CHAPTER **6**

BAGGAGE, OFF-AIRPORT PROCESSING, AND SECURITY

CONTEXT OF CHAPTER 6

A major impediment to the choice of a public mode for ground access is the difficulty in accommodating baggage. Chapter 6 will review a wide variety of strategies to deal with the challenge of baggage in the context of an increased priority for the security of transportation operations. The chapter commences with a review of various strategies from best-case practices to deal with the problem of baggage, some of which do assume off-site processing and others of which do not. The second major theme of the chapter concerns the implications of the events of September 11, 2001, on national policies toward dealing with security issues that impact baggage handling and other aspects of airport ground access.

The traveler usually has a choice of ground access modes, each of which has different attributes in terms of responding to the needs of the customer. At one end of the spectrum of accommodation are the private car, the taxi, and the private limousine, all of which have the advantage of personal service and ample room to deal with baggage. At the other end of the spectrum are all shared-service strategies, particularly those that rely on existing fixed-route and schedule service designed for metropolitan commuting, which must deal "after the fact" with the requirements of baggage (see Figure 6-1). In the middle of the spectrum are shared-ride vans and dedicated rolling stock, which can be designed to accommodate baggage from the outset. A key issue in the design of a program of airport access public mode services is to accommodate the checked baggage of potential passengers, by one strategy or another.

UNDERSTANDING THE NEED FOR BAGGAGE-HANDLING STRATEGIES

The Duration of Air Trips

It is important to understand the make-up 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. The amount of baggage is influenced largely by the duration of the trip; and the duration of the trip is influenced largely by the purpose of the trip. Aviation trips as a whole are divided evenly between those less than 5 days and those longer than 5 days. Specifically, 46% of all air passenger trips are less than 4 days, 34% of trips are between 4 and 6 nights, and 20% have duration of longer than 6 nights.

Trip purpose has a strong influence on trip duration because the work trip tends to be shorter than the leisure trip. Table 6-1 shows that for those traveling on business, 62% of 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 1 week while 26% of non-business trips take more than a week. The non-business traveler emerges as a major challenge for baggage handling.

Effect of Trip Duration on Choice of Ground Access Mode

For the 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 gets longer. This reflects, among other things, the cumulative costs of several days of parking—which increases linearly with trip duration. For trips of 3 nights or less, 14% of national airport access is by modes other than the private car; for trips with more than 6 days, 18% are 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 days down to 38% of those traveling for more than 6 days.)

For the Non-Home End of the Long-Distance Trip

At the non-home end of the long-distance trip, parking fees are no longer a variable, and the same pattern does not occur. For those trips of 1 week or under, 28% of the airline passengers choose a mode other than automobile pick up and automobile rental. 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,

Photo: Matthew A. Coogan.

Figure 6-1. This light-rail rider from BWI Airport had problems dealing with baggage on the train.

which jumps from 32% for the trips of fewer than 4 days to 49% for trips of more than 1 week. Trips of long duration, which tend to be not for business purposes, are marked by the willingness of friends, relatives, and colleagues to provide the pick-up and drop-off access trip. This form of transportation serves as a serious competitor to all public modes for the long-duration trip.

Strategic Implications

Overall, the data on trip duration suggests that fully half of the trips to and from airports are made as part of a trip of 5 days or longer. For the shorter-duration trips, public modes face serious competition from the park-at-airport mode; for the longer-duration trips, the strongest competition tends to come from the pick-up and 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 does the business trip; the challenge stems for the fact that these "leisure" trips tend to have longer duration and are associated with larger amounts of baggage. The issue of dealing with baggage, then, requires the review of a candidate set of strategies to deal with the problem.

TABLE 6-1 Duration of airline passenger trips by purpose

Duration	Biz	Non-biz
0 nights to 3 nights away from home	62.1%	34.6%
4 nights to 6 nights away from home	26.8%	39.0%
8 or more nights away from home	11.1%	26.3%

SOURCE: American Travel Survey.

STRATEGIES FOR IMPROVING BAGGAGE HANDLING FOR PUBLIC MODE SERVICES

Chapter 6 examines three major categories of baggage-handling strategies: (1) those that do assume off-airport baggage check-in services; (2) those that do not assume off-airport baggage check-in services; and (3) hybrid combinations that provide for some, but not all, desired services. Within the first category, strategies are examined in which the airlines provide the baggage processing as well as strategies in which a third party provides the baggage processing. Within the second category, strategies are reviewed to improve baggage handling for dedicated airport ground access services and for services shared with traditional fixed-route and schedule operations. Within the third category, strategies are reviewed in which baggage check-in services are provided for some, but not all segments of the trip; strategies are reviewed in which some, but not all, baggage-processing services are provided off-site.

STRATEGIES THAT USE OFF-AIRPORT BAGGAGE CHECK-IN

Off-Airport Baggage Processing by the Airlines

The most comprehensive, and the most costly, strategy to deal with baggage on public mode services is based on the concept that the airlines will undertake both the check-in process (issuing the boarding pass) and the baggage-acceptance process.

Off-Airport Terminals, Full Service

Downtown terminals, operated by airline employees, were in operation in many places throughout the world, but fell out of favor because of cost considerations. Such facilities existed in New York, London, Paris, San Francisco, and Zurich, among other places. London had two downtown check-in facilities: one for long-distance flights from near Victoria Station and a second for shorter-distance flights from the West End of London. All of these facilities operated with dedicated airport buses, which carried the checked baggage.

Photo: Matthew A. Coogan.

Figure 6-2. Airline employees provide check-in services at London's Paddington Station.

The first downtown check-in facility to operate with airport rail service was opened in 1959 at the Central Station in Brussels, served by the Belgian National Railways and by dedicated bus service from the same location. This service is no longer in operation. At the present time, through-ticketed rail passengers accessing Paris' Charles de Gaulle Airport are offered baggage check-in the Brussels high-speed rail station, while passengers accessing the Brussels Airport are not offered this service.

At the present time, full downtown airline check-in services are available at London (in two locations) (see Figure 6-2) and in Hong Kong, with similar services in Osaka's Kansai International Airport in Japan. An analysis of the operations of the baggage-handling procedure for these services was included in Chapter 5 of *TCRP Report 62.* In the year 2002, Kuala Lumpur's Express Rail Link intends to open the world's first facility that will allow both downtown check-in services, and through-routed downtown check-out services. The baggage-claim function for appropriately tagged baggage would occur in the downtown train station.

The world's first downtown airport check-in system built for a rapid transit system is now in operation in Madrid at Avienda de America. The front car of the municipal transit vehicles carries the checked bags to Madrid Barajas International Airport. Downtown check-in services commenced in May 2002 and are now being provided for Iberia Airlines and for those airlines serviced by Iberia.

The baggage check-in function in operation until the mid 1980s by the Marin County Airporter bus services was unique in that two airlines, United and American, both provided off-site baggage check-in. This highly popular amenity was discontinued by the airlines at the onset of the Gulf War.

Off-Airport Baggage Check-In Operated by a Single Airline

Historically, there have been many examples of a single airline offering off-site check-in services in conjunction with dedicated airport bus and van services (see Figure 6-3). Such services were offered by Delta Air Lines in Atlanta from a major off-site parking facility. American Airlines operated a variety of park-and-fly operations with off-site baggage check-in at several sites in the Dallas and Fort Worth areas. America West operated a full-scale check-in station in Scottsdale, Arizona. These services were all discontinued in the 1980s. Examples of more recent joint operations (providing off-site baggage handling) are summarized in this section. Prior to September 11, 2001, two airlines (Frontier Airlines and Continental Express) operated remote baggage check-in and baggage-claim facilities that could be used by their customers as well as by customers connecting to other airlines.

Frontier Airlines (Boulder, Colorado). Frontier Airlines operated the FreeWay Flyer nonstop bus service between the Regal Harvest House hotel in Boulder, Colorado, and the Denver International Airport, with six daily round trips. Frontier Airlines ceased operation of this service on September 11, 2001, prior to the imposition of the new federal security regulations. When the service was in operation at the Regal Harvest House, Frontier Airlines customers could check baggage to their destinations, claim baggage from arriving "flights," make flight reservations, pick up tickets, and arrange seat assignments. In addition to traditional hotel and conference center services, other amenities were available to FreeWay Flyer passengers including valet parking, laundry and dry cleaning, a rental car desk, and a fax and photocopy center. One-way travel time between Denver International Airport and the Regal Harvest House was approximately 1 h. The FreeWay Flyer bus service, which was offered free of charge, was available only to Frontier Airlines passengers (see Figure 6-4).

Photo: Collection of John Andrews.

Figure 6-3. The old Republic Airlines offered an off-site check-in service for this bus.

Photo: Collection of John Andrews.

Figure 6-4. An earlier Frontier Airlines operation by passed the passenger terminal.

To check baggage to their final destinations (even if it involved an interline connection) at the Regal Harvest House, passengers were required to answer FAA-required security questions (e.g., Have your bags been under your control since you packed them?). Frontier Airlines agents then tagged the bags to their final destinations and secured the bags in a container with a lockable roll-up door. Before the FreeWay Flyer bus departed for Denver International Airport, the agents loaded the baggage into a separate, lockable compartment under the bus.

Passengers were dropped off at the commercial vehicle (Level 5) curbside at Denver International Airport, where they could proceed directly to security checkpoints and then on to the Frontier Airlines gates (assuming they had completed the check-in process at the Regal Harvest House before boarding a FreeWay Flyer bus). After dropping off passengers, the bus proceeded to an air operations area (AOA) access point (i.e., entrance gate), where the bus driver was required to use an airport employee identification card and present other required security identification to gain access on to the AOA. After clearing security, the FreeWay Flyer bus proceeded to the Frontier Airlines gates, where the bags were sorted and loaded onto appropriate aircraft.

Customers returning to Boulder via the FreeWay Flyer service boarded the bus and departed from Frontier Airlines' Gate 34 on the A Concourse. Inbound passengers were able to claim bags in Boulder that had been checked on Frontier Airlines or another connecting airline (i.e., interline baggage).

Continental Express (Lehigh Valley International Airport). Continental Express, a partner of Continental Airlines, operates a bus service between Lehigh Valley International (formerly Allentown-Bethlehem-Easton) Airport and Newark International Airport, with eight daily round trips. Continental Express treats the bus service between these two airports as a traditional commuter airline flight. For example, Continental Express customers could check baggage to destinations and claim baggage from arriving "flights" and could still make reservations, pick up tickets, and arrange seat assignments at the Lehigh Valley International Airport terminal, whether they were boarding a bus or plane. One-way travel time between Newark International Airport and Lehigh Valley International Airport is approximately 90 min. The bus service is available to all passengers (e.g., even if they are connecting in Newark to an airline other than Continental or Continental Express).

Prior to September 11, 2001, Continental Express passengers boarding a bus at the Lehigh Valley Airport could check baggage with Continental Express agents who asked passengers FAA-required security questions; tagged the bags to their final destinations; and secured the bags until they were loaded into a separate, lockable compartment under the bus. On reaching Newark International Airport, passengers were dropped off at the terminal curbside where they could proceed directly to security checkpoints and then to the aircraft gates. Prior to September 11, 2001, the bus driver then cleared security (swiped an airport identification card and provided other required identification) and proceeded into the AOA, where the bags were sorted and loaded onto appropriate flights. Passengers returning to Lehigh Valley International Airport from Newark boarded the bus at a Continental Express gate at Terminal C, and then upon arriving at Lehigh Valley International Airport, could claim bags that were checked on Continental Airlines, Continental Express, or other connecting airlines (i.e., interline baggage).

Because of to the recent FAA security restrictions, passengers must now recheck their baggage at Newark. However, Continental Express is seeking an amendment to current security procedures to allow the remote baggage-handling services to be reinitiated at Leigh Valley International Airport.

Off-Airport Baggage Check-In Serving Cruise-Ship Passengers

Prior to September 11, 2001, to facilitate the group movement of cruise-ship passengers between the port of arrival and the departure airport, several major cruise lines and airlines had implemented baggage check-in services aboard the ship or at the pier at several major ports. Unlike the airline-operated baggage services described above, these baggage-handling services were provided in one direction only (i.e., for disembarking cruise-ship passengers to their final airport destination, but not from the departure airport directly to the cruise ship).

Examples of cruise-ship ports providing remote baggage check-in included Port Everglades (with baggage transported to Fort Lauderdale-Hollywood International Airport); the Port of Miami (with baggage transported to Miami International Airport); and Port Canaveral (with baggage transported to Orlando International Airport). The specific baggage-handling

and security procedures at each port varied depending on the participating airlines and their policies and union agreements and the policies of the cruise-ship companies.

The baggage-handling and security procedures at Miami were typical of those used at other ports. At the Port of Miami, airline representatives stationed at baggage check-in podiums located at the piers assisted domestic airline passengers departing for Miami International Airport to check baggage to destinations, arrange seat assignments, answer the FAA-required questions, and obtain boarding passes. (International passengers cannot check baggage and must accompany their baggage to the terminal ticket counters.) After all bags were checked in, a third-party bonded baggage-handling company, paid for by Royal Caribbean Cruise Line, loaded the bags into trucks and delivered them to the airport's AOA. Passengers were transported in charter buses from the port to the terminal curbsides.

Some cruise lines at Port Everglades employed an alternative process. These cruise lines permitted airline representatives to board the ship the morning of disembarkation and process passengers. The airline representatives asked passengers the FAA-required security questions and then issued boarding passes and baggage tags. After disembarking, passengers claimed their baggage, affixed the baggage tags, and conveyed the baggage to a waiting truck. The trucks were loaded by airline representatives, sealed with the airline's security decals, and driven to the airline's baggage makeup area on the AOA. As with Port of Miami, passengers were bused to the departures-level curbside at the airport.

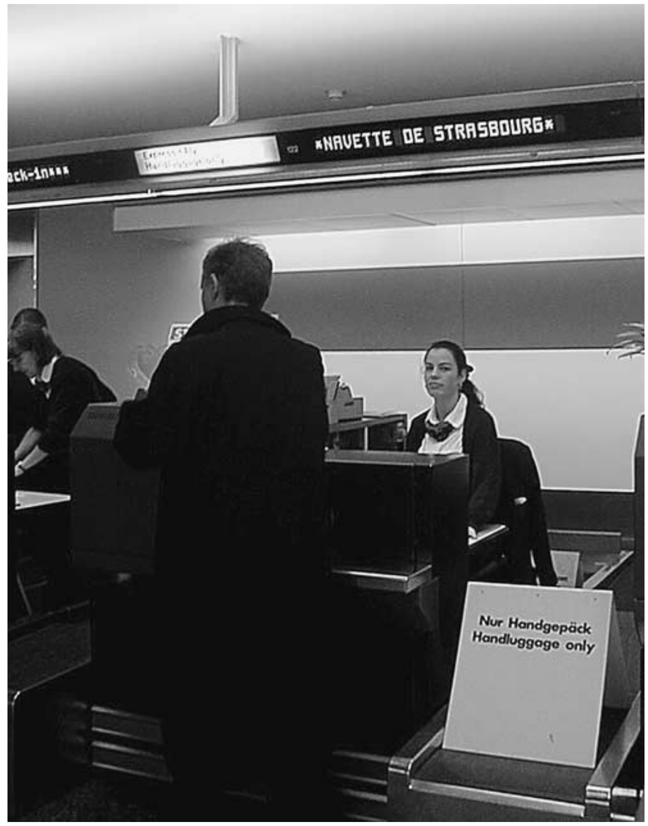


Photo: Matthew A. Coogan.

Figure 6-5. Express check-in is offered at Zurich Airport to passengers who have sent their baggage ahead.

Off-Airport Baggage Processing by a Third Party

Swiss National Railways

The largest network of baggage check-in services in operation currently is run by the Swiss National Railways, providing baggage processing from 116 separate railway stations, with full check-in (with boarding pass) at 60 rail stations in 2002. This is a service of the national railways, and no airline personnel are involved in accepting the baggage. The Swiss National Railway charges about US$15.00 per bag checked for the service. It is reported that 270,000 travelers a year use this program. A through-routing service is also offered for bags coming into Switzerland, with a customs declaration form included in the ticketing process. Air travelers who have participated in the program and arrive at the airport with only hand baggage can use special check-in stations with shorter lines and shorter transaction times (Figure 6-5).

It has been estimated that about 4% of the originating air travelers at Zurich Airport make use of the off-site baggage check system. Zurich officials report that the system is particularly popular with skiers and others with large, clumsy baggage. Since its inception, the system has been operated with a full baggage-matching operation—one of the first systemwide applications of the concept.

Certified Airline Passenger Service

Prior to September 11, 2001, passengers departing McCarran International Airport on 1 of 10 airlines (including Virgin Atlantic) could check in their baggage and receive boarding passes and seat assignments at counters located at more than 12 Las Vegas–area resorts and casinos. These baggage check-in counters were operated by Certified Airline Passenger Service (CAPS), a privately owned company created by major Las Vegas resorts and a local baggage-handling company. 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. However, in 1999, prior to the introduction of the CAPS service, passengers on National Airlines flying to Las Vegas could check their baggage directly to one of two resorts and casinos, the Rio All-Suite Casino Resort and Harrah's Las Vegas Casino Hotel. Passengers using this service were not required to claim their baggage upon arriving at McCarran International Airport.

Airline passengers using the CAPS service were required to check in their baggage 2 to 12 h prior to their scheduled flight departure time and pay a $6.00 per-passenger service fee. Baggage was trucked from the individual hotels directly to McCarran International Airport. Security procedures similar to those established at Denver and Newark International Airports were employed to control truck access to the AOA and travel to the terminal baggage-operations area. While the Frontier and Continental Airlines buses stopped at a single baggage-handing area, the CAPS truck made multiple stops to unload the baggage because CAPS served multiple airlines. The international passengers, including those of Virgin Atlantic, were required to have their baggage rescreened and inspected at the airport.

The CAPS service was permitted to provide off-site baggage check-in services for scheduled and charter airlines under the Off Airport Baggage Acceptance Amendments enacted by 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 CAPS' baggage-handling facilities were subject to FAA personnel inspection to ensure compliance with security regulations.

The CAPS service was growing in popularity and was being expanded to serve additional hotels and airlines prior to September 11, 2001. This success could be attributed to several factors, which are unique to Las Vegas. For example, as in many communities, hotel guests are required to check out by noon; but unlike in most cities, in Las Vegas, many visitors prefer to remain at the casinos and resorts as long as possible and depart Las Vegas on evening flights. Prior to the availability of the CAPS service these visitors typically deposited their baggage with hotel bellmen and, at the end of the day, reclaimed their baggage and carried it to the airport for check-in. This process typically involved tipping the bellmen and airport skycaps. Thus, many Las Vegas airline passengers prefer to check their bags several hours before their flight and are accustomed to paying for this service. This is not true in most other cities, which have more resident airline passengers and fewer non-resident passengers than does Las Vegas and therefore have fewer passengers wishing to check-in their bags several hours before leaving their home or office or who are accustomed to paying for such baggage-handling service.

As noted, CAPS has been discontinued because of the recent FAA security restrictions. However, CAPS representatives are negotiating a security Amendment and hope to renew the prior baggage-handling procedures in early 2002. The new procedures will require 100% passenger baggage matching (i.e., that is the tracking of all passengers and their baggage) for domestic passengers and the continuation of special check-in procedures for international passengers and certain other airline passengers (e.g., those selected for more intensive screening).

The Las Vegas–based CAPS program is an adaptation of non-airline baggage strategies. The defining characteristic is that the act of collecting the baggage is contracted out to an entity other than the airline. Another potential variation on this concept is the choice by the traveler to send bags ahead by an overnight service delivery company in order to minimize the complexity of baggage processing at major airports. Some analysts have predicted this option will gain in popularity as the implications of recent legislation concerning baggage-handling become better understood or if the airlines impose a fee or surcharge for checking baggage (rather than providing this service for free).

Constraints on Off-Airport Baggage Processing

The ability to process passenger baggage at remote locations (i.e., away from the terminal building) was constrained by regulations established by the FAA prior to September 2001, with more stringent requirements subsequently imposed by the FAA and Congress. This chapter summarizes the federal requirements imposed by the Aviation and Transportation Security Act and the newly formed Transportation Security Administration.

Remote Baggage-Handling Operations after September 2001

The Emergency Security Amendment implemented by the FAA on September 12, 2001, imposed Alert Level IV security measures at all U.S. airports. These measures, most of which remain in effect at the time this report was prepared, include the Prohibition of Remote Baggage Check at Hotels and Other Locations regulation. This regulation resulted in the temporary discontinuance of all the remote baggage-handling services described above (e.g., the Continental Express service, CAPS in Las Vegas, and the cruise-ship programs). Only the Frontier Airline service was discontinued for business reasons prior to the imposition of these regulations. As noted above, at the time this report was prepared, Continental Express and CAPS were seeking amendments to security procedures to re-institute their remote baggage check-in services.

In November 2001, the Aviation and Transportation Security Act was signed into law. This Act, which established the Transportation Security Agency (TSA), requires that the TSA and the airlines (1) ensure either the inspection of all (100%) of checked passenger baggage by staff, specially trained dogs, or explosive detection systems (EDS), or the implementation of baggage-reconciliation procedures that match all baggage and airline passengers on board an aircraft (i.e., positive passenger bag match) and (2) inspect all checked passenger baggage using EDS by the end of 2002 if equipment is available. Prior to September 11, 2001, all checked baggage screening was performed only for international flights originating or terminating in the United States

and for selected passengers on domestic flights. Furthermore, TSA is requiring that before the end of 2002, all passenger and baggage screening be performed by TSA employees.

Thus, to comply with these regulations, it would be necessary for a remote terminal seeking to provide baggage check-in services (1) to provide 100% positive baggage matching (like that to be provided by CAPS in Las Vegas) and (2) by the end of 2002, for the operator (or its designee) to install and supervise the operation of EDS equipment, which would be operated by TSA employees. At present, certified EDS equipment costs more than $1 million per screening unit. As a result of these additional restrictions and costs, it is anticipated that remote terminals with baggage-check services will be feasible only at those locations that can charge passenger service fees (like those levied in Las Vegas), that can attract sufficient passenger volumes to warrant the investment in EDS screening equipment and operating costs, or both. At this time it is not known whether per-passenger security-fee revenues could be used to fund passenger and baggage-screening equipment or operations at remote terminals. However, the projected shortfalls in the funding of TSA operations suggest that the use of funds for remote locations is unlikely.

STRATEGIES THAT DO NOT ASSUME OFF-AIRPORT CHECK-IN

Although many of the most dramatic strategies to deal with the problem of baggage on the public mode airport access service do assume off-site baggage processing, there are a series of others that do not. Most airport ground access systems around the world have not chosen to implement off-airport baggage handling. This section reviews the experience of dedicated airport access services, and then services, that are shared with standard metropolitan commuting functions. This section is followed by an analysis of "partial-solution" strategies that provide some, but not all, of the functions provided in the full-service systems.

Baggage Accommodation in Dedicated Service

Examples of rail services that are designed exclusively for airport access services and, thus, that are equipped with ample baggage-storage areas include Oslo's Airport Express train, London's Stansted Express, Milan's Malpensa Express, and Stockholm's Arlanda Express trains. The design of the baggage-storage areas varies among the separate operations. The most innovative storage area is included in the Oslo Airport Express trains, in which a major baggage-storage area is included in the middle of the vestibule area, directly visible from adjacent seating areas, as is shown in Figure 6-6. Market research in Oslo suggested that having the baggage visible was a desired service characteristic.

Photo: Adtranz.

Figure 6-6. Dedicated services such as Oslo's Airport Express can deal with baggage-storage issues.

Airport buses designed for dedicated service to airports are in operation throughout the world. Different bus operations deal with baggage storage in different ways. For most airport operations, the baggage is placed in the hold area under the high platform floor and is accessed only by the driver. This causes long dwell times for multistop service because the driver must leave the bus to gain access to the baggage. In Paris, a compromise was developed in which an employee of the airport bus company was stationed at key locations along the route and opened the baggage bins without the intervention of the driver. Buses designed for urban transit and shuttle operations tend to store the bags within the passenger area of the bus, eliminating some seating area.

Baggage Accommodation in Shared Services

There are a variety of strategies to incorporate appropriate baggage-storage areas on board vehicles designed for shared use with non-airport travelers. In cases in which the rail vehicles have been designed for longer-distance trip making, adequate storage area usually is provided at each end of the vehicle. Longer-distance high-speed trains serving Paris' Charles de Gaulle Airport and Frankfurt Airport are examples of vehicles in which ample baggage storage areas are provided as a matter of course. Longer distance standard speed trains serving Zurich, Geneva, and Amsterdam's Schiphol Airports have baggage-storage areas. Metropolitan commuter trains serving these airports vary in the adequacy of provision for long-distance baggage.

A good example of a metropolitan system that has dealt creatively with the problem of baggage and accessibility is the new rail system connecting Denmark and Sweden, providing service to the Copenhagen Kastrup Airport. The new trains have a highly creative design with standard height floors on the first and third cars of each train set and a low-platform specialty car in the middle. As shown in Figure 6-7, the vehicles

Figure 6-7. Serving Copenhagen Airport in Kastrup, this unusual rail car accommodates bikes, wheelchairs, and persons with baggage.

Photo: Matthew A. Coogan.

Figure 6-8. This baggage rack in the Madrid Metro line serving Barajas Airport is an example of good baggage storage.

were designed to serve a variety of users, including those with special access needs.

The use of standard rail transit equipment in airport access has been a challenge for airport access designers. Rail transit services often provide very limited amounts of space in the shelf above the seats, which poses a problem of both convenience and safety with larger bags. Many transit agencies cannot justify the provision of special baggage-storage areas because of the loss of space for general local commuting functions. Examples of such rail systems offering limited baggage facilities include the German S-Bahn service to Munich and Frankfurt and the French RER system (the electrified suburban rail network), serving both Charles de Gaulle and Orly Airports in Paris.

There are, however, some examples of transit agencies that have dealt with the problem with their newer equipment. The new Madrid Metro Airport service (shown in Figure 6-8) provides three shelves of baggage space—providing more storage area than any other urban rapid transit service. A compromise has been developed on the the new Picadilly Line equipment, which has no shelves, but rather an open area that can be used for bags or for standing room as needed.

In general, even when baggage storage is available on the vehicle, systems that share service with general-purpose commuting rely on an overall infrastructure that was not designed for people with multiple bags. This is particularly true with older transit systems, whose stations are not equipped with good vertical circulation and often experience serious crowding problems. As noted in this text, some market segments will find the baggage problem worse than will other market segments.

HYBRID STRATEGIES: STRATEGIES FOR PARTIAL PROCESSING

To this point, Chapter 6 has reviewed (1) strategies that rely on off-airport check-in, including acceptance of baggage; and (2) strategies that attempt to accommodate the baggage onboard the vehicle, with the traveler retaining the responsibility of getting the baggage to the airport check-in station. A final set of strategies includes those that provide some aspects of off-site processing, but not all aspects. This section of Chapter 6 first examines efforts to provide specialized baggage check-in services within the legal confines of the airport, located conveniently for those arriving by public mode services. The section then concludes with a review of strategies to provide the traveler with airline check-in functions at the off-site public transportation terminal, including the assignment of baggage tags, while the passenger retains the responsibility of getting the bag to the airport.

On-Airport Remote Terminal Check-In

Within the boundaries of the airport, additional locations can be added to check in baggage for the convenience of the users of public modes (or for any other targeted group). In the past, additional check-in areas have been placed within a GTC; within a car rental facility (e.g., those provided at Hertz Rental Car return counters when Hertz and United Airlines were jointly owned); or within an airport hotel, such as the Japan Airlines check-in facility at the Narita Nikko Hotel or the Alaska Airlines facility at the Doubletree Hotel in Seattle.

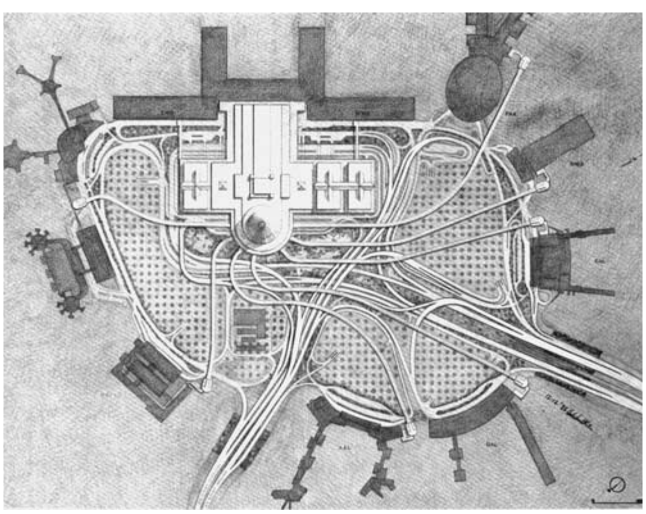
JFK 2000

The most elaborate proposal to create an all-airline check-in center for the benefit of public mode users was the JFK 2000 plan developed in the late 1980s. A significant restruc-

turing of John F. Kennedy Airport was proposed, in which all air passengers arriving by scheduled buses and vans would be processed in a centrally located terminal within the center of the highly decentralized airport, as is shown in Figure 6-9. Having checked their baggage and received their boarding cards at the Transportation Center, the passengers would board people-mover shuttles near the terminal of departure. Importantly, the designers were not able develop a similar baggage-handling system for the disembarking airline passengers to the central facility. For the disembarking passengers, baggage would be reclaimed at the existing air terminals and either rechecked at baggage desks for transportation back to the Transportation Center or carried up to the people-mover station and back to the Center. This plan was developed to significant architectural detail by the firm of I. M. Pei & Partners, but was abandoned because of opposition from the airlines.

Atlanta Hartsfield Delta Check-In

A small, but significant, example of additional baggage processing on the airport property for the benefit of the public mode user is the construction by Delta Air Lines of a specialized check-in location at the fare-collection area of the Metropolitan Atlanta Regional Transit Authority (MARTA) station within the Hartsfield Airport terminal building. Although it need not be categorized as “remote” because of its location within the terminal, it does represent a commitment by the airline to give better service to the users of rapid transit services. The bags are transferred by cart to the baggage make-up area, as is shown in Figure 6-10. Similar examples are provided by US Airways at Washington’s Reagan National Airport for passengers arriving via the Washington Metro system.



SOURCE: Planning Research Corporation.

Figure 6-9. The JFK 2000 plan of the late 1980s proposed a separate check in terminal for public mode users.

Photo: Matthew A. Coogan.

Figure 6-10. Rapid transit users in Atlanta have a special check-in facility at the MARTA fare-collection area.

Newark AirTrain Rail Station

In October 2000, PANYNJ opened a major airport facility at the Newark Airport Rail station located on the Northeast Corridor served by Amtrak and New Jersey Transit, linking Boston and Manhattan to the north and Philadelphia, Baltimore, and Washington to the south. From a legal point of view, both AirTrain (formerly called the Airport Monorail) and the rail station are part of Newark International Airport; AirTrain is operated solely for the use of airport users and does not carry any general-purpose traffic. Given the very significant difficulties in establishing full baggage check-in in New York City (such as space constraints at Penn Station), this strategy calls for the traveler to be responsible for the baggage until his or her arrival at the rail station, which is considered part of the airport infrastructure.

The Newark AirTrain station on the Northeast Corridor rail system includes a baggage check-in station offered to all airlines and currently used by Continental Airline’s hub operation. Baggage is accepted at the mezzanine level (see Figure 6-11) on the direct path from the rail platforms to the AirTrain station. The baggage is sent to the ground level in a spiral ramp, as is shown in Figure 6-12. From this point, the baggage is 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, Continental requests that baggage be checked 2 h prior to departure time, but the staff has accepted bags with as little as 45 min remaining. There is no charge by Continental for the service; the user of AirTrain has paid between $5.00 and $6.00 above the standard rail ticket to gain access to the AirTrain facility.

JFK AirTrain to Jamaica Station

At present, construction is continuing on a similar transfer facility connecting John F. Kennedy International Airport

Photo: Matthew A. Coogan.

Figure 6-11. Continental Airlines now offers baggage check-in at the Newark Airport rail station.

Photo: Matthew A. Coogan.

Figure 6-12. The bags are sent by spiral ramp to ground level where they are taken by truck to the baggage make-up area.

with Jamaica Station on the Long Island Railroad, as is shown in Figure 6-13. The 3-mile route to JFK Airport will be served by four car trains, designed to carry both checked baggage and baggage carts on board. The line will also connect to Howard Beach Station for connection to New York City Transit service. Including the airport loop, the new line covers 8 miles. The same check-in services offered at the Newark Airport rail station could be offered at the new Jamaica Station facility. The task of implementing such a program, however, may be considerably more difficult at JFK because of the lack of single dominant airline at the airport and because of the high portion of international departures. The JFK AirTrain and the changes to the Jamaica Station are being built by PANYNJ as a part of the JFK International Airport and are thus included in this discussion of "hybrid" baggage-handling strategies.

Hybrid Solutions: Partial Off-Site Check-In Services

Automated Check-in Services in European Rail Stations

Some European systems, including several in Scandinavia, are operating under a system of partial off-site processing. In this hybrid alternative, passengers are encouraged to check-in and receive their boarding pass at the off-site location, which could be located at a rental car facility on the airport or at a rail station off the airport. The passenger is provided with a boarding pass and baggage tags. It is the responsibility of the passenger to place the baggage tags on the handles of the baggage. At this point, the passenger retains control of the baggage and takes it to the airport, where a "fast bag drop-off station" processes only these bags and does not provide standard ticketing or processing. In some cases, these stations are manned; in other cases, it is a simple drop-off function. In all reported cases, bags processed in this manner are treated with the highest level of security.

At Heathrow Airport, British Airways passengers are encouraged to obtain their boarding pass and baggage tags at locations such as the Avis Rent-a-Car facility while retaining control of their bags. Figure 6-14 shows the location of the "fast bag drop-off," which offers short lines for all who have selected the automated check-in option.

The advent of the automated check-in process allows some functions that used to take place only at the airport to take place virtually anywhere. Thus, the subject of processing baggage must be seen as part of the larger process of automating the check-in function. Several U.S. airlines now allow the check-in function to occur via cell phone; others allow the function to occur at home or at a personal computer. Northwest Airlines allows the boarding passes to be printed by the customer at his or her computer.

For the user of public mode airport ground access services, early check-in at an off-airport site allows for efficient use of time even if that site does not actually take the baggage from the traveler. Time spent waiting for the airport access bus or train can be used to obtain the boarding pass and to affix the

Photo: PANYNJ.

Figure 6-13. The design for the new AirTrain transfer at Jamaica Station allows for check-in services.

tags on the baggage. In these hybrid solutions, the task of getting the bags to the airport drop-off point remains the responsibility of the traveler. At the time of arrival at the airport, processing time in the airport is minimized.

IMPLICATIONS OF BAGGAGE-HANDLING STRATEGIES

As fully half of all aviation trips have a duration of 5 days or longer, the handling of baggage will continue to be a challenge, and a major impediment, to the selection of public mode services in airport ground access. In the U.S. experience, the most commonly proposed strategy to deal with this issue is the creation of a full-scale “downtown” airport check-in facility with full airline processing of passengers and their baggage. What receives less attention is the wide variety of strategies to improve the handling of baggage for the public mode users without full investment in the downtown check-in facility.

Photo: Matthew A. Coogan.

Figure 6-14. “Fast bag drop-off” serves travelers who have already used automated check-in at various locations.

Lessons Learned from Best Case Practice

From the study of best case practice, the attributes of a successful downtown check-in facility can be quickly established. Services in downtown Hong Kong and at London’s Paddington Station represent the state-of-the-art application of this strategy—each location is served by a high-quality dedicated rail service with the highest standards of security. The opening of the Madrid check-in facility in May 2002 establishes a precedent for operation as part of a shared-service urban rapid transit facility.

However, it is important to note that in the clear majority of cases in which downtown check-in was originally considered, that implementation simply has not occurred. Major new rail systems in Stockholm, Oslo, Copenhagen, and Milan currently operate without the benefit of downtown check-in facilities. Without challenging the level of service brought about by these state-of-the-art facilities, the issue of operating cost must be dealt with. At the Heathrow Express, every shift requires more than 15 employees to operate the high-security baggage-transfer system alone, quite separate from the airline staffing of the facility itself. In the case of Heathrow Express and the Hong Kong Express, premium rail fares allow the possibility of subsidization of the baggage service by the rail operators. In the case of lower-priced transit service, the costs of the operation must be dealt with by some entity; this problem has not been solved in most candidate implementations.

Between the option of no help to the customer and the full implementation of the airline-operated downtown check-in facility, there exists a wide variety of “compromise” or hybrid strategies, each of which should be examined by U.S. decisionmakers contemplating a downtown airline-operated facility. The concept that a third party could be authorized to deal with baggage issues has been taken to a high degree of sophistication in Switzerland and in Las Vegas. Such a concept has a sound precedent in the fact that most curbside baggage check-in is not accomplished by employees of the airlines, but rather by employees of companies that provide the services for the airline. In both the Swiss and Las Vegas systems, the traveler must pay for the service. There are many scenarios that might emerge over the next few years. In some scenarios, the third-party handlers would become extensions of the government’s role in baggage screening; in others, the government-run screening operations might be decentralized into off-site locations. The manner in which such a public-private partnership might evolve will be only be resolved over time.

Exploring Innovative Hybrid Strategies

To the extent that the public mode airport access services are provided on a dedicated basis, the equipment can be designed to efficiently accommodate baggage. One study at Boston-Logan Airport examined the concept that dedicated airport buses could accommodate specially designed baggage carts, which would allow convenient baggage transport from the off-airport bus station to the check-in point at the airport. Innovative designs in lighter-weight baggage carts were also examined in the development of the Oslo Express concept.

Of course, such a concept would require a significant redesign of buses. However, the U.S. DOT's Intelligent Vehicle Initiative has now solved the problem of level entry to buses, with a combination of low bus platforms and raised curbs at terminals. Such level-entry buses are now in standard service in France, accommodating wheelchairs and riders with special needs, such as those with heavy baggage. The innovative low-platform rail cars serving Copenhagen were designed to deal with bicycles, wheelchairs, and large units of baggage. Baggage carts are currently allowed on some airport people movers, including London Gatwick and Newark Airports, as shown in Figures 6-15 and 6-16.

In this concept, the operator of the ground transport services would provide assistance as needed to get the baggage to the airport. The present widespread implementation of automated check-in services (often associated with electronic ticketing) allows some of the airport processing to occur off the airport in coordination with such services.

To the extent that public mode services are provided by traditional local transit equipment, the case can be made for special baggage racks on equipment serving airports to the extent that it is feasible. In many cases, U.S. rail transit equipment is designed with significant standing room at some of the doors, which is often used for wheelchairs or bicycles as required;

Photo: Matthew A. Coogan.

Figure 6-15. Specially designed vehicles can accommodate baggage carts.

Photo: Matthew A. Coogan.

Figure 6-16. The Newark AirTrain cabs can allow baggage carts on the system; "bus rapid transit" vehicles could be designed to accommodate baggage carts.

travelers with baggage benefit when these spaces are available. In other cases, some rail transit and bus equipment simply cannot offer space for the traveler with multiple bags. However, providing baggage-storage space on standard transit services may be the lowest-cost option to be addressed.

Conclusion: The Need for Cost-Effective Solutions

For those U.S. cities that examine full downtown check-in terminals and reject them because of cost, there are a wide variety of compromise or hybrid strategies that should be thoroughly examined to deal with this constraining factor in public mode usage. The implementation of the airline-operated check-in at the Newark Airport Rail station stands as a good example of a hybrid strategy, giving help to the traveler for some, but not all, segments of his or her trip. The concept of "outsourcing" some of the job of baggage processing to third parties is being explored to determine its feasibility as new government responsibilities for baggage screening are established. However, perhaps the most basic strategy is that which makes it easier to carry the bag on the transit vehicle. In its simplest application, this means larger baggage-storage racks; in its most dramatic application, new buses can be designed to allow baggage carts to roll on and roll off, allowing the traveler to keep possession of the bags for the whole trip. All of these are examples of concepts that need to be explored further.

OTHER CHANGES FROM RECENT REGULATIONS

While Chapter 6 is concerned primarily with baggage-management strategies, other aspects of airport ground access

were also influenced by regulations established after September 11, 2001. Some of these are summarized below:

- *Prohibition of unattended vehicles within 300 ft of a terminal building*—The primary effects of this rule are (1) to reduce curbside dwell times of vehicles (particularly those waiting to pick up deplaning passengers) and (2) to eliminate the use of public parking spaces located within the 300 ft of the front of the terminal.
- *Restrictions on the number of shared-ride vans allowed to wait at the deplaning curbside, particularly at those airports that do not have full-time starters or dispatchers*—This restriction adversely affects the operator's ability to assign passengers to a waiting vehicle and thereby minimizes the number of en route stops and travel time.
- *Restrictions on the ability of scheduled bus and van drivers to enter the terminal, contact waiting passengers, and assist these passengers with their baggage*.
- *Restrictions on vehicles or drivers without airport permits approaching or stopping at the curbsides*—This restriction adversely affects the use of temporary vehicles or drivers.
- *Restrictions on the use of airport terminal facilities*—For example, private vehicles were prohibited from using the curbsides for more than 2 months at Los Angeles International Airport. During this period, only authorized commercial ground transportation vehicles were allowed to pick up or drop off passengers at the terminal curbsides. Initially, private motorists were required to pick up and drop off passengers at a remote parking lot.
- *Restrictions (or prohibitions) on the well wishers, meeters, and greeters accompanying passengers to and from gates and waiting for passengers at curbsides*—Anecdotal information suggests that these restrictions are causing an increase in the use of public transportation and a reduction in the proportion of deplaning passenger traveling in private vehicles that did not park (i.e., private vehicle pickups). Available data suggests that public transportation vehicle occupancies at airports increased in the months following September 11, 2001.

CHAPTER **7**

GETTING INTERMODAL INFORMATION TO THE CUSTOMER

CONTEXT OF CHAPTER 7

Chapter 7 examines the development of new and evolving information technology to bring intermodal information and ticketing options to the traveler. It describes the last phase of an integrated program of market-based improvements to airport ground access public modes concerning the need to the get information about the services to the customer. A series of more immediate, near-term strategies to improve passenger information are reviewed in Chapter 5.

Assuming that the practitioner has collected and analyzed the basic ground access market data (as discussed in Chapters 2 and 3) and defined key groups for targeted services, the task remains to get information describing the services to the potential consumers. Once the customer has been made aware of these services, the option of payment should be integrated into the information system used to reach the customer. Because of the close interrelationship with the purchase of the long-distance mode service, solutions for getting passenger information to the airport ground access customer will most probably be developed as a subset of larger strategies to get passenger information about the full trip of the intermodal tripmaker.

MARKET RESEARCH AND MARKETING STRATEGIES

It is recommended that market segmentation be undertaken at two levels: (1) submarkets need to be identified based on their geographic characteristics, and (2) these submarkets need to be further examined in terms of demographic segmentation. In its simplest form, a geographic segmentation defines the area in which a given service is relevant (e.g., a bus service to the North Corridor should only be marketed to those going to the North Corridor). Within a geographic area in which the service is indeed relevant, demographic segmentation suggests examination of four market segments: Resident Business, Resident Non-business, Non-resident Business, and Non-resident Non-business. Each of the market segments has separate constraints and distinct sensitivities to price and service quality.

Components of the Longer-Distance Trip

The established literature on passenger information systems for the longer-distance trip proposes that there are three segments of the trip and three timeframes in which the information is needed. The longer-distance trip can be analyzed in terms of a "collection" segment, a "line-haul" segment, and a "distribution" segment. Determining the line-haul (i.e., long-distance) segment is usually the most important decision made by the traveler (e.g., from airport of origin to airport of destination.). The collection segment decision determines the mode and path from the origin to the point of transfer to the line-haul mode (e.g., home to the airport). The distribution segment decision determines the mode and path from the line-haul mode to the destination (e.g., from the airport to the convention center).

Timeframe of the Decision to Choose a Service

Three major timeframes for each decision can be defined. Passenger information is needed

1. At the time of trip planning,
2. At the time of trip commencement, and
3. While en route.

The study of airport ground access inherently focuses on the collection segment (decision of mode and path *to* the airport) and on the distribution segment (decision of mode and path *from* the airport to the destination). It is a characteristic of the choice of the airline segment that the *decision is made long before the day of departure, often weeks before the trip is made,* particularly if lower fares are sought. Thus, for those marketing airport ground access services, it is considered highly desirable to sell the ticket at the time of the purchase of the airline ticket. In this manner, the task of convincing the traveler to purchase the ground access service is already accomplished by the time the traveler commences that trip segment.

In theory, a comprehensive marketing strategy would include a component for each identifiable market segment, expressed for each of the three timeframes. An example of best case practice in this area is the work of the Arlanda Express marketing team in Stockholm. As noted in Chapter 3, the Arlanda managers have taken the four-category demographic segmentation proposed and further stratified it by International Trip versus Domestic Trip. This stratification results in the formation of eight market research categories,

to which the Arlanda Express team has added the Charter Flight as a ninth category.

Best Case Practice: Matching Strategies to Market Segments

In Figure 7-1, which was prepared by the Arlanda Express marketing team, the nine market segments are arrayed as the top level of boxes, with the total number of passengers in each segment stated within each box. The first four boxes from the left represent the Non-resident segments; the last four boxes from the right represent the Resident market segments. Importantly, the graphic summarizes the number of travelers in each segment category.

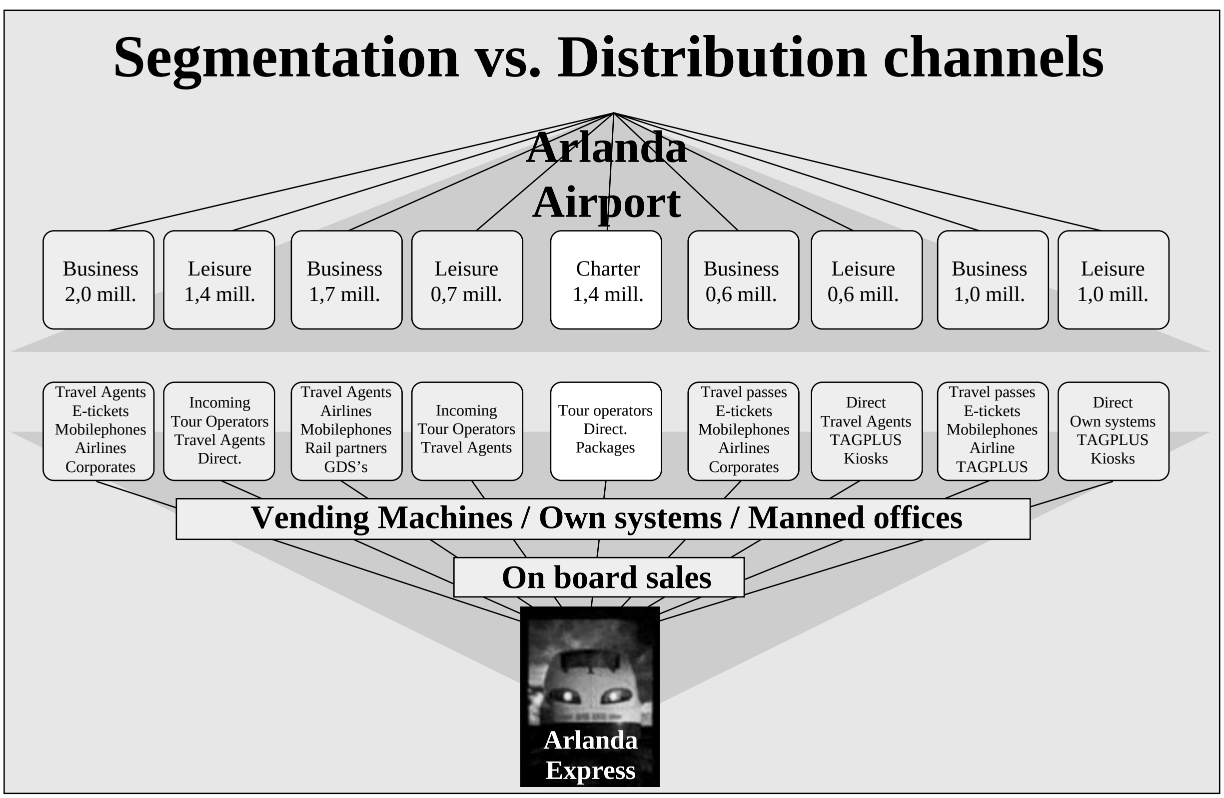
Looking at the Resident market, the graphic shows that 3.2 million scheduled airline passengers live in the Stockholm in the Arlanda Airport catchment area. Looking at the Non-resident market, the graphic shows that 5.8 million scheduled airline passengers at the Arlanda Airport are not residents of the catchment area.

Establishing Scale

Before any strategies are established, it is important to document the scale of each market. A multimillion-dollar commitment to capture the international market might be unwise if the majority of air travelers are domestic in nature. A major local advertising campaign might be unwise if the majority of air travelers were non-resident in nature. In the United States, an airport such as Orlando's or Las Vegas's may be overwhelmingly non-resident in nature while Hartford's is predominantly resident in nature. The Arlanda Express graphic provides that information to the decisionmaker in the context of the recommended strategy for each such segment.

Advanced Sales, Terminal Sales, and En Route Sales

In Figure 7-1, the second row of boxes describes the marketing tools to be applied to deal with each segment, specifying the distribution channels for the issuance of the ticket. To sell advanced tickets to charter-flight travelers, the strategy is to sell to tour operators directly. For the Resident markets, the strategy calls for the use of locally available Swedish systems such as TagPlus, the national trip-planning system. For the higher-scale Resident Business markets, the strategy emphasizes the use of mobile phones and evolving e-ticketing concepts. For the lower-scale Non-business market segments, the strategy emphasizes sales at kiosks. For those destined for international destinations, travel agents are emphasized. For those with destinations in Sweden, the strategy suggests



Source: Travelutions.

Figure 7-1. Nine market segments are linked to nine sets of marketing strategies in Stockholm.

bypassing travel agents and selling the tickets directly by the company. Similar differentiations are made for the Nonresident market segments.

This second row of boxes presents the strategies for advanced ticket sales *or sales at the time of trip planning.* The row beneath (the third row) shows the strategies to sell tickets *at the time of trip commencement*, with vending machines and manned offices at the terminals. The lowest box (the fourth row) presents the strategies for sales *while en route*—for example, on board the Arlanda Express train. (The price of tickets on board is set at about 20% above tickets sold at the station, reflecting the willingness of the user to pay for this convenience.)

INTERMODAL INFORMATION AT THE TIME OF TRIP PLANNING

A major objective of airport ground access information systems is to get information to the traveler during the process of trip planning—the time in the trip-making process during which the major decision faced by the traveler concerns the route and path of the long-distance segment of the trip. Chapter 7 explores recent technological developments in the implementation of information systems relevant to the challenge of airport ground access. The chapter is structured in five sections, which

1. Review the extent to which aviation-based passenger information systems have been integrated with available ground transportation information systems,
2. Review recent development in U.S. local passenger information systems,
3. Review recent developments in non-aviation–based passenger information systems in Europe,
4. Review recent developments in multistate or multinational passenger information systems, and
5. Review recent and ongoing developments for shared ticketing and payment.

INTEGRATION OF AVIATION AND GROUND INFORMATION SYSTEMS

Those interested in purchasing a public mode airport ground access service must, at one point or other, make a larger (and more expensive) decision about the mode and path of the long-distance segment of their trip. Thus, in order to encourage the customer to make an early decision to commit to the public mode, it is highly desirable for information about the ground access mode to be presented to the customer at the time he or she is obtaining information about the long-distance segment of the trip, that is, the airline trip. Such integration could be provided by the carrier or by the airport to be used. In either case, information about ground transportation options needs to be integrated with information about the airline trip.

The quality and usability of airport-based passenger information systems are improving rapidly; the extent to which they are well integrated with ground-based public transportation continues to be a challenge. This section of Chapter 7 reviews examples in which airport-based and local ground transport information systems have, and have not, been integrated on behalf of the customer.

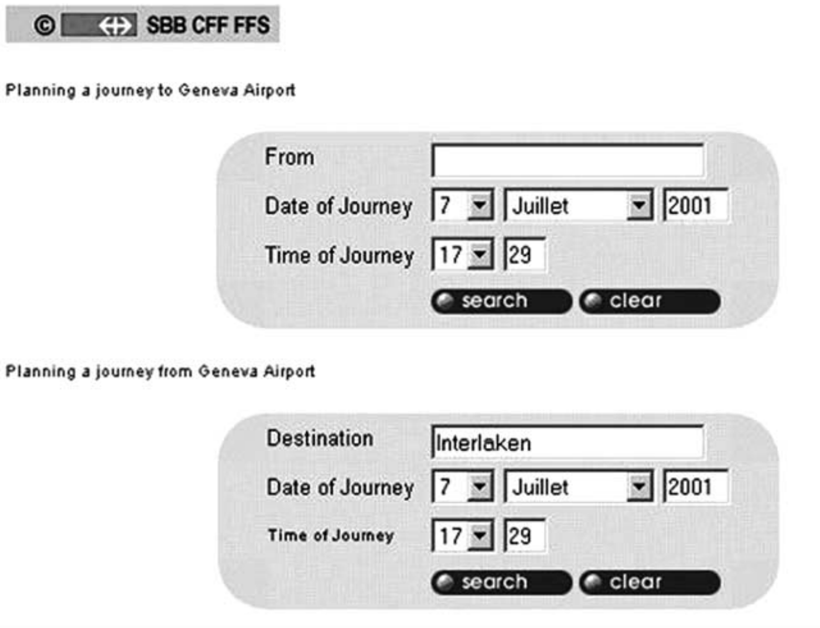
Integration of Airport and Ground Systems at Geneva International Airport

In most cases examined around the world, airports have attempted to provide information about ground transportation services, but with little utilization of the passenger information services actually available in the local area. This section will explore this concept in Paris; Washington, D.C.; and Copenhagen. The website for Geneva International Airport in Switzerland can be used as a good example of the integration of airport and ground-based systems.

Figure 7-2 shows a portion of the ground transportation information system at the Geneva website. A common practice is for a website to hyperlink the user to another server, where the user must restart the process of querying for transportation information. As shown in Figure 7-2, the program has already established that the customer is requesting a trip either to or from the airport. For the trip from the airport, the user need only fill in the destination town. At this point, the user is transferred to the server run by the Swiss National Railways. The act of requesting ground transportation services from the airport website has been accomplished in a seamless manner. These details are critical in the effort to integrate separate information systems into what is perceived as “one system.” Figure 7-3 shows the screen that is produced in response to the request for service between the airport and Interlaken.

A very good example of how a ground-based transportation agency designs information specifically to serve the needs of the airport user is the airport connection page on the French National Railways (SNCF) website. On the first page of the website dealing with the Paris region, the needs of airport passengers have been highlighted, with a special set of direction for Parisian airports.

Figure 7-4 shows the detail produced by the SNCF passenger information program for travelers to and from Charles de Gaulle Airport. This trip recommends a commuter rail (Line B of the RER), two metro connections, and a 5-min walk to this particular location. In a manner similar to most airports around the world, the Parisian airport authority, Aéroports de Paris, has elected not to use the high-quality passenger information system offered by the state railway. In its place, a very simplified description of rail services is offered, as shown in Figure 7-5. The elaborate trip-planning capability of the national railways program is not offered to the user.



SOURCE: Geneva Airport.

Figure 7-2. The Geneva Airport website offers ground transportation information.

This pattern, in which the airport does attempt to provide ground access traveler information, but does not utilize the available local systems is found in Copenhagen and Washington, D.C., for example. No airport in the Washington area offers the ability to link directly with the powerful Ride Guide trip-planning program offered by the Washington Metropolitan Area Transit Authority (WMATA). Similarly, the Copenhagen Airport website does not link to the national system of itinerary trip planning. For the moment, at least, the systems remain unconnected.

By contrast, the Portland International Airport website links directly to the itinerary trip-planning system provided by Tri-Met, as is shown in Figure 7-6. Substantively, the linking of the Portland sites leads the user simply and clearly to the trip-planning capability of the regional system. The Geneva system, by comparison, offers the trip-planning option on the airport website, and the airport as "origin" or "destination" has already been entered into the system. As a result, a trip itinerary between the airport and the desired location is accomplished with minimized data entry.

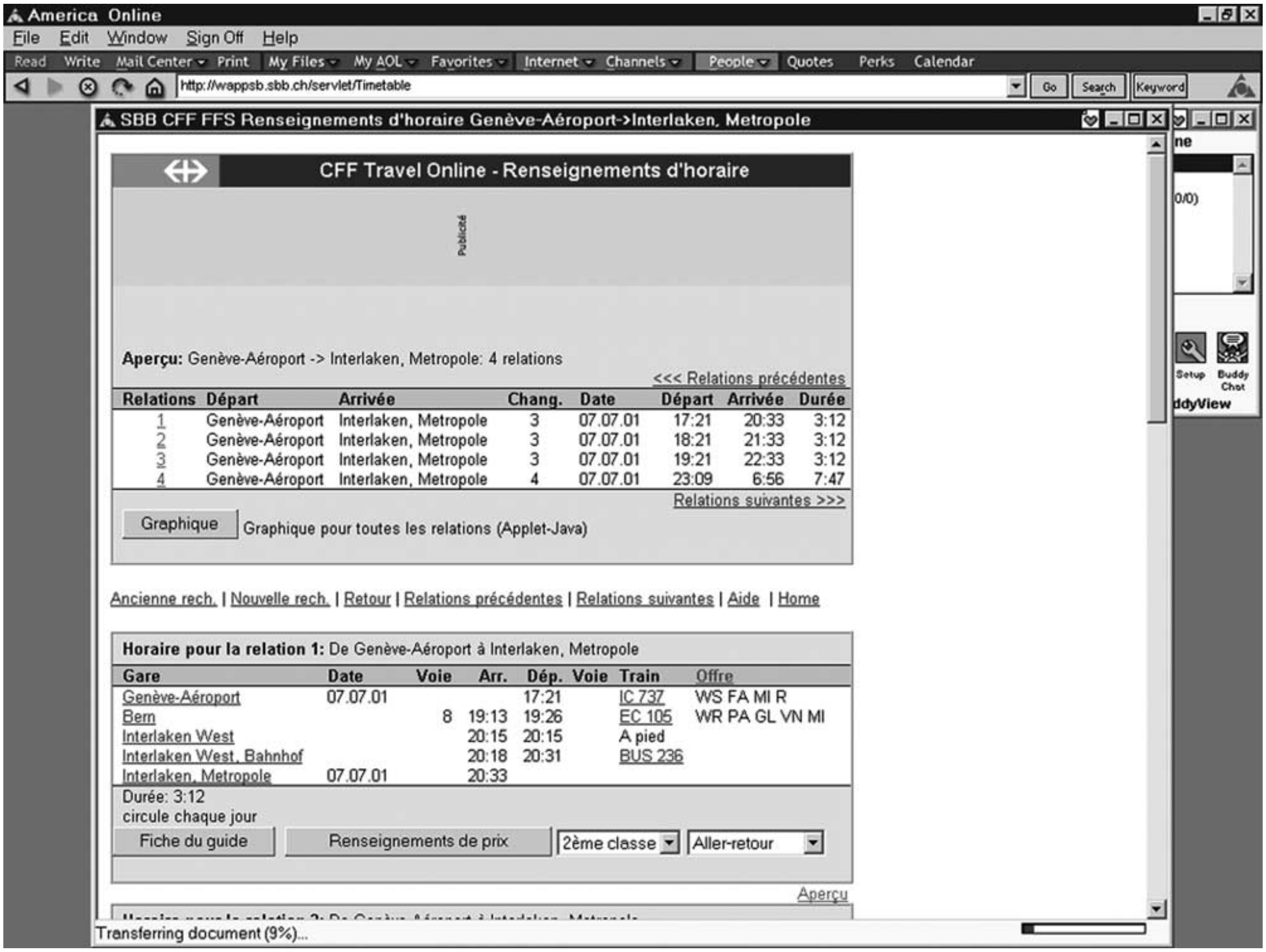
Integration of Rail and Airline Schedules in the United States

Schedule Information in the Official Airline Guide Travel Information System

Traditionally, information about airline schedules has been offered separately from information about other modes. A good example of a single mode, terminal-to-terminal trip-planning system is the recent development by the Official Airline Guide (OAG) of the OAG Travel Information System. OAG, well known for its publication of printed travel guides, has developed a computerized version for use by businesses in the planning, but not in the purchasing, of longer-distance trips. In Spring 2000, the OAG added information on Amtrak's Metroliner service to the computerized travel system. Based on this addition, the traveler from Manchester, New Hampshire, to Washington, D.C., could plan a multi-segment, multimodal trip.

Querying for information about a trip from Manchester Airport to Union Station in Washington results in a series of flights to BWI Airport and many connecting flights to Reagan National Airport. The present system does not merge the Amtrak data directly into the airport-to-airport algorithm. Figure 7-7 was created by making two separate "flight" requests of the system. Once the trip to BWI is brought to the screen, the user can manually request information about Metroliner connections, but the search processes for the two modes have not been connected.

Importantly, the data about air trips and about Metroliner trips are included in the database of the same program. In the short term, this gives the intermodal traveler an option for connecting flight information with at least some (but not all) information about possible rail connections for the onward journey from BWI. In the long term, full integration of the schedule information from the two modal sources remains to be accomplished.



SOURCE: SBB (Swiss National Railways).

Figure 7-3. The Geneva airport website connects seamlessly to the Swiss national rail system.

Providing Schedule Information Across Modes: Continental Airlines' Website

In what may be the first U.S. example of a major airline providing connecting rail information, the website of Continental Airlines provides a complete Adobe Acrobat version of the rail schedules between Newark International Airport and New York City's Penn Station. The traveler making decisions about purchasing an airline ticket is offered full information about these ground transportation connections, as is shown in Figure 7-8.

LOCAL PASSENGER INFORMATION SYSTEMS IN THE UNITED STATES

In the U.S. experience, there has yet to be implemented a door-to-door trip-planning system to help the U.S. air traveler plan a trip to his or her destination, including all the specialized bus and van services in operation at the airport. However, airports have been integrated into several U.S. passenger information systems that cover some, but not all, public mode services available to the traveler. Examples of transit mode itinerary trip planning including airports exist in Washington, D.C.; San Francisco; San Diego; Portland, Oregon; and New Jersey, among others.

Philadelphia—An Example of Transit Itinerary Trip Planning to an Airport

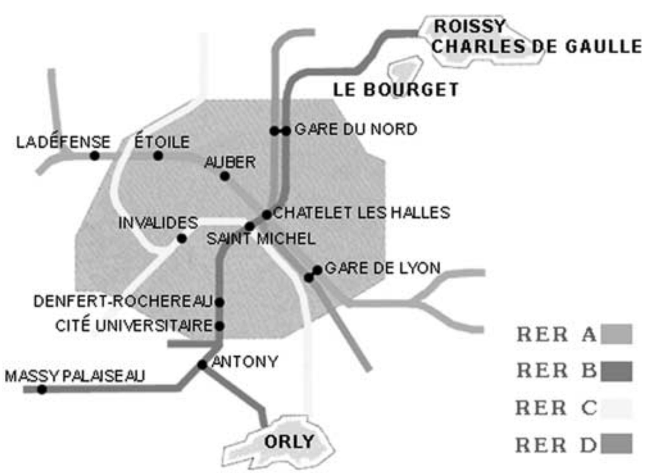
Since the publication of *TCRP Report 62*, more U.S. airports have been tied into advanced passenger information systems. The HaCon HAFAS system has been developed and put into operation in Philadelphia by the Southeastern Pennsylvania Transportation Authority (SEPTA). Figure 7-9 shows the power of the information provided by this intermodal itiner-

SOURCE: SNCF.

Figure 7-4. The local transit operator offers excellent airport-based itinerary trip planning in Paris.

ary trip-building system. Figure 7-9 shows that the "intuitive" route to Swarthmore College—by using the rail into the city and the rail to the Swarthmore commuter station—would have trip duration of 1 h and 10 min, leaving the airport at 1:42 in the afternoon. That trip would have three modal segments.

The program shows that by leaving at 1:36 P.M. by bus to the Chester Transportation Center, the trip can be made in 56 min, with only two modal segments. Both trips would require a 10-min walk to the college campus. The program then offers some rather basic graphics, which are quickly



SOURCE: Aeroports de Paris.

Figure 7-5. The airport website does not connect with the local information system.

imaged on the Internet, showing both trip options in diagrammatic format. The program offers the option of seeing the stop-by-stop schedule of each of the segments and a consolidated screen for quick printing (as shown in Figure 7-9).

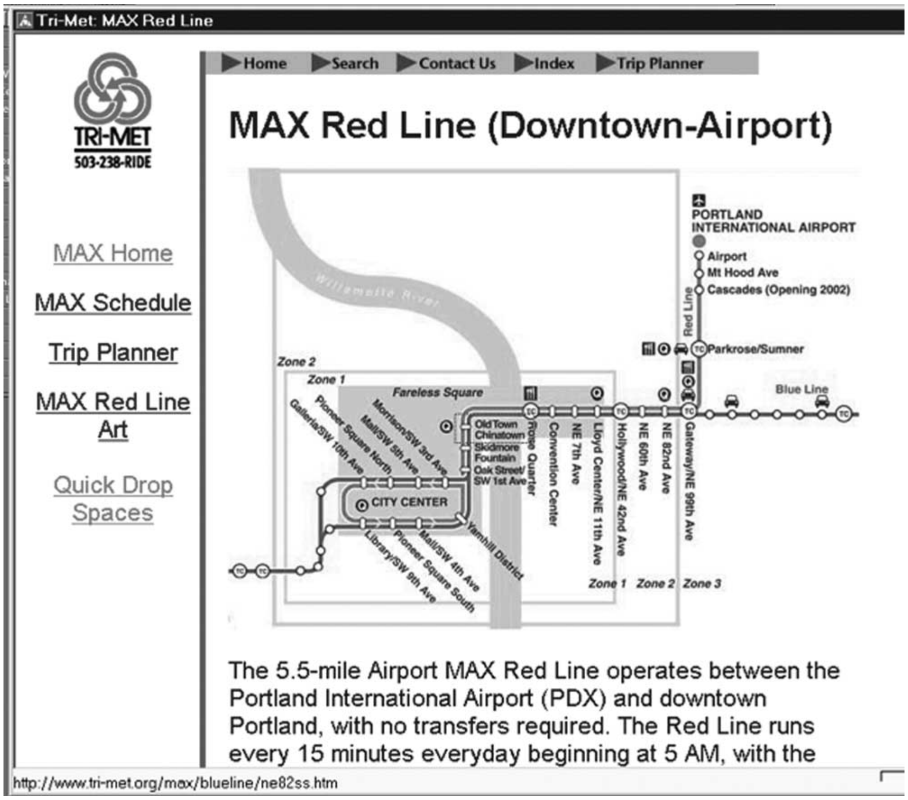
As expected, the SEPTA site describes all SEPTA public transportation services from the Philadelphia Airport, but not other services, including specialized bus and van options. However, given that it is based on the same technology as that used in the Zurich example earlier in this chapter, it is clear that the application program can be expanded in terms of both modal and geographic content.

Other Transit Information Systems Currently in Operation in the United States

Itinerary trip planning for transit systems has been implemented in the United States by a variety of software designers. The TranStar itinerary trip planning system was first developed by the ride-matching agency now part of SCAG. Because the program has been applied throughout Southern California, there is considerable experience in its application to trips between metropolitan areas. The technology program has been adopted in the Bay Area of Northern California, in Denver, and in the New York City–area Model Deployment Initiative (MDI). At the time this report was written, the New York MDI project was undergoing the final phases of beta testing before its inauguration.

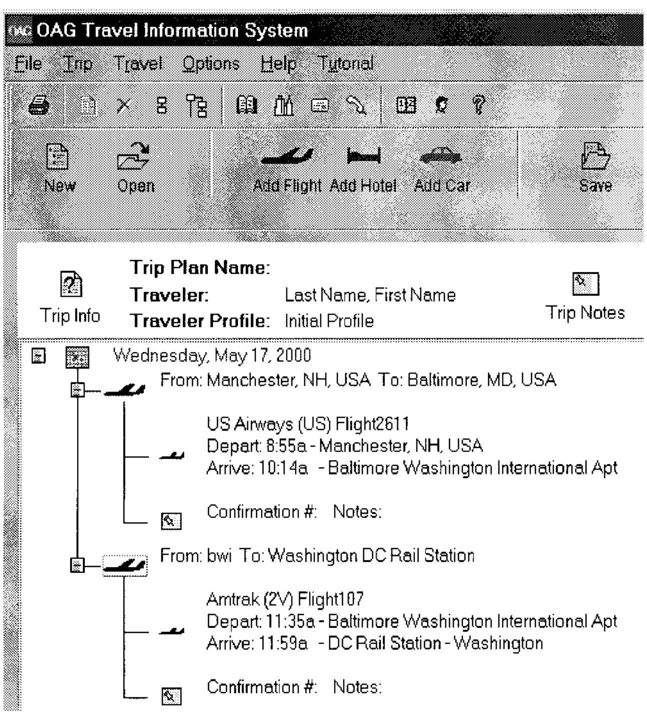
The Automated Traveler Information System (ATIS) developed by ManTech/Trapeze is currently in use at WMATA in Washington, D.C., and is being implemented statewide by New Jersey Transit. Earlier applications include New York City and Westchester County. The program is being implemented in Hampton, Virginia; Detroit, Michigan; San Diego, California; and Portland, Oregon. Other implementations in progress include Austin, Texas, and regional implementations for the Chicago and Seattle-Tacoma areas. The program was developed in 1989 using software called the Rapid Routing Module (RRM), "a search algorithm which automates information on cross-referencing and retrieval and achieves remarkably fast response times to complex trip planning and other transit information questions."

A U.S. example of a map-based approach was developed for the Greater Cleveland Regional Transit Authority, as is shown in Figure 7-10. Later examples of the program—entitled the "MIDAS Customer Information System," or CIS—are directly accessible by the traveler via Internet or kiosk. The program allows a high degree of integration with GIS and utilization of a wide variety of graphic images. The program is being used in Cleveland, Ohio; Fort Lauderdale, Florida; Omaha, Nebraska; Pittsburgh, Pennsylvania; Springfield, Massachusetts, and Portsmouth, New Hampshire. Like The Dutch PlannerPlus program discussed below, MIDAS CIS can be seen as the current state of the art in the application of map-based GIS technology to passenger information systems.



SOURCE: Tri-Met.

Figure 7-6. This Tri-Met page is accessed directly from the Portland Airport's website; door-to-door trip planning is offered on the left.



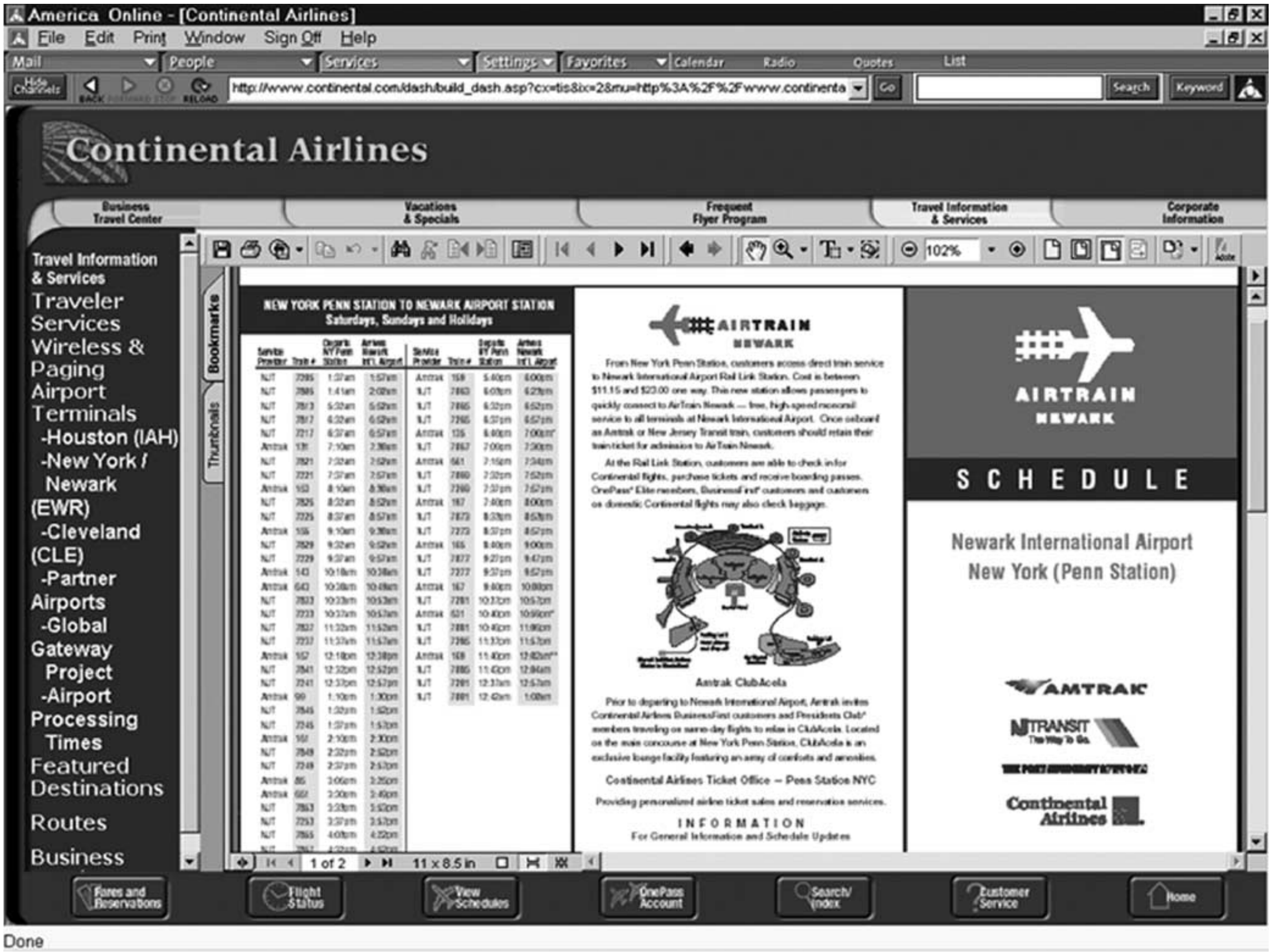
SOURCE: OAG Travel Information System.

Figure 7-7. The OAG Travel Information System contains schedules for airlines and Amtrak's Metroliner services.

INTEGRATION OF AVIATION AND GROUND PASSENGER INFORMATION SYSTEMS IN SWEDEN

The first organization to propose the integration of aviation-based trip information with ground-based information is the Samtrafiken i Sverge AB (Samtrafiken) in Stockholm. Samtrafiken currently operates a nationwide multimodal passenger trip-planning system, which integrates information from the Swedish railways and the local bus companies. The Samtrafiken team has completed the technical task of integrating the domestic aviation passenger information system into their existing intermodal passenger information system. In essence, this means that for a trip between Malmo and Uppsala, intermodal trips that use rail for the long-distance segment will be displayed on the same screen as trips that use air for the long-distance segment. In both cases, the town center–to–town center trip-planning capability of the program, TagPlus, will include regional buses needed for the journey, but not local transit operations.

The program has been developed to use a locally owned version of the Amadeus aviation information system. At the time of this writing, the integration of airline schedule information into the TagPlus program is complete from a technical standpoint. The organization is now dealing with the question of ticketing journeys planned by the system. The sales



SOURCE: Continental Airlines.

Figure 7-8. Continental Airlines provides rail schedules from Newark Airport to New York City.

requirements of the airline ticket are different than those of the rail and bus systems, including major variations in fare levels. One option being explored in Stockholm now is to let the user plan the entire trip on the Internet, with a link to a travel agent of the customer's choice for ticketing and payment.

Best Case Practice in Intermodal Passenger Information: Samtrafiken

If Samtrafiken becomes the first entity to offer the customer a passenger information system that truly integrates the ground and aviation elements, it will be the result of many years of building a highly specialized institution dedicated to passenger information. (The word *samtrafik* means coordinated public transportation.) Samtrafiken is owned by Swedish Rail companies and Sweden's County Public Transport Authorities, which makes it an interagency organization. It was established in 1993 to deal with the challenges of longer-distance intermodal trip making (see Figure 7-11):

> The objective of Samtrafiken is to get more passengers traveling by public transport with a focus on intermodality. Most travelers don't start their journey at a railway station and do not end their journey at a railway station. They need to combine rail transport with other modes of transport. (*13*)

The organization is concerned with more than just passenger information: it is concerned with point-to-point trip-planning information and "is also promoting better sign-posts at stations and terminals, producing maps, etc. . . . making plans for planning co-operation, time table shifts, transfer points for changing modes, transfer times, etc." The group is also planning for "guaranteed connections between train and regional public transport and 'information co-operation' between Swedish Rail and the County Public Transport Authorities during travel."

Samtrafiken has developed the system of transit information and through-ticketing called "Tagplus." Samtrafiken provides the Tagplus Guide in both online and off-line formats. The program was developed by Electronic Data Systems and is described by its authors as follows:

> *Tågplus Guiden* is an interactive timetable information system that searches for the shortest journey between two sta-

HAFAS

SEPTA
SERIOUS ABOUT CHANGE

Connection Details

2. Stop	Date	Time	Train No	Direction/Comments
RR AIRPORT TERMINAL B, PA RR CHESTER TRANS. CENTE, CHESTER	06/29/2001	dep 1:36 PM arr 1:56 PM	Bus 37	RR CHESTER TRANS. CENTE, CHESTER (Wheel Chair Accessible)
RR CHESTER TRANS. CENTE, CHESTER CHESTER RD SWARTHMORE AV, SWARTHMORE		dep 2:05 PM arr 2:22 PM	Bus 109	MFL 69TH ST. TERMINAL, UPPER DARBY (Wheel Chair Accessible (on call))
CHESTER RD SWARTHMORE AV, SWARTHMORE LM SWARTHMORE COLLEGE, SWARTHMORE			on foot	10 minutes
Duration: 0:56; See Trip Guide for days of operation See "Legend" below for additional information.				

3. Stop	Date	Time	Train No	Direction/Comments
RR AIRPORT TERMINAL B, PA RR UNIVERSITY CITY, PA	06/29/2001	dep 1:42 PM arr 1:57 PM	RR Rai R1	RR GLENSIDE, GLENSIDE
RR UNIVERSITY CITY, PA RR SWARTHMORE, SWARTHMORE		dep 2:13 PM arr 2:34 PM	RR Rai R3	RR ELWYN, MIDDLETOWN
RR SWARTHMORE, SWARTHMORE CHESTER RD SWARTHMORE AV, SWARTHMORE		dep 2:39 PM arr 2:42 PM	Bus 109	MFL 69TH ST. TERMINAL, UPPER DARBY (Wheel Chair Accessible (on call))
CHESTER RD SWARTHMORE AV, SWARTHMORE LM SWARTHMORE COLLEGE, SWARTHMORE			on foot	10 minutes
Duration: 1:10; See Trip Guide for days of operation See "Legend" below for additional information.				

Legend

Wheel Chair Accessible

Wheel Chair Accessible (on call)

SOURCE: SEPTA.

Figure 7-9. SEPTA offers high-quality information from Philadelphia Airport.

tions or stops, and gives the departure, arrival and interchange times. You can get timetable information for trains and regional busses (coaches) all over Sweden. The journey route suggested is based on the quickest journey possible, with as few changes of transport modes as possible. (*13*)

In terms of best case practice for providing intermodal passenger information to the user, the work of the Swedish Samtrafiken group is unique in scope. The organization has already linked all ground transportation, has developed the capability to incorporate airline schedules, and (as will be discussed below) sells the intermodal tickets that it recommends.

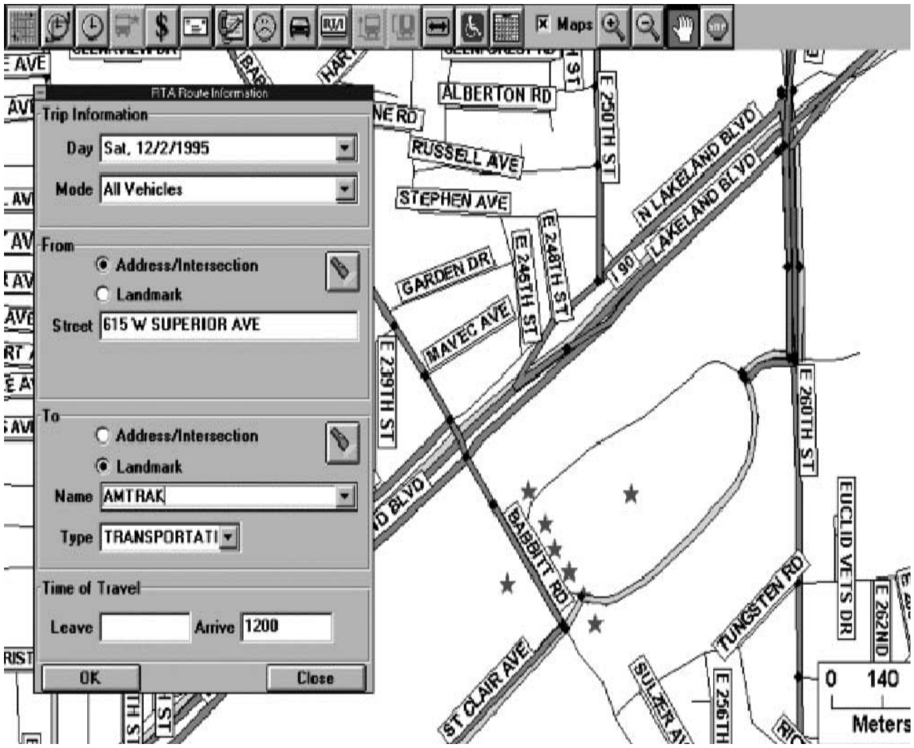
NON-AVIATION INTERMODAL PASSENGER INFORMATION SYSTEMS IN EUROPE

Progress on International Systems: Switzerland and Holland

In the development of a national intermodal trip-planning capability in the United States, it is instructive to review various strategies to combine systems designed to serve long-distance segments with systems designed to serve short-distance segments. Most passenger information systems are designed to serve a particular metropolitan area; others are designed to serve a particular mode or company service. Thus, a trip from Washington, D.C., to Boston might require the use of a metropolitan information system managed at WMATA, an airline information system such as USAirways.com, and a ground-based system in Boston. In the past few years, there have been several attempts to build combined systems designed to serve both local and longer-distance trip segments. Good examples of these strategies exist in Switzerland and in Holland.

In each case, the designers of the system have attempted to provide the appropriate level of detail: on one hand, comprehensive information is desirable; on the other, comprehensive information throughout makes files bigger and choices more cumbersome. The two examples below deal with the problem in two different ways. The information system from Holland provides a level of detail about local services that augments its primary role as a provider of longer-distance information on a nationwide scale. The information system from Zurich combines door-to-door service detail in the home metropolitan area and less information about the characteristics of the trip on the nationwide level.

In these new models, no assumption is made that any one system can, or should, provide all of the information. In some cases, an address-to-address format is retained. In other cases, a town center–to–town center approach is taken for the longer-distance trip.



SOURCE: Caliper Corporation.

Figure 7-10. The Greater Cleveland Regional Transit Authority was the first to develop a map-based Customer Information System.

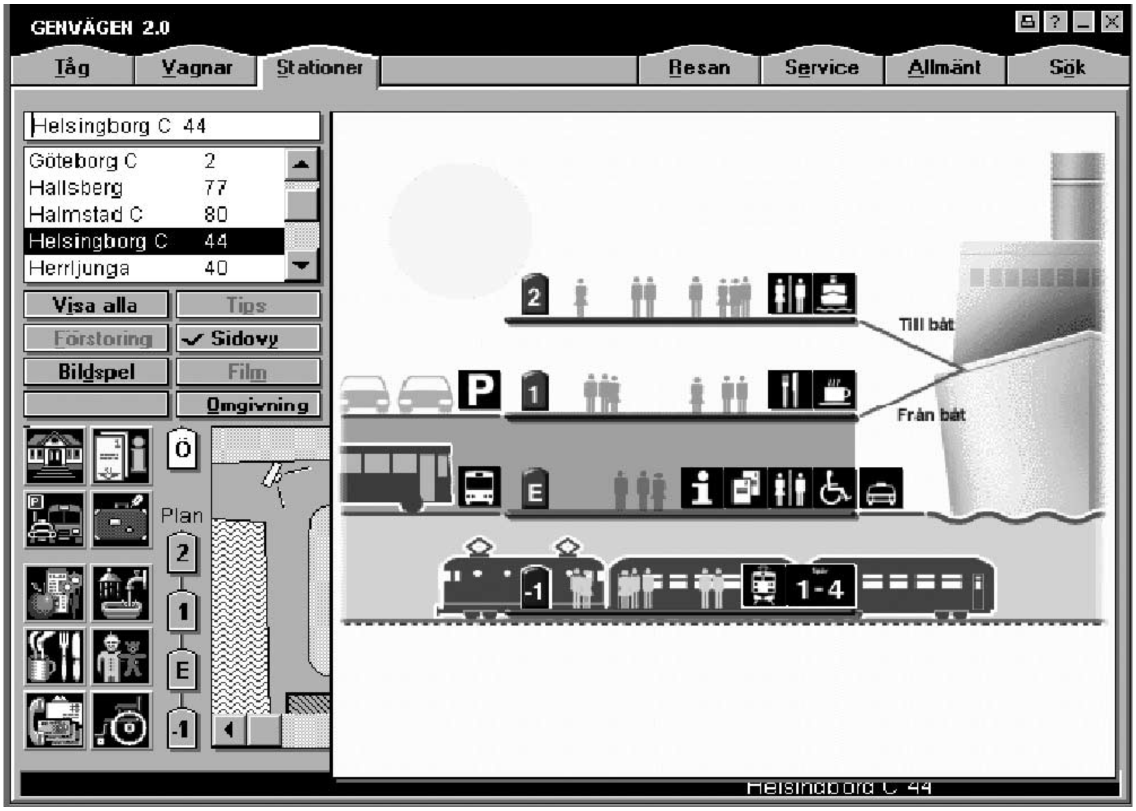
A Combined Metro and National Information System in Zurich

Passengers using the Zurich Airport can get trip-planning service from a locally managed transit information system that also provides nationwide trip planning by regional services. The Zurich HAFAS passenger information system was created by the local transit system and sold as a CD-ROM at ticket sales offices. The entire local transit network for the Zurich metropolitan area—including tramways, local bus, ferries, mountain funiculars, and commuter rail—is included in the itinerary trip-planning system; at the same time, the *national* intercity network is included at a scale of detail appropriate for longer-distance trips. The program is so geographically precise that, for a given street, it offers only address numbers that are listed as having buildings.

For the planning of a trip outside of the metropolitan area, however, the HAFAS system offers less detail at the non-Zurich end of the trip. A trip could be planned from a specific address in a Zurich suburb to a train station near Geneva, but not to an address in Geneva. In effect, the system has merged the local network of Zurich with the national intercity network of the country, but has not attempted true door-to-door trip-planning capability for the entire country. Figure 7-12 shows the results of a search from a specific address in Zurich, with local transit in Zurich, to a regional bus stop in Geneva, at which address-to-address services are not offered by the program.

A National Information System with Local Details in the Netherlands

Passengers using Amsterdam's Schiphol Airport can get trip itinerary–planning services from a new ground passenger information system in addition to those systems already described in *TCRP Report 62*. The Netherlands' PlannerPlus is sold as a CD-ROM in the stations of the state railway. PlannerPlus incorporates a GIS map–based description of the entire country, specific to a block-by-block basis. Figure 7-13 shows the description of the airport from the screen of the GIS-based information system. The system is designed so that the customer can move the "origin" icon to any geographic point and move the "destination" icon to any geographic point; from there, the system will start describing public transportation options to link the two points. No text need be added by the user. A network has been created that does not attempt to include all of the local services in the

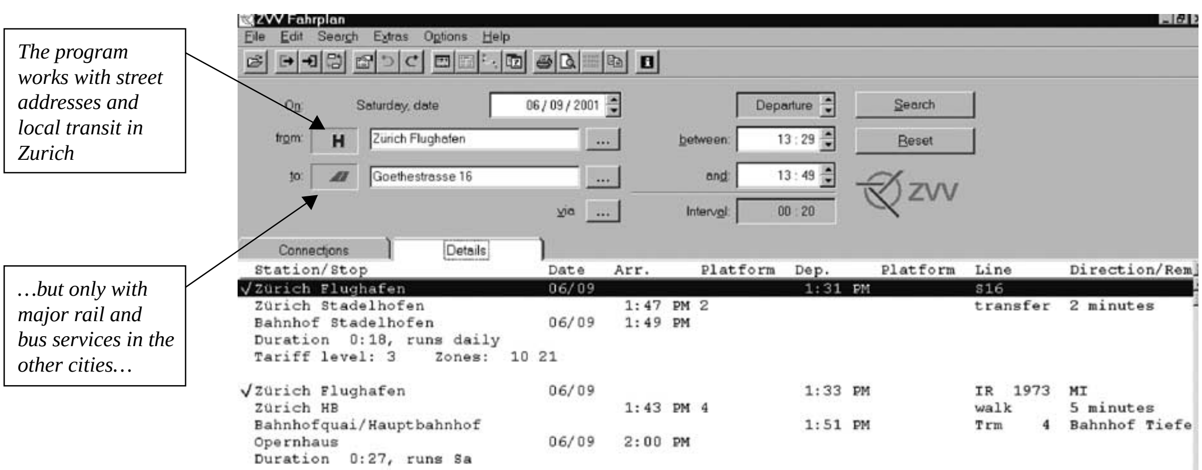


SOURCE: TagPlus.

Figure 7-11. The Swedish information system shows details of intermodal connections. Source: TagPlus.

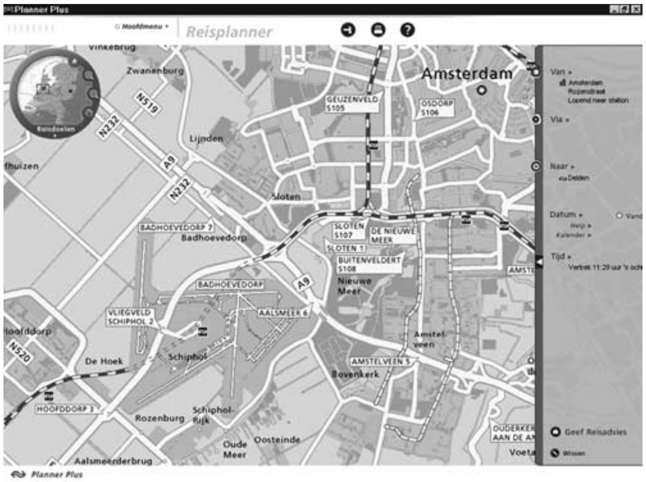
country, but rather those of regional or national significance. This point-to-point capability is then applied to those modal services defined as national in nature. Figure 7-14 shows a map that allows the user to locate his or her origin and the closest train station, but it does not have the light-rail timetables built into the system.

Both the Zurich and Dutch examples provide interesting models for the possible creation of an U.S. system of intermodal trip planning for the longer-distance trip. In both cases, national information has been provided at a reasonable level of detail for this kind of trip planning. In both cases, some, but not all, local services are also included in the larger national system.



SOURCE: Zurich Transit Agency.

Figure 7-12. The Zurich system combines both local and long-distance systems.



SOURCE: Netherlands State Railway and PlannerPlus.

Figure 7-13. The Dutch PlannerPlus program uses GIS maps, including this map of Schiphol Airport.

MULTIJURISDICTIONAL PASSENGER INFORMATION SYSTEMS

European Experience

Europe: Progress with EU Spirit

EU Spirit is a major international program to bring door-to-door trip planning to the longer-distance European trip. Funded by the European Union (EU) in 1998, the project "aims to develop and demonstrate a customer-friendly, Internet-based, multimodal information system." At present, the system focuses on long-haul rail services and does not include an aviation component. The logic of the program, however, could be applied to any longer-distance trip, including combinations of rail and air services.

From a technical point of view, the EU Spirit program is the most important model for a strategy that connects many separate systems, each of which operates independently. Both the Dutch and the Swiss national systems discussed are based on a centralized concept—they operate from a single national network, which is managed in one place. By contrast, EU Spirit is based on a *distributed* concept, in which local systems are managed locally and are interconnected only when necessary for joint operation.

Whatever intermodal passenger information system is ultimately developed in the United States, the system should benefit from the extensive experience of the EU Spirit team in creating an integrative long-distance architecture, which the team considered both a *centralized* data management model and a *distributed* model. EU Spirit was designed on a *distributed* model after careful consideration of the two options. In the technical approach described above for systems in Sweden, Switzerland, and the Netherlands, the system is simulated as one network, centrally owned and centrally managed. Thus, a change in a bus schedule in one part of the country would be updated by the same technician (using a common network) as a change in a bus schedule at the opposite end of the country. Advocates of this approach argued that the task of planning optimized trips required a single computerized network over which alternative paths would be examined with greatest efficiency. In the 1998 selection of the project team by the EU, a totally different approach was taken:

> Following a distributed concept, existing and independent transport travel planning systems from several long-distance and local operators will be connected. By using the so-called EU-Spirit travel planning ring, the participating operators will be able to provide integrated door-to-door public transport information to customers across Europe. (*14*)

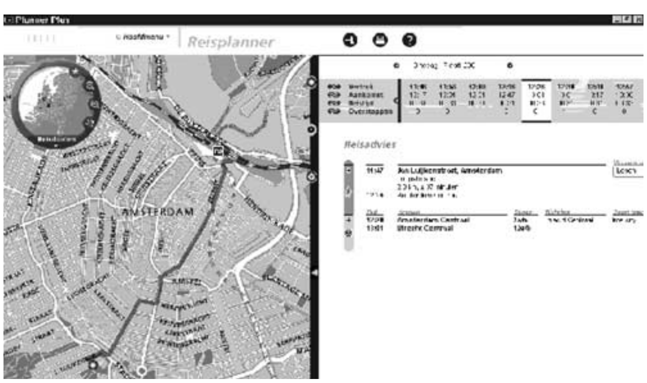
This distributed concept uses data sources from three systems:

1. The existing long-distance trip-planning capabilities of the European railways,
2. The passenger information system of the local transit company in the region of trip origin, and
3. The passenger information system in the region of trip destination.

In the creation of a U.S. multistate passenger information system capable of providing airport ground access information at the non-home end of the trip, the EU Spirit model of interconnecting, highly independent, locally managed systems could be a major precedent.

A British National System: Transport Direct

Currently, at the University of Southampton, British researchers are preparing a distributed information system that is similar in theory to the EU Spirit model developed in Germany. The approach being taken by the Southampton team allows for certain simplifying assumptions, primarily con-



SOURCE: Netherlands State Railway.

Figure 7-14. The program shows access to the rail station by foot, bike and automobile.

cerning the local points of interface with the long-distance systems. The local system operator would define the most logical points of transfer as input into the search process and input these assumptions manually into the system. The Southampton software will be the basis for a national public transportation information system in the United Kingdom, known as "Transport Direct."

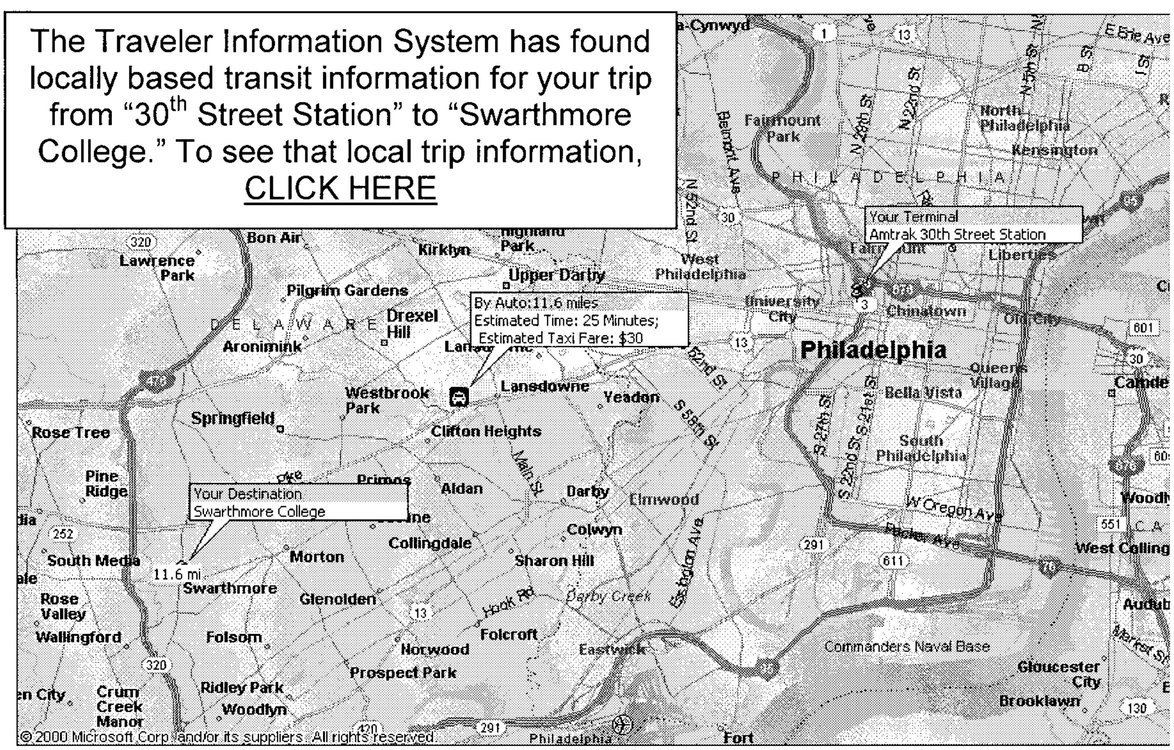
U.S. Multijurisdictional Initiatives: The I-95 Corridor Coalition

In the United States, there are currently relatively few efforts to develop passenger information systems on a geographic scale larger than the metropolitan area. For example, the Oregon DOT is currently committed to the creation of a statewide itinerary-building trip-planning system and is exploring cooperation with the State of Washington. However, here are few such efforts underway in the United States. This lack of effort poses a real challenge for the use of these systems to supply information about the non-home end of the longer-distance airline trip. In some format, an intermodal information system would link the consumer at one end of the trip with the data and systems at the other end. The relatively low level of interest in an integrated system at a national level may now be changing because of the nationwide implementation of the 511 passenger information system.

On a statewide basis, New Jersey Transit has inaugurated a statewide passenger itinerary-planning system to cover the service that the agency provides, but not to cover other services. Of the statewide interests, Oregon seems to have made the largest commitment to making a statewide intermodal system work. The I-95 Corridor Coalition has undertaken a program to examine the feasibility of the creation of a region-wide (and conceptually, a nationwide) program of public mode trip itinerary planning. A recent report prepared for the Coalition has proposed a candidate structure for the development of such a program.

Figure 7-15, reproduced from the I-95 Corridor Coalition study, shows the results of a query for information from Manhattan to Swarthmore College in Pennsylvania. In the first step of the information provision process, the program would provide the results from the long-distance trip database. A long-distance mode (in this case, a Metroliner from New York City's Penn Station to Philadelphia 30th Street Station) is recommended; simultaneously the program offers known *static information* (not specific to routes and schedules) and the option of accessing the local information system for more information. The traveler can either accept the basic map-based information provided or can click to attain the specific connecting information. The draft conclusions of the I-95 Corridor Coalition report included the following:

> The system should be seen as primarily one of a service to the longer distance public mode traveler in the multistate region. . . . While there will be need in some regions to connect with a locally operated trip planning system, the system should be designed to incorporate as much information relevant to the longer distance traveler as possible in the core system. (*15*)



SOURCE: I-95 Corridor Coalition Intermodal Passenger Information Project.

Figure 7-15. The I-95 Corridor Coalition is exploring the possibility of integrating local and long-distance systems.

Expanding the Involvement of Airports

The I-95 Corridor Coalition leadership has set as a high priority an effort to reach out to the airports of the 12-state region and to increase the airports' involvement in the activities, particularly in the development of a corridorwide intermodal passenger information system that specifically includes aviation and airports.

One option being examined in this process is the concept that passenger information about locally authorized transportation services at airports be managed by a coalition of the airports. The project report notes that

> . . . the major east coast airports might prefer to work together on a common method of organizing ground access information, and bear the cost of that clearing house function themselves. These airports could retain a high level of quality control over information associated with their public image and reputation. . . . (*15*)

At the present time, the I-95 Corridor Coalition program is working with major transportation providers, including Greyhound and Amtrak, on the development of various system concepts. The increased involvement of airports and interested airlines could widen the overall scope of the project. The results could be relevant to the task of getting airport ground access information to the traveler.

NEW AIRLINE RESERVATION SYSTEM TECHNOLOGY—IMPLICATIONS FOR GROUND ACCESS

Given the scale of the U.S. transportation system, the creation of a passenger information system, which incorporates both aviation trip options and local connection trip options, will be a major challenge. The Swedish example, however, implies that a solution can be found. Clearly, the search engine for an intermodal passenger information system would have to be sophisticated enough to consider many trip segment combinations at once. New breakthroughs in the design of trip-planning search engines may provide the answer. In late spring 2001, a new airline trip-planning technology was introduced that demonstrates the ability to deal with increasing complexity and increasing challenge. The new search technology was developed by a Cambridge Massachusetts firm called ITA and has been applied by Travelbyus.com and by the Orbitz consortium of seven world airlines. The importance of the fact that the consortium of major airlines chose this search technology in its unified bid to enter the travel agent business should not be underestimated.

Until the development of this powerful new technology, the task of finding appropriate flights in markets such as Boston to Washington, D.C. has been a matter of hunting through various combinations of airports, including airports in Providence (Rhode Island), Worcester (Massachusetts), and Manchester (New Hampshire) at the northern end of the trip and BWI, Reagan National, and Dulles Airports at the southern end of the trip.

Now, with the use of more powerful information technology, a simple Boston-to-Washington query with a request to show all airports within 50 miles of each of these cities, produces a simple 4-×-3 matrix with the lowest fares between and among all of the airports identified. All combinations of trips connecting the seven airports in the matrix are then arrayed by categories defined by the customer, including minimized cost.

The development of search engines of this power could, in theory, make the addition of actual travel times or specific ground services more probable than with earlier reservation technology. In addition to knowing the air schedule between Manchester Airport and BWI, the customer might also want to know the estimated roadway travel time from his or her specific point of origin to his or her specific point of destination. It is clear that multiple segment trip options, via multiple gateways, can now be examined simultaneously—a key requirement for a future intermodal passenger information system.

JOINT TICKET SALES—AIR AND RAIL

Although most of this chapter has examined progress, or lack of progress, in the area of multimodal information, the ultimate goal of the integrated information system is to provide for both unified information and ticketing. One of the few examples of the provision of both services at once comes from Samtrafiken in Sweden. Samtrafiken's TagPlus passenger information program also includes the issuance of combined multimodal tickets, as is shown in Figure 7-16. Here, a simple trip on services of the national railway and private bus company was planned on the TagPlus system over the Internet.

The customer is issued a number code for the ticket. The customer can pay for the trip either at the time of reservation or at the time of picking up the ticket. The Swedish authorities have established an innovative, cost-effective manner to print and distribute the tickets. The tickets are printed by the legalized gambling and lottery agents located throughout the country. Figure 7-17 shows the signs located on the gambling shop, which note the sales of tobacco; horse-racing bets; and intermodal rail and bus tickets, noted by the words *biljett direkt*. The national railway has begun a program to discourage the sales of rail tickets at lightly used stations and heavily promotes the use of this alternative ticket distribution channel. The commission from the sale of these intermodal tickets pays for the operation of Samtrafiken.

Integrated Air and Rail Tickets: Long-Distance Systems

Over the past decade, major changes in law have allowed for the sale of rail tickets by airlines on an international basis. For long trips in which the cost of the rail ticket is high and the cost of the commission is profitable to those involved in the transaction, the sale of rail tickets as part of a larger air-

Figure 7-16. Sweden's Samtrafiken distributes multimodal tickets from the TagPlus system.

line ticket has become commonplace. As discussed in *TCRP Report 62*, IATA three-letter codes are assigned to rail stations, and the reservation and ticketing mechanisms of the airline industry are used. High-speed rail services from both Frankfurt and Charles de Gaulle Airports are good examples of the use of through-ticketing for air and rail.

Photo: Matthew A. Coogan.

Figure 7-17. Intermodal tickets are sold at the state lottery shops in Sweden.

Several European railways, including the Danish and Norwegian railways, participate in a program run by a Canadian firm that has created "placeholder" airlines to be included in the airline computer reservation and ticketing networks. Within the placeholder airlines are the rail schedules being offered by the railways participating in the system. The costs of the airline reservation and general distribution ticketing mechanisms are incorporated into the price of the railway ticket. At present, the firm and several major European airport railway operators are exploring Access Rail—the application of this reservation and sales mechanism to the problem of the lower-cost, short-distance airport access trip.

Strategies to Market Low-Priced Tickets

For the short journey associated with most metropolitan systems, the problem of selling a $5 or $10 ticket through the airline's computer reservations and ticketing systems remains unsolved. There simply is not enough profit in the low-priced ticket to pay for the cost of access through the airline reservation systems.

There are remarkably few examples of through-ticketing between airlines and metropolitan-scale railways. A good example of a strategy to deal with the problem creatively is

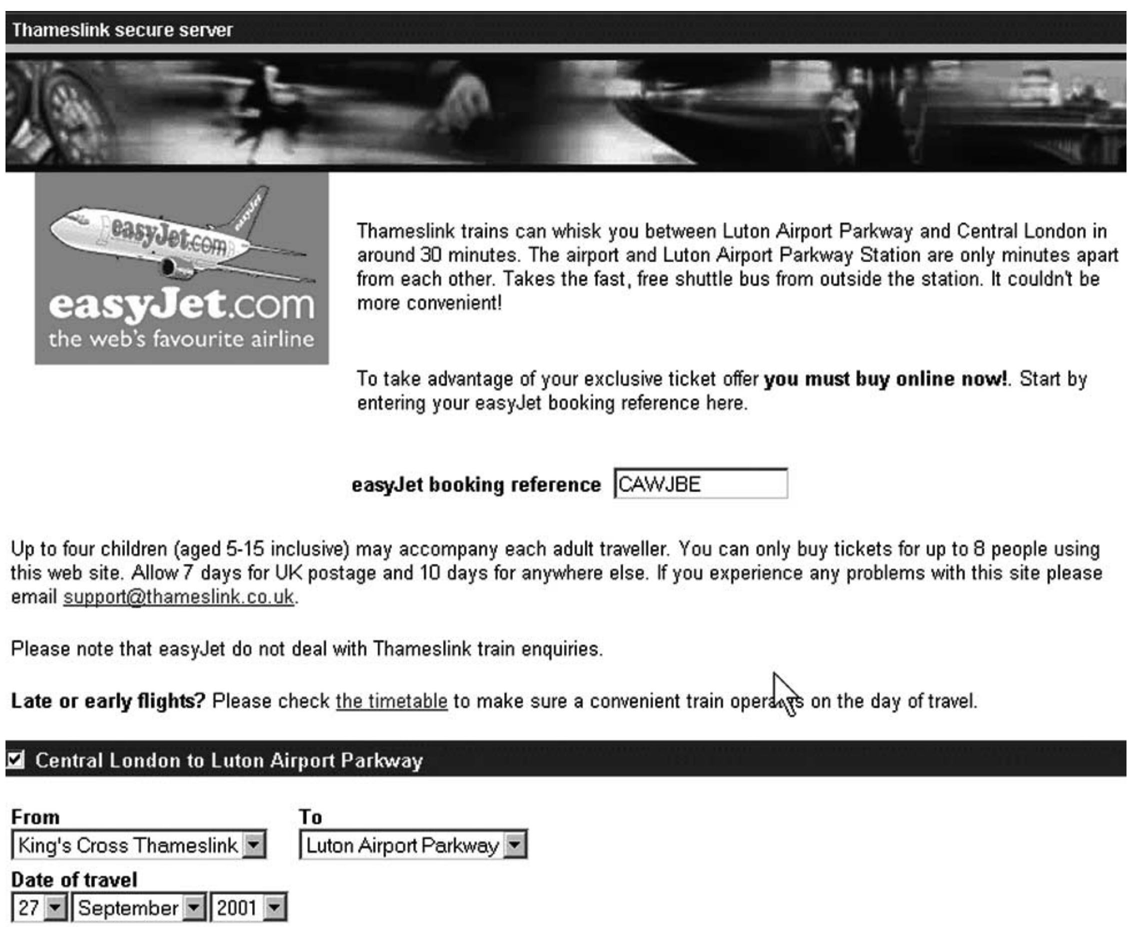
the strategy of RyanAir service to Stansted Airport near London. On board the airplane, in-flight attendants sell Stansted Express Tickets to the passengers in the plane. The flight attendants keep the commission that would otherwise be paid to a travel agent.

A breakthrough in the coordination of ticketing efforts between airlines and rails has been accomplished by easyJet Airlines in London. Most easyJet tickets are sold via the Internet. When the traveler has purchased an airline ticket from an airport served by the Thameslink railroad (either Gatwick or Luton Airports), the screen offers the customer the option of being sold a discount rail ticket. Importantly, when the customer agrees to continue, the key information used in the airline ticket sale, including flight day and time, and all passenger identification *except* the credit card number are immediately sent to the railroad's server. Figure 7-18 shows the content of the screen. After confirming that the information is correct, the only keystrokes needed by the customer are those for the credit card number. All of the content shown in Figure 7-18 has been supplied automatically by the program.

The Need for E-Ticketing Solutions

The collaboration between the ticketing systems of easyJet and the ticketing system of Thameslink is a good example of creative solutions to real problems. At the airport, the easyJet organization does not use paper tickets and needs only the passport of the traveler to allow for boarding. For the rail operator, getting the ticket to the traveler is more complicated. The rail operator must print a ticket and mail it to the customer in time for its use. In the case shown above, that ticket must be mailed from the United Kingdom to the United States, all for the purpose of selling a $6 ticket. This suggests that lower-cost mechanisms for ticket distribution need to be developed. The concept of the "paperless" ticket may prove to be at least a partial solution for these problems.

The innovative Heathrow Express was the first airport railway to introduce e-ticketing. If the ticket has been paid for with a credit card, that credit card can be inserted in a machine that will print the previously purchased e-ticket. In other cases, the traveler can go to the ticket office, show



SOURCE: easyJet.com.

Figure 7-18. The easyJet website transfers customer information to the rail server for rail ticketing.

appropriate identification, and be given the printed e-ticket at that point. The last 2 years have witnessed a proliferation of these strategies by airlines and by Amtrak for the longer-distance trip. Addressing the issue for the relatively cheap and relatively short airport ground access trip is just beginning to occur.

Customer-Printed Tickets

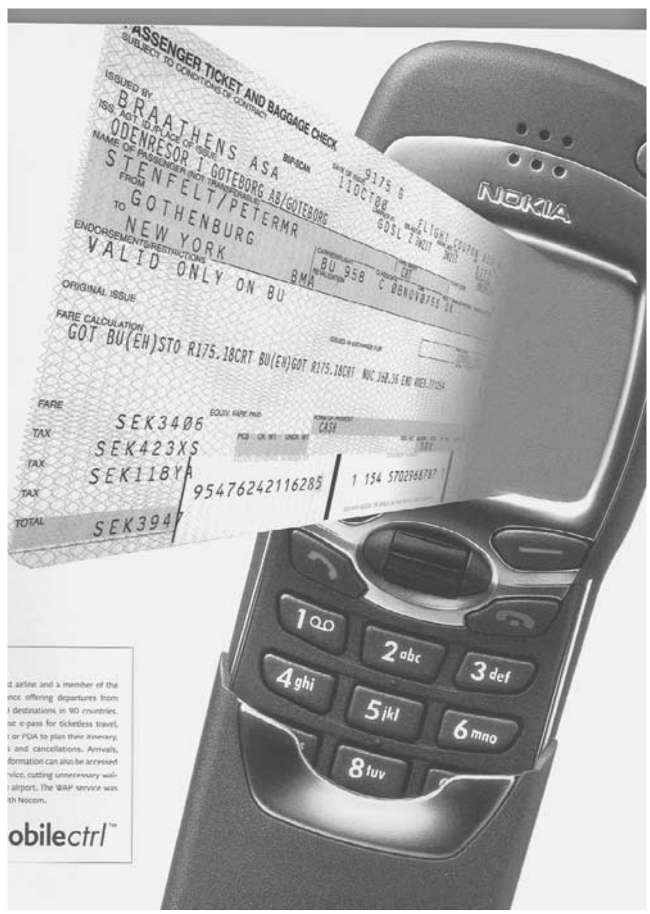
The acceptance of bar-code technology allows for information to be printed (or displayed) through a wide variety of media. Bar codes can be used within the screen of a cell phone and can also be printed out by basic home printers. Bar-code technology can be printed just about anywhere, which is a sharp contrast to magnetic-strip technology. The FedEx Ship program is entirely based on the customer printing the airbill that once was done with layers of carbon copies. Home-printed stamps are now accepted by the U.S. Postal Service. Northwest Airlines now allows its passengers to print their boarding passes on home computers. All boarding passes at Northwest gates are now based on quick reading bar-code technology. Bar code–based boarding passes are printed at eTicket machines throughout the airport, as well as by the customer.

The implications of these ticketing mechanisms for the lower-cost airport ground access ticket could be extremely important. In theory, it should be straightforward for some sales institution (such as the airlines in the easyJet example) to sell the airport ground access ticket over the Internet, within the same transaction as the airline ticket. The hand-held computer of the rail conductor would recognize the code (or reject it as counterfeit) with a simple flash of the bar-code reader.

The Role of Cell Phones

The marketing team at the Stockholm Arlanda Express has been examining the potential role of cell phones in the task of ticket sales. During their project, the team developed a program that uses very simple bar codes on the screens of advanced cell phones. The traveler would bypass any ticket lines and board the train, even at the last minute. The traveler would then dial a 900 number and, in effect, purchase the railway ticket from the phone company. The cost of the rail ticket would appear on the monthly phone bill. Once the transaction was completed, the screen of the cell phone would show a bar code containing the message that the ticket had been paid for. The on-board conductor already carries a small computer capable of reviewing credit cards for bad numbers; that computer would contain a small bar code–reading device commonly available at low cost. At present, the Arlanda team is still developing the concept, responding to concerns that not all cell phones have the capability to display the bar code. The implications of the concept, however, are very important to the study of possible new forms of ticket sales and financial settlements. The same team working for the airport railway has developed a fully implemented program to use the cell phone as the e-ticketing mechanism for Norway's Braethens Airlines, as is illustrated in Figure 7-19.

At the Tokyo Narita Airport, work is now underway on a comprehensive program to use cell phone technology for a wide variety of airport processing functions, ranging from biometric identification to gate changes in its E-Airport Program. As shown in Figure 7-20, which was taken from an electronic movie created by the E-Airport Program, the cell phone would be used to convey ground transportation door-to-door trip itinerary planning, seat reservation, and payment. The program is presently conceived to include police and customs processing as well as ticketing for all segments of the long-distance trip. The E-Airport Program is a joint activity of Narita Airport and a consortium of Japanese communications companies.



SOURCE: Nocom Travelutions, AB.

Figure 7-19. In Scandinavia, cell phones are used as e-ticketing devices.

SOURCE: Narita Airport Authority.

Figure 7-20. A worried airline passenger is given door-to-door ground transportation trip planning by cell phone in this cartoon issued by the Narita Airport's E-Airport Program.

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 **8**

PUTTING IT ALL TOGETHER: SIX STEPS IN A MARKET-BASED STRATEGY FOR IMPROVING AIRPORT GROUND ACCESS

CONTEXT OF CHAPTER 8

Chapter 8 presents a "guidebook" summary of the key elements in the creation of a market-based strategy for improving public transportation access to large airports. TCRP Projects B-18 and B-18A, "Strategies for Improving Public Transportation Access to Large Airports," examine airport access based on the travel needs of various market segments. This chapter reviews the key steps for improving public transportation access to airports and summarizes portions of the content of the previous seven chapters. It is intended to point the reader to best case practices in the United States that can be explored for additional information on each of the concepts.

A Six-Step Approach

There are six steps in the process outlined in this chapter.

Step 1. Establish the public policy goals:
- Form the collaborative effort that will be needed for implementation, and
- Understand the travel behavior of the longer-distance traveler.

Step 2. Undertake the program of data gathering and system monitoring:
- Design the survey to reveal key market characteristics, and
- Emphasize accurate geography and market segmentation for both air passengers and airport employees.

Step 3. Interpret the markets and their relationship to candidate modes:
- Understand the makeup of the overall airport market,
- Establish the target markets at several levels of trip-end density, and
- Understand the precedents for market support of various modes and services.

Step 4. Design a program of services and strategies:
- Understand the quality attributes achieved by successful services,
- Match modes with markets, and
- Acknowledge role for dedicated higher-cost services.

Step 5. Manage the airport to encourage HOV use:
- Examine priorities and implications of curbside allocation and pricing and
- Evaluate the level of amenity experienced by the public-mode user.

Step 6. Get the word out:
- Provide basic service description to the users and
- Develop programs for integrated passenger information and ticketing.

STEP 1: ESTABLISH PUBLIC POLICY GOALS

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. This 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 decisionmaking.

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 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 tripmaker*

Preparing to address airport ground access involves many stakeholders, including airport managers, public transportation operators, private transportation operators, roadway system managers, 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 importance of early involvement of the agencies with environmental review power cannot be overstated because results from the planning process are often integrated into key environmental documents.

Dr. Christine Johnson, former Director of the U.S. DOT's ITS Joint Program Office, has noted that "no institution 'owns' the congestion or safety problem at the local level or state level." This observation is particularly true for the subject of improved airport ground access: someone has to get the right players around the table, and someone has to be accountable for the performance of the system. Dr. Johnson's comment was made concerning roadway congestion, which involves a single mode; the challenge facing the designers of a multimodal, multiagency strategy is much greater still.

Those with responsibility for regional ground transportation decisions must be brought to the table as early as possible in the process. In most cases, transportation solutions are selected based more on regional policies and constraints than on acts of the airport or the preferences of the airport user. In some metropolitan areas such as Houston, a commitment has been made for high-quality bus lanes as part of a larger regional transportation strategy. In other areas such as Portland (Oregon), the regional strategy emphasized a rail solution in the corridor ultimately leading to the airport and discouraged the use of separate bus lanes. In Denver, the question of new rail service versus new bus lanes was sent to the Denver Regional Council of Governments, where the airport access strategy was created. In each case, the decisions affecting the mode for airport service were made as part of a regionwide consensus, not a strategy based narrowly on the airport access issue. All of this requires a sense of collaboration among the various parties that have a part to play in the creation of a wider set of services.

Coordinate with Regional Planning Process

The parties need to define the extent to which the airport ground access issues are regional in nature because 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 MPO. Failure to do this will result in serious problems in attaining funding and in obtaining needed environmental clearances.

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. It is the role of the CMS 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 airport access improvement strategy should be working closely with regional managers of the CMS. The data created in the CMS helps to establish the regional context of the airport-related traffic and allows the comparison of scale with other potential investments in the region.

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 MPO 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 most limited value to the analysis of airport access. MPO may, or may not, be prepared to analyze the transportation behavior patterns of the longer-distance traveler, in this case the air traveler.

Prepare 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 (EIS) or a Finding of No Significant Impact. In either case, the rules for formal scoping, 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. The exact process of trade-off between the general transportation-planning process and the

creation of project-specific environmental documentation is the subject of considerable debate since Congress removed the requirement for a Major Investment Study, which served as the mechanism for that transition.

For the reasons discussed in the preceding paragraphs, it is clear that any major attempt at applying regional resources to improving public mode services to airports must either be initiated by the regional planning body or be 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, whether or not federal funds are proposed in the planning or implementation efforts. Indeed, the most recent funding legislation (e.g., the Transportation Equity Act for the 21st Century) requires that the operators of airports be members of the MPO.

The premature adoption of mode-specific measures of performance should be avoided at this point in the planning process. The analysis process should not focus on the apparent solutions. A planning process based on a premise such as "How do we attract people to rail?" is inappropriate at this point. Because at this point in the legally required analysis of alternatives, the possibility of early bias can raise serious legal problems when the documentation is used in later environmental processes.

Understand the Unique Behavior of the Longer-Distance Traveler

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. From the outset, the analysts need to see the problem in terms of the full trip of the customer. 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 tripmaker 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 trip maker. These decisions are different in terms of uncertainty and lack of knowledge about the nonhome end of the trip. The decisions are different because of the amount of baggage being carried by the traveler, the sense of urgency about the reliability of the trip and arriving on time, and the total trip costs.

The metropolitan decisionmakers—from MPOs, to transit managers, to airport managers—are faced with designing airport access services for a market whose needs are largely different from the needs of the majority of daily commuters. Often, the major institutions that provide transportation service are designed to provide only a small portion of the complex, multisegment trip. It is often difficult to find a "champion" of the needs of the longer-distance tripmaker, particularly for those elements of the trip that are not profit making.

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 4 and 5 of *TCRP Report 62* were created to encourage this kind of research and education.

Best Practices in the United States: Establishing the Process

There are many good examples of coordination with the regional transportation planning organizations in the U.S experience. Some of those examples are as follows:

- The role of the San Francisco Bay Metropolitan Transportation Commission in the planning of airport access improvements in the Bay Area,
- 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 SCAG in the formulation of aviation policy in the Los Angeles region,
- The role of the City Planning Commission in Atlanta to insist on a direct terminal link between MARTA and Hartsfield Atlanta International Airport, and
- The role of PANYNJ in forging a coalition with New Jersey Transit and Amtrak for the Newark AirTrain project.

STEP 2: UNDERTAKE THE PROGRAM OF DATA GATHERING AND SYSTEM MONITORING

In Step 2, the manager must create a database upon which to plan and monitor the services and facilities for improved airport access. This 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 to apply to gain the information needed for a market-driven customer-oriented process. Decisions can then be made on a modally unbiased basis, stemming from the analysis of the needs of the customer: this process cannot be commenced without high-quality data describing just who those customers are and where they are coming from.

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*

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 Chapters 2 and 3, it is important to establish a market description of that population 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 to test, there will be a geographic area in which that service makes sense as a logical choice and a geographic area in which 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 $50,000 and $200,000. Without this information, the process of matching services to market needs cannot be undertaken.

Content of the Airport Ground Access Survey

The principles of a market research–based planning process were examined in detail in Chapter 3 of *TCRP Report 62*. That chapter documented five steps:

Step 1: Decide what information to collect,
Step 2: Select a data-collection method,
Step 3: Determine the sampling frame and sampling method,
Step 4: Develop the questionnaire, and
Step 5: Summarize and analyze the results.

Key issues for data collection include the exact geographic origin of the ground access trip, time of day, trip purpose, and residency status of the traveler. *TCRP Report 62* 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" (*1*).

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 GIS. The origin of the ground access trip can be determined either by the user providing the zip code of origin or with 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 process short. The analyst may be interested in trip purposes such as medical, personal business, school, or vacation. For the needs of the travel–demand analysis process, however, the most important 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 1, 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 pick-up or drop off-mode or for the drive-and-park mode) is substantially higher at the home end of the full trip 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 or 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 the 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, and
- Non-resident non-business.

Why Look at Separate Market Segments?

Chapter 3 has applied these four market segments to a cross section of U.S and European airport ground access markets. Importantly, none of these categories can be applied as a "cookie cutter" approach to predicting behavior. Chapter 3 established that in situations in which the rail option is faster (and more expensive) than its alternatives, rail becomes the superior good and is chosen more by the business traveler than the non-business traveler. In most cases, rail is slower

than alternative modes and is chosen less often by the business traveler than by the leisure traveler. In each case, however, the choice of mode is influenced by both the residential status of the traveler and the purpose of the trip.

The four market segments allow the observation of several subsets of the market 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 will a door-to-door shared rider service at $15. During rush hours at Baltimore-Washington International Airport, customers are offered multistop Maryland Rail Commuter (MARC) services to Union Station at $5 or Amtrak Metroliner service at 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/limo/van” may be a reasonable breakdown. For the analysis of public transportation patterns, it is critical to break out publicly available bus and van 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 toward desired behavior patterns occurs on the first question.

Data Collection to Monitor System Performance

It is very important to address the measurement of system performance in the data-collection process. A classic example of a commitment to measurement exists in the contractual relationship between the Massport and the Conservation Law Foundation. 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 of travel (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 a ground access survey.

A very basic example of a system of performance measurement was developed by Massport in the mid-1980s. Table 8-1 shows the number of vehicle trips on the roadway created by one air traveler gaining access to Boston-Logan 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. Thus, an air traveler who parks at the airport has generated .74 vehicle trips while an air traveler who was dropped off has generated 1.29 vehicle trips. In the evaluation of the performance of the system, a given strategy was evaluated positively 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 (a move up the rows of the table).

TABLE 8-1 Measures of effectiveness in the Massport Program: ground access vehicle trips per air passenger trip

Mode	Vehicle Trips per Air Passenger Trips
Pick-up/Drop-off	1.29
Taxi	1.09
Drive-and-park	.74
Rental car	.69
Door-to-door van	.33
Scheduled bus	.10
Rapid transit	0

SOURCE: Massport.

Some changes in travel behavior are intuitively obvious: a new express bus service that diverts a traveler away from his or her former drive-and-park mode is a more efficient mode and is evaluated positively. But not all mode changes are intuitively obvious in their implications. If, for example, on-airport parking rates are set extremely high and this discourages the use of drive-and-park, the implications are not so clear. If that trip is diverted to pick-up/drop-off mode, the implications for VMT 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.

In the establishment of measures of performance, the unique characteristics of airport ground access should be taken into consideration when they differ from those of other regional transportation programs. For example, in the analysis of airport ground access, the pick-up/drop-off mode creates far greater VMT (and pollution, etc.) than does the drive-and-park mode. Thus, a well-intentioned program to give high-occupancy private vehicles a priority access lane into the airport may be encouraging the worst modal pattern at the expense of less environmentally damaging modes.

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. Good examples of commitments to monitoring the performance of the system through surveys include the following:

- The Air Passenger Survey Program of PANYNJ, which operates the largest and most comprehensive data-gathering program for airport ground access in the country.

- The role of the 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 Boston-Logan Airport.
- The airport passenger survey program of WASHCOG, 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

At this point in the process, the bonds of collaboration with other stakeholders have been made, the data has been collected and is now available for analysis. With these necessary foundations in place, the process of targeting markets for accessing an airport by public transportation can commence.

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 per square mile, and understand the nature of the market within this area*
- *Analyze how each of the three market areas may require different kinds of services*

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.

GIS now allows 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 distribution patterns in 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 has defined the primary market area for the airport as a whole as the area composed of zones that have more than 5 airport trips per square mile, by all modes. This has proven to be an effective way of focusing attention on those areas where empirically some 70% of the airport's ground transportation originates. In the densely developed area served by Washington, D.C.'s Reagan National Airport, the geographic area composed of zones with at least five trip ends per square mile covers only 484 square miles. In the highly suburbanized geography of Los Angeles International Airport, the geographic area composed of zones with at least five trip ends per square miles spreads over 1,500 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. But, in order to understand the ability of markets to support specific services, it is necessary to disaggregate the total airport market into at least three categories of trip-end density.

Three Categories of Trip-End Density

For the purpose of this national overview appropriate for TCRP, three basic categories of trip-end density have been created:

1. Fewer than five trip ends per square mile,
2. Between five and 50 trip ends per square mile, and
3. More than 50 trip ends per square mile.

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

The examination of geographic areas made up of zones with at least 50 airport trips 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 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 8-2 ranks the U.S airports in our sample in order of the portion of their ground transportation markets originating in zones with densities greater than 50 trips per square mile.

TABLE 8-2 U.S airports ranked by orientation to dense urban markets

Airport	Percent of airport ground origins from zones with more than 50 trips per square mile	Trip-end density from these zones, as trips per square mile	Daily air passengers from these zones
San Francisco	57%	225	18,000
Reagan National	52%	216	9,840
New York LGA	49%	409	11,700
New York JFK	44%	310	10,450
Boston-Logan	35%	210	9,300
Los Angeles	33%	77	12,970
Dulles	30%	110	4,280
Denver	29%	100	8,600
Seattle	28%	126	4,700
Tampa	25%	126	3,025
Newark	22%	215	6,200
Baltimore	13%	205	1,865
Portland	7%	66	650

SOURCE: MarketSense, from local airport surveys.

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

Fixed-route and schedule service requires a certain intensity of trip-end density to operate at reasonable headways. Table 8-2 ranks 13 major U.S airports in terms of the portion of their ground access market originating in zones with densities greater than 50 airport trips per square mile. The table shows that of U.S airports, only San Francisco International and Reagan National have a majority of trip origins coming from our most dense category: those areas with more than 50 trip ends per square mile.

The use of the category of “greater 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 narrowing down to specific service proposals, ranging from scheduled hotel loop service (appropriate to most large airports) to full-scale regional rail transit coverage, such as WMATA (applicable to a small number of airports).

Whereas the first data column of Table 8-2 summarizes the extent to which an airport is oriented to our highest category of trip density, the second data column provides more information about the trip-end density within that geographic area. This information is needed to observe the ability of the market to support fixed-route and schedule services. This can be used as an indicator of the potential for high-capacity service to be successful. By far the airport with the greatest concentration of trip ends is New York’s LaGuardia Airport, with more than 400 trips per square mile for this analysis area. At the other extreme, the low trip-end densities for analysis areas in Los Angeles and Portland 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 are at play, it is clear that volume of, and density of, trip ends are critical elements in understanding the ability of specific markets to support specific modal services.

A key conclusion of this project is that the observation of 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 2 reviewed a wide variety of specific services in the context of their logical catchment area.

Chapter 2 presents a quantitative approach for defining the catchment areas within which to analyze the market share gained by each mode. For each service, the geographic area that provides 70% of the ridership of a given service is defined as the area’s service-specific “primary geographic market.” By using this constant definition of the prime catchment area for each service, we can observe trip-end densities that are supportive of a wide variety of airport access modes. This is an essential element of the process of understanding each of the submarkets that together comprise the total airport ground access market.

Air Passenger Markets Supportive of Rail Services

The primary geographic market for rail services for airport passengers to Boston-Logan Airport is characterized by a density of 150 total airport trip ends per square mile. Within this logical catchment area, MBTA rail services attain a mode share of 16% of the air travelers to Boston-Logan Airport. The same analysis process has determined that the prime geographic market for rail services to Reagan 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 National.

Air Passenger 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 markets areas with less than five trip ends per square mile. The Van Nuys FlyAway bus service was supported by a market area with eight trips per square mile. Express bus services from regional collection points to Boston-Logan Airport attained greater than 20% mode share in their markets while the Marin Airporter captured greater than 30% of its primary market area. Similar strong markets are reported from other data sources for longer-distance bus and van services serving JFK and Boston-Logan Airports.

Air Passenger Markets Supportive of Door-to-Door Services

A wide variety of door-to-door services were examined in this project. In both Seattle and Oakland (California), the logical catchment areas for door-to-door van services were characterized by airport trip-end densities averaging about 15 trips 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; Los Angeles' primary market supported door-to-door services with an average of 27 trip ends per square mile.

Door-to-door vans capture a variety of mode shares from their respective logical catchment areas. Mode shares of fewer 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. Although there are clearly densities below which door-to-door van services cannot be supported, they are also 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 trips per square mile.

Airport Buses to Downtown

Examples of airport-oriented bus services from downtown hotels and major activity centers exist in most major U.S airports, serving a wide variety of downtown trip densities. Although these buses serve central-business-district densities as high as 500 trips 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 strong market shares.

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. Although the details of effective market segmentation will vary from airport to airport, it is fair to say that a comprehensive strategy to deal with airport ground access must deal with *at least three* submarkets: a dense urban market, an exurban market, and a middle market.

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 trips per square mile can support such services on their own. Successful rail services have been observed in market areas of well over 100 trip ends per square mile. Hotel loop buses serve small geographic areas with highly compact markets: Seattle's Grayline Express serves a hotel-oriented concentration of more than 400 trip ends per square mile. Boston's central business district generates more than 500 airport trips 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 in which collection services need to be provided by means other than the vehicle providing the 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, in a category whose upper and lower boundaries are less clear; the largest of the three categories for U.S airport ground access are zones of origin generally greater than 5 and less than 50 trip ends per square mile. As will be discussed below in Step 4, this may be the most difficult market to serve, with various forms of shared-ride services.

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 U.S experience, airports cannot be characterized as all exurban in nature; they cannot be characterized as all urban in nature. The following are good illustrative examples of three types of airports oriented to dense urban, exurban, and middle markets.

An Airport Oriented to a Dense Urban Market

To the 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 greater than 50 trip ends per square mile, an area with an overall average of about 225 trips 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 five trips per square mile. In our sample, Denver's airport had the highest volume of "exurban" trips, coming 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 areas that are neither dense nor exurban in nature: about 21,000 air travelers originate in areas with less than 50 trips per square mile, but more than five trips per square mile—an area with an overall average of about 15 trips per square mile. This represents the United States' largest market for medium-density modes such as door-to-door vans.

Step 3 in the six-step process has emphasized the need to examine the nature of market segments per se, even before attention is turned to the design of services and the selection of mode for services. The design of a series of services should follow from an understanding of market characteristics. The process of matching technologies and service configuration to the needs of the market is discussed below in Step 4.

STEP 4: DESIGN A PROGRAM OF SERVICES AND STRATEGIES

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 modal services must be selected, determined by the needs of the travelers and ability of the markets to support specific services.

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 the central business district*
  - *Connection at the airport*
  - *Service beyond the central business district*

  Appropriate baggage strategy
- *Design a set of services to appeal to four submarkets:*
  - *Resident business*
  - *Resident non-business*
  - *Non-resident business*
  - *Non-resident non-business*

Based on the review of many U.S airport access case studies, it can be concluded that in many cases, the choice of mode had been made before the analysis of the optimal solution was commenced. In many cases, a predilection that rail would be the most important contribution to an overall airport access program made an unbiased analysis of alternatives highly problematical. In this step of the process, the revealed characteristics of the market and the needs of the traveler expressed in service attributes can be applied to the choice of modes of services for each of the market segments.

The decision about whether to build a rail system to a U.S airport may be more driven by the overall public transportation strategy of the region rather than by airport access needs examined 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 serve a component part of a bigger network of collection and distribution, the investment in a stand-alone system to the airport may not make sense.

In this phase of the process of improving public modes to major airports, it is important to design services that achieve certain service-quality attributes revealed in the analysis of successful systems around the world. In *TCRP Report 62*, Chapter 5 summarized a set of attributes that are important for services. Those attributes are not specifically tied to the choice of bus versus rail, but rather serve as a description of the needs of the customer without regard to mode or technology (*1*).

Lessons Learned from the Successful Systems

The key lessons from the analysis of international systems presented in *TCRP Report 62* do not form an argument for or against rail solutions in the United States. The key issues are 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 report can be reviewed for the implications for a choice of mode in the United States.

Quality of the Line-Haul Connection to the Central Business District

Finding an available right-of-way is a problem for the designer of a bus access system, and it is also a problem 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. Multistop rail service to Paris' Charles de Gaulle Airport is now perceived to require the investment in a new, dedicated high-speed service. Planners at Munich's airport are looking at maglev (i.e., magnetic levitation) alternatives to deal with the historically slow rail travel times there. What does emerge from the data presented is that the relative speed and travel times of the chosen mode must be competitive with, or superior to, its competing alternatives.

Universally, buses stalled in general-purpose traffic cannot provide a competitive advantage over the automobile. By contrast, volumes on the Logan Express bus service 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.

The conclusion that the consumer will select rail services "generically" when in competition with bus services is likewise not supported by the data presented in *TCRP Report 62*. In Stockholm, bus services with direct connections to hotel pick-up points did not decline when faced with new competition from regional rail services. In Hong Kong, the expected diversion from bus to rail with the opening of the new airport did not occur (*1*).

Good connections to the main downtown area require consistent headways and minimized waiting time throughout the day. High-quality airport rail systems offer service every 15 min in such varied areas as Oslo and London (on the Heathrow Express). Highly successful non-stop shuttle bus services, such as that in New Orleans, offer departures every 15 min, with a downtown loop for distribution near major hotels. Longer headways, such as the 30-min rail headway from Philadelphia are associated with extremely low mode share.

Quality of Connection at the Airport

This attribute is not mode-specific. Airport design could cluster check-in facilities around a superior rail station or around a "bus-palace," as was contemplated in the JFK 2000 scheme (which was never built). The passenger departing from the airport by high-occupancy public mode should experience a short walking distance and quick transfer times between the public-mode connection and the check-in and baggage-collection locations. As will be discussed in Step 5, the level of amenity experienced while waiting for a public transportation connection should be qualitatively the same as the wait for an airplane.

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 Las Vegas' McCarran Airport from within a unified terminal complex adjacent to a common baggage pick-up area, while many U.S rail services operate from locations located 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.

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's rail station are totally integrated into the national rail system, and mode share to national destinations is extremely high. Again, the issue is not rail versus bus: the issue is the design of the transportation system. Mode shares attained by the Marin Airporter or the Logan Express are higher than rail mode shares from Heathrow to similar locations outside of Central London. In the United States, the new Amtrak services from the Newark Airport

Rail station will provide valuable experience about the use of rail to longer-distance ground access markets. Whichever mode is chosen in the process, the design of services to lower-density remote locations must be dealt with.

Existence of a Strategy for Baggage

The problem of baggage handling has not been solved in most European railway systems, and it has not been solved in the United States. Rail operators in Europe have not rushed to adopt the high-quality system developed for the Heathrow Express, which stands as the best solution yet developed. Off-site check-in operated in downtown Munich has been abandoned. Expected off-site check-in services throughout Scandinavia simply have not been built. The rate of usage of the Swiss nationwide system of baggage check in is quite low. Systems operating national, longer-distance rail equipment—such as that in use in Copenhagen—can allow for the compromise 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.

Good examples of off-site check-in to support bus systems are similarly rare. Downtown check in for Tokyo's Narita Airport is available for bus service, but not for rail service. Historic bus operations by the Scandinavian Airlines System (SAS) and SAS Hotels for in-hotel check-in have been scaled back. By contrast, the commitment of Continental Airlines to full passenger check-in at the new Newark Airport Rail station represents a solid, realistic compromise between the systems we would like to see and the systems we have.

Generically, the handling of baggage is not an issue between bus and rail, but rather an attribute to be sought by the service designer. *Dealing with the baggage issue tends to support the adoption of dedicated services (by whatever mode) rather than for shared service of traditional multistop transit (by whatever mode)*. Whether it is a dedicated train or a dedicated airport bus, baggage handling can be designed in from the outset.

Summary: Designing to Deal with Revealed Attributes

For each of the four design areas specified above, 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 that has greater than 50 trips per square mile, submarkets can be sought at significantly higher market concentration. With knowledge of the location of these strong market segments, consideration of rail services and others can be undertaken. This report's market research method 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. Based on the analyses undertaken in TCRP Project B-18, at least three geographic areas should be examined for the service most likely to meet the needs of the customer. From the data presented, the following are the findings for each market type.

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. For this area, it is expected that fixed-route service with a frequent headway can be operated for most of the hours in which the airport is operating. Examples of high-quality rail services include Washington's Metrorail and MARTA service to Hartsfield Airport. Examples of high-quality bus service to the central business district include the specialized airport bus services from New Orleans International Airport and to Denver and to downtown Seattle. Bus service to Pittsburgh's International Airport also benefits from the creation of the new West Busway.

Services for the Exurban Market

Dedicated airport bus service from specially designed regional parking facilities should be examined to offer services to those areas for which airport trip-end densities cannot justify or make feasible collection services.

Services for the Middle Market

A variety of strategies should be explored for the majority of U.S airport tripmakers who come from outside of the most dense downtown areas, but within the principal market area of the airport, defined here as the area with five or more airport trips 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. Each geographic area should 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 at 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 levels of 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 market 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 Practice in the United States: Service Based on Markets

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

Best Case Practice 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 captures about 15% of the entire airport market. Its mode share rate for its primary market area (downtown) may be the highest of any U.S airport. Between San Francisco International Airport and the primary market in San Francisco, high airport trip-end density supports a capture rate of 20% to door-to-door services, with another 9% choosing bus options. To Reagan National, the Metrorail service covers the geographic area in which 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 airportwide mode share of 12%—the highest recorded rail share.

Best Case Practice for the Exurban Market

The Logan Express system serving Boston-Logan 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 did the entire fixed-route and schedule public transportation system. The Marin Airporter is a privately owned service that is noted for its understanding of the market needs of its customers. Chapter 2 estimated that the Marin Airporter captures 30% of the travelers in its market area. The Van Nuys FlyAway is a mature dedicated airport bus operation, capturing an estimated 17% of the travelers from its catchment area.

Private bus and van operators in exurban markets around the country have high mode shares for highly specialized market areas, which do not attempt to provide door-to-door service, but use collection points such as major hotels and motels.

Best Case Practice for the "Middle" Market

Although the collection-point 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 from 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 trips per square mile. Door-to-door services in an area immediately south of San Francisco Airport, with much shorter trip distances, attract about 7% of their logical catchment area. *TCRP Report 62* documents similar markets in Las Vegas and Orlando, in which door-to-door vans capture greater than 10% of the airportwide ground access market. In Boston, Seattle, and Los Angeles, door-to-door vans captured greater than 5% of their respective market areas in areas of middle-market density. This market, which is represented in this analysis by 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 occupancy levels approaching those of single party taxis, it is the market segment that needs the most research.

STEP 5: MANAGE THE AIRPORT TO ENCOURAGE HOV USE

Although many elements of a comprehensive strategy to improve public mode airport ground access will involve a major regional investment, other elements can be implemented within the boundaries of the airport. The manner in which the airport is managed can have a significant effect on the quality of the experience for those customers who have chosen to access the airport by more efficient, higher-occupancy modes. This experience is influenced both by the operating policies and by the quality of the physical plant of the airport. Operating and regulatory policies can influence the availability and desirability of publicly available, higher-occupancy services; details of architectural amenity offered to the customer transferring to or from the public modes can similarly influence the perception of the quality of the trip.

Key Challenges in Step 5

- *Manage the airport with a "transit first" policy*
- *Allocate curb space to give priority to those arriving by higher-occupancy mode*
- *Improve the architectural standards experience by the public-mode user*
- *Build transfer facilities for bus and van 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*

The various strategies for improving public transportation access to airports are set against the backdrop that U.S airports are not managed to encourage higher-occupancy use; in many cases, the opposite is true. Airports are seen primarily 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 GTCs) is to remove the larger vehicles from the primary roadway, which is then 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, there is currently only one airport in which rail transportation carries more air travelers for ground access than does the bus or van alternatives: Reagan National Airport in Washington. Even at airports that initiated new rail services such as Portland's Airport, more passengers will be dependent 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 terminals.

Ironically, the modes that are the 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 to the present pattern of encouraging the pick-up and drop-off mode, which is the opposite of what is called for in a logical strategy for the control and minimization of VMT.

All too frequently, the traveler who chooses more efficient, higher-occupancy modes from the airport is sent to an outer curb, is unprotected from weather, and is given 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 passenger that the bus is on time, is late, or has already departed. Often, passengers waiting at the curb for a shuttle bus to a regional rail system are given information about neither the arrival time of the bus, nor the operations of the rail system it is serving.

Learning from Recent U.S Designs

Recent U.S design experience at key rail projects can point the way toward the adoption of higher standards for transfer facilities for bus and van. The passenger 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 are made within the interior spaces of the air 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 passenger. At the reconstructed Reagan 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 in order to get to the parking garage. The public transportation terminals built by WMATA in Washington and the Bay Area Rapid Transit (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, air conditioned, and brightly lit. In San Francisco, the arriving ground transportation passenger at the new International Terminal will disembark from the BART train at the same level as the airport check-in function: no bridges, no elevators, no escalators will impede passenger flow from the three-track station.

The recent inauguration of a Delta Air Lines check-in facility at the MARTA station within the Atlanta Hartsfield landside terminal is another example of high-quality architectural integration. That station is located immediately adjacent to the common baggage-claim facility for the entire airport, allowing a 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 GTC is the optimum solution; in others, it is not. Clearly, if there is a guiding public policy to encourage higher-occupancy usage, *the level of amenity offered to the connecting public transportation passenger 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 users often board their vehicles at parking lots, dead-end locations, outer curbs, and other facilities with no passenger-support services.

Designing 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 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 GTC at Minneapolis-St. Paul 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 and air-conditioned interior space that is integrated into the airport terminal complex. Similar high-quality pedestrian connections are offered in the underground connections to the departure area at Portland's redesigned PDX terminal complex, where ground transportation information and ticketing is provided within the underground walkway system.

All taxi, bus, and van departures from Atlanta's Hartsfield 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 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.

Regulations to Encourage Higher-Occupancy Strategies

Many local policies concerning the potential encouragement of higher-occupancy patterns are determined by preexisting regulations concerning the management of taxis. In some airports, a customer standing at the curb seeking to purchase a shared-ride service is often told that he or she cannot enter the vehicle unless the customer 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.

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

Best Case Practices in the United States: Management and Amenity

U.S best case practices in this category tend to include examples of good architectural treatment of amenities for transferring passengers rather than any for airportwide strategy to manage for higher occupancy. Examples of such details include the following:

- The revised GTC in the center of Minneapolis International Airport is a rare example of an improved amenity for the user of buses and vans;
- The City Bus Center at Chicago-O'Hare International Airport provides deplaning passengers a comfortable waiting area, with seating, in which they can purchase food, beverages, and newspapers and magazines and which is linked directly via an underground walkway to each terminal;
- The reconfiguration of Washington's Reagan National Airport for better access to the Metrorail, including the partial service check-in desk operated by US Airways for those arriving by rail; and
- The location of the MARTA station in the Atlanta Hartsfield terminal and the location of the new Delta check-in at the MARTA station.

STEP 6: GET THE WORD OUT

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

Key Challenges in Step 6

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

Building a Ground Transportation Information Strategy

The customer needs to be aware that the 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. Logically, these systems should tie directly into the reservations systems of the ground transportation operators. A simple example of an airport-based trip-planning system has been in operation at Geneva Airport for several years. This system provides trip itineraries to every city and town in Switzerland, whether served by rail or by national bus.

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. Such a program would logically include estimated taxi fares and travel times, accurate by time of day. It can be observed that no presently available regional trip-planning program includes a full description of all vans, limousines, and buses approved for airport use.

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

Best Use of Present Resources

In a pathbreaking example of early integration, the passenger information booths at Newark Airport are now being equipped with computers connected to the New Jersey Transit itinerary trip–planning services available on their website. This important resource provides public transportation trip itineraries to all destinations in New Jersey, but with less-detailed coverage for other areas, including Manhattan. Later, further improvements at integration will be available with the commencement of the Trips 1-2-3 Program, which will be managed at TransCom. However, the managers of this trip itinerary–planning system do not currently plan to incorporate airport-specific public modes, such as limousines, vans, and airport express bus services.

A good example of integration of ground transportation information at an airport website is that of the Portland International Airport. The user is encouraged to use the hyperlink feature directly to the Tri-Met website, which includes door-to-door itinerary trip planning as one of its optional features. More commonly, ground access providers are listed by their geographical area, as is done on the San Francisco International Airport webpage. No access is currently provided to origin-destination itinerary trip–planning services from most airport websites, even when mature systems have been developed by the dominant public transportation operators.

Envisioning the Fully Integrated System

Information Systems

A fully integrated passenger information system for airport ground access will allow the traveler to plan his or her trip from door of origin to door of destination in an integrated, seamless manner that will allow trip optimization to truly occur. Information about ground transportation times and costs would be calculated together with airline times and costs to produce truly multimodal trip alternatives. At the same time, door-to-door trip options between airports and specific destinations would be made available through a universally formatted application of the nationwide 511 telephone.

At the present time, public policy toward the development of a nationwide program of traveler information is underway, stimulated by the decision of the Federal Communications Commission to grant the 511 number to that purpose. The transit industry is working with others to ensure the complete coverage of public transportation in the development of local 511 programs. Airports and local transit providers have a chance to influence the development of these new passenger information programs.

Payment Systems

Truly multimodal implementation of smart cards and automated payment mechanisms are making both ticketing and financial settlement seamless and nearly invisible. An early implementation of a coordinated system of payment is now underway in the nine-county San Francisco Bay Area under the coordination of the Metropolitan Transportation Commission. The $61 million TransLink Project is expected to be fully in place in Winter 2002. At present, the program is being developed for more than 20 public transit systems in the region. Logically, the expansion of the program to cover private operators, including those offering airport access services,

could be implemented at a later date. A similar program to unite the payment systems of major transit operators has been announced in the New York City–metropolitan region.

With the adoption of nationally accepted protocols, locally issued payment mechanisms will be able "to talk to each other" and will provide national coverage. Under such a system, a passenger could hail a passing multiparty airport van, walk on board, and have the payment transferred by electronic communication between the smart card and the onboard reading mechanism on the vehicle.

Best Case Practice in the United States: Passenger Information

The application of ATISs for airport use has not been fully undertaken anywhere in the world; therefore, not only are few good examples of best case practices in the United States, there are few good examples anywhere. The real-time Amtrak and New Jersey Transit train departure screens in key locations at Newark International Airport are a good example of the kind of passenger information that has to be developed in the United States. Real-time airline departure information is presented within the train stations mezzanine level.

Both Amtrak and New Jersey Transit rail tickets to Newark Airport Rail station include the cost of the ticket on the Newark AirTrain people mover. Customers holding the correct rail ticket gain immediate access into the paid area for the people mover. Port Authority customer service representatives will have access to New Jersey Transit's automated itinerary trip planning, creating optimum trips from the airport to all destinations in the state of New Jersey. Trip itinerary planning is now accessible from the Portland International Airport website by virtue of a hyperlink to the Tri-Met website.

CONCLUSIONS

A major theme that emerges from this analysis 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 granting 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; there are often costs associated with the continued subsidy of these services. In nearly all of the best case practices such as the terminal changes at Reagan National or the early development of the Logan Express, there have been financial costs to bear. There is no working assumption that a solution to these problems will be without costs.

FURTHER RESEARCH RECOMMENDATIONS FOR EACH STEP

An outline of issues to be dealt with in further research would include the following.

1. Establishing the process:
   - Who are the champions?,
   - What are examples of collaborative strategies?,
   - Best case practices in establishment of public policy purpose, and
   - Dealing with environmental restrictions to growth.
2. Conducting data collection for airport access:
   - Document the pitfalls,
   - Document base case practices, and
   - Implications for the future of the National Travel Survey, etc.
3. Understanding the market condition:
   - Understanding the middle market–density tripmaker,
   - Cost-benefit ratio of various forms of service, and
   - Performance measures to support this analysis.
4. Designing services to meet the market needs:
   - Bringing out the full potential from bus systems,
   - The application of the Bus Rapid Transit System, and
   - Integration of commuter rail systems with airport access.
5. Addressing infrastructure and management:
   - Architectural elements—designing for the transfer experience,
   - Managing the curb, and
   - An alternative paradigm for airport management—"transit first."
6. Getting the word out:
   - Develop a prototype airport ground access website,
   - Apply itinerary planning to ground access segment, and
   - Apply origin-destination itinerary planning to entire multimodal, multisegment trip.

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GLOSSARY

ABBREVIATIONS AND ACRONYMS

£	British pound
ADA	Americans with Disabilities Act
AOA	air operations area
ATIS	Advanced Traveler Information System
ATS	American Travel Survey
AVI	automated vehicle identification
BAA	British Airports Authority (formerly)
BART	Bay Area Rapid Transit (San Francisco)
BOS	Boston-Logan International Airport
BWI	Baltimore-Washington International Airport
CAA	Civil Aviation Authority
CAPS	Certified Airline Passenger Service
CIS	Customer Information System
CMS	Congestion Management System
DCA	Reagan National Airport (Washington, D.C.)
DEP	Department of Environmental Protection
DIA	Denver International Airport
DOT	department of transportation
EDS	explosive detection system
EIS	environmental impact statement
EU	European Union
EWR	Newark International Airport
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
GIS	geographic information system
GTC	ground transportation center
HOV	high-occupancy vehicle
IAD	Dulles International Airport (Washington, D.C.)
IATA	International Air Transport Association
ICC	Interstate Commerce Commission
IVI	Intelligent Vehicle Initiative
JFK	John F. Kennedy International Airport (New York)
LAWA	Los Angeles World Airports
LAX	Los Angeles International Airport
LGA	LaGuardia Airport (New York)
maglev	magnetic levitation
MAP	million airport passengers
MARC	Maryland Rail Commuter service
MARTA	Metropolitan Atlanta Rapid Transit Authority
Massport	Massachusetts Port Authority
MBTA	Massachusetts Bay Transportation Authority
MDI	Model Deployment Initiative
MPO	metropolitan planning organization
OAG	Official Airline Guide
PANYNJ	Port Authority of New York and New Jersey
PDX	Portland International Airport (Oregon)
RER	electrified suburban rail network (Paris)
RRM	rapid routing module
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
SSB	Swiss National Railways
STB	Surface Transportation Board
TPA	Tampa International Airport
TSA	Transportation Security Agency
TCRP	Transit Cooperative Research Program (TRB)
TEA-21	Transportation Equity Act for the 21st Century
TRB	Transportation Research Board
Tri-Met	Tri-County Metropolitan Transportation District of Oregon
U.S.DOT	United States Department of Transportation
VMT	vehicle miles traveled
WASHCOG	Washington Council of Governments
WMATA	Washington Metropolitan Area Transit Authority

AIRPORTS CITED

Asia and the Pacific Rim

Hong Kong
Hong Kong International Airport

Japan
Kansai International Airport, Osaka
New Tokyo International Airport Narita (Tokyo Narita)

Malaysia
Kuala Lumpur International Airport

Europe

Belgium
Brussels International Airport

Denmark
Copenhagen Airport (Kastrup)

France
Charles de Gaulle Airport, Paris
Paris Orly Airport (Orly)

Germany
Frankfurt International Airport
Munich Franz Josef Strauss Airport (Munich)

Italy
Malpensa Airport (Milan)

the Netherlands
Schiphol Airport, Amsterdam

Norway
Oslo International Airport

Spain
Barcelona Airport
Madrid Barajas International Airport

Sweden
Arlanda Airport, Stockholm

Switzerland
Geneva International Airport, Cointrin
Zurich Airport

United Kingdom
Heathrow Airport
London Gatwick Airport (Gatwick)
London Luton Airport (Luton)
London Stansted Airport (Stansted)
Manchester Airport

United States

Alabama
Birmingham Airport

Arizona
Phoenix Sky Harbor International Airport

California
John Wayne Airport, Orange County
Los Angeles International Airport (LAX)
Metropolitan Oakland International Airport (Oakland)
Sacramento International Airport
San Diego International Airport
San Francisco International Airport (SFO)
San Jose International Airport
Van Nuys Airport

Colorado
Denver International Airport (DIA)
Denver Stapleton International Airport

Connecticut
Bradley International Airport (Windsor Locks)

Florida
Ft. Lauderdale-Hollywood International Airport
Miami International Airport
Orlando International Airport
Tampa International Airport (TPA)

Georgia
William B. Hartsfield Atlanta International Airport (Hartsfield Atlanta)

Illinois
Chicago Midway Airport (Midway)
Chicago-O'Hare International Airport (O'Hare)

Indiana
Indianapolis International Airport

Kentucky
Louisville International Airport at Standiford Field

Louisiana
New Orleans International Airport

Maryland
Baltimore-Washington International Airport (BWI)

Massachusetts
Boston General Edward Lawrence Logan International Airport (Boston-Logan) (BOS)
Worcester Airport

Minnesota
Minneapolis-St. Paul International Airport

Missouri
Kansas City International Airport
Lambert-St. Louis International Airport

Nebraska
Omaha-Eppley Airfield

Nevada
Las Vegas McCarran International Airport

New Hampshire
Manchester Airport

New Jersey
Newark International Airport (EWR)

New Mexico
Albuquerque International Airport

New York
John F. Kennedy International Airport, New York City (JFK)
New York LaGuardia Airport, New York City (LaGuardia) (LGA)

Ohio
Cleveland Hopkins International Airport

Oregon
Portland International Airport (PDX)

Pennsylvania
Lehigh Valley International Airport, Allentown
Philadelphia International Airport
Pittsburgh International Airport

Rhode Island
Providence Airport

Texas
Bush Intercontinental Airport/Houston
Dallas/Fort Worth International Airport (Dallas/Fort Worth)

Utah
Salt Lake City International Airport

Washington
Seattle-Tacoma International Airport (SEA)

Washington, D.C.
Ronald Reagan Washington National Airport (Reagan National) (DCA)
Washington Dulles International Airport (Dulles) (IAD)

Abbreviations used without definitions in TRB publications:

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
NCHRP	National Cooperative Highway Research Program
NCTRP	National Cooperative Transit Research and Development Program
NHTSA	National Highway Traffic Safety Administration
SAE	Society of Automotive Engineers
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board
U.S.DOT	United States Department of Transportation