upon their earlier arrival; however, non-residents would represent only one portion of air travelers.
- Even if asking air travelers about their egress modes were realistic, a survey participant may become confused if asked the ancillary information needed to understand an egress mode choice in the same survey addressing access mode.
- To answer the question of egress mode choice accurately, a separate surveying effort is needed. This additional effort would be costly but may be necessary if other information about ground transportation modes indicate an imbalance in inbound versus outbound passenger flows.

Step 2: Select a Data Collection Method

Surveys and focus groups are commonly used—sometimes in combination—to understand factors that influence mode choice. Surveys generally provide quantitative data, while focus

Table 6-2. Information to be collected from airport employees.

- Residence location
- Mode of transportation to the airport, including
  - Private vehicle (drop-off, parked near work site, parked on airport and shuttle bus, or parked off airport and shuttle bus)
  - Car or van pool
  - Taxi
  - Bus (express or multistop)
  - Rail service
  - Other (walking or bicycling)
- Amount of time spent commuting
- Airport work location
- Work schedule (daily or weekly)
- Employer
- Employee's household income before taxes in the year preceding the survey
- Employee's gender
- Employee's age
- Number of people in the employee's household
- Whether employer provides free or subsidized parking and the location of parking
- Requirement for overtime work

SOURCE: *TCRP Report 62*, MarketSense.

groups are qualitative in nature. Considerations for each approach are presented in the following paragraphs. All types of surveys require the use of prepared questionnaires. Each of the two methods—focus groups and surveys (*46*)—will be discussed in detail in the following sections.

Focus groups provide an excellent way to investigate customer responses to a subject in depth. A focus group is usually a small group of no more than 12 individuals who are interested in a topic and who, with the guidance of a facilitator, discuss the topic for a period of 1 to 2 hours. Focus groups do not require questionnaires, but they do require preparation and input from the airport staff to the consultant conducting the interviews. A focus group is a relatively inexpensive way to explore the dimensions of air travelers' ground access concerns. A series of focus groups could be set up to represent both the geographic distribution of air travelers as well as the market segments. With a skilled facilitator, a focus group can provide valuable information and ideas about the selected topic—information and ideas that are more insightful than any that could be obtained through a prepared survey. Focus groups can also help airport managers develop a survey instrument by identifying topics to study, determining what attributes are important, and defining other specifications for questionnaire development. Focus groups do not necessarily represent the actions or opinions of all ground access travelers, but they do provide a way to understand the concerns or reactions of a subset of ground access travelers.

Surveys are one of the most widely used forms of market research. Because they present respondents with a set of multiple choice questions, surveys can standardize the answers received from customers and allow analysis for different subsets of respondents. Surveys can be administered in a number of ways, including mail, telephone, personal interview, and on-site self-completion. Surveys can provide a wealth of information concerning the respondents and their service choices for ground access. Most airports that have conducted market research have used some type of survey methodology.

Because all air travelers who use ground access eventually congregate at the airport, most surveys contact air travelers at this location. These surveys only need to filter out air travelers transferring between flights who have not left the airport. Two frequently used survey techniques are personal

interviews and self-completion questionnaires. A personal interview ensures a more thorough completion of questions with the added advantage of enabling the interviewer to query the respondent when answers are ambiguous. The drawbacks of personal interviews are the limited number of surveys that can be completed in a given time frame and the potential for either under-sampling travelers who are more time conscious or oversampling travelers who arrive far ahead of scheduled departures (primarily non-business travelers). Personal interviews may be a reasonable option when the survey to be administered is complex. The other approach, self-completion surveys, requires the distribution and collection of questionnaires at designated airport locations such as security checkpoints and aircraft boarding lounges. The advantage of this method is that many surveys can be distributed and completed in a limited amount of time. The drawbacks of self-completion surveys include limited returns from just-in-time air travelers, the inability of the respondent to ask questions about how to properly complete the survey, and the extra effort needed to ensure adequate sample sizes.

To collect ground access information from airport employees, surveyors either distribute self-completion questionnaires at the airport work site or mail the forms to home residences. The difficulty in conducting an airport employee survey is the need for a list of all airport employees. The development of this list will be discussed under the topic of sampling frame in the next step.

Step 3: Determine the Sampling Frame and Sampling Method

The Sampling Frame

Obviously, it is not feasible to contact every ground access traveler and ask him or her questions about his or her access trip. In sampling, a small group of ground access travelers is selected to provide information that is considered representative of the entire population of travelers using an airport. The entire population of ground access travelers is known as the *universe*. The *sampling frame* is a list representing the universe from which a sample is selected. Because a perfect list is impossible to have, a good research study team will understand the shortcomings of the sampling frame so that it can make allowances in the design of the study. The principal concern in conducting airport market research is the development of the sampling frame. To ensure that results of a survey can be generalized to the entire population of ground access travelers, care should be taken to construct a list that is representative of all air travelers and airport employees. The actual implementation of sampling and the selection of a sample are complex tasks and require knowledge of statistics and probability.

In developing an airport employee sampling frame, more than one source of information may be required. The airport administration should have a list of companies leasing space from the airport. Even if this list only provides the names and administrative addresses of the employers, the employers can be contacted and asked to provide more detailed information. This could include information about their different facilities and locations on the airport, the number of employees reporting to each location, and the number of airport-based flight crew employees. Finally, security access methods used by the airport and air quality ridesharing/trip reduction reports required in certain cities may provide other potential sources of information about airport employees.

Probability versus Non-Probability Sampling

The heart of sampling is the difference between probability and non-probability sampling. Probability sampling, also referred to as "random sampling," means each sampling unit has an equal, known chance of coming into the sample. In probability sampling, a random sample allows the calculation of the accuracy of the results; non-probability sampling does not. Probability sampling should be used for determining the access choices of air travelers and airport employees because it provides a known degree of accuracy. The degree of accuracy required and the survey sample size is related to (1) the size of the geographic zones that will be used in analyzing the airport ground access market area and (2) the cost of the survey.

Step 4: Develop the Questionnaire

The survey questions are critical to the success of the research effort. For ground access purposes, the questions should, at a minimum, relate to the list of information needs listed in Tables 6-1 and 6-2. Although the information required of air travelers and airport employees is similar, the surveys will have questions unique to each group. Additional questions can be tailored to the characteristics of the specific airport. For surveys targeting multiple airports, questions should be included to determine the relative use of one airport versus another. Caution is advised when adding questions, because the length of the survey may affect the number of individuals completing the survey. The longer and more complicated the survey, the less likely a traveler is to complete and return it.

Developing a good questionnaire is an art; the manner in which questions are phrased, the order of questioning, the grammar, the length of the form, and the type of information that is requested—all have implications for the successful completion of the survey. The wording of each question should be as simple and direct as possible and should be neutral in tone. Finally, the questionnaire should be tested on a small group of individuals from the sampling frame. Table 6-3 presents an outline for a sample questionnaire.

Survey respondents may be sensitive to requests for certain personal information. For example, individuals are often reluctant to report information such as income and age, and when they do respond, the information may be inaccurate. However, this type of information is needed for classification and segmentation purposes among certain consumer groups and is worth including in the questionnaire. It is advisable to have requests for this type of information located near or at the end of the questionnaire, so that if respondents skip the personal questions, they are still likely to complete the rest of the questionnaire.

Step 5: Summarize and Analyze the Results

When the research plan is prepared, how the collected information will be used and who will use it must be considered and documented. While data can always be summarized, information

Table 6-3. Example of an air traveler survey outline.

Greeting and introduction to survey

A. Instructions for completing questionnaire
B. Questions concerning the ground access trip to the airport
   1. Mode of access
   2. Detailed questions about particular modes
   3. Questions about the origin of the ground access trip (type of location, departure time, arrival times at airport, and so forth)
   4. Questions about alternative modes and ground access services
D. Questions about the air travel trip
   1. Final destination
   2. Purpose of air travel
   3. Questions to determine resident versus non-resident status of traveler
   4. Questions to determine the length of the trip (days or nights away from home)
   5. Questions about the travel party
   6. Frequency of air travel to subject airport
E. Classification questions
   1. Home address
   2. Demographic information
   3. Airline, flight number, and departure time

SOURCE: *TCRP Report 62*, MarketSense.

collected and stored in a summarized fashion cannot be broken down into its component parts. Therefore, it is advisable (1) to collect and store data in the most discrete manner needed for any required analysis and (2) to use one of many available statistical software programs to aggregate the information for purposes of summary tables or discussions.

Once the data have been stored in database format, they can be processed and analyzed using any of a number of software packages. These packages usually have different modules for specialized, as well as general, analysis. Because of the extent of currently available computing power, most procedures are fairly straightforward for an analyst to complete. An analyst does not need to be a statistical expert to complete many types of analysis; more important is for the analyst to be familiar with the subject population, which will help ensure that the end results are meaningful.

Use of Market Research Information

Air traveler and airport employee survey data provide valuable information about potential customers for ground access services. Once the survey data processing is completed and responses have been scaled to represent all airport ground access travelers, the findings can be used to support a range of programs. Table 6-4 provides examples of survey data and their potential applications for planning an airport public transportation access service.

Market research sets the stage for developing a realistic planning approach to developing airport ground transportation services that respond to traveler needs and support airport ground access objectives. This section provides a geographic approach for analyzing ground access patterns at airports by introducing the concept of the primary market. The next section, "Influence of Geography and Demographics on Ground Transportation Markets," discusses applications of a demographic approach for understanding variations in access mode by market segment for travelers accessing a single airport (Reagan Washington National Airport) and at multiple airports serving a single market area (the Washington, D.C., market).

Air Traveler Trip-End Densities Associated with Ground Transportation Markets

The following analysis uses two types of data that characterize the airport ground transportation environment: quantitative (number of ground access trips) and geographic (origin

Table 6-4. Uses of airport ground access survey information.

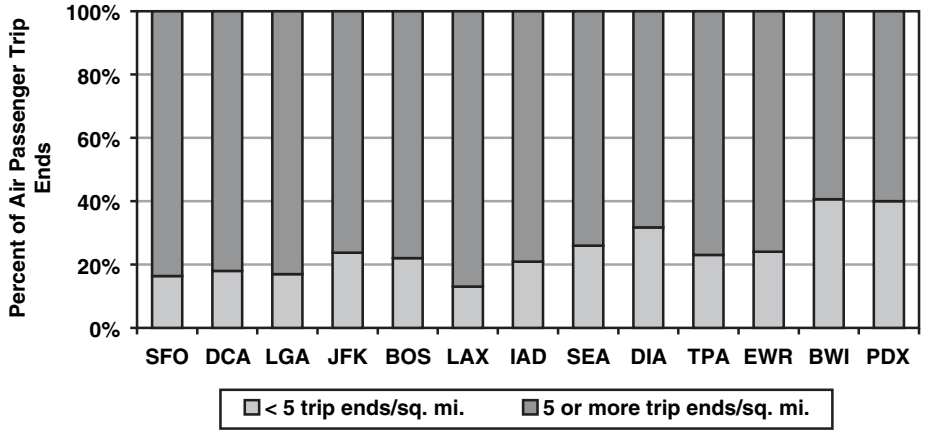
Air traveler and airport employee survey data	Uses in planning public transportation service to airport
Distribution of air traveler and employee arrival and departure times	Developing public transportation service schedule
Air traveler trip purpose and home residence location (market segments)	Identifying the potential for alternative pubic transportation services
Geographic location of air traveler and employee origins	Locating public transportation boarding sites (station, terminal, stop)
Distance and concentration of air traveler and employee origins from the airport	Identifying suitable types of transportation access services
Air traveler evaluations of public transportation service attributes	Designing public transportation service features

SOURCE: *TCRP Report 62*, MarketSense.

location of ground access trips). The measure of trip-end density, which combines these two elements, provides a standard way of presenting market characteristics. Trip-end density also provides a means to evaluate the viability of an airport market for a particular ground transportation service and compare the service under consideration against similar services at other airports. The purpose of this section is to provide evidence of the combined quantitative and geographic characteristics of airport markets that support public transportation modes currently in operation.

Information from air traveler surveys conducted at 13 U.S. airports was used to determine where air travelers began their ground transportation trip to the airport and which modes they selected. These surveys yielded information about trip-end density, defined earlier as the number of air traveler trips per square mile. Not surprisingly, a wide range of trip-end densities is found in the ground transportation markets associated with large U.S. airports. Nevertheless, there is broad similarity in the distribution of trip-end densities for large U.S. airports. Figures 6-2 and 6-3 demonstrate the relationship between trip ends and ground transportation based on the findings from the air traveler surveys. Figure 6-2 illustrates that the majority of air travelers start their ground access trip from areas with five or more trip ends per square mile. Figure 6-3 illustrates that the majority of the land area within a ground access market is composed of areas with fewer than five trip ends per square mile.

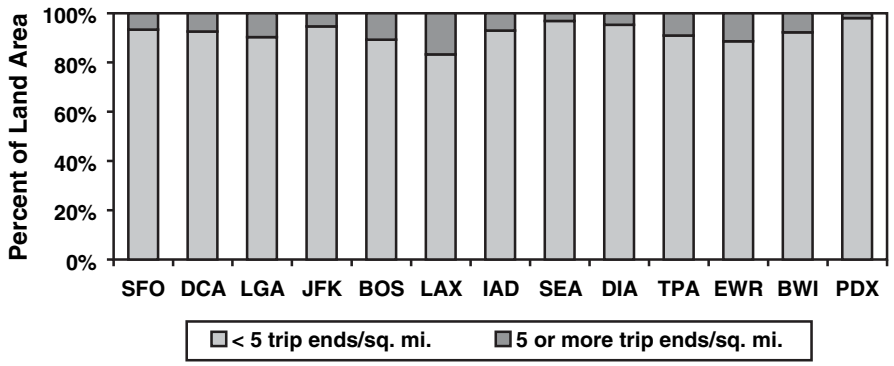
The proportional relationship between trip ends and land area for airport ground transportation markets is quite dramatic. The figures illustrate that a relatively small area of land in each ground access market is associated with a very high proportion of air traveler trip ends. In most cases, approximately 60% to 80% of all air traveler trip ends are generated from an area equaling not more than 10% of the total area associated with ground transportation trips to an airport. All airport ground transportation markets exhibit this general pattern to some degree. This observation has implications for designing airport ground transportation services because it suggests that a large proportion of all ground transportation trips to an airport are generated from a relatively small physical area. In planning airport ground transportation services, the area with five or more trip ends per square mile should be the focus for maximizing mode share potential.



SOURCE: *TCRP Report 83*, MarketSense.

NOTE: SFO = San Francisco; DCA = Reagan National, Washington D.C.; LGA = LaGuardia, NY; JFK = John F. Kennedy, NY; BOS = Boston; LAX = Los Angeles; IAD = Dulles, Washington D.C.; SEA = Seattle-Tacoma; DIA = Denver; TPA = Tampa; EWR = Newark; BWI = Baltimore/Washington; and PDX = Portland, Oregon.

Figure 6-2. Air traveler trip ends in ground access market areas for 13 large U.S. airports.



SOURCE: *TCRP Report 83*, MarketSense.

NOTE: SFO = San Francisco; DCA = Reagan National, Washington D.C.; LGA = LaGuardia, NY; JFK = John F. Kennedy, NY; BOS = Boston; LAX = Los Angeles; IAD = Dulles, Washington D.C.; SEA = Seattle-Tacoma; DIA = Denver; TPA = Tampa; EWR = Newark; BWI = Baltimore/ Washington; and PDX = Portland, Oregon.

Figure 6-3. Land area of ground access market areas for 13 large U.S. airports.

The Importance of Primary Ground Transportation Markets

The previous section highlighted the significance of geographic areas where trip-end densities equal or exceed five trip ends per square mile. This area can be described as the primary market. Borrowed from the field of marketing geography, a primary market is defined as the area associated with at least 60% of all customers, in this case, air travelers using ground transportation. It is important to the success of any ground access service to understand where the majority of potential customers are located, that is, the area that contains the highest concentration of travelers. The share of air travelers using a particular access mode from a given area will vary depending upon a number of factors, one of which is the origin location of their access trip to the airport. Identifying the primary market for an entire airport is the first step in defining the markets for various public transportation modes.

Applying the definition of primary market to trip-end densities, analysis shows that the primary markets for the airports studied have average densities of five trip ends per square mile or higher. As shown in Table 6-5, primary markets account for 59% to 87% of all trip ends and 2% to 17% of the land area associated with the ground transportation service area of an airport. For the majority of airports, the land area in their primary market is between 500 and 950 square miles, the exceptions being Newark (1,429 square miles) and Los Angeles (1,551 square miles). Table 6-5 summarizes the characteristics of the primary ground transportation markets for 13 airports.

The concept of a primary market area is important for understanding the service and operating environment of an airport's ground transportation network. It is also an important concept to keep in mind when evaluating the role of an individual ground transportation service. The primary market provides a framework for assessing operations and the potential demand for a new service and comparing market characteristics of a new service to those characteristics that support existing services. The following analysis looks at the use of shared-ride transportation at several major airports. A similar analysis can be conducted with other access modes.

The Geography of Public Ground Transportation to Airports

Multiple forms of ground transportation are required to meet the needs of the many travelers using today's airports. Planning new or improved public transportation services requires an

Table 6-5. Primary ground transportation markets.

Airport	Land area (square miles)	Percentage of total ground transportation market area	Number of air traveler trip ends	Percentage of total air traveler trip ends	1999 population estimate (000's)
New York LaGuardia	744	10%	19,850	84%	9,200
New York JFK	622	6%	18,200	76%	9,500
San Francisco	760	7%	26,200	83%	3,900
Boston	944	11%	20,400	78%	2,950
Newark	1,429	13%	21,500	75%	8,300
Seattle	637	3%	12,100	72%	2,500
Denver	886	7%	20,500	69%	1,750
Los Angeles	1,551	17%	34,000	87%	10,100
Tampa	484	9%	9,325	77%	1,300
Portland (Oregon)	425	2%	5,765	60%	1,300
Reagan National	484	7%	15,500	82%	NA
Washington Dulles	515	7%	11,010	77%	NA
Baltimore/Washington	599	8%	8,490	59%	NA

SOURCE: *TCRP Report 63*, MarketSense.

understanding of the geographic markets supportive of the particular modes under consideration. Summarizing the geographic patterns of public transportation use at large airports is a way of identifying these characteristics.

Most discussions of airport ground transportation focus on the mode share for general categories of ground transportation available at an airport. While general mode share is a valid measure of how well ground transportation is serving an airport's entire ground access market, it is not a good measure of the market potential for an individual service. The assessment of mode share must be linked to a realistic description of a service's market area in order to develop market profiles that are comparable between airports. Focusing instead on the primary market—the area where at least 60% of all ground transportation trips to an airport are generated—indicates that primary ground transportation markets for large airports circumscribe a geographic area where trip activity is five or more air traveler trip ends per square mile.

Research conducted about market conditions supportive of three basic categories of public ground transportation (traditional fixed-route services, shared door-to-door services, and express bus service from a regional collection point) provides empirical observations about airport ground transportation markets and how air traveler trip ends are distributed within those markets.

Traditional Fixed-Route Services

Existing traditional rail services that can be considered successful (mode shares of 15% or greater in their primary market) are located in urban areas with high trip-end densities. Primary markets for the two successful services presented in this research—Washington, D.C.'s Metro-Rail and Boston's MBTA subway services—average 125 to 150 trip ends per square mile in an area encompassing 60 to 100 square miles.

No successful examples of traditional multistop bus services were found in this study. Public multistop bus services in New York and Portland, Oregon, have mode shares of 3% to 5% in their respective primary markets. Trip-end densities associated with public multistop bus services had a very wide range, from slightly more than 20 trip ends per square mile to more than 600 trip ends per square mile, indicating that there are other factors affecting the performance of this service.

Scheduled bus services operating from downtown locations and running express to the airport have considerably higher mode shares in their respective primary markets. The examples included express service from downtown Seattle to the airport with a 15% share of the market and express service from Manhattan to JFK airport with a 7% mode share. Very high densities of 475 to 600 trip ends per square mile found in narrowly defined urban downtowns support these services.

Shared Door-to-Door Services

Observations about market characteristics supportive of shared door-to-door services are limited because of the manner in which available survey information is recorded. From examples in this study, shared door-to-door services operate in a variety of markets, in which densities range from 15 to more than 300 trip ends per square mile. Mode shares in primary markets for these services range from 5% to 21%; however, the examples do not necessarily represent individual services, making the fundamental market requirements difficult to understand for this category of public ground transportation. The physical size of the primary markets identified for shared door-to-door services also has a very wide range, from 50 to 500 square miles in area.

Express Bus Service from a Regional Collection Point

Express bus transportation operating from remote suburban terminals serving San Francisco, Los Angeles, and Boston airports are examples of successful public ground transportation services. This category of public transportation is the only example found in the current research providing some measure of service to geographic areas outside of primary airport ground transportation markets in which trip-end densities are very low (less than five per square mile). All of the services operate from locations that are at least 10 miles from the airports they serve and are located at a major regional collection point where the roadway network funnels automobile access trips destined for the airport.

Available market information for express bus services indicates that the average density in the primary markets for individual services ranges from four to eight trip ends per square mile. The physical size of market areas for these services range from approximately 250 to 500 square miles. Mode shares of 17% to 31% in primary markets are the highest found among the three types of public ground transportation to airports.

A Hierarchy of Markets for Public Ground Transportation Services

Research has shown that each type of ground transportation service is associated or supported by a roughly defined range of air traveler activity. Using data from air traveler surveys, Table 6-6 lists the size of the primary market associated with the mode and the number of annualized air travelers generated from the primary market area.

Express bus service, either from downtown or a regional collection point, requires a market of roughly 1.2 million to 1.6 million annual air travelers. Shared door-to-door modes serve geographic areas generating 2.0 to 4.9 annual air travelers and rail service is found in areas with 6.6 million to 8.2 million annual air travelers. These results provide a general indication of the air traveler activity supportive of public ground transportation services at large airports and point

Table 6-6. Primary markets associated with public ground transportation services.

Mode	Size of primary market for public mode (square miles)	Total annualized origin/destination air travelers (two-way trips)
Rail/Subway	60 - 90	6,600,000 - 8,200,000
Shared Door-to-Door	60 - 450	2,000,000 - 4,900,000
Express Bus (Regional)	275 - 550	1,200,000 - 1,600,000
Express Bus (Downtown)	4	1,300,000
Multistop Bus	75	1,000,000

SOURCE: *TCRP Report 83*, MarketSense.

to the role of public transportation modes in the family of ground transportation services needed to support a large airport.

Defining the market conditions that support individual public transportation services provides analogous models to use in planning new or improved services for airport ground transportation markets.

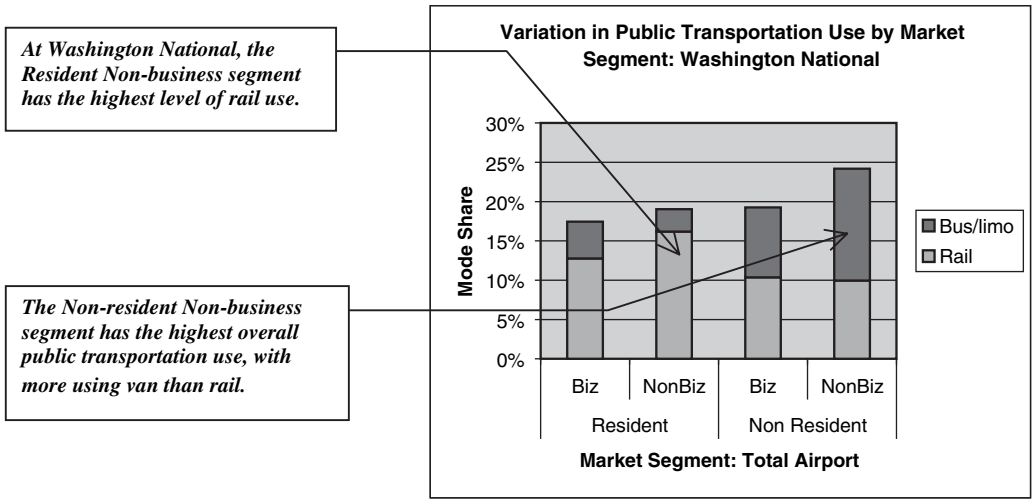
Influence of Geography and Demographics on Ground Transportation Markets

The previous section reviewed the relationship between geographic characteristics of the market and the market's ability to support various modes of airport ground access, focusing on the density of the trip ends at the non-airport end of the ground access trip. Building on that analysis, this section examines the interaction of both elements of market research: identifying strong markets in terms of geographic segmentation and demographic segmentation. Initially, the analysis should identify the geographic area where a given service makes sense. Following that assessment, the influence of demographic variables should be undertaken for the defined area.

The following example reviews the ground transportation markets in Washington, D.C. The goal is to understand the influence of two separate factors—geography and demographics—on the propensity to select public transportation services. Once geographic conditions are held constant, it becomes possible to isolate the variation in market behavior stemming from the unique characteristics of the four demographic segments.

Variation by Demographic Segment: Total Airport Market

As an introduction to examining the separate behavior of the separate market segments, the ground transportation behavior at Reagan Washington National airport is assessed. Overall, 21% of air travelers use public transportation services at Reagan Washington National and 12% use rail. Focusing more narrowly on the public transportation modes at Reagan Washington National, variations by market segment can be observed in Figure 6-4. For public transportation as a whole, the non-resident non-business segment has the highest share, with the shared-ride van capturing a considerably higher share than rail. For MetroRail, the strongest segment is the resident non-business segment, with about 16% of the market share. In terms of rail usage, the resident business traveler has a higher propensity to select rail than the non-resident business traveler.



SOURCE: *TCRP Report 83*.

Figure 6-4. Public transit variations by market segment at Reagan Washington National Airport (1998).

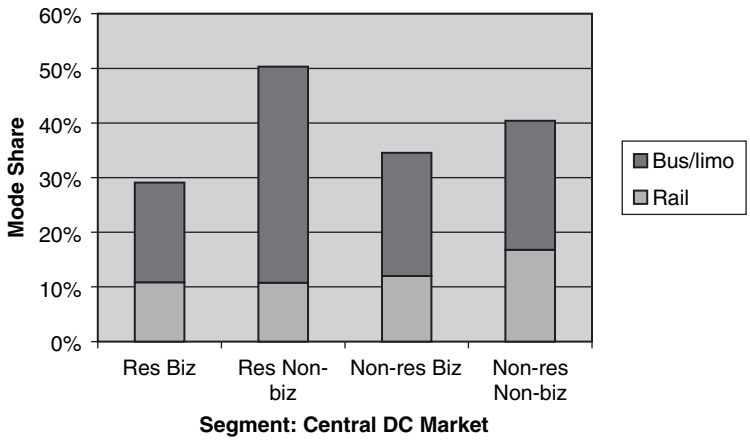
Variations among mode-choice patterns by market segment for the total airport market have been examined at several major U.S. airports. In most airports where variation was found, non-business segments had a higher public transportation share than did business travelers, with resident business travelers usually having the lowest. In several areas such as New York City, analysis of patterns for the airport as a whole revealed little variation in public mode shares. The following section examines the influence of geography on the variation by demographic segmentation. To better understand the variation by segments that are attributable to demographic factors, a specifically defined geographic area, not the airport as a whole, should be examined.

Variation by Demographic Segment: Washington, D.C.

In the analysis of factors that encourage or discourage the use of public modes in airport access, those factors that stem from inherent differences in demographic makeup should be isolated from those factors that reflect the service availability by geographic area. This section will examine ground access service to major market areas, where trip-end densities can support public transportation services.

Airport ground access patterns are examined for the three airports serving Washington, D.C.: Reagan Washington National, Washington Dulles International, and Baltimore/Washington International Airports. The market area is the common origin zone for the three separate airports. The analysis will examine the extent to which demographic segmentation does and does not reveal differences between the subgroups for a specific market area. In all cases, good public transportation services do exist. These services are defined as rail, scheduled bus, and limousine/van services (including private limousine services) operated for the purpose of shared rides. Specifically excluded are charter buses and hotel courtesy buses.

Many U.S. airports offer services that perform quite strongly in their target markets. Washington, D.C., is the premier example. For this analysis, a 39-square-mile area was defined around Washington, D.C., called "inner Washington" or "central DC." This area included major activity centers in the District of Columbia and northern Virginia and had significant concentrations of trip-end clusters for all three airports.



SOURCE: *TCRP Report 83*.

Figure 6-5. Variation by market segment: Inner Washington to Baltimore/Washington airport (1998).

The total public transportation market share attained in each of the airports seems to reflect distance as much as any other factor, including service quality. Airports close to the CBD offer low taxi fares, which compete favorably with public transportation options. From this high-density Washington, D.C., market area, 39% of those bound for Baltimore/Washington airport take public transportation; 28% of those going to Dulles take public transportation, and 19% of those going to Reagan National take public transportation. In other words, the transit share increased with distance from the airport.

Washington, D.C., to Baltimore/Washington Airport

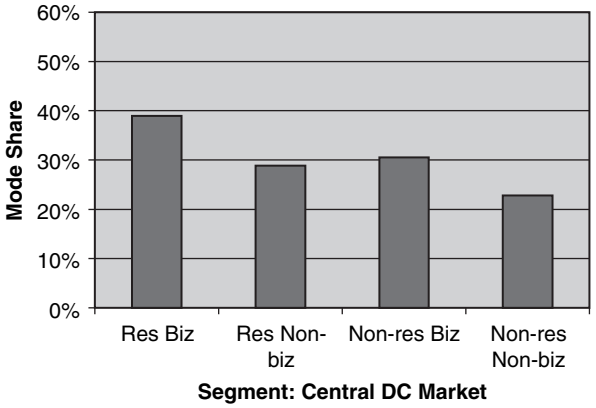
Between Baltimore/Washington airport and inner Washington, 39% of air travelers choose public transportation services. As shown in Figure 6-5, air travelers between Baltimore/Washington airport and downtown Washington, D.C., select the bus and van services over the rail option for this 30-mile journey. Most variation among the segments occurs in the selection of the bus/van modes, with the train capturing about 10% of the market for most segments. The resident non-business travelers select the bus/van service over the trains by a factor of about four to one; for the resident business traveler, it is about two to one in favor of the bus/van option. Consistent with most of the patterns examined in this chapter, the highest overall market for public transportation comes from the resident non-business traveler.

Inner Washington to Washington Dulles Airport

For the 26-mile journey from Dulles to inner Washington, the system of buses and vans in the Washington Flyer program captures about 28% of the air traveler trips. In the survey data, the option of MetroRail to West Falls Church, with a connecting bus to Dulles, does not manage to achieve a full percentage for any segment, as shown in Figure 6-6. The meaning of the variation by market segment is somewhat unclear, as resident business appears in the data with a higher mode share than resident non-business, which is a pattern usually only associated with the use of high-cost options, such as the Heathrow Express.

Inner Washington to Reagan Washington National Airport

With powerful competition from taxis, which capture 53% of the market to immediately adjacent inner Washington, public transportation gets about 19% of this market. As shown in Figure 6-7, rail gets the majority of the public transportation mode share and non-resident non-business travelers are the most likely to select bus/van services from Reagan Washington National Airport. Consistent with the most common pattern revealed in this chapter, the strongest demographic



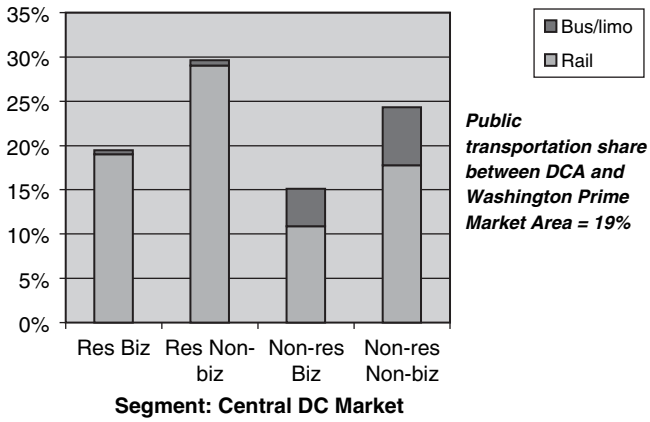
SOURCE: *TCRP Report 83*.

Figure 6-6. Variation by market segment: Inner Washington to Dulles airport (1998).

segment for rail and public transportation is the resident non-business traveler. The non-resident business traveler is the least likely to choose the public options, with a high 61% market share to taxi.

Applying the Four Market Segments: Looking for the Factor of Familiarity

Careful use of market segmentation allows the analyst to understand which factors are influential in the decision of the mode of ground access to an airport. As noted in Chapter 4, O'Hare airport as a whole has a relatively low mode share to rail. This statistic might imply that the citizens of Chicago have significantly less propensity to choose rail than do citizens of other cities. However, when the two stages of market segmentation are applied in this case—first geographic segmentation and then demographic segmentation—a more interesting picture of market behavior can be drawn. One of the reasons that the rail mode share is low for the full airport is that the airport has a wide coverage area, and the majority of travelers are simply not coming from or going to the area served by Chicago transit. When a prime market area for the rail service is defined, then the mode share observed in that area quadruples. When the second step of market segmentation is applied (i.e., within the smaller geographic area defined by the prime



SOURCE: *TCRP Report 83*.

Figure 6-7. Variation by market segment: Inner Washington to Reagan National airport (1998).

market area), rail market share for residents is revealed to be far stronger than for non-residents. In fact, between the CBD and O'Hare, the market segment with the highest share to rail is the resident business market. It can be argued that travelers who are most familiar with the very reliable service from the downtown to the airport are the most prone to select it. The non-resident business market, faced with the same travel times and costs, has a much lower share to rail.

Market segmentation of this kind has been applied to better understand concept of "familiarity" in the choice of airport access mode. In Scandinavia, data collected on all four market segments is further divided into domestic vs. international flights. In Sweden, it was found that, looking only at the non-resident business market, visitors to the city of Stockholm from within Sweden chose the fast rail at a market share (60%) almost three times that of the visitors from outside Sweden (21%) (*47*). Looking for this issue of familiarity for the Oslo fast train, the analysts found that, looking only at the non-resident business market, visitors from within Norway had a much higher mode share to rail (69%) than did visitors from outside of Norway (51%.) For the managers of the rail system, this market research then focused the management issue on the challenge of getting their marketing message out to international visitors not familiar with the system. This kind of market research can be undertaken only when other powerful factors, such as the *geography* of the trip end and the *demographics* of the trip maker, are properly taken into consideration. In both these research examples, each of the two groups approached the same geographic area, with the same trip purpose, and exhibited radically different market behavior.

Conclusion

Market segmentation by geographic area, and by demographic characteristics, is a powerful tool that allows the analyst to understand market conditions on a more disaggregate basis. It allows the comparison of "apples to apples," which in turn can reveal pronounced differences in market behavior by parallel market groups in different cities, and on different continents. It allows many variables to be held constant, while highlighting legitimate differences between target groups.

Most important, the application of the two levels of market segmentation allows the transportation manager to carefully design services that will attract more people into efficient, higher occupancy modes for airport ground access.

CHAPTER 7

Managing the Airport Landside System

Chapter 7 reviews reasons ground transportation services need to be managed and strategies for managing them, including measures to enhance public transportation services. The chapter further examines the operational and institutional challenges for implementing these strategies and identifies potential funding sources.

The Need to Manage Services

The goals of most airport operators include providing the traveling public with safe, convenient, and efficient access to all airport facilities and encouraging the use of public transportation by airline passengers and employees in a manner that is consistent with other goals of the airport and the community it serves. To accomplish these goals, airport managers typically seek to manage and control public transportation and commercial ground transportation services operating at the airport to the extent permitted by local, state, and federal laws. There are many reasons that such oversight is necessary:

- In most communities, no single state or local agency is responsible for enforcing the operations of all these commercial ground transportation services.
- The state and local agencies responsible for enforcing ground transportation services typically have (1) responsibilities for multiple industries (e.g., public utilities, towing services, as well as bus and limousine services) and (2) insufficient staff resources to inspect vehicles and enforce the established rules.
- The providers of airport ground transportation services are typically a mixture of public agencies, and large and small private businesses having a wide range of capabilities, financial resources, and interest in attracting business by providing high levels of customer service.
- Often the owners of the ground transportation services have little direct control over the behavior or actions of the drivers or operators who lease (or sublease) vehicles and who have direct contact with airline passengers.
- In the absence of regulations (because there are few institutional, legal, or financial barriers), airport ground transportation services can be readily initiated at U.S. airports by individuals who lack sufficient financial resources (to maintain their vehicles or market their services) or sufficient experience in operations, customer service, or other skills. If these operators are unable to attract sufficient customers legitimately, they may attempt to solicit business illegally, defer vehicle maintenance, or engage in other improper activities that result in diverting customers and revenues from other operators.
- New services can be difficult to introduce or promote if they do not easily come within the jurisdiction of existing regulating agencies or can be challenged by existing operators on the basis of need and necessity.

Airport Ground Transportation Management Strategies

Most airport managers require all operators of commercial ground transportation services doing business at the airport to enter into a formal business relationship with the airport authority or operating agency. (In most communities, any vehicle is allowed to drop off passengers at the airport, but only authorized or permitted vehicles are allowed to pick up passengers.) Typically, commercial vehicle operators are required to obtain an airport permit in order to do business at the airport. By obtaining and signing the airport permit, the commercial vehicle operator indicates its willingness to abide by the rules and regulations established by airport management, and pay certain specified fees. Airport rules typically regulate (1) the use of airport roadways and other facilities; (2) the age, condition, and minimum insurance coverage for the vehicles used to transport passengers; and (3) the behavior and appearance of the drivers or representatives of the commercial vehicle operators.

Airport Fees

Airport fees are typically imposed to recover airport management's costs of administering the permits and providing and maintaining the airport facilities used by the commercial vehicle operators. Commercial vehicle fees can also be established to achieve other goals:

- Encourage the use of public transportation by reducing or not charging fees. For example, most airport managers do not charge any fees to scheduled public bus and rail services picking up airline passengers and airport employees.
- Support public transportation by using fees to contribute to the cost of constructing facilities serving public transportation operators that are located on airport and used exclusively to transport airline passengers and airport employees.
- Achieve air quality goals by encouraging the use of vehicles using alternative fuels or hybrid vehicles, or by requiring the consolidated courtesy vehicle services.
- Promote efficient operations by restricting the number of trips made by individual operators or promoting consolidated operations by courtesy vehicles.
- Encourage the efficient use of airport facilities by limiting curbside dwell times or the number of circuits made around airport roadways.

Measures to Encourage Use of Public Transportation

Airport managers can encourage the use of public transportation by (1) providing a separate roadway for commercial ground transportation (e.g., commercial lanes or drives), (2) prioritizing or reserving other portions of the terminal buildings, and/or (3) developing transit hubs on the airport. These measures are described in the following paragraphs.

Commercial Lanes

A number of airports reserve separate roadways or commercial lanes, along with the adjacent curbside areas, for commercial vehicles. Access to these commercial roadways may be gate controlled, so that only authorized vehicles can enter and pick up passengers. Drivers of authorized vehicles must have proximity cards or radio frequency identification system transponders (e.g., automated vehicle identification system tags) to activate the gates or signify that they are permitted to access the passenger pick-up areas.

Prioritized Facilities

Providing staffed counters in baggage claim areas and passenger waiting areas or shelters can enhance the level of service for public transportation customers. The operations of public

transportation services can be improved by providing direct connections between airport roadways and HOV lanes or by reserving space to serve the needs of the transit providers.

Transportation Counters in Baggage Claim Areas. Access to transportation or ticket counters, typically found in the baggage claim area, can benefit potential customers and ground transportation providers. Counters can help passengers (1) identify available public transportation services; (2) readily determine the optimum route, schedule, and fares; and (3) purchase a ticket before boarding the vehicle. Operators have found that staffed counters in the terminal can assist in increasing their market recognition, round-trip ticket sales, and volume of walk-up business. Several airport operators limit the ground transportation providers that are allowed to staff counters in the baggage claim area, generally preferring those who have concession contracts or operate scheduled services.

Passenger Waiting Areas. To improve customer service, several airport managers provide heated/air-conditioned waiting areas with seating and other customer amenities located adjacent to the transportation counters or the curbside pick-up areas. Several airports provide ground transportation centers (GTCs) or intermodal centers, which provide waiting and seating areas at a remote location. GTCs are described in more detail later in this chapter.

HOV Lane Access. Public transportation operations, particularly travel speeds and travel time reliability, are enhanced by the availability of HOV or bus-only lanes linking the airport with the city center or other major destinations. In some communities, all commercial passenger vehicles are allowed to use the HOV lane, including deadheading taxis and limousines. In others, the roadways are reserved for bus use only. For example, scheduled airport buses serving Pittsburgh International Airport use the West Busway, a 5-mile-long exclusive roadway that links downtown Pittsburgh with the Borough of Carnegie. As of May 2001, about half of the 2,400 bus riders using the Busway were traveling to and from Pittsburgh International Airport. In Connecticut, HOV lanes on I-91 allow commercial ground transportation vehicles accessing Bradley International Airport (Windsor Locks, Connecticut) to bypass highway congestion.

Transit Hubs and Layover Points

At some airports, the airport curbside operates as a transit hub; public bus schedules are designed so that bus riders can transfer to other routes stopping at the airport. Such schedules improve public transit access to the airport, but the large number of non-airline passengers may add congestion at the terminal building curbside area. Often bus routes terminating at an airport are scheduled to provide layover time (or recovery time) so that drivers can take their scheduled break inside the terminal, while the unattended bus remains parked at the curbside. Airport managers can help enhance transit operations and service by working with public transit operators to allocate the required space at a mutually convenient location, while recognizing the trade-offs between encouraging the use of public transportation and promoting the efficient use of curb space. Currently, activities occurring within 300 feet of the air terminal are limited for security reasons; such a transit center would logically be located further from the terminal building.

Customer Service Enhancements

A ground transportation center or intermodal center is similar to a bus terminal or rail station located near an airport terminal facility. Customer services provided at a GTC may include covered boarding areas for buses and vans; heated and air-conditioned waiting areas; restrooms; ground transportation ticket sales/information counters; kiosks or stands selling magazines, food, beverage, and other passenger amenities; and access to rental car areas. Prior to the homeland security changes implemented after September 11, 2001, some GTCs offered airline ticketing/baggage check-in areas and baggage claim facilities. In 2007, airport operators used third-party baggage-handling companies to provide remote baggage check-in services, as discussed in Chapter 5.

By consolidating ground access services in a single location near the passenger terminal, a GTC can benefit the traveling public and encourage the use of public transportation in the following ways:

- A GTC allows commercial ground transportation passengers (and vehicles) to make fewer stops, especially at airports with multiple terminals or multiple passenger pick-up/drop-off areas, thereby reducing passenger travel times.
- A GTC reduces curbside requirements at the terminal buildings.
- A GTC reduces traffic volumes and vehicle miles of travel on terminal area roads.
- A GTC allows passengers to more easily recognize the entire array of transportation choices and thereby compare available service, fares, and travel times.
- A GTC facilitates the provision of staffed transportation and ticket sale counters and supports kiosks or small news/food/beverage concessions.
- A GTC provides a central location for commercial vehicle staging and holding.
- A GTC reduces the operating costs for the public transportation providers, especially at airports with multiple terminals or multiple commercial vehicle stops.
- A GTC can support or be combined with a consolidated rental car customer service center.

Among the key factors required to encourage use of the public transportation services at a GTC are (1) short walking distances to/from the aircraft boarding gate areas (or the availability of a reliable and comfortable linkage, such as an automated people mover that provides single-vehicle service to/from the GTC) and (2) passenger service equivalent to that provided at the airline terminal. This level of passenger service implies that passengers have the ability to check and claim baggage at the GTC and do not need to carry their bags long distances or on and off a people mover or shuttle bus.

At some airports, a GTC is simply a surface parking lot or portion of a parking structure reserved for certain commercial ground transportation services (e.g., scheduled vans/buses or courtesy vehicles). Miami International Airport is completing the early elements of the Miami Intermodal Center, an ambitious GTC that will allow airline passengers to transfer to/from regional rail systems, scheduled buses, rental cars, private vehicles, taxis, bicycles, and pedestrian ways. Ultimately, the Miami Intermodal Center will provide airline ticketing and baggage-handling facilities. In the long term, an automated people mover would link the Miami Intermodal Center with airport passenger terminal buildings, with potential connections to the Miami cruise ship berths. The Miami Intermodal Center is being funded, in part, through loans advanced through the Transportation Infrastructure Finance Act. Long-range plans for the center include a mixed-use development including office, hotel, retail, and entertainment space.

Automated Traffic Monitoring and Management Programs

More than 25 U.S. airports use automated vehicle identification (AVI) systems to improve the management of commercial vehicle activity. AVI systems provide reliable data on the volume of vehicle trips by location, date, and operator. Common AVI system applications at airports include monitoring commercial vehicle activity, controlling access to restricted areas, dispatching/controlling shuttle bus and taxi operations, and providing shuttle bus passengers with arrival time and stop location information.

AVI systems can allow airport managers to promote the efficient use of airport facilities by establishing the following:

- Restrictions on number of trips—The AVI system can record the number of trips each ground transportation operator makes so that airport management can set limits on hourly, daily, and/or monthly trips.
- Measures to encourage consolidated operations—Management can promote consolidated courtesy vehicle operations by charging participating ground transportation operators

discounted access fees (calculated on a per-trip basis). AVI systems can record the number of trips made by each operator and identify those that are not participating.
- Dwell time restrictions—Managers can encourage efficient use of curbside areas by placing limits on dwell time (the length of time a commercial vehicle remains parked at the curbside or is on airport roadways). AVI systems can track when a vehicle enters and exits a curbside area (or airport property) and identify vehicles that exceed prescribed limits.
- Restrictions on the number of circuits—Airports can set restrictions on the maximum number of permitted circuits that a commercial vehicle can make around the airport roadway system within an established time period. These restrictions are intended to discourage drivers of empty (or partially empty) vehicles from circling continuously to advertise their service or solicit additional passengers. The AVI system automatically detects any van exceeding a circuit limit and provides documentation supporting penalties and fines.
- Restricted access to commercial lanes—As noted above, some airports issue AVI transponders to control access to commercial lanes or passenger pick-up areas. For these airports, the AVI system also provides enforcement capability by allowing airport management to deactivate the transponders when providers violate airport rules.
- Schedule adherence—The AVI system can monitor the headways or trips per hour or day made by each scheduled ground transportation operator. These data can be used to confirm adherence to posted schedules or maintenance of established maximum passenger wait times.
- More efficient vehicle dispatching—At airports where AVI transponders have been installed on taxis and limousines, the AVI systems can be used to dispatch taxis and pre-arranged limousines from a holding area (or stack) to the appropriate curbside area and to ensure the correct sequencing of these vehicles.

Business Arrangements at Airports to Improve Service to the Traveling Public

Airport managers use various business arrangements with ground transportation operators to provide the traveling public with a high level of customer service and to encourage the use of public transportation. The most common forms of business arrangements are open access, exclusive or semi-exclusive concession agreements, and third-party management contracts. Increasingly, airport managers appear to be establishing exclusive or semi-exclusive agreements. With these arrangements, the airport operator has a better ability to ensure service quality and performance, and the operator has a greater financial incentive to maintain the desired standards.

Open Access

With open access systems, any ground transportation operator, properly licensed by the local regulatory authority, can pick up passengers at an airport. The primary benefit of this system is that any business, large or small, can serve the airport. Such open access, in turn, provides customers with options and promotes competitive fares and services. Small ground transportation operators often favor open access and lobby local politicians to implement or maintain such arrangements. Open access systems function well in communities with multiple, well-operated transportation providers (e.g., multiple taxi companies), and with effective enforcement. Key concerns with an open access system include the following:

- Lack of control over service levels—Airport management has little ability to control the level of service standards for vehicle appearance/maintenance or driver appearance/knowledge. Instead, other agencies are responsible for specifying and enforcing the minimum standards for vehicles and drivers.

- Inability to balance supply and demand—In communities where the number of ground transportation providers exceeds passenger demand, operators will experience long waits and earn less revenue. Some drivers may be tempted to improperly solicit passengers or engage in other illegal activities. Conversely, in a community with few taxis or other ground transportation services, there may not be enough airport service during late night hours, periods of inclement weather, or when there are requests for service at other locations (e.g., downtown or a convention center).

Exclusive and Semi-Exclusive Concessions Agreements

Most airport managers have agreements with concessionaires to provide certain services on an exclusive or semi-exclusive basis. Concessionaires typically include hotels, food and beverage sellers, and rental car companies. Concession agreements specify the services that the companies are allowed to offer at the airport, the manner in which they are to be offered, the prices or mark-up permitted, and the airport fees and charges. The fees are normally calculated on the basis of some measure of activity (e.g., percentage of gross revenues or per deplaning passenger) and include a required minimum annual guaranteed payment. Concession agreements are usually awarded through a competitive bid or proposal process that allows airport management to consider the experience of the operator, service quality, and fees.

Many airports also use exclusive or semi-exclusive concession agreements for ground access services, including taxi, shared-ride van, and scheduled bus or van service. As part of a concession agreement, airport management typically specifies the minimum required service standards. These standards may include the following:

- Minimum hours of operation—For example, a concessionaire may be required to ensure that vehicles are waiting at the airport from the time of first arriving flight until 1 hour after the last scheduled arriving flight.
- Adequate supply of vehicles—A concessionaire may be required to ensure that sufficient vehicles will be available to serve the expected volume of deplaning passengers at all times, particularly at airports with a small public transportation market or that experience seasonal fluctuations in demand.
- Level of customer service—The concession agreement may specify the maximum waiting times, the maximum number of en route stops, requirements for transporting disabled passengers, acceptance of credit cards, and requirements for schedule adherence.
- Fares or surcharges—Airport management may require the concessionaire to specify its fare structure, including applicable surcharges (e.g., for baggage).
- Geographic coverage—The request for proposals or bids would typically specify the minimum geographic area(s) that the concessionaire would serve.
- Vehicle standards—Concession agreements typically specify the required standards for vehicle safety (e.g., properly functioning brakes, lights, and emissions controls), cleanliness (e.g., prohibition of dents, rust, or torn or soiled seats), convenience and comfort (e.g., air conditioning), two-way radio, exterior signage or lettering, and maximum age of vehicle. The agreement may also specify vehicle size, passenger capacity (e.g., number of seats), and baggage room, if these standards are not already defined by local authorities.
- Driver standards—Agreements typically establish or support airport standards for expected driver behavior (e.g., no solicitation), appearance and attire, personal hygiene, local knowledge, and/or customer service skills.

Balancing Supply and Demand

Concession agreements allow airport management to balance supply and demand by requiring the contractor to direct company-controlled drivers to serve (or not serve) the airport as warranted.

The concessionaire is responsible for meeting these requirements while also ensuring that the drivers are assigned an appropriate number of trips and receive an opportunity to earn a fair salary. In absence of a concession agreement, airport managers have only a few other options to balance supply and demand:

- Limiting the number of vehicles serving the airport each day—For example, managers can implement odd-even license plate programs that allow only half of the authorized taxis to serve the airport on a given day.
- Closing the entrance to the hold lot—This action effectively closes the airport to commercial vehicle operators and prevents additional vehicles (e.g., taxis) from entering the airport.
- Increasing the minimum standards—By establishing higher standards for ground transportation providers (e.g., minimum fleet size or insurance requirements), vehicles (e.g., maximum age of vehicles), or driver qualifications, airport management can discourage less qualified companies from serving the airport.

With a concession agreement, airport management typically grants the concessionaire certain privileges, including access to preferential curb space and to ticket/information counters in the terminal building, and the exclusive right to provide service to certain geographic areas (e.g., downtown). For sufficiently lucrative services, the airport may be able to require the concessionaire to support services that are less lucrative or not self-supporting. For example, airport management can require the concessionaire awarded a shared-ride van or taxi contract to also operate or provide a scheduled bus service to downtown or other destination. Such arrangements are particularly feasible in communities where a major corporation owns both a major taxi service and provides scheduled airport bus service or, alternatively, in communities that have established goals for disadvantaged business participation in airport services.

Third-Party Management Contracts

Airport management may also contract with a third party to manage and enforce ground transportation operations at the airport. For example, at San Francisco International Airport, a third-party contractor is responsible for dispatching taxis, and controlling and monitoring charter buses and limousine operations. At Portland (Oregon) International Airport, a third-party contractor is responsible for providing information, directing passengers to ground transportation services, dispatching taxis, and monitoring operations along the commercial roadways. While management of both airports retains the responsibility for establishing policies, fees, and regulations, the third-party contractor can significantly influence the level of service provided to the traveling public.

Regulatory Considerations for the Introduction of New Services

Airport managers must consider numerous regulatory, institutional, and market factors when introducing new airport ground transportation services. Some of the issues and challenges related to regulating and promoting public transportation services are described in the following sections.

Challenges of Introducing New Services

In most communities, it is necessary to obtain state authority to introduce a new door-to-door, shared-ride, or scheduled transportation service. Typically, the operator of the new ground transportation service must meet the following requirements:

- Describe where and how it will serve the public, including the proposed fares or tariffs
- Demonstrate sufficient demand for the service

- List all other routes that operate partially or wholly within the proposed service area
- Present a business plan indicating the expected revenues and costs of operation
- Provide a financial statement and evidence of insurance

In some instances, the operator must demonstrate that the local public transit operator is unable to meet the transportation needs of the target market or to describe the impact on existing public transit services. The operator is usually required to provide letters from the public (e.g., local communities or other sources) and evidence to demonstrate need and necessity for the proposed service. Existing operators are permitted to file objections to the statements of need to introduce new services and to challenge the new operator's ability to sustain a business without adversely affecting existing businesses. The operator can apply for an airport permit only after obtaining the required state or local operating permits.

These procedures may present a significant hurdle for a small operator, particularly an operator without a properly defined business plan or service plan, without prior experience in the industry, and without sufficient capital resources. Typically, airport management does not have programs to support or assist new businesses seeking to initiate transportation service.

Competition and Enforcement

Considerations when introducing new public transportation services include the perceived and actual competition between differing classes of ground transportation services, the need to be able to enforce regulations restricting and controlling ground transportation services, and the potential overlap between the services provided by each class of service. Balancing the differing (and competing) requirements of multiple services may be especially challenging when selecting ground transportation services for a planned GTC. Some of those challenges involve the following services and concerns:

- **Private vehicles**—The primary purpose of a GTC is to serve commercial ground transportation services. Therefore, airline passengers traveling in private vehicles would likely be directed to space at the terminal building curbsides, while the GTC would be reserved for commercial ground transportation services.
- **Private vehicles versus privately owned limousines**—Airline passengers traveling in privately owned or corporate-provided limousines would normally expect to receive a level of service similar to that available to passengers traveling in private vehicles. Therefore, privately owned limousines would likely be directed to curb space at the terminal building.
- **Privately owned versus pre-arranged limousines**—If passengers perceive that being picked up and dropped off at the terminal provides a higher level of service and convenience than being picked up and dropped off at the GTC, they will request that privately owned limousine services stop at the terminal building rather than the GTC. As it would be difficult for police to readily distinguish between a privately owned limousine and a pre-arranged limousine or town car service, it would be difficult for police to prevent privately owned limousines or town car services from stopping at the terminal building curbsides. If police are unable to prevent, or enforce regulations prohibiting, use of the terminal curbside by pre-arranged limousines, these limousines would likely be permitted to use the curbsides.
- **Pre-arranged limousines versus taxis**—Taxi operators perceive limousines as competitors. If pre-arranged limousines are permitted to use the terminal building curbsides, taxi operators would likely pressure airport management (or perhaps city or county government leaders) to allow taxis to use the curbsides. The taxi operators would claim that they would lose customers to their competitors (i.e., limousines) and/or that their customers would not use the GTC. At airports that have planned GTCs, management has agreed to allow taxis to drop off and pick up customers at the terminal building curbside.

- **Taxis versus shared-ride vans**—The operators of shared-ride vans perceive that they are competing with taxis for on-demand customers. If taxi operators are permitted to drop off and pick up customers at the terminals, the operators of shared-ride van services would likely demand the right to provide equivalent services, especially if the operators perceive that customers value access to the terminal building over access to the GTC. Again, as with the taxi operators, the decision would likely involve others besides airport management.
- **Shared-ride vans versus scheduled vans/buses**—The operators of scheduled vans and buses, particularly at downtown locations, perceive that they compete with the operators of shared-ride van services. The scheduled van operators will likely resist picking up passengers at a location that they perceive provides an advantage to their competitors.
- **Courtesy vehicles**—Local rental cars, hotel/motels, and other operators of courtesy vehicles would also likely demand that they be permitted to drop off and pick up customers at the terminal buildings rather than at a GTC.

As a result of the enforcement challenges and competitive factors described above, some airport managers have determined that the only users of the GTC would be public transit services and scheduled buses and vans. All other transportation services were directed to pick up and drop off passengers at the terminal building. While such allocation decisions may enable airports to offer a range of ground transportation services, this approach could discourage the use of public transportation by airline passengers or employees, particularly if baggage check-in or baggage claim services are not available at the GTC.

Factors Governing Airport Financial Operations

Airport authorities exist in a variety of forms, and their specific powers and responsibilities are established by their enabling legislation. Some airport authorities are independent public bodies created by state legislation; others are municipal corporations or agencies created by one or more local jurisdictions under general state statutes governing the establishment of independent authorities. Many airport authorities sponsored by state or local legislation operate relatively independently of their governmental sponsors, while remaining responsive to political concerns and priorities. In other cases, the sponsoring jurisdiction retains some oversight of airport operation, such as approval of operating budgets and bond issues.

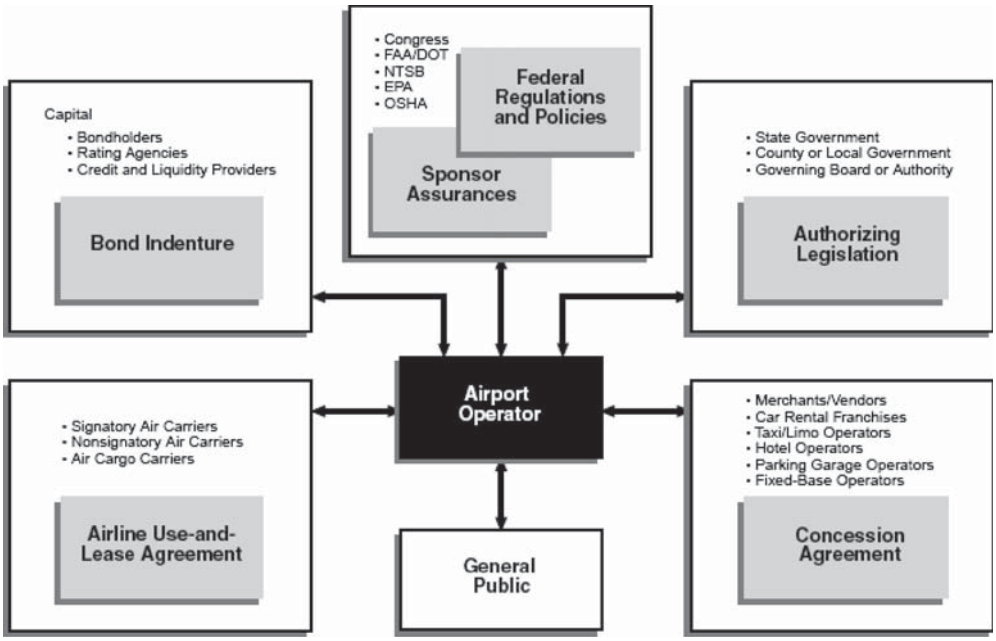
This section provides an overview of the key legal, financial, institutional, and jurisdictional factors affecting public transportation to airports. As illustrated in Figure 7-1, typical factors include (1) federal regulations and policies and grant assurances made by airport sponsors, (2) the airport operator's authorizing legislation, (3) the bond indenture for the airport, and (4) the airport's airline use-and-lease agreements. The airport's concession agreement(s) also affect the airport operator's net revenue and financial capacity.

Authorizing Legislation

Airport operators that are independent entities or enterprise funds of a city, county, or state government typically are governed by authorizing legislation or a local charter that establishes the airport operator's organizational structure, responsibilities, and powers. The authorizing legislation may specify facilities, such as airport access roads, that the airport operator is responsible for developing, maintaining, or both.

Bond Indenture

The bond indenture—also called a bond resolution or bond ordinance—provides the legal basis for issuing airport revenue bonds and defines the terms under which additional bonds



SOURCE: Jacobs Consultancy.

NOTES: FAA/DOT—Federal Aviation Administration/Department of Transportation
NTSB—National Transportation Safety Board
EPA—Environmental Protection Agency
OSHA—Occupational Safety and Health Administration

Figure 7-1. Factors governing airport financial operations.

might be issued, including the need for revenue-generating projects. The bond indenture defines what may or may not be included in the definition and computation of airport revenues and expenses. The indenture establishes various funds and accounts for the payment of interest and principal on the bonds from airport revenues; establishes the priority of payments for all of the airport operator's obligations; and sets forth covenants between the issuing entity and the bondholders, including a rate covenant requiring the airport operator to set rates and charges to produce specified levels of revenues. Some airport bond indentures may also include principles to guide the establishment of rates and charges for the use of airport facilities.

Airline Agreement

An airport–airline agreement generally stipulates the rights, privileges, and obligations of the airport operator and the airlines serving the airport and sets forth the manner in which the rentals, fees, and charges paid by the airlines for use of the airport are calculated and adjusted. The airline parties in such use-and-lease agreements are called "signatory airlines."

Many airline agreements contain provisions that require a certain number or percentage of the signatory airlines to approve or disapprove certain decisions of the airport operator, particularly capital expenditures. These provisions are known as "majority-in-interest" (MII) provisions and are designed to give the signatory airlines some control over the long-term financial obligations undertaken by the airport operator for which the airlines are committed to pay.

Some airports, however, are not governed by such agreements; instead, rates are established by ordinance or regulation. In those instances, the airport operator typically adopts a policy for calculating user rentals, fees, and charges and applies those procedures consistently from year to

year. The FAA's Policy Regarding Airport Rates and Charges broadly governs airport rate-setting in the absence of an airline agreement and dispute resolution.

Concession Agreements

Many airport operators enter into agreements with service providers, including parking garage operators, rental car agencies, and vendors of food, news items, and gifts. These agreements are often the largest source of non-airline revenues at most airports and do not govern how those revenues can be used.

Sources of Funding

FAA grant assurances require airports in the United States to be as financially sustaining as possible. Accordingly, rentals, fees, and charges should cover all operating and capital costs, including retirement of debt. The capital requirements of airports are significant today and are expected to increase in the future. The main sources of funds to build airport projects include the following:

- **Internally generated capital resulting from retained airport revenues**—Airport operators charge and collect rentals, fees, and charges for the lease and use of facilities to passenger and cargo airlines, concessionaires, and others providing airport support services.
- **Bond proceeds**—Four basic types of bonds are issued to fund airport capital improvements: (1) general airport revenue bonds (GARBs) secured by the revenues of the airport and other revenues as may be defined in the bond indenture; (2) bonds backed either solely by passenger facility charges (PFC) revenues or by PFC revenues and airport revenues generated by rentals, fees, and charges; (3) special facility bonds backed solely by revenues from a facility constructed with proceeds of those bonds; and (4) general obligation bonds supported by the overall tax base of the issuing entity (the airport sponsor).
- **PFC revenues**—Subject to authorization by FAA, commercial service airports are allowed to impose a $1, $2, $3, $4, or $4.50 PFC per enplaning passenger. The $4 and $4.50 PFC amounts are pursuant to the Aviation Investment and Reform Act for the 21st Century (AIR-21) FAA reauthorization. PFC revenues may be used as they are received (on a pay-as-you-go basis) to directly pay for approved capital projects or they may be used to pay debt service on bonds backed by PFC revenues.
- **Federal grants**—Federal Airport Improvement Program (AIP) grants are funded by aviation-user taxes. AIP grants are made available to airport operators in two forms: (1) entitlement funds, which are apportioned to airports based on levels of passenger traffic and landed weight (for cargo entitlement funds), and (2) discretionary funds, which are distributed based on the ranking of the airport's projects in relation to other projects deemed most important for improving the national air transportation system. Federal funding is also occasionally provided for airport surface transportation projects by FHWA and FTA.
- **State and local grants**—State funding for airport and aviation-related projects typically comes from a variety of sources. Some of these, such as outright grants and matching share for federal AIP grants, represent direct funding for airports. Others, such as registration, licensing fees, and dedicated or special taxes (e.g., fuel taxes), are collected as funding for more general state expenditures. Support from local government generally takes the form of bonds backed by general taxes, but can also include operating funds from local taxes.

The distribution of funding sources for large- and medium-hub airports nationwide is summarized in Table 7-1. As shown in the table, airport revenue bond proceeds constitute the most significant source of funding, accounting for 58% of total funding for airport capital projects. AIP grants accounted for 21%; PFCs accounted for 11%; and retained earnings and local revenue accounted for 10% of the total.

Table 7-1. Estimated U.S. airport capital sources (5-year annual average, 2000–2004).

Capital Funding Source	Funding ($ billions)	Funding (% of total)
Bond Proceeds ("new money" bonds backed by airport revenues, including about 30% of PFC collections)	$ 6.9	58%
AIP Grants	$ 2.4	21%
PFC Collections (approximate 70% share used for pay-as-you-go funding)	$ 1.3	11%
Pay-as-you-go Funding (from retained earnings, state & local grants, other)	$ 1.2	10%
Average Annual Funding	***$11.8***	***100%***

SOURCE: Jacobs Consultancy, FAA, U.S. Treasury, Thomson Financial Securities Data, ACI-NA.

Federal Funding and Financial Oversight of Airports and Airport Access Projects

In developing any strategy for funding off-airport access projects, it is important to recognize the challenges uniquely associated with each funding source and to identify the external approvals required for each, if any. This summary examines federal funding and financial oversight of airports and focuses specifically on AIP grants, PFCs, and use of airport revenue.

AIP Grants

The federal AIP provides grants to support eligible capital projects. AIP funds come from the Aviation Trust Fund that is funded by taxes or user fees, including the airline ticket tax, a tax on air-freight waybills, an international departure fee, and a tax on general aviation gasoline and jet fuel.

Eligible Access Roads. AIP grants can be used for airport access roads that meet the following conditions as provided in FAA Order 5100.38C, AIP handbook, Paragraph 620.a:

- The access road may extend only to the nearest public highway of sufficient capacity to accommodate airport traffic.
- The access road must be located on the airport or within a right-of-way acquired by the airport sponsor.
- The access road must exclusively serve airport traffic.

Any section of the roadway that does not exclusively serve airport traffic is ineligible. More than one access road is eligible if the airport surface traffic is of sufficient volume to require more than one road.

Related facilities such as acceleration and deceleration lanes, exit and entrance ramps, street lighting, and bus stops are also eligible when they are a necessary part of an eligible road.

Certain access roads and related facilities are not eligible for AIP funding, including the following:

- Roads necessary to maintain FAA facilities installed under the Facilities and Equipment Program (which is budgeted separately from AIP)
- Roads exclusively serving industrial or non-aviation–related areas or facilities
- Roads exclusively used for connecting parking facilities to an access road

Eligible Rapid Transit Facilities. Facilities within the airport boundary that are necessary to provide a connection to a rapid transit system may be eligible if they primarily serve the airport. FAA reviews such projects on a case-by-case basis. When an on-airport facility would have

both airport and general use, FAA has limited AIP and PFC funding to components of the project that are reserved for exclusive airport use.

Passenger Facility Charges

In 1990, the U.S. Congress authorized PFCs to provide airports with an additional source of funding for capital projects. Under U.S. DOT regulations, a public agency that controls a commercial airport may be authorized to impose a PFC of $1, $2, or $3 per enplaned passenger.

Projects eligible for PFC funding include those that preserve or enhance safety, capacity, or security of the national air transportation system; reduce noise from an airport that is part of the system; or furnish opportunities for enhanced competition between or among air carriers. In 1991, federal guidance made ground transportation projects eligible for PFC funding if the public agency owns or acquires the right-of-way and any necessary land, although the FAA did not set any eligibility restrictions on the mode of transportation for airport access projects nor did it impose any requirements on the geographic proximity of the project to the airport. Typically, these projects are limited to areas on the airport or adjacent to the airport in light of the right-of-way requirement. Such projects are subject to FAA review on a case-by-case basis.

AIR-21 authorized airports to collect PFCs of $4 and $4.50, but included additional eligibility requirements on the amounts that exceed $3. Large- and medium-hub airport operators must demonstrate that (1) a project will make significant contribution to improving safety and security, to increasing competition, to reducing current or anticipated congestion, or to reducing the impact of noise and (2) the project cannot otherwise be paid for from AIP. For surface or terminal projects, airport operators must be able to demonstrate that they have already made adequate provision for financing airside needs. In addition, large- or medium-hub airport operators charging a $4 or $4.50 PFC must forgo 75% of their AIP entitlements.

Use of Airport Revenues

Four federal statutes govern the use of airport revenue:

- Airport and Airway Improvement Act of 1982 (AAIA), as amended—AAIA directed airport operators to "use all revenues generated by the airport for the capital or operating costs of the airport, the local airport system, or other local facilities which are owned or operated by the owner or operator of the airport and directly related to the actual transportation of passengers or property."
- Airport and Airway Safety and Capacity Expansion Act of 1987—Among other provisions, this act narrowed the permitted uses of airport revenues to non-airport facilities that are "substantially" as well as directly related to actual air transportation.
- FAA Authorization Act of 1994—This act strengthened enforcement of revenue-use requirements and required annual reporting of airport finances and amounts paid to other units of government. Section 110 added a policy statement concerning the pre-existing requirement that airports be as self-sustaining as possible.
- FAA Authorization Act of 1996—This act codified the pre-existing grant assurance–based revenue-use requirement and expanded the application of the revenue-use restriction to any airport that has received federal assistance.

In 1999, the FAA Policy and Procedures Concerning the Use of Airport Revenue clarified a number of procedural and substantive rules that had been in effect since 1982. Key provisions are explained in the following paragraphs.

Ground Access Capital Costs. Airport revenue may be used for the capital costs of an airport ground access project or for the part of a local facility that is owned or operated by the airport owner or operator and is designed exclusively for the use of air transportation of

passengers or property, including use by airport visitors and employees ("incidental use" by non-airport users is permitted).

Ground Access Operating Costs. Airport revenue may also be used to pay the operating costs of an airport ground access project that can be considered an airport capital project or, as is the case for capital costs, the operating costs of the part of a local facility that is owned or operated by the airport owner or operator and is directly and substantially related to the air transportation of passengers or property. Allowing airport revenues to be used to pay the operating costs of a ground access project represents a change in FAA policy. (Generally, if a facility is not on land owned or controlled by the airport, airport revenues cannot be used to pay for it.)

Use of Property for Publicly Owned Transit Projects. Airport property can be made available at less than fair market value for public transit terminals, rights-of-way, and related facilities without being considered a violation of federal statutes governing airport finances if (1) the transit system is publicly owned and operated (or operated by contract on behalf of the public owner) and (2) the facilities are directly and substantially related to the air transportation of passengers or property. A lease of nominal value would be consistent with the requirement for airports to be self-sustaining.

Use of Property for Private Transit Projects. The final policy states that, generally, private ground transportation services are comparable to private taxi and limousine services and are charged fees for the non-aeronautical use of the airport. These private entities are commercial enterprises that operate for profit, that are not supported by general taxpayer funds, and that are a significant source of revenue for the airport. However, in cases in which publicly owned transit services are limited and in which a private transit service (bus, rail, or ferry) provides the primary source of public transportation, the airport operator may make airport property available at less than fair market value.

Federal Credit Assistance

The Transportation Infrastructure Finance and Innovation Act (TIFIA) established a direct federal credit program. TIFIA authorizes the U.S. DOT to provide direct loans, standby lines of credit, and loan guarantees to public and private sponsors of large surface transportation projects that meet certain eligibility criteria. Project sponsors of highway, mass transit, passenger rail, and intermodal facilities must submit an application to U.S. DOT for approval of funding assistance. TIFIA funding is limited and projects are selected on a competitive basis.

To be eligible to receive TIFIA credit assistance, a project must be "of national significance" and must meet the following five criteria:

- Before an agreement is made for federal credit assistance, the project must be in an approved state transportation improvement plan (STIP).
- The entity undertaking the project must submit a project application to the U.S. Secretary of Transportation.
- Eligible project costs must equal or exceed the lesser of $100 million or 50% of the amount of federal-aid highway funds apportioned to the states for the most recently completed fiscal year.
- Project financing must be repayable in part or in whole from tolls, user fees, or other dedicated revenue sources.
- If the project is not undertaken by a state or local government or an agency or instrumentality of a state or local government, the project must be included in both the state transportation plan and an approved STIP.

Grant Anticipation Revenue Vehicles (GARVEEs) and Transit GARVEEs

Other federal legislation also permits federal aid funds to be used for debt-service and debt-issuance costs, which permits states to raise funds for current projects by issuing bonds backed by future federal aid highway funds.

Environmental Implications of Federal Funding for Airport Access Projects

Funding for airport access projects is subject to the provisions of both the National Environmental Policy Act (NEPA), the Clean Air Act Amendments of 1990 (CAAA), and about 20 other federal environmental laws, regulations, and executive orders. NEPA is the basic national charter for the protection of the environment and establishes policies and sets goals. Regulations at 40 CFR Part 1500 et seq. provide means to carry out NEPA. For certain types of federally funded or federally approved transportation projects, NEPA will require the preparation of an Environmental Impact Statement. Moreover, certain types of transportation projects will require the determination of air quality conformity pursuant to CAAA (ensuring that the proposed project will not worsen or impede efforts to reduce violations of the National Ambient Air Quality Standards in non-attainment or maintenance areas).

CHAPTER 8

Improving Public Transportation Mode Share for Employees

Chapter 8 describes ways to improve the public transportation mode share for airport employees. The chapter begins with a discussion of factors that influence employee use of public transportation. Next, the results of a survey of the employee commuting patterns at representative airports are summarized and key considerations for improving employee public transportation mode share at airports are presented.

The Objective and the Challenge

Airport employees represent a large potential market for public transportation. As Table 8-1 shows, the average number of daily employees at major U.S. airports can exceed 40,000. There are a number of challenges, however, to implementing successful public transportation services for employees at an airport. First, airports are usually located in suburban locations, which can be difficult to serve with traditional transit services. Second, airports are in operation 24 hours a day, and many work shifts do not coincide with typical transit schedules. Third, airports have multiple employers, each of whom has a variety of constraints and regulations regarding shift timing, parking reimbursement, overtime, etc. Taken together, these challenges can affect employee mode choice.

Factors That Influence Employee Use of Public Transportation

Although data on employee transit use are limited, four factors are believed to influence the mode choice of airport employees:

- **The availability of transit service at the employee residences.** Is transit service to the airport reasonably accessible in areas where employees live? In many communities, available public transportation links the airport with the regional core or major activity centers. Employee residences, however, may be concentrated in other corridors where housing is less expensive and travel is less congested. Public transportation connections to the airport may not be readily available in these locations.
- **The accessibility of the employee's worksite to transit service.** Does the transit service provide a convenient connection to the employee's final destination on the airport? Many airport employees work in areas beyond the passenger terminal, such as ramp areas, cargo centers, aircraft maintenance facilities, and other employment sites scattered around the airport property.
- **The availability of transit during non-traditional work hours.** Does the transit service offer convenient frequencies of service when employees need to travel to work? Many airport employees

Table 8-1. Number of employees at selected airports.

Airport	Size *(a)*	Estimated 1998 average daily employees
New York JFK	L	41,000 (1987)
Dallas/Fort Worth	L	40,000 (2000)
Chicago O'Hare	L	40,000
Los Angeles	L	40,000
San Francisco	L	31,000
Phoenix	L	23,665
St. Louis	L	19,000
Denver	L	17,400
Boston	L	14,600 (2000)
Houston	L	14,406
Salt Lake City	L	13,026
Seattle	L	11,375
Oakland	M	10,500
Tampa	L	8,219
Las Vegas	L	8,000 (2000)
Portland (Oregon)	M	5,000
San Jose	M	3,500
San Diego	L	3,000
Omaha	M	2,500 (2000)
Sacramento	M	1,500 (2000)
Orange County John Wayne	M	1,000 (2000)

(a) FAA hub size: L = Large, M = Medium, S = Small

SOURCE: *TCRP Report 83*, Jacobs Consultancy, based upon data provided by individual airport operators. Data was provided for 1998, unless otherwise noted.

have schedules dictated by aircraft operational patterns that are outside of the typical peak-period commuting hours of 6 a.m. to 9 a.m. and 4 p.m. to 7 p.m.

- **The availability and cost of parking for employees.** How much do employees pay for parking? While some airports are providing subsidized car pools or transit passes, few employees pay market rate parking fees.

These factors were used as a starting point to expand the available knowledge base for identifying ways to improve employee usage of public transportation at airports.

To gain additional insights into the factors affecting employee use of public transportation, surveys were distributed to 34 U.S. airports. Approximately one-third of the surveys were returned and were evenly split between large hub airports and small/medium airports. Survey findings are summarized in the following sections.

Transit Service Characteristics

Information from the survey responses concerning the existing transit service at the airport such as type, frequency, stop locations, and employee transit mode shares is summarized in Table 8-2.

Transit Service

Transit service to airports is typically limited in terms of the number of routes and the frequency of service. Only Chicago O'Hare, Reagan Washington National, and Boston airports have relatively robust service with the presence of a rapid rail station on each airport.

Los Angeles International Airport has a significant amount of service nearby, but routes serve a transit center and rail station remote from the terminal. Most bus routes only run twice an hour.

Table 8-2. Airport transit service characteristics summary.

Airport		No. of Transit Routes		Bus Frequency per Route		Rail Frequency per Route		Number of Stops		Other
	Size *(a)*	Bus	Rail	Peak (trips per hour)	Off-peak (trips per hour)	Peak (trips per hour)	Off-peak (trips per hour)	Terminal	Non-terminal	On-airport shuttle?
Birmingham (AL)	S	0	0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	No
Boston	L	2	1	1-3	0-2	15	5-6	4	1	Yes
Chicago O'Hare	L	3	1	1-2	1	8-10	6-8	1	1	Yes
Dallas/Ft. Worth	L	2	1 *(b)*	1-2	1-2	2 *(c)*	1 *(c)*	2	4	Yes
Denver *(d)*	L	8	0	1-2	0-2	n.a.	n.a.	2	0	Yes
Orange Co. John Wayne	M	2	0	2	1	n.a.	n.a.	1	0	No
Las Vegas	L	2	0	2-5	2-3	n.a.	n.a.	1	2	No
Los Angeles *(d)*	L	12 *(e)*	1 *(b)*	1-4	1-4	9	4	9	?	Yes
Louisville	M	3	0	2	1-2	n.a.	n.a.	1	1	No
Omaha	M	0	0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	No
Phoenix *(d)*	L	2	0	4	2	n.a.	n.a.	3	0	No
Reagan National	L	1	2	4	6-8	12-20	6-8	1	0	Yes
Sacramento	M	1	0	1	0-1	n.a.	n.a.	2	0	Yes
Salt Lake City	L	3	0	1-2	0-1	n.a.	n.a.	1	3	No
Seattle *(d)*	L	6	0	1-3	1-2	n.a.	n.a.	1	0	Yes
San Diego	L	1	0	6	4-6	n.a.	n.a.	3	0	No

(a) FAA hub size: S = small; M = medium; L = large.
(b) Remote rail station.
(c) Frequency based on shuttle bus to terminal from remote rail station.
(d) Remote bus station.
(e) Linked to terminals with shuttle bus; frequency based on Metropolitan Transit Authority bus schedule.

SOURCE: *TCRP Report 83*, Jacobs Consultancy, based upon data provided by individual airport operators.

In addition, only two bus routes serve the west end of the airport, a major employment center where airline maintenance facilities and air cargo hubs are located.

Of the other airports that responded, only Las Vegas and Orange County, California, airports have buses that run more than twice per hour.

Transit Mode Share

The data in Table 8-3 show that for airports with bus service only, typical employee transit mode shares are approximately 2% to 5%. Most airports with bus service only are toward the lower end of the range. The exception is Denver International Airport, which has SkyRide, a successful bus system oriented to the airport. SkyRide is a semi-express bus service from numerous free park-and-ride lots directly to Denver International Airport.

Airports with rail service on the airport have significantly higher employee transit mode shares. O'Hare International Airport (Chicago) has the highest reported employee transit use with more than 23% of employees commuting to work on a typical day using rail or bus. Nearly all of these employees use rail. Most of the rail use was reported by airport employees who do not work for any of the airlines. Non-airline airport employees reported that 34% used rail, while airline employees reported 7% used rail. Non-flight crew airline employees reported the lowest

Table 8-3. Airport employee public transportation mode shares.

Airport		Employee Mode of Access						
		Public Transportation						
	Size (a)	*Local bus*	*Express bus*	*Private bus/van*	*Rail*	*Subtotal—transit*	*Non-transit*	***Total***
Birmingham (AL)	S	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100%
Boston	L	1.0%	4.5%	0.1%	11.0%	16.6%	83.4%	100%
Chicago O'Hare *(b)*	L	0.4%	2.4%	N/A	20.7%	23.5%	76.5%	100%
Dallas/Fort Worth	L	1.0%	1.0%	1.0%	1.0%	4.0%	96.0%	100%
Denver	L	0.0%	14.2%	0.0%	0.0%	14.2%	85.8%	100%
Orange Co. John Wayne	M	1.0%	0.0%	1.0%	0.0%	2.0%	98.0%	100%
Las Vegas	L	2.0% to 5.0%	0.0%	0.0%	0.0%	2.0% to 5.0%	95% to 98%	100%
Los Angeles	L	0.0%	2.5%	0.0%	0.0%	2.5%	97.5%	100%
Louisville	M	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Omaha	M	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100%
Phoenix	L	1.7%	0.0%	0.0%	0.0%	1.7%	98.3%	100%
Sacramento	M	1.0%	0.0%	0.0%	0.0%	1.0%	99.0%	100%
Salt Lake City	L	1.0%	1.0%	0.0%	0.0%	2.0%	98.0%	100%
Seattle	L	2.0%	0.0%	0.0%	0.0%	2.0%	98.0%	100%
San Diego	L	2.0%	0.0%	0.0%	0.0%	2.0%	98.0%	100%

(a) FAA hub size: S = small; M = medium; L = large. *(b)* O'Hare data is based on a 1990 employee survey.

SOURCE: *TCRP Report 83*, Jacobs Consultancy

transit usage of the three employee groups. At Boston airport, Massport reports more than 16% of the employees used transit, of which 11% used rail.

Employee Characteristics

Information concerning the characteristics of employees at the airport (such as the number of employees, work locations, commute times, and employee parking cost) is summarized in this section.

Number of Employees

As indicated by the missing data in Table 8-4, good information about the number of employees working at an airport, and whether they work at the terminal or remotely, is not universally available. The number of employers combined with complex work schedules and dispersed work locations make tracking the number of employees working at the airport on a given day especially challenging. Flight crew members are especially difficult to track for survey purposes; they may commute to work only one day a week or even arrive from another city via airplane.

Data provided in the O'Hare employee survey provide some insights. Of the employees that responded to the survey, only 50% reported to work sometime on a given Wednesday. Flight crew members had the lowest percentage with less than 20% reporting to work on a given day.

Percentage of Employees Working in the Terminal Area

As suggested earlier, many employees have job locations dispersed throughout the airport. Based on typical data from the survey responses, 20% to 55% of employees at an airport do not

Table 8-4. Airport employment characteristics.

Airport	Size *(a)*	Estimated number of employees on-site, typical day	Estimated percentage of employees working in terminal area	Estimated percentage of employees traveling during commute peaks	Estimated percentage of employee residences served by transit	Other major employment centers	
						Number of centers	Number of centers with transit
Birmingham (AL)	S	n.a.	50%	70%	0%	3	3
Boston	L	14,600	68%	78%	n.a.	2	2
Chicago O'Hare	L	n.a.	56%	48%	n.a.	3	1
Dallas/Fort Worth	L	40,000	n.a.	90%	70%	2	2
John Wayne	M	1,000	50%	70%	80%	0	n.a.
Las Vegas	L	8,000	85%	30%	90%	0	n.a.
Louisville	M	n.a.	5%	10%	n.a.	1	1
Omaha	M	2,500	45%	33%	0%	0	n.a.
Sacramento	M	1,500	80%	25%	50%	0	n.a.
Salt Lake City	L	n.a.	75-80%	60%	75%	3	3
San Diego	L	3,000	97%	15%	n.a.	0	n.a.

(a) FAA hub size: S = small; M = medium; L = large.

SOURCE: *TCRP Report 83*, Jacobs Consultancy, based upon data provided by individual airport operators.

work in the terminal area. (See Table 8-4.) For these employees, a transit trip would require a transfer to a circulator shuttle bus or service with a stop at their workplace.

Employee Commute Times

A significant percentage of employees at an airport do not travel during peak commuting times, when transit service frequencies are the highest. The reported range is 10% to 90% with most responses being 70% or below. Airline crew employees typically have the highest percentage of commute times outside normal commute hours.

Transit Service to Major Employers

The survey responses indicate that when major employers are present at an airport, scheduled public transit service is typically provided. The frequency of the transit service may not be high, but it is usually provided by the local transit operator due to the concentration of employees.

Cost of Employee Parking

The survey responses confirm that the cost of employee parking is low at airports (see Table 8-5). The net cost to the employee is typically less than $1 per day and in most cases the employer pays for parking.

Transit Subsidies

A number of airports do partially subsidize the cost of transit for their employees. These airports include Boston, Sacramento, Salt Lake City, and San Diego. Salt Lake City provides transit passes that cover 50% of the cost to the employee. Sacramento subsidizes $35 of the $55 monthly cost of a bus pass for county employees only.

Table 8-5. Airport employee parking costs.

Airport	Size *(a)*	Cost per Month	Employee Parking *Who Pays?*	Transit Subsidy and/or Incentives?
Birmingham (AL)	S	$0	n.a.	No
Boston	L	$0 to $70	Employer	Yes
Chicago O'Hare	L	n.a.	n.a.	n.a.
Dallas/Fort Worth	L	$0	n.a.	No *(b)*
Orange Co. John Wayne	M	$35	Varies by company	No
Las Vegas	L	$0 to $25	n.a.	No
Louisville	M	$0 to $12	Employer	No *(c)*
Omaha	M	$12	Employer	No
Sacramento	M	$0 to $35	Varies	Yes
Salt Lake City	L	$0	n.a.	Yes
San Diego	L	$8 to $50	50% employer, 50% employee	Yes

(a) FAA hub size: S = small; M = medium; L = large.
(b) County employee rideshare program is available.
(c) Local MPO sponsors a vanpool program.

SOURCE: *TCRP Report 83*, Jacobs Consultancy, based on data provided by individual airport operators.

Key Considerations for Improving Employee Public Transportation Mode Share

This section describes the key considerations for improving employee transit mode share at airports.

Comparative Travel Time of Transit and Automobile

For the large majority of employees, public transportation must compete with the convenience provided by the automotive mode of travel. Travel times on transit need to be *comparable* with, not necessarily equal to or less than, those by automobile.

As demonstrated in places such as Denver and San Francisco, express or semi-express service oriented to the airport is an important factor. The Denver SkyRide system provides semi-express service for most routes. The long-standing subscription bus program in San Francisco, operated by United Airlines for employees at its Maintenance and Operations Center, provides travel times fairly comparable with driving.

The frequency of service is also an important consideration in travel times. Frequent service not only reduces wait times for passengers, but also increases an employee's flexibility in terms of the timing of the trip to work. Current experience with the light rail line that terminates at the Baltimore/Washington International Airport terminal suggests that the low employee mode share (1% to 2%) may result from the line's 17-minute headways.

Comparative Comfort of Transit and Automobile

Public transportation not only competes with automobiles in terms of travel time, but also in terms of comfort. The experience at San Diego International Airport helps to illustrate this point. Despite having relatively frequent bus service (four to six buses per hour throughout the day), the employee transit mode share is 2%. The noted automobile-oriented culture of the region is likely a contributing factor.

While it is difficult for transit to compete with the comfort that automobiles provide, passengers also perceive the need to transfer and wait as a significant "discomfort." Thus, the closer a

service is to door-to-door service, the higher the comfort level that will be perceived. Boston's successful Logan Express bus service provides an over-the-road coach vehicle that travels from a park-and-ride lot directly to the airport. Employees are currently entitled to free parking at the bus terminal and a significant discount on the fare.

Extent and Adequacy of the Transit Service Area

All things being equal, the ultimate success of public transportation for employee mode of access will depend upon the extent and adequacy of the transit service area. The significant transit mode shares at Boston and O'Hare airports are largely due to the maturity and robustness of the regional transit system. These mature systems support high service frequency and expansive regional coverage. Conversely, another reason for the lower usage at Baltimore/Washington International Airport is the limited service area of the regional rail network, which currently has a single light rail line and a single heavy rail line.

The Boston employee transit mode share is somewhat suppressed because areas north of the airport are home to many employees but these areas are not well served by transit. This latter point illustrates the importance of the *adequacy* of the transit service area for airport employees. Service to the airport should be placed where airport employees reside. Two of the routes of the SkyRide system in Denver are oriented to locations near the former site of Stapleton airport to serve the concentration of employees still located near the old airport.

LAWA provides a convenient transportation link for airline passengers and employees working at Los Angeles International Airport who live or have destinations in the San Fernando Valley. The Van Nuys FlyAway bus service operates scheduled express buses between the Van Nuys Airport, located in the Valley, and Los Angeles International Airport. Employees are provided with free parking in a dedicated lot at the Van Nuys FlyAway terminal.

The buses operate 24 hours per day with schedules designed to better meet the needs of employees. For example, buses to Los Angeles International Airport operate at 15-minute headways during employee peak hours (4:45 a.m. to 8:00 a.m.). Employees pay about half the regular fare and can receive a deeper discount by purchasing a book of tickets. In 1999, employee ridership represented 20% of the total ridership on the FlyAway service.

In addition to providing service to areas where employees are known to reside, transit providers should consider targeting service to areas with potential employees that are likely to use transit to travel to the airport (e.g., areas with lower automobile ownership).

Proximity and Accessibility of Transit Service at Both Trip Ends

Convenient connections between the transit vehicle and the work site or home are important for two reasons. First, convenient connections make the service easy to use and accessible. Second, a convenient connection will improve employee travel time.

On the home end of the trip, experience at Denver and Boston illustrates how suburban areas can be well served with free park-and-ride lots. The work end of the trip is just as important. As the surveys indicated, many airport employees do not work in a terminal building. Transit service should be provided directly to locations near significant concentrations of employees, either at the terminal or at remote facilities. If possible, passengers should not have to transfer. If transfers are necessary, however, an on-airport shuttle bus service should be provided to link the public transportation system with the work sites for employees.

Availability, Cost, and Convenience of Parking at the Work Site

The availability, cost, and convenience of parking play a significant role in the choice or consideration between transit and automobile modes of access. While an increasing number of

airport operators have located employee parking lots to remote sites, most operators still provide space for ample employee parking somewhere on the airport.

A few airports such as Boston, LaGuardia, and San Francisco have severely constrained sites where parking costs begin to approach those seen in congested downtown areas. In these communities, despite aggressive programs to encourage the use of public transportation, large employee parking facilities are provided to accommodate the needs of airport, airline, and other tenants. For example, the available parking supply for employees working at the United Airlines Maintenance and Operations Center at San Francisco International Airport significantly exceeds the demand. United is bound by employee labor agreements that require parking for each employee. Nevertheless, the closest and most convenient parking spaces are reserved for vanpools and buses to provide some incentive for using public transportation or ridesharing, while much of the single-occupant automobile parking is located a significant distance from the work site. In addition, as noted earlier, United Airlines offers bus service to employees at this facility.

The typically low cost of parking for employees is also a significant barrier to encouraging transit use. Given the typically longer travel times and lower comfort levels of transit compared to a private vehicle, the availability of free or low-cost parking makes transit even less competitive.

It is difficult to increase the cost of parking paid by individual employees at the airport. Some airports have employee parking costs defined in their airline use-and-lease agreements. Often, the airlines are bound by employee labor agreements that specify availability, proximity (or travel time), and cost of parking. Consequently, airport operators may not be able to increase the costs for employee parking, either because rate increases are not allowed or because the additional costs could not be passed on to employees. Thus, the net cost of parking that the employees pay is low and is often free. The lack of this disincentive to the automobile is a major challenge.

Some airport operators offer transit subsidies to selected groups of employees. While this can help provide comparable costs between driving and public transportation, subsidies can become expensive and require continuous monitoring to prevent abuse. As an alternative to direct subsidies, the federally sponsored Commuter Check program is available to employers with more than 100 employees. Commuter Checks, up to a maximum of $100 per month, permit employees to save paying taxes on the amount and save the employer payroll taxes. The program does require the employers to incur administrative costs to either operate the program themselves or hire a third-party administrator. United Airlines operates a Commuter Check program in Denver. Employees are required to turn in their parking permit to receive $30 commuter checks each month.

In some communities, employee discount programs are offered by the private and public operators of scheduled bus services. Bus operators serving airports in San Francisco and Los Angeles offer commuters substantial discounts when they buy ticket books.

Another challenge to effectively using these types of incentives on a wide scale is the airport's multiple employers, each with a full range of employee types. Because subsidies are frequently provided through employers, a comprehensive program requires significant coordination and commitment by all parties.

Extent and Adequacy of Transit Service Hours

To be a viable option for a significant percentage of employees, the hours of operation for the transit service must address the operating conditions at an airport. It is not unusual for employee shift times to begin at 4:00 a.m. or 5:00 a.m. and other shift times to end at 10:00 p.m. For transit to be an option for employees, the service needs to be operating at those times. In addition, the service needs to be operating at a convenient frequency. In Boston, early morning shuttle

service is provided from nearby communities to supplement the regional transit service that opens later. As noted previously, the Van Nuys Flyaway service operates reduced headways beginning at 4:45 a.m.

Perceived Safety of Transit, Particularly at Night

Given the other challenges of comparable cost and convenience, employees need to perceive the transit service and waiting areas as safe throughout the operating hours. The provision of well-lighted waiting areas, obvious security presence, and late night on-demand escort service are features that can be used to help mitigate this concern.

Airport Employee Market Segments

Public transportation may be a more convenient alternative for certain groups of airport employees. The travel patterns of different market segments are discussed in the following paragraphs.

Flight Crew

Flight crew employees include pilots and flight attendants who are based in a particular city and travel to the airport to begin their rotation or tour of duty. A tour of duty can last several days. Therefore, their trip from the airport may come a few days after their access trip, and they may not commute more than once a week to the airport. Overall, they constitute a significant proportion of total airport employees but are not a large market for public transportation because of their infrequent commuting. Many flight crew members park their cars at the airport for the duration of their trips.

Non-Flight Crew

Airport employees who are not members of a flight crew will have a work commute of a more regular nature. These employees have varying types of work schedules, some of which change at specified time intervals. Some employees work additional hours on a regular basis or are subject to non-scheduled overtime. If employees have on-airport parking privileges, parking is often free or subsidized; however, the location of the parking may not be convenient to airline passenger terminal locations and may require the use of shuttle bus service. These shuttle services may not operate with the same level of service provided to passengers. The more inconvenient airport employee parking is, the more willing employees are to use an alternative that either decreases the amount of time they must wait for connections or increases the ease with which they can reach their reporting locations. As is the case for other commuters, airport employees are more sensitive to the cost of an access service, because they will be using the service multiple times during the week.

One group of nonflight crew airport employees who are strong candidates for public transportation to an airport is airport employees in the many entry-level, low-wage service jobs available at an airport (e.g., restaurants or cleaning). Because these jobs can require work commutes at hours not covered by the regional public transportation system and because so many potential candidates do not have access to a private vehicle, airport employers sometimes find it difficult to fill open positions for these jobs. Low-wage employees at an airport would be very sensitive to the cost of an airport access trip; this underscores the need for a pricing system differentiating between air passengers and airport employees.

CHAPTER 9

Getting Ground Access Information to the Traveler

Over the past 5 years, there has been a revolution in the way that airports can present ground transportation options to their travelers. Tools and media that would have been unimaginable just a decade ago are now readily available to airport managers interested in creating better public mode ground transportation strategies to their airport. Chapter 9 examines those tools and those media in the context of the central theme of the report: that planning and implementation of ground access services must be undertaken to meet the needs of the user as defined and refined in a program of market research and segmentation.

Thus, the chapter examines the development of new and evolving information technology to bring airport ground access information and ticketing options to the traveler. The presentation of service options to the traveler is presented here as the last phase of an integrated program of market-based improvements to airport ground access public modes.

Getting Information about Ground Access

To an increasing extent, airline trip planning is either (1) accomplished by the traveler using the Internet or (2) accomplished by a travel advisor to the traveler using the Internet. Thus, this section of Chapter 9 will first focus on the manner in which airport websites are or are not providing high-quality information to the traveler (or advisor) about ground access services to/from the specific airport. Ultimately, information about local airport services will be interconnected with other media and tools used in the trip planning process. If each airport website can accurately describe the ground transportation services available at that airport, integration of that information with other media used by the traveler (such as airline websites, Expedia, Travelocity, Google, etc.) will logically occur over time.

Airport managers will need to provide to the traveler several different kinds of ground transportation information, not only information about airport-managed, -regulated, and -monitored ground services that are operated specifically for the airport market—taxis, airport limousines, airport vans, and airport coach bus services (sometimes called "airporters")—but also information about the regional public transportation system in general, including service details that are far beyond the responsibility of airport management.

Thus, one of the challenges in the design of the airport-based website on the subject of ground access services is the need to provide direct, quick access both to those services that are well documented by airport management and to those services that are best organized and described by others in the region. In 2007, three new services attempted to integrate the two kinds of information: one in the United States, one in Europe, and one in Asia.

How U.S. Airport Websites Cover Ground Access

Details about public transportation modes to the airport are not necessarily the highest priority element in an airport's website and thus, some level of navigation through some hierarchy of website structure is required. A currently favored format is to provide flight status information, as well as security updates and constraints, on the home page of the website. A tab is often presented for several categories of information, one of which usually describes ground transportation services. Thus, ground transportation is usually created in a second tier of information.

In a commonly used format, the user must select which mode of transportation is of interest. After the selection of that mode, the user is provided a page that gives a summary of the services of that mode and paths of navigation to get to more detail. The following sections will review this approach and document how different approaches are now being developed in Europe, Asia, and the United States.

Ground Access Information on the San Francisco Airport Website

San Francisco can be used as a case study in the provision of airport ground access information because of the high quality of traveler information available:

- The San Francisco airport website is well managed and has traditionally been a good example of airport ground access information. In previous years, the San Francisco airport website directly provided schedule information from private and public carriers. As discussed later in this chapter, the website now uses hyperlinks for most carrier service descriptions.
- The dominant single-mode operator, the Bay Area Rapid Transit District, has traditionally been a leader in the task of giving out passenger information about the rail options.
- A dominant multimodal information program managed at the Metropolitan Transportation Commission in Oakland provides regional traveler information about all public transportation modes and services.

As can be seen in this case, the challenges associated with good multimodal information do not come from a lack of well-managed information; the challenges come in the manner in which it is assembled and presented to the public.

Passenger Information Provided by the Airport

The navigation hierarchy of the San Francisco airport website structures ground access information, first, by mode and, second, by geography of the destination. First, the user selects the mode; then, the user specifies a geographic area for the destination. Third, the user is presented with the selected modal services for the selected geographic area.

The user may select a mode from the following list:

- Limousines
- Taxis
- Door-to-door vans
- Pre-arranged vans
- Public transit
- Airporters
- Charter operations

At this point, the user must have some understanding of the meaning and relevance of each of the categories. Once a category is chosen, the user is presented with a regional map with four general sub-regions defined. Under the category of public transit, the user is provided with a

thumbnail description of the rail service or bus route numbers, and then offered a quick hyperlink to the actual carrier, where the information-seeking process starts again.

For example, a user selecting the mode "airporter" must then select the portion of the region where he/she wishes to go, for example, the East Bay. Only at that moment will the user learn if the airporter even goes to the East Bay.

In theory, there are some potential inefficiencies in this hierarchy. For example, if the user selects airporters, as opposed to vans or public transportation, and then specifies the city of San Francisco, he/she is informed that there are no airporters to San Francisco. Thus, the user must start the process again. In short, the user has to make a choice of mode before knowing anything about that mode. *Optimally, the system would be designed to interactively help the user know what his/her reasonable options are as he/she navigates through the hierarchy of screens and information.*

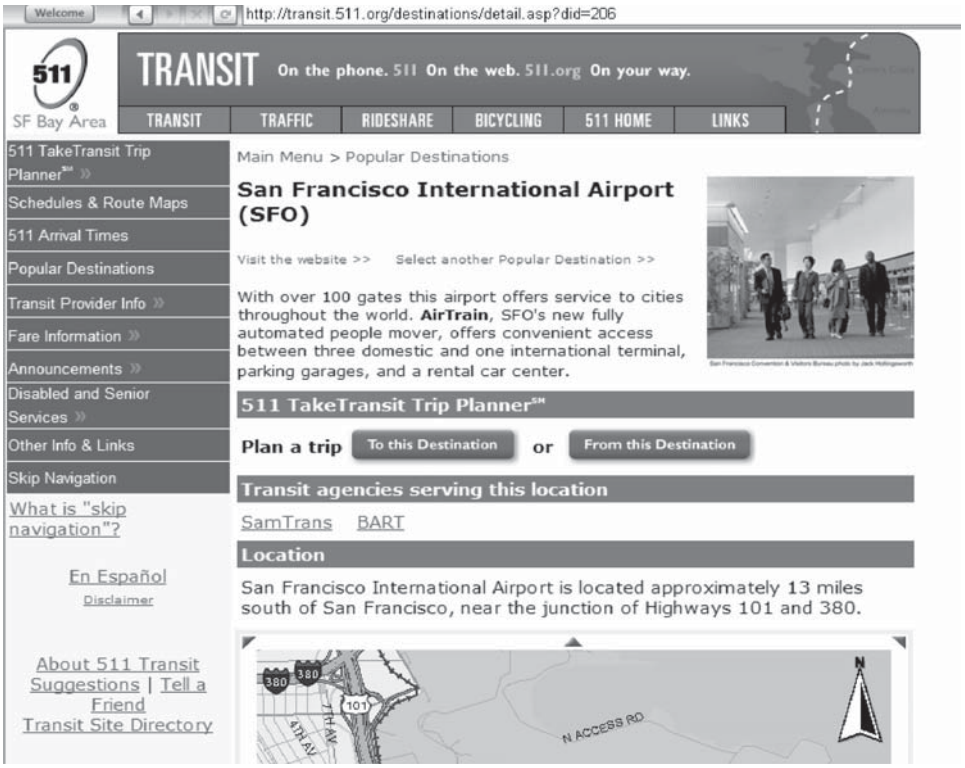
Passenger Information Provided by Other Agencies

Part of the information about ground access services is best maintained, managed, and provided by agencies other than the airport management. The airport website needs to include navigation that offers these connections to users that need them. Under the category "Public Transit," the user is offered a direct link to the BART system, which goes directly to a feature called "Quick Planner." At the "Quick Planner," user interface, the user is offered a drop-down menu of origins, including every BART station name, one of which is "San Francisco International Airport." In addition, the BART page may offer the opportunity to click on the words "Airport Service." Here the user chooses between an information page for Oakland International Airport or for San Francisco International Airport. After that selection is made, an excellent summary of information and issues about access to the selected airport is presented to the user. Thus, the BART managers have created a summary description of information needed by users of San Francisco International Airport, but the user must employ some navigational skill to find it when starting on the San Francisco International Airport website. In theory, the airport website could offer a direct hyperlink to this informative BART web page.

The San Francisco Bay Area is also home to one of the most comprehensive multimodal trip planning programs in the United States, called simply "511.org." The San Francisco International Airport's website offers a near seamless integration with the ambitious multiagency, multimodal trip itinerary planning capability. On the "Ground Transportation" opening page of the San Francisco International Airport website, a hyperlink is offered to 511.org. This link takes the user directly to a "popular destination" page, shown here as Figure 9-1, specifically designed to help airport users. At this page, the user can navigate to any service provided by 511.org, while most information is designed to help provide information about the San Francisco International Airport. As shown on Figure 9-1, a "Plan a Trip" feature is offered with a button that specifies "from this Destination." Because of the careful design of this program, the next screen has *already* filled in San Francisco International Airport as the origin of the trip itinerary planning query.

The multimodal system can recommend a trip from an airport using rapid transit provided by one agency, which connects to a local bus from another agency, which services the requested destination. In the navigation from the airport website to this screen, the needs of the airport were handled in an efficient "seamless" manner. The program also offers a chance to plan a return trip, to alter the trip optimization assumptions, or to continue from the requested destination to yet another segment.

To summarize, the San Francisco International Airport website essentially offers two alternative paths of navigation for the air traveler who wants to plan a public transportation trip.



SOURCE: "511.org," Metropolitan Transportation Commission, Oakland, CA.

Figure 9-1. The regional information system provides an airport specific first page.

For the public transportation network as a whole, the traveler can transfer seamlessly to the regional traveler information system and plan any trip by traditional public transportation modes. By staying within the airport website, the user can navigate to learn about airport specific services.

The challenge comes for trips that might fall under both categories. A high-quality airporter, whose tickets are available to the general public, operates non-stop between the airport and the terminal in Marin County. The 511.org transit trip recommendation, however, was through a local bus line to downtown—a bus line that specifically bars riders from carrying luggage on the bus. Briefly stated, the regional multimodal transit routing service does not, and does not pretend to, present a summary of services specifically designed for airport users.

What results is the need for two separate paths of information. If the air traveler had followed the standard navigation to "Airporter" first, to North Bay second, and then clicked on Marin Airporter, a full description of these services would be provided.

Integration with Real-Time Flight Information

The San Francisco International Airport website is pioneering the concept of providing ground service information tied to the timing and location of specific flights, both arriving and departing. The service, called "SFOnroute," currently provides highly detailed walking path information for those passengers or meeter/greeters who arrive by automobile; basic hyperlinks are offered to the website's descriptions of public transportation options. The program is compared later in this chapter with a more integrated ground access trip planning program now being tested with Narita International Airport.

Ground Access Information on the Portland (Oregon) Airport Website

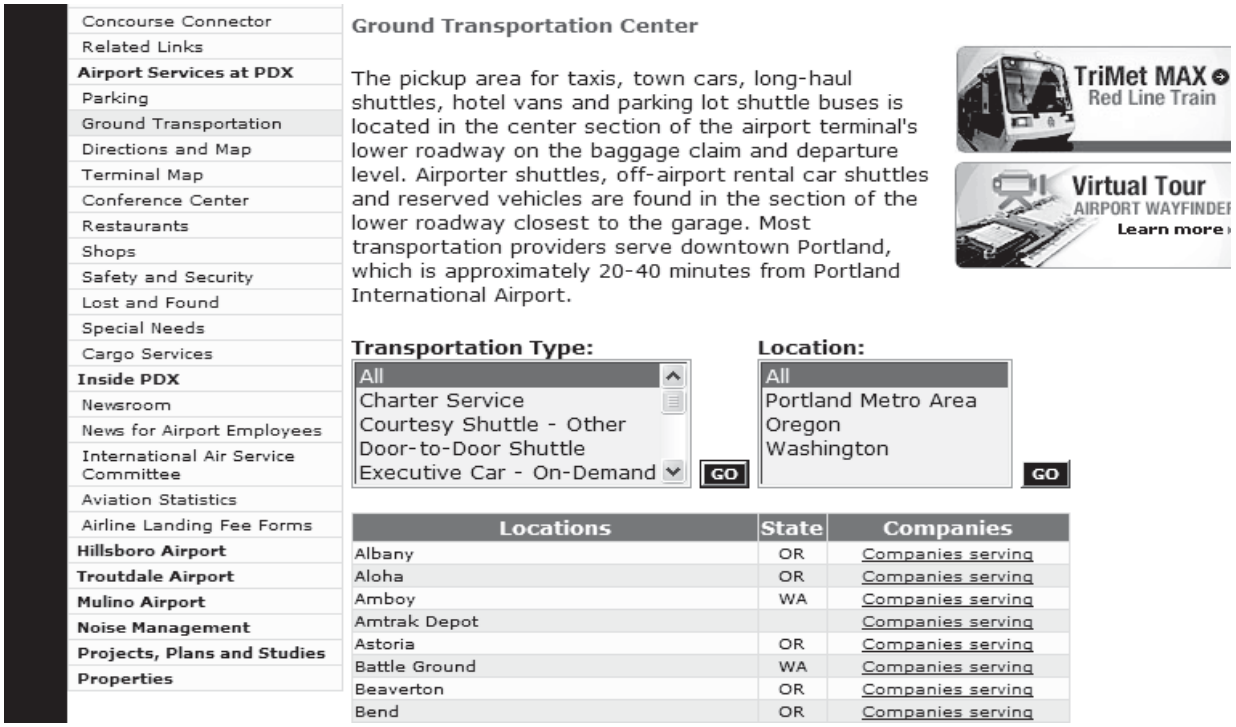
Like other airport websites in this review, the Portland (Oregon) airport offers "Ground Transportation" as a choice for the second screen immediately following the introductory screen (home page). Unlike many sites, details about arrivals and departures are not shown on the opening screen; however, that screen must provide information on three additional airports, also operated by the Port of Portland.

Like Boston, the Portland (Oregon) airport offers the Airport Wayfarer(tm) product. The opening segment of this highly sophisticated simulation program presents an informative transition from satellite-type graphic images into three-dimensional schematic graphic images, which include a clear description of the location of rental cars and the light rail station. However, it does not include a walking path simulation to any connecting public mode services. By comparison, the simulation of the walking path from short-term parking is presented with a remarkable level of realism.

Passenger Information Provided by the Airport

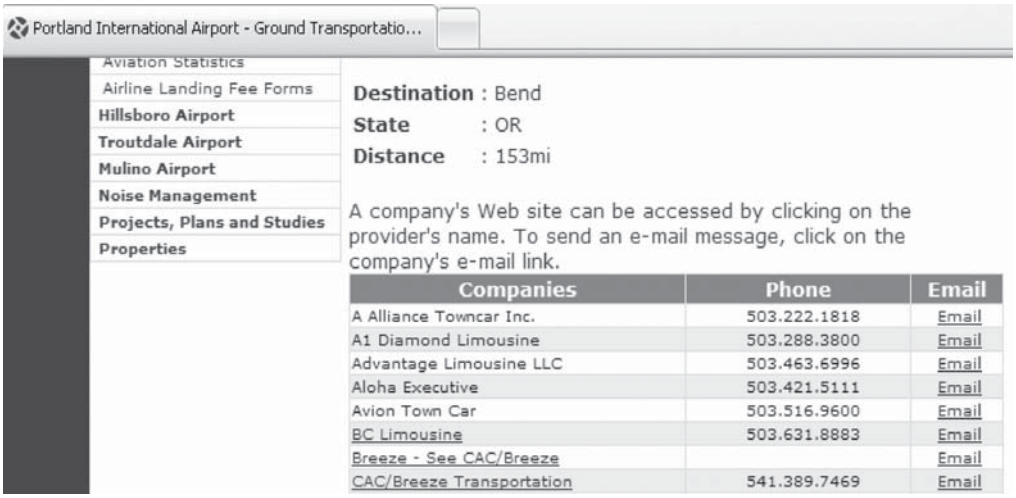
The "Ground Transportation" screen is unlike any other U.S. airport website reviewed in this ACRP project because the drop-down menus allow the user to narrow the search for a local service *either* first by modal category or first by geographic area (Figure 9-2). As in most airport websites, navigation is offered by mode first, and then by company. The choice of "Door-to-Door Shuttle" produces a screen that lists about 17 companies authorized to provide those services to Portland International Airport; the link for a specific company then reveals a list of the destinations the company serves.

In addition, the Portland (Oregon) airport website offers the same information, organized first by geography, defined as the non-airport end of the trip. Thus, the choice of "Portland



SOURCE: Portland International Airport website.

Figure 9-2. The Portland International Airport system lets the user specify destination first or query by mode category.



SOURCE: Portland International Airport website.

Figure 9-3. When the user specifies the destination, the Portland International Airport system provides the list of carriers.

Metro Area" on the opening ground transportation page produces a screen with a wide variety of very specific destinations in the Portland Metro area: examples include The Rose Gardens in Washington Park, Powell's Bookstore, and the Amtrak Depot, as well as more traditional listings of towns and cites. The choice of "Washington" produces a list of about 28 candidate destinations within the state of Washington. When the user finds the desired destination, clicking on the link produces the list of companies that serve that destination (Figure 9-3).

Passenger Information Provided by Other Agencies

The opening page for ground transportation services on the Portland International Airport website has a large icon on the upper right that offers a direct transfer to Tri-Met, the local public transportation operator. Importantly, the link is made to a page providing information about *the specific line* that serves the airport, rather than linking to a more general-purpose agency home page. At the light rail page, origin-to-destination trip itinerary planning is on the next level of services offered. At the data input page, the "origin" (Portland International Airport) has not been filled in as it was in the case of the Bay Area's 511.org.

Clicking on the light rail map itself produces a highly interactive map of the rail system. Clicking on the icon for the airport station produces a complete description of services and amenities at the airport station.

In theory at least, the transit operator could create a first page that is specific to the needs of those who come to the site from the hyperlink on the airport website. As it is, a very good summary of the services of the airport rail station is provided via a relatively indirect path: airport website to light rail line page to interactive map to station details provided via the interactive map. As it stands, the user of the airport website may or may not succeed in navigating to the transit agency's airport station information page.

Ground Access Information on the Boston Airport Website

Passenger Information Provided by the Airport

The website for Boston's Logan International Airport also has the Airport Wayfinder(tm) graphics system, a portion of which is devoted to showing ground transportation departure locations at

each of the four terminals. Long loading times at start-up make this feature less usable than at the Portland International Airport website.

For bus or van services, the data are organized by carrier: carrier name first, destination second. Thus, the user selects the name of the company and then learns where the company goes. There is no structuring of companies in the manner developed in Portland, which is organized by geography first.

Passenger Information Provided by Other Agencies

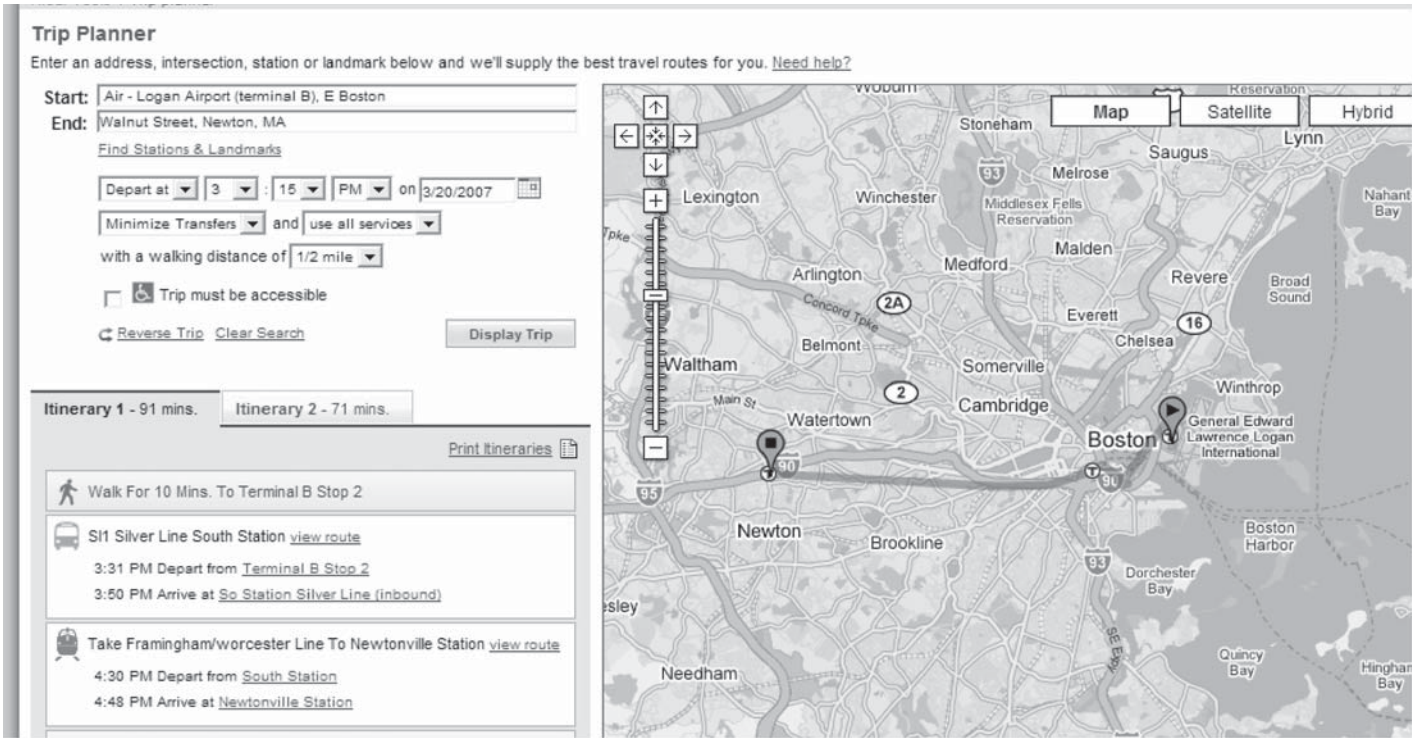
The navigation structure of Boston's airport website also follows a hierarchy by mode: after the user chooses public transportation, a hyperlink to the MBTA's home page is offered. From there, the user may or may not discover a well-presented page entitled "Take the T to Logan," which offers comprehensive routing advice by corridor of origin. The page is located in a more general category of how to ride the system.

The home page offers origin-to-destination trip itinerary planning, which shows all MBTA services to Logan International Airport, but not those of the Logan Express bus service or the many private carriers that serve the airport directly (Figure 9-4). For example, a query on the MBTA trip planner for a trip from Logan International Airport to Natick does produce a combined bus plus commuter rail trip, but does not include the Logan Express, which is available to the general public.

Ground Access Information on the New York JFK Airport Website

Passenger Information Provided by the Airport

Under the category "Ground Transportation," the user can choose between the categories "Car/Van Service," "Bus," or "Train." Information about van service is available for connections



SOURCE: MBTA website.

Figure 9-4. The MBTA Trip Planner will recommend a trip on local transit, but not on the Logan Express.

to other airports and then to five separate geographic areas. In practice, standard bus coach services are included in these listings.

The ground transportation section of the website contains no specific reference to information about, or any hyperlinks to, the AirTrain, which is the backbone of many connections from JFK airport. For some reason, AirTrain is included as a tab on the initial airport home page, but not as a tab on the ground transportation page.

Once found, the AirTrain section of the website is one of the best custom-designed information modules on any U.S. airport website. Presented in this section is an innovative feature called the "Trip Planner." Ten geographic areas are offered via a drop-down menu: for example, separate screens are produced for Midtown and for Downtown (Lower) Manhattan. Given that the "Trip Planner" is located on the AirTrain section of the website, only information about trips that utilize the AirTrain is presented.

In the AirTrain section, the airport managers at JFK airport have taken a slightly different approach. Given that the transfer at Jamaica Station is not intuitively easy, once the general area of the trip destination has been specified by the user, text is provided that describes each aspect of the service and, more importantly, the processes of transfer and fare payment.

The AirTrain section of the JFK airport website also offers what it refers to as a "virtual tour," a 360° view of the station at a point immediately in front of the turnstiles. It is not a simulation of a walking path as used on the Portland or Boston websites.

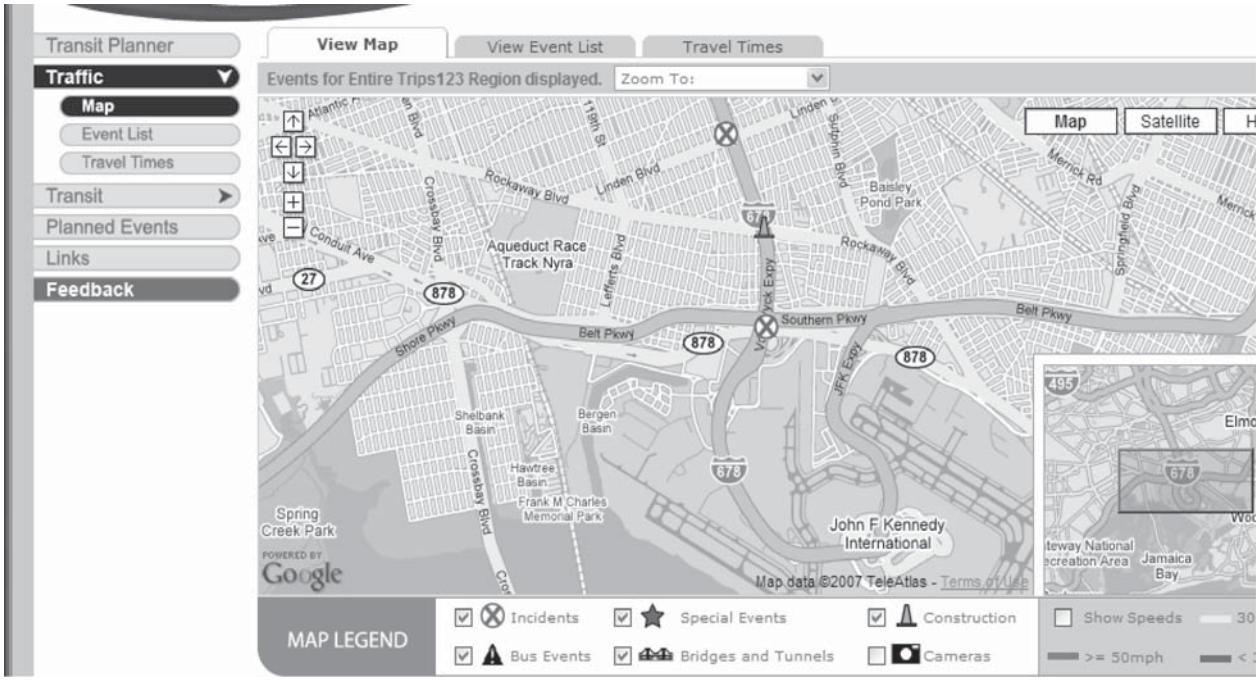
Passenger Information Provided by Other Agencies

After the user has selected either the bus or train mode in the Ground Transportation section, the JFK website says "click here for bus schedules" or "click here for train schedules," respectively. These hyperlinks take the user to the home page of Trips123. Trips123 is the major multimodal traveler information program for the three-state New York City metropolitan area, managed by TRANSCOM, the Transportation Operations Coordinating Committee.

On the home page of the Trips123 system, a hyperlink to the transit trip planner is available. On the data input page of the transit trip planner, the origin "JFK" has not been filled in. However, the system accepted the input terms "JFK Airport" and "Herald Square" without seeking further clarifications. (The system defaulted to the assumption that the trip commenced at JFK Terminal One.) Maps were offered by the Trips123 system that did not include the existence of the AirTrain on airport property or the existence of the AirTrain at its point of transfer at Jamaica Station.

A sample trip from JFK airport to Grand Central Station was routed by a local bus to a transfer in a residential neighborhood to a second public transportation bus to Madison Avenue near Grand Central Station, with a travel time of more than an hour. Clearly, the direct non-stop airporter coach bus from JFK airport to Grand Central Station was not included in the Trips123 inventory of public transportation services.

The regional trip itinerary planner, Trips123, is able to provide real-time information about the location of both construction and incidents on the highway system. Figure 9-5 shows a recent screen capture in which two traffic incidents and one construction site were reported on the Van Wyck Expressway (I-678) in the general area of JFK airport. In early 2007, Trips123 is expecting to offer real-time travel times on the roadway system, which could be a key input consideration for those choosing between transit and automobile ground access modes to the airport.



SOURCE: Trips123 website.

Figure 9-5. The Trips123 Screen for JFK airport shows real-time traffic incidents, but not the JFK AirTrain.

Ground Access Information on the Atlanta Airport Website

Passenger Information Provided by the Airport

At the Hartsfield–Jackson Atlanta Airport website, the first ground transportation screen summarizes and shows the location of a ground transportation information center on the airport. The user is given access to a very detailed map of the bus/van departure area, which is updated to show the exact location of construction activities and the changes in pedestrian paths caused by that construction. Also offered on the opening screen is a simulated walk-through and drive-through of the airport, including the principal locations for ground access information.

Upon clicking "Metro Shuttles," the user is shown a list of about 50 destinations that are served from the airport. The user can click on a given town and is provided with a list of the van operators who are authorized to provide service to that town and their telephone numbers. For the shuttles outside of the metro area, a pull-down list of served communities is provided, followed by a "submit" button. The van operators authorized to serve that area are presented on the following screen. Thus, for the shuttle van system, the airport website offers a navigation system that queries geography first and provides a list of service options second.

Upon clicking "Metro Trains," the user is offered a two-paragraph introduction to the MARTA system, with a hyperlink to the MARTA home page.

Passenger Information Provided by Other Agencies

As of early 2007, MARTA does not have the kind of origin–destination trip itinerary planner offered by BART or the MBTA. Upon arrival at the MARTA home page, the user is offered a large interactive map, upon which the user can zoom in and out for various levels of detail. However, not referenced on that home page is a service under "Exploring Atlanta" called the "Airport

Station Helper." This page has helpful information about how to use the MARTA trains to access the airport. In short, valuable transit information is available, which may or may not be discovered in the normal act of navigation from the airport website.

How European and Asian Airport Websites Cover Ground Access

On February 28, 2007, the most advanced program for covering airport ground access services was inaugurated at Schiphol Airport in Amsterdam, The Netherlands. The program provides for a seamless integration of trip planning for ground access services managed by the airport with those services not managed by the airport. In concept, the new website is remarkably similar to the experimental airport ground access module being developed for the Baltimore/Washington International Airport, discussed at the end of this chapter.

Ground Access Information on the Amsterdam Airport Website

Passenger Information Provided by the Airport

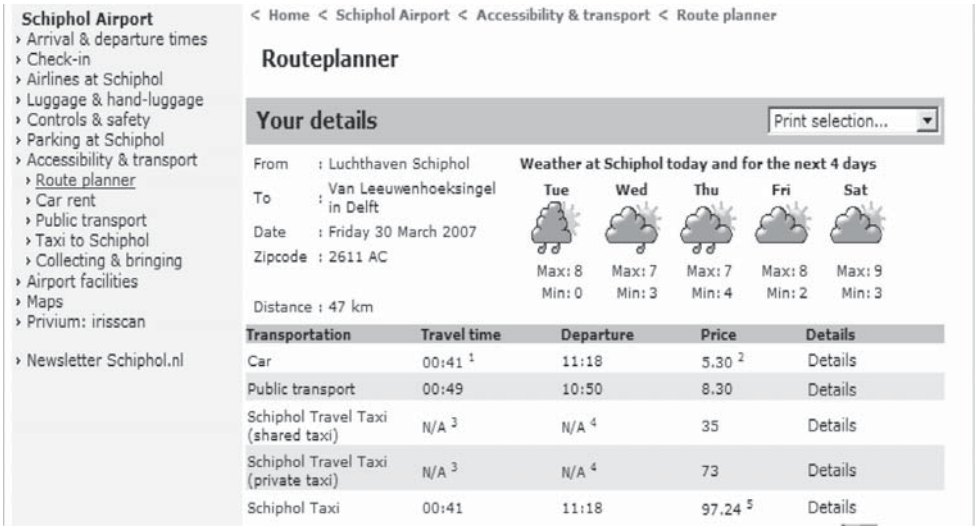
The institutional relationship between Schiphol Airport and the national provider of multimodal passenger information is very similar to that in operation in San Francisco and in the New York City region: the regional provider of multimodal systems is independent from the line operators of the transportations services and facilities. Each of the U.S. case studies reviewed the way in which the U.S. airport covered the airport-based transportation options separately from the more commonly available fixed-route and -schedule services included in the regional system. From the airport manager's point of view, "contracting out" the provision of ground transportation information may not be wise because the regional system may not cover all of the key airport-based services. For example, in the JFK airport case study presented previously, the nonstop bus from JFK airport to Grand Central Station, operated by New York Airport Express, was not included in the dataset accessed to plan a trip from JFK airport to Grand Central Station. Therefore, the proposed trip resulted in a transfer on a residential street, an option that would discourage many travelers.

Like the experimental ground access module being developed for Baltimore/Washington International Airport that will be discussed later in this chapter, the Schiphol website integrates the database of airport-specific ground transportation services and traditional publicly available transit services. This integration allows the trip planning module to propose all modal solutions to the user simultaneously.

Figure 9-6 shows the results of a query about a trip from Amsterdam Schiphol Airport to the town of Delft. The private automobile (and the taxi) can make the trip in 41 minutes; public transportation can make the trip in 49 minutes. The private taxi will cost €73, while the train will cost €8.30. The shared taxi will cost €35. In the case of The Netherlands, "public transport" will usually mean rail, but the logic of the program could easily be applied to bus service as an alternative to rail.

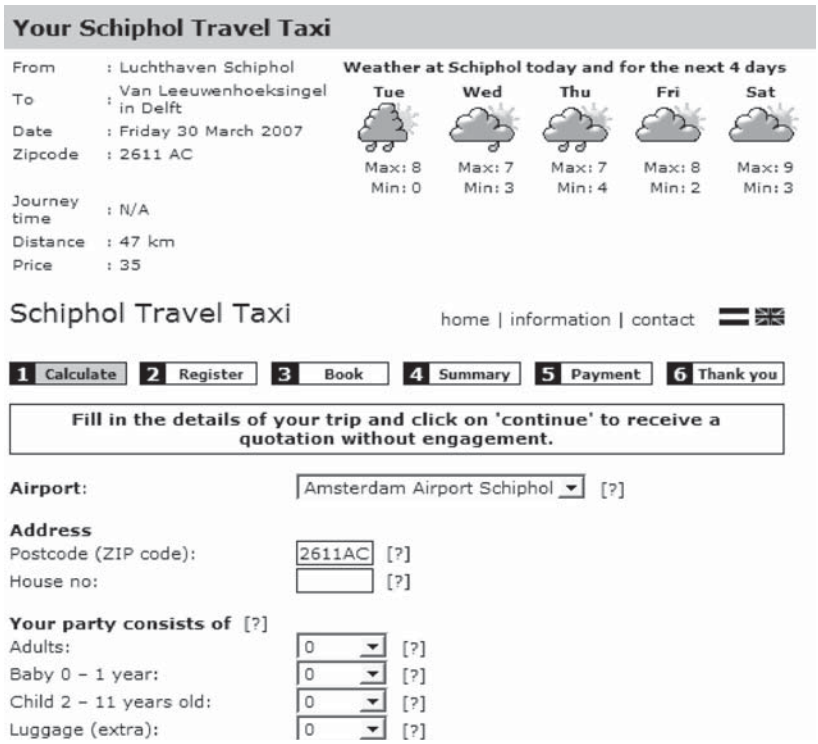
These transport options have been placed on the same screen as an interactive map, which has shown the origin (Schiphol Airport) and the destination (Delft) of the trip. The map is highly scalable, and the user can center the screen and zoom in to find whatever detail about the trip that is desired.

Figure 9-7 shows the screen presented when the user asked for more details about the shared-ride taxi. In the forms that need to be filled out to reserve such a taxi, the program has already supplied the zip code for the area traveled to (Delft). The user need only add the house and apartment details. The shared-ride taxi request must be made 24 hours before the trip is undertaken.



SOURCE: Amsterdam Schiphol Airport website.

Figure 9-6. Amsterdam airport's travel planner summarizes times and costs for all modes serving the airport, including both airport and public transport options.



SOURCE: Amsterdam Schiphol Airport website.

Figure 9-7. The Amsterdam airport website offers direct booking of shared-ride taxi/van service to and from the airport.

From the vantage point of the user, the destination and date are specified first, and a sketch level summary of all the travel options to that destination is presented. The user selects a mode for more information and then can proceed linearly to the process of buying/reserving the service. The Schiphol Airport trip planner is integrated in terms of all modal options and in terms of supporting reservations and sales.

Passenger Information Provided by Other Agencies

The Schiphol Airport ground access information system provides most of the information needed to plan a trip by *any* mode (whether dominated by the airport management or by the national systems) anywhere in The Netherlands. In addition, traditional hyperlinks to all the actual carriers are included elsewhere on the website.

Ground Access Planning on the Narita Airport Website

At about the same time that Amsterdam Schiphol Airport was taking the lead in integrating all ground access information, a new approach was launched by the ambitious *e*-airport program, which was described in *TCRP Report 83*. Under the *e*-airport program, Narita International Airport has developed the first ground access trip planning system that is tied to specific airline flights. Figure 9-8 shows that the program has four options for getting started depending on the needs of the user:

- The program can be started to support a departing flight.
- The program can be started to support an arriving flight.

SOURCE: Narita Airport website.

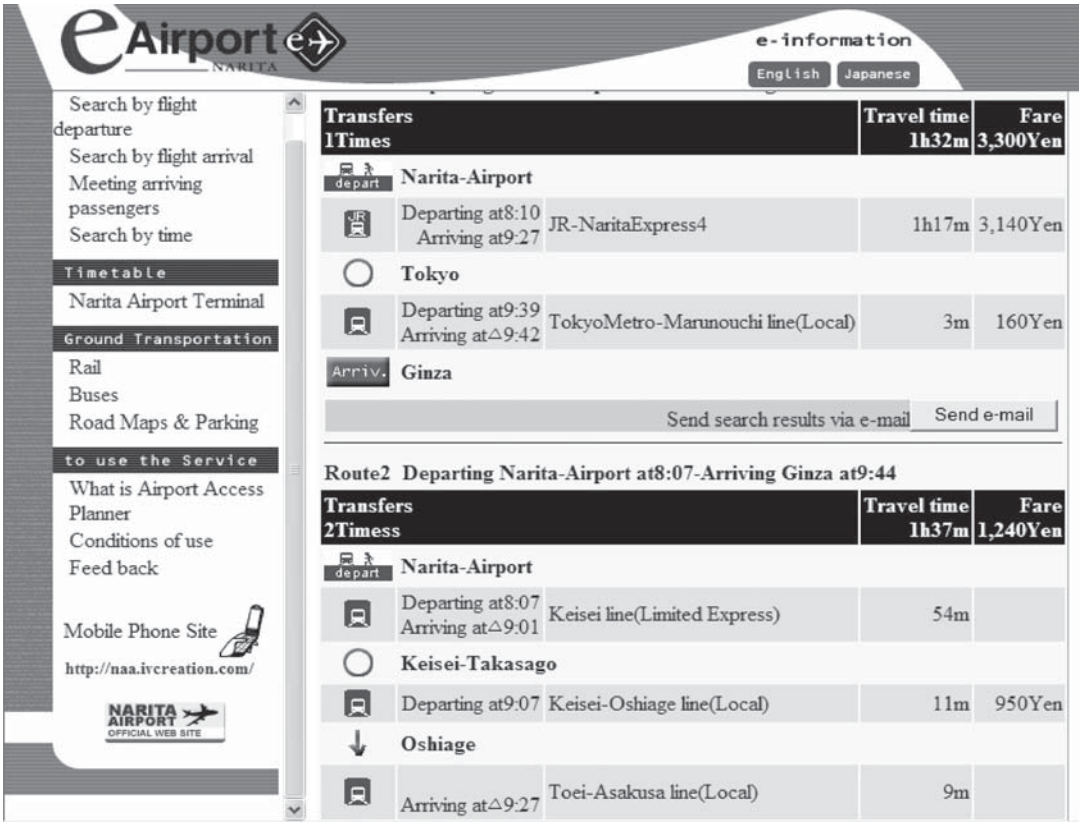
Figure 9-8. "Narita Airport Access Planner" allows the user to plan the ground access trip to connect with the departing or arriving flight.

- The program can be aimed at the needs of the meeter/greeter.
- The program can be started by simply entering a date and time.

Through a series of queries, the user is offered a long list of hotels and rail stations in the area. With the ground access departure time established by the scheduled arrival/departure time of the plane (via an Official Airline Guide static schedule), the user informs the system of his/her willingness to use bus, rail, and/or premium rail, and a set of recommended ground access trips are offered timed to the specific airplane flight.

As a result of query for a trip to the Ginza district, Figure 9-9 shows two high-quality rail options, one via the Narita Express costing 3,300 yen, taking 1 hour and 17 minutes to the destination, while a cheaper rail connection takes 5 minutes more, at a cost of 1,240 yen. A brief testing of the system suggests that the program will send the user by rail when rail stations are specified as the destination and by bus when hotels are specified as the destination.

The concept of linking supportive ground information to the needs of air travelers, and meeters/greeters, to specific flights is now being further developed on the San Francisco International Airport website. Unlike the Narita program, the user begins the process by obtaining the real-time status of the particular flight; for example, for greeters meeting a specific flight, the program produces a recommended short-term garage, along with a walking path from the garage to the end of the security arrival point, and pictures of that designated meeting area. This San Francisco International Airport program is not fully described in this report, because it does not interconnect with public transportation information at this time.



SOURCE: Narita Airport website.

Figure 9-9. The Narita trip planner compares one rail trip to Ginza for 3,300 yen with a second trip for 1,200 yen which is only 5 minutes longer.

Ground Access Information on the London Heathrow Airport Website

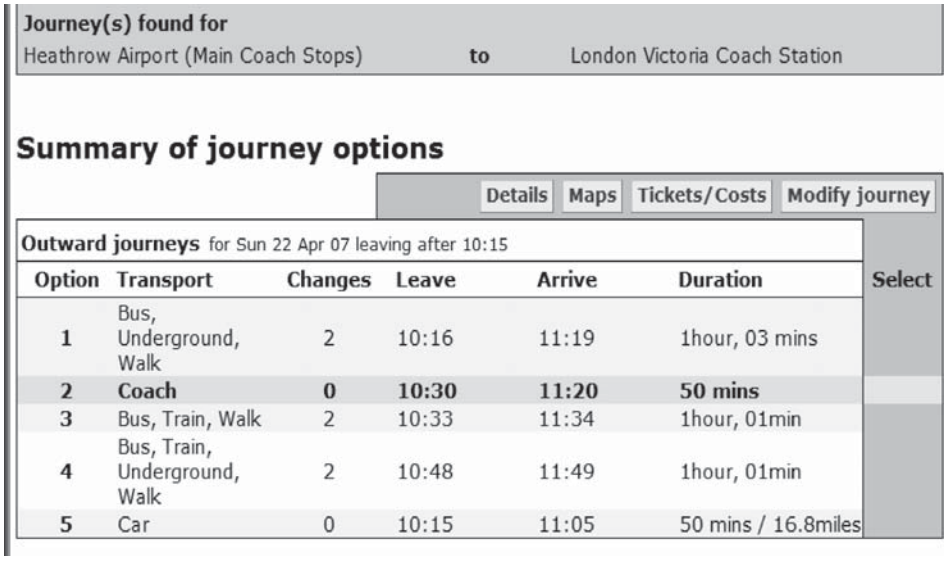
Passenger Information Provided by the Airport

Like most airport websites, the London Heathrow Airport website has a second tier page (following the home page) where all transportation modes are listed, and the user must choose among train, bus, taxi, etc.; that is, the hierarchy of navigation is mode first, geographic detail second. However, for those travelers going to or from London, a hyperlink at the same level as the major modes takes the user to a simple and straightforward summary of the various modes (from the taxi to the premium priced train) to get to and from London. Therefore, for the trip to London only, the hierarchy of navigation is geography first, modes second, and details of the selected mode third.

Passenger Information Provided by Other Agencies

The ground transportation section of the Heathrow Airport website offers a link to the United Kingdom's national program of traveler information, called "Transport Direct." The program provides both public and automobile trip planning from every point in the United Kingdom to every point in the United Kingdom through a remarkable assembly and integration of national and local trip planning systems and databases. Figure 9-10 shows the results of a query for trips from Heathrow Airport to a point in the Victoria Station area of Central London. As is shown, the program reviews all possible combinations of modal segments. The program has the ability to include air as well as ground segments, although this is irrelevant to the discussion of trip planning from the airport. Importantly, the program also includes times for automobile trips, which serves as a surrogate for taxi times in this context.

Figure 9-10 shows a quick summary of all modes available for the trip to Central London. This format differs slightly from the multimodal origin–destination trip itinerary planners in San Francisco and New York City, both of which made a specific trip recommendation by public transportation. The Transport Direct trip recommendation page always offers several modal combinations and immediately presents their travel times, but not their costs. For this



Journey(s) found for
Heathrow Airport (Main Coach Stops) **to** London Victoria Coach Station

Summary of journey options

Details | Maps | Tickets/Costs | Modify journey

Outward journeys for Sun 22 Apr 07 leaving after 10:15

Option	Transport	Changes	Leave	Arrive	Duration	Select
1	Bus, Underground, Walk	2	10:16	11:19	1hour, 03 mins	
2	**Coach**	**0**	**10:30**	**11:20**	**50 mins**	
3	Bus, Train, Walk	2	10:33	11:34	1hour, 01min	
4	Bus, Train, Underground, Walk	2	10:48	11:49	1hour, 01min	
5	Car	0	10:15	11:05	50 mins / 16.8miles	

SOURCE: Transport Direct website.

Figure 9-10. The Transport Direct website shows all modes, including the automobile, from Heathrow Airport to a point in Central London; standard bus coach service is the fastest and cheapest.

particular destination, the fastest trip is by a National Express Coach, an option not always considered for an airport with both direct rapid transit and direct high-speed rail service.

Transport Direct can offer ground transportation advice between all airports in the United Kingdom and any point in the United Kingdom.

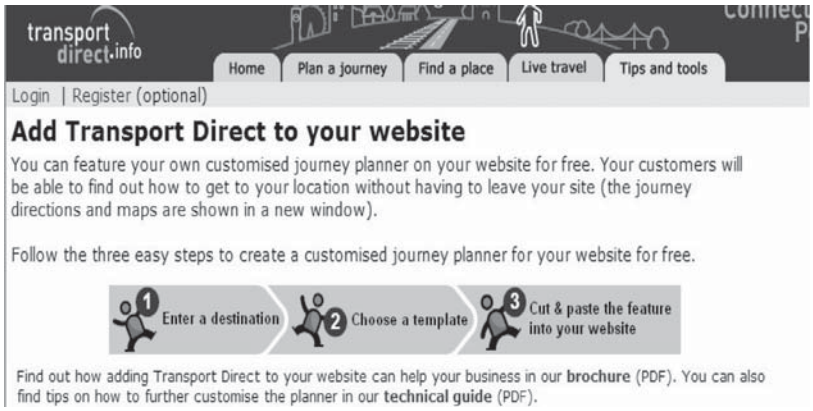
At the present time, the Heathrow Airport website offers the user the link to the Transport Direct website on the second page, under "To and from Our Airport." The user is then offered the standard Transport Direct opening screen, which has a great deal of information that is not at all relevant to the needs of an air traveler planning a trip in the future, including roadway detours all around the United Kingdom. At this point, the user must type in the words "London Heathrow" and the appropriate destination. The program then follows with a screen asking the user to confirm or clarify the same words, even if they were correctly entered.

The management at Transport Direct has currently embarked on a major program to simplify the process of transfer between websites, which could improve the integration of the services. As shown in Figure 9-11, Transport Direct has developed an application programming interface (API) to improve the access from individual websites into the Transport Direct trip planning process. Any website associated with an organization (such as Joe's Restaurant) with an address is provided with a Transport Direct icon with words such as "Get Directions to Joe's Restaurant here." Clicking the icon causes a new window to open in which Joe's Restaurant is already specified as the destination of the trip, and the user must specify only the trip origin. In effect, the API has eliminated both the need to enter the address and the need for the program to clarify or confirm this address. This service is currently being offered at no cost for use in every website in the United Kingdom. When it is adopted by the airports, it will make the transfer process to national trip planning system far more seamless. According to interviews with the managers of Transport Direct, this program will form the basis of their developing relationships with airports.

Ground Access Information on the Zurich Airport Website

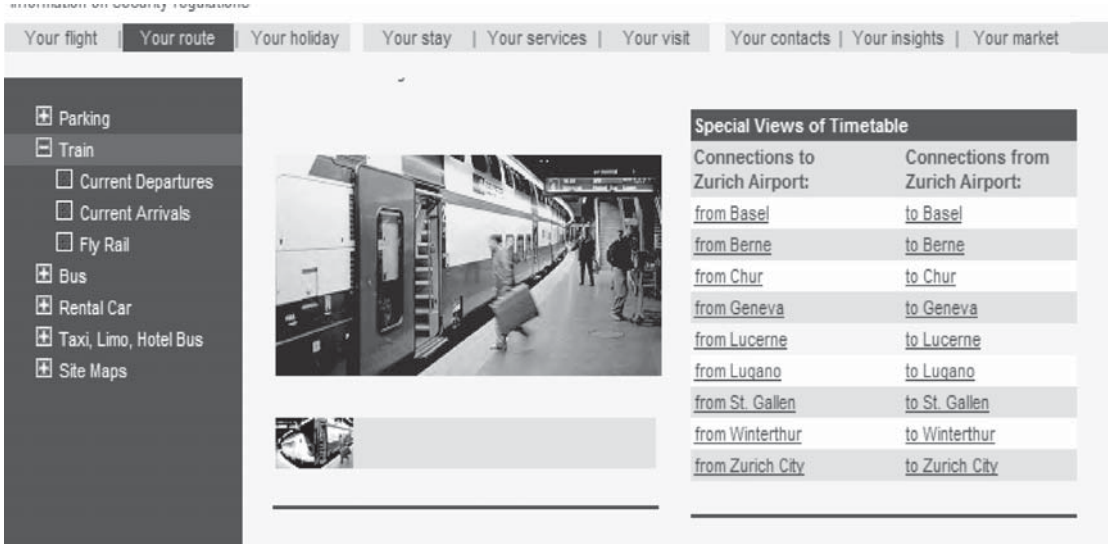
Passenger Information Provided by the Airport

Public mode access to Zurich Airport is overwhelmingly provided by the national rail system, whose transfer and link is discussed in the following paragraph. Thus, the home page actually uses the phrase "rail connections" to link the user to the next level of ground transportation



SOURCE: Transport Direct website.

Figure 9-11. The trip planning services of Transport Direct will be made available for free to every website in the United Kingdom, including all airports.



SOURCE: Zurich Airport website.

Figure 9-12. The Zurich Airport trip planner hyperlinks to the Swiss Federal Railway trip planner, where the origin and destinations are automatically entered.

information. For bus connections, the website provides a hyperlink to a regional transit information system, at which the user can navigate to origin–destination trip itinerary planning. The Zurich Airport website offers a link to a regional bus system, but no major transfer for local trip planning is emphasized on the airport-based website. An earlier link to door-to-door trip planning in the destination area has been eliminated. In Munich, the airport website simply offers a hyperlink to either the national railway website or the local transportation management agency website; there, an airport-specific page is available, but the airport website does not attempt to link directly to that page.

Passenger Information Provided by Other Agencies

The Zurich Airport website offers a somewhat unique approach to the question of the transfer to a second information provider. On the first page of ground transportation information, the user is offered hyperlinks in two columns of the nine most popular rail destinations (e.g., to Lucerne or from Lucerne) as shown on Figure 9-12. The hyperlinks take the user away from the airport website into the trip itinerary planning system of the Swiss Federal Railways, where *both the origin* (Zurich Airport) *and the destination* (Lucerne) are already entered into the data entry page. If the user does not enter his/her desired date and time, the system defaults to the present hour and proceeds to look up the trip options for the specified time. Once in the rail website, the user can proceed directly to ticket purchase. The net effect is quite seamless as most users would not be aware that they were no longer connected to the airport website.

The Baltimore/Washington International Airport Prototype Ground Access Module

Most major U.S. airports are now aggressively telling their story to the public via airport-based websites on the Internet. A major research effort is now under way to create a prototype format for presenting ground access information to airport customers, funded and managed by the I-95 Corridor Coalition. Based on that research, a partnership has developed between the Coalition and Airports Council International/North America to support the development of common formats and protocols for ground access information content on airport websites.

The Baltimore/Washington International Airport (BWI) project seeks to use map-based interactions to simplify the airport ground access trip itinerary planning process, while at the same time allowing for text-based data entry for users who prefer it. The project, which has been under development for several years, provides the traveler with immediate access to readily accessible information, followed by additional screens and hyperlinks to external sources only when needed and selected by the user.

The project proposes that a hierarchy of screen information be provided to the traveler using the airport website:

1. The user should specify where he/she wants to go upon leaving the airport by using a single click on an interactive map (or entering the destination as text).
2. The program should quickly and briefly describe *all* modes of transportation that are available to that general area, whether they are airport-based or traditional public transportation services.
3. The user should be able to request additional information on the chosen option(s) if needed.
4. The program should quickly provide the information that is relevant and appropriate to the service being queried. Some of this information will be stored in the airport's server; in other cases, a transfer to a second regional traveler information system will be initiated.
5. More detailed information specific to the proposed solution should be provided to the user, which can include product sales by the proposed carrier when appropriate.

Passenger Information Provided by the Airport

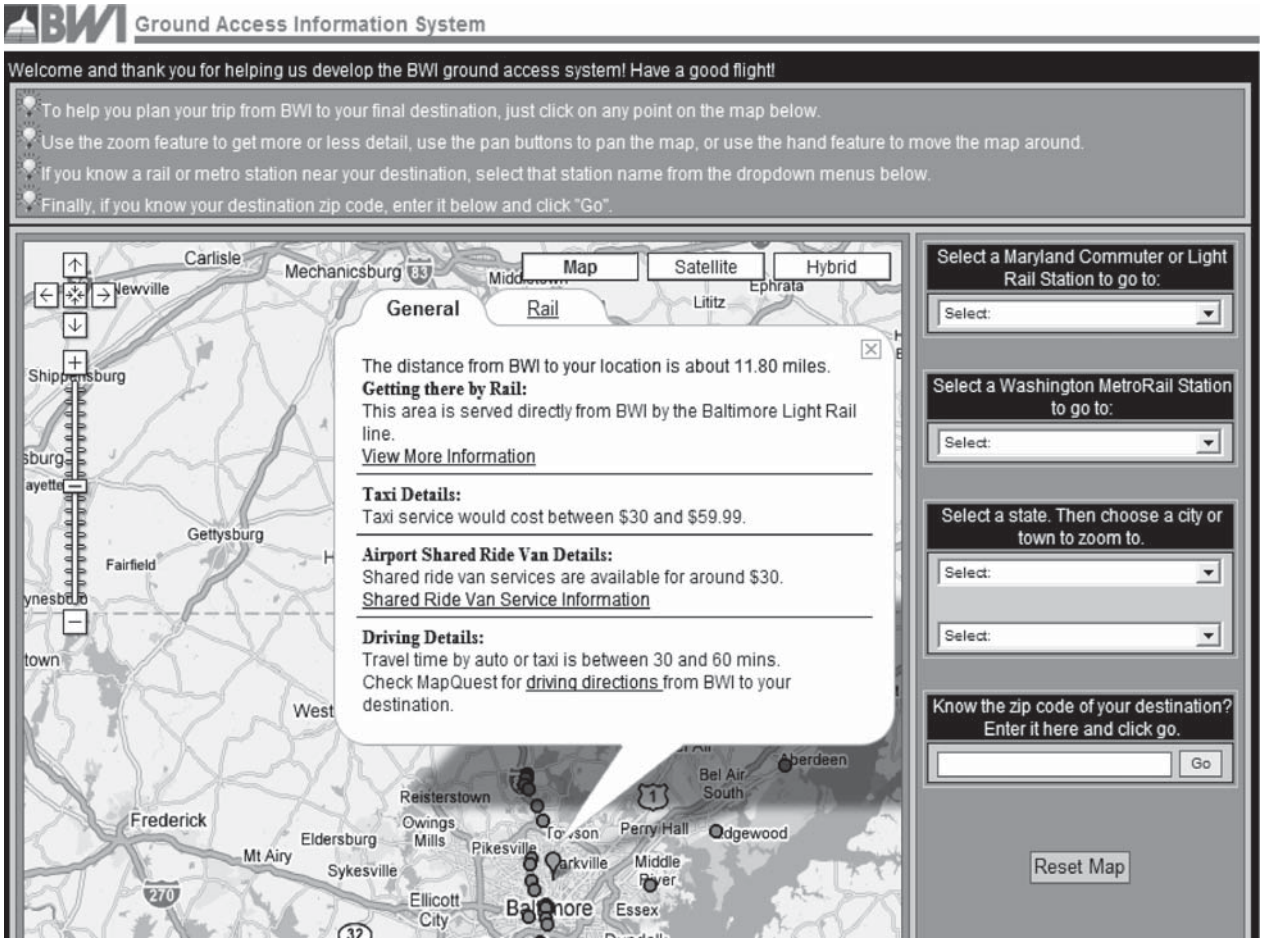
Figure 9-13 shows the opening screen of the BWI Ground Access Information System. The user is requested to specify his/her destination; this specification can occur on the Google map, using standard Google navigation procedures. The user is encouraged to click on a point "somewhere near" his/her proposed destination. More detail about geographic location can be provided later in the process if needed. Alternatively, the user may select a destination from a series of drop-down lists offered by town/city name, by WMATA MetroRail station, or by MARC commuter rail station. Beneath the drop-down lists, the user can input the zip code of the destination, if known.

If the interactive map has been used, the map centers itself on the clicked destination, and a summary of immediately available information is presented for taxi, shared-ride van, bus, or rail service to the area. Rough travel times and costs are included. For each destination, the program gives a proposed fare on the shared-ride system and offers a link to the company that serves that particular zip code. On the display panel, a rail tab that brings up a second display panel is offered for the user desiring more detail about rail connections. Figure 9-14 shows an example of the content of the rail-oriented display panel, including the next four departures from Baltimore/Washington International Airport to that destination.

If the user has entered the destination by choosing a rail station specifically, the rail-oriented display panel opens first, and hyperlinks to more information are provided for the other modes. The hyperlink for automobile directions transfers the user to MapQuest, where the origin "BWI Airport" has already been entered in the request form.

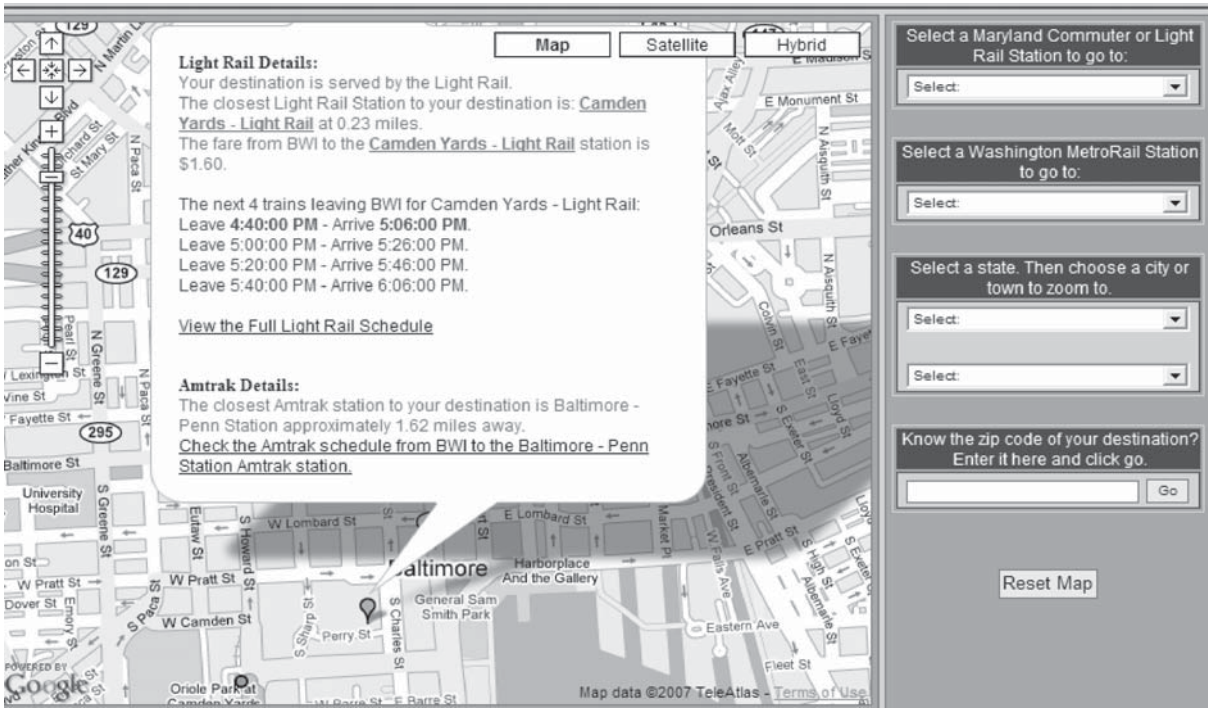
Passenger Information Provided by Other Agencies

The program is still under development, and the project managers are now working on the issue of transfer to automated origin–destination trip itinerary planners operating in areas adjacent to the airport. Ultimately, the user could be satisfied with the station-to-station level routing advice given directly by the program or choose to go to a more detailed door-to-door itinerary trip planning system for his/her specified destination.



SOURCE: Beta testing version of BWI system under development by the I-95 Corridor Coalition.

Figure 9-13. The BWI ground access module allows the user to click on any destination on the interactive map, which produces options by automobile, taxi, van, and rail services.



SOURCE: Beta testing version of BWI system under development by the I-95 Corridor Coalition.

Figure 9-14. The airport user seeking rail information is presented with trips from BWI to the nearest commuter rail, light rail, and Amtrak stations.

At a later point in development, the beta testing module will be put into operation for all trips *to* the airport. Later research will explore the challenges of offering such an airport-based trip itinerary planning system via cell phone with screen use and via telephone without the assumption of the ability to use screens.

Conclusions

In many cases, the potential users of public mode services simply do not know that high-quality alternatives to the automobile and taxi exist. The U.S. transit industry is now in the process of adopting highly effective origin–destination trip itinerary planning systems that show how any given trip, such as one to or from the airport, can be accomplished by public transportation. In Europe, these programs have been applied on a nationwide and even international scale. As yet, the full integration of ground transportation information with aviation-based passenger information has yet to be implemented anywhere. Planners implementing information systems should consider the needs of later systems that truly integrate information for all modes and provide for immediate tickets sales for all segments of the longer distance trip.

CHAPTER 10

Further Research

As ACRP is well under way, many major research tasks have now been identified. This brief section deals with subjects that could receive additional research attention, to augment the research now under way. The recommendations for further research are categorized by the process described in Chapter 1.

Step 1: Establish the Public Policy Goals for Airport Ground Access

Concerning the many factors relevant to Step 1, the researchers believe that ACRP, NCHRP, and TCRP could work together to help understand the nature of the collaborative, multijurisdictional decision-making process that characterizes the early phases of airport access planning. Questions arise such as:

- Who are the champions?
- What are examples of collaborative strategies?
- What are the best practices in establishment of a genuinely multimodal planning process?

An early product of such a research effort (whether by ACRP, NCHRP, or TCRP) might be better documentation of the role of FAA-sponsored planning efforts within the traditional MPOs. The program has been well established in major MPOs, but the activities of the aviation planners are not always well understood by the rest of the transportation planning community. Such a study could examine the effectiveness of the existing planning program and make recommendations for strengthening the link between aviation planning and traditional metropolitan transportation planning.

Step 2: Undertake the Program for Data Gathering and System Monitoring

The ACRP has already announced a major study to support the creation of improved airport access surveys and methods (ACRP Project 03-04), which was an implicit recommendation stemming from Step 2.

At this time, it is still unclear if any research program is adequately addressing the issue of basic data in support of the study of the travel patterns of airport employees. As shown in Chapter 8, the basic data available to support the examination of employee travel behavior is out of date and highly inconsistent in format and content. The researchers highly recommend that employee travel to airports be raised in priority for immediate research.

Finally, the valuable work once undertaken by the American Travel Survey is not currently being funded by the U.S. DOT. A fundamental observation of this report is that the behavior and

transportation choices made by the long-distance traveler are fundamentally different from those made by the same person in day-to-day metropolitan travel. The researchers strongly recommend that the subject matter originally covered by the American Travel Survey be recommenced by some agency of the U.S. DOT.

Step 3: Understand the Markets Revealed and Their Relationship to Candidate Solutions

This report has suggested that there are three categories of demand for airport ground access. First, there is the traditional, high-density market that gets attention when capital-intensive solutions such as rail are discussed. This report has presented a significant amount of information about such services between airports and traditional downtowns. Another category of market demand is that of the lowest density category, in which trips often start by automobile to major park-and-ride facilities served by dedicated airport buses; this category of market demand is being extensively documented in ACRP Project 10-02, "Planning Guide for Offsite Terminals."

By contrast, comparatively little analysis exists about the third market category described in this report, the middle-density market often served by shared-ride vehicles. Some airports, such as Los Angeles International Airport, have provided a disciplined program to limit the number of shuttle van companies competing for this market, while other airports have failed to provide this essential direction. More research should be undertaken to help airport managers understand what powers they do and do not have over these important operations. New hybrid service can offer scheduled services to specific destinations (such as hotels) and continue on with pre-arranged on-demand services to other destinations. For most U.S. airports, this market category is often the largest segment of the full market with comparatively little known about the nature of demand therein.

In addition, the researchers recommend that the study of airport ground access alternatives be widened to include the smaller U.S. airports. In many cases, the managers of smaller airports are willing to participate in programs to encourage high-occupancy solutions, but very little guidance is available. Options such as shared-ride taxis need to be explored for their application at the mid-sized and smaller U.S. airports.

Step 4: Design a Program of Services and Strategies for Airport Ground Access

Without question, rubber-tired public transportation vehicles will remain the dominant public transportation access mode in the United States. It is surprising, then, to see so little attention paid to either the fully developed program of bus rapid transit or even the smaller steps of HOV planning for major U.S. airports. At present, only one such airport program exists, the Silver Line to Boston's airport. Similarly, the number of airport buses successfully utilizing HOV lanes is small; major positive examples are at Los Angeles International Airport and, to a lesser extent, Boston's airport. For some reason, bus rapid transit options do not survive in the planning process for airport ground access, where rail solutions are almost always recommended. The researchers recommend that more attention be paid to advanced bus design options, including low-floor entry for ease of travelers carrying baggage. Such systems are commonplace around the world but have rarely been applied at major airports.

Step 5: Manage the Airport to Encourage Higher Occupancy

At present, the ACRP has under way an innovative study of alternative terminal configurations (ACRP Project 07-01), which marks a major change from the traditional approach to airport

design, an approach that did not give high priority to the public transportation/HOV implications of the design process. While a major concern of this airport terminal study is security, options are being examined in which "landside processing" is separated from "airside processing"; within this concept could be major new roles of airport ground access systems. While this study is proceeding, airports such as Los Angeles International Airport may be facing the possibility of major reconfiguration of existing terminal facilities. The research into terminal design concepts needs to be closely coordinated with advanced airport ground access concepts.

Step 6: Present the Ground Access Services to the Traveler

The researchers recommend to the ACRP that a study be undertaken to create a standard approach to presenting ground access information on airport websites. Chapter 9 clearly shows that many U.S. airports have developed major programs for providing ground access services, but there is no common format for presenting these services to the public on airport websites and other electronic media. While many U.S. airports have made, or are considering making, major capital investments to improve public mode access, no consistent format has been put forward for quickly and effectively presenting viable ground access travel options to the traveler. While many metropolitan areas are developing "511" advanced traveler information systems, to date none of those systems have incorporated travel modes that are specific to the users of the airports.

The Airports Council International–North America has identified a need for airports to work together to create a common set of procedures for presenting ground access information. Optimally, the traveler who has become accustomed to the method of attaining ground access information in one U.S. airport would quickly and efficiently be able to access similar information at an airport with which he/she was not familiar.

The objective of the proposed research would be to help the airport community develop a common format for presenting all ground transportation options to the traveling public, particularly to the non-resident market. If many of the large airports adopted a common format, the process of presenting ground transportation services to new travelers at an airport could become more efficient, and faster for the traveler. Possibly, the adoption of a common set of procedures would eliminate the need for many airports to separately undertake the same market research and software development. The product would be both a set of guidelines for presenting ground access services and a working web-based prototype of such a system for possible adaptation for use at specific U.S. airports.

The intent of the proposed research is not to create any form of mandatory "standard" for the individual airports to adopt; rather the research is intended to establish a common logic of information presentation that could be used as each individual airport updates its existing websites.

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APPENDIX

Abbreviations and Acronyms

ACI	Airports Council International
ADP	Aéroports de Paris
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
ATS	American Travel Survey
AVI	Automated vehicle identification
BAA	The company that owns and operates three London airports: Gatwick, Heathrow, and Stansted
BART	Bay Area Rapid Transit (San Francisco)
BOS	Logan International Airport (Boston)
BRT	Bus rapid transit
BWI	Baltimore/Washington International Airport
CAPS	Certified Airline Passenger Service
CBD	Central business district
CMS	Congestion Management System
DCA	Reagan Washington National Airport
DIA	Denver International Airport
DOT	Department of Transportation
EIS	Environmental impact statement
EU	European Union
EWR	Newark Liberty International Airport
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
GAO	Government Accountability Office
GIS	Geographic information system
GPS	Global Positioning System
GTC	Ground transportation center
HEX	Heathrow Express
HOV	High-occupancy vehicle
IAD	Washington Dulles International Airport
IATA	International Air Transport Association
JFK	John F. Kennedy International Airport
LAWA	Los Angeles World Airports
LAX	Los Angeles International Airport
LGA	LaGuardia Airport
LIRR	Long Island Railroad
Maglev	Magnetic levitation
MAP	Million annual passengers

MARC	Maryland rail commuter service
MARTA	Metropolitan Atlanta Rapid Transit Authority
Massport	Massachusetts Port Authority
MBTA	Massachusetts Bay Transportation Authority
MPO	Metropolitan planning organization
MWCOG	Metropolitan Washington Council of Governments
NCHRP	National Cooperative Highway Research Program
OAG	Official Airline Guide
PANYNJ	Port Authority of New York and New Jersey
PDX	Portland (OR) International Airport
RER	Regional Transit System, Paris
RTP	Regional transportation plan
SAS	Scandinavian Airlines System
SCAG	Southern California Association of Governments
SEA	Seattle–Tacoma International Airport
SEPTA	Southeastern Pennsylvania Transportation Authority
SFO	San Francisco International Airport
SNCF	French National Railways
TPA	Tampa International Airport
TSA	Transportation Security Agency
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century
TRB	Transportation Research Board
Tri-Met	Tri-County Metropolitan Transportation District, Portland OR
VMT	Vehicle miles traveled
WMATA	Washington Metropolitan Area Transit Authority

Abbreviations and acronyms used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation