COMPARING AIRPORT GROUND ACCESS

A TRANSATLANTIC LOOK AT AN INTERMODAL ISSUE

Matthew A. Coogan

Since the passage of the Intermodal Surface Transportation Efficiency Act in 1991, transportation planners and administrators have sought a better understanding of how individual modes—and the quality with which they have been integrated into the total trip—contribute to the quality of transportation service from the customer's perspective. In 1993 TRB formed the Intermodal Task Force, the members of which have been examining the implications of the total-trip concept for both freight and passenger service. A revolution has already occurred in freight; companies that no longer rely on a single modal element are now dominant over those that do. The revolution in passenger transportation is coming about more slowly; transportation professionals often still see their task in narrow modal terms, such as optimizing the finances of an airport or maximizing the number of vehicles that flow on a highway. ISTEA required the creation of management systems, two of which are encouraging planners and administrators to develop strategies that transcend traditional modal boundaries: the intermodal management system and the congestion management system. A key area for the application of these systems is the merging of aviation and ground systems at major airports.

With the direct input of the TRB Task Force (through its Conference on Intermodalism in New Orleans, Louisiana, in December 1994, for example), the Federal Aviation Administration has undertaken a series of studies in cooperation with the Federal Highway Administration, to help transportation plan-

Matthew Coogan, transportation consultant and former Undersecretary of Transportation for the Commonwealth of Massachusetts, specializes in intermodal planning issues.

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Chicago Transit Authority system provides direct service from O'Hare Airport (*left*). Bus and limousine services are also convenient to main terminal (*right*).

ners consider the total trip when planning for ground access. These include the development of two new curricula for the National Highway Institute and a handbook for airport ground access planning.

One of the tasks of the research was to define the lessons to be learned from airport ground access planning in Europe. Specifically, the study team compared mode shares for ground transportation to airports in the United States and Europe to help establish a reasonable level of expectation for planners to work toward in the design of airport ground-access strategies in the United States. The fundamental differences between European and U.S. access patterns were examined, and conclusions were drawn about which practices could be transferred to the United States in the near future. The study results have been incorporated into NHI teaching materials, and their implications for public policy in the United States have proven surprising.

Trends in U.S. Ground Access Patterns

In many instances, U.S. airports show a much more positive trend toward the use of higher-occupancy modes than does the nation in general. A few exceptions stand out in contrast to a strong national trend away from higher-occupancy modes. For example, at Logan International Airport in Boston, Massachusetts, use of the automobile (owned and rented) for ground access declined from 82 percent to 54 percent during the last 25 years. Taxis account for 20 percent of other ground travel, and public modes account for 26 percent. Closer examination of the data reveals that most of the growth in public modes has occurred in rubber-tired public modes instead of rail. Rail use grew modestly during the past 20 years; use of buses and limousines grew from about 4 percent in the 1970s to nearly 20 percent in 1993, according to ground access surveys by the Massachusetts Port Authority and the Massachusetts Bay Transportation Authority between 1970 and 1993. In Washington, D.C., public mode share to National Airport rose from 4 percent to 23 percent between 1973 and 1987, largely attributable to the opening and operation of Metrorail. Although ridership on Metrorail service to National Airport, which accounted for a 15 percent mode share in 1987, has declined during the recent construction of a new main terminal, the total volume of travel to the airport by public modes is still high by national standards (*1*).

Another strong trend in larger cities—such as New York, New York; Chicago, Illinois; and San Francisco, California—is the willingness of air travelers to pay higher prices for better-quality, more direct services. The most dramatic example is the rise of door-to-door shared-ride services to and from the San Francisco/Oakland Airport (SFO). In a field in which consumer behavior changes slowly, the rise of this mode has been sudden. In 1985 shared-ride vans carried less than 3 percent of air travelers to SFO; in 1993 they carried 14 percent. The inclusion of private hotel van services yields a total of 19 percent of SFO's air passengers arriving by this mode. During most of this period the use of traditional bus service declined sharply despite significantly lower average fares than those of van services (*2*).

TABLE 1 — COMPARISON OF RAIL MODE SHARE IN AIRPORT ACCESS (4)

EUROPEAN AIRPORTS		U.S. AIRPORTS	
Zurich	34%	Washington National	15% (1987)
Munich	30%	Atlanta Hartsfield	9% (derived)
Frankfurt	29%	Boston Logan	6%
London Gatwick	26%	Chicago O'Hare	5%
Amsterdam Schipol	25%	Philadelphia	5%

Higher-priced, more direct transportation is gaining in market share at other American airports. In New York City, specialty limousines have eroded the market share of both traditional bus service and taxi cabs: they now carry about 20 percent of all riders to the three New York airports combined—a similar share to that of taxis and larger than the shares for rental cars or traditional public modes. At O'Hare International Airport in Chicago, specialty limousine services have grown rapidly to capture about 13 percent of all O'Hare air travelers (3). As in San Francisco, the consumer in New York and Chicago is showing a willingness to pay the higher fares charged by services that can provide higher-quality ground access without transfers. However, consumers in these two cities are choosing single-party service, in marked contrast to the shared-ride concept developed in the Bay Area.

Use of Rail in Europe

Table 1 shows the mode share for rail at five European airports and five U.S. airports. The table seems to indicate a fundamental difference in travel behavior between the U.S. and European populations: rail services at the Zurich, Switzerland, airport capture some 34 percent of the riders, whereas rail services to airports in Chicago; Philadelphia, Pennsylvania; and Cleveland, Ohio, capture about 5 percent. However, the FAA research indicates that the difference in traveler choices for airport access (including bus and limousine services) in Europe and the United States is less than originally supposed.

Components of Successful European Rail Ground Access Services

Seven major European airports that are well served by rail were studied to determine what attracts air passengers to rail. Three elements of the total ground access trip were examined: the quality of transfer between ground and air at the airport, the characteristics of the in-vehicle portion of the ground access trip (such as speed and comfort), and strategies to assist the traveler

PHOTOS BY COOGAN

Baggage assistance is offered on specialized bus services from Charles de Gaulle Airport to downtown (*left*). High-speed rail service to cities beyond Paris was recently inaugurated at the airport (*right*).

TABLE 2—ATTRIBUTES OF EUROPEAN GROUND ACCESS SYSTEMS (4)

AIRPORT	QUALITY OF AIRPORT CONNECTION		BAGGAGE ASSISTANCE	CHARACTERISTICS OF GROUND SERVICE	RAIL MODE SHARE
	CENTRALIZED AIRPORT	LOCATION OF RAIL CONNECTOR			
Zurich	Yes	In terminal	At 125 rail stations	National and commuter rail	34%
Munich	Yes	In terminal	Central business district	Commuter rail	32%
Frankfurt	Yes	In terminal	Airport express	National and commuter rail	28%
London Gatwick	Yes	In terminal	Central business district	Dedicated, nonstop national rail	27%
London Heathrow	No	Long walk	No	Local subway	20%
Paris de Gaulle	No	Shuttle bus	No	Commuter rail	13%
Paris Orly	No	People mover and bus	No	Commuter rail	4%

with baggage and other needs at the nonairport end of the trip. The empirical observations showed a direct correlation between the apparent quality of the three components of the total trip and the high rail ridership.

A wide range of services and facilities is offered at the seven airports. Four of the airports have a centralized configuration with adjacent ticketing and baggage return areas that allow easier connections to ground transportation services. All four of these facilities have a rail station within the airport terminal building. Baggage assistance strategies among the seven vary; in Zurich a system of 125 separate rail stations offer services to check baggage for the airlines. Munich Airport in Germany and London Gatwick Airport in the United Kingdom offer downtown flight check-in. Some services from the airport in Frankfurt, Germany, offer on-train baggage check-in for rail services operated by the major national airline. Baggage assistance is not offered on the rail route to the two Paris airports, but is offered on specialized airport bus services to downtown locations. The Zurich, Frankfurt, and Paris Charles de Gaulle airports are connected to both national rail and metropolitan commuter rail services, whereas the Munich and Paris Orly airports are connected only to regional commuter rail services.

Zurich Airport ranked highest in the three areas studied and had the highest rail mode share. Paris Orly International Airport ranked lowest in the areas studied and also had the lowest rail mode share. There is no basis for the assumption that adopting these service characteristics in the United States would result in corresponding mode shares, but certain attributes of the more successful European airport operations merit further policy attention. Although the study showed that only about one rail passenger in five actually used the option of off-site baggage check-in services in Switzerland and London Gatwick, the existence of *some* program to assist the passenger when necessary appeared to be a critical element for success.

Users of Successful Rail Services

The makeup of the ridership of the most successful rail access systems was studied. A common characteristic of each successful system was the strength of its connection to a wider national rail system; in many cases, the level of ridership on services to the airport depends largely on the contribution of the market served by the national intercity system, not on the metropolitan market usually served by U.S. rapid transit networks. The most dramatic illustration of this point is to be found in Zurich, where high-quality rail services run every 15 minutes from the airport to the Zurich Central Station, which also serves as a hub for rail services throughout the region (this service is almost the model for the many intermodal centers planned in U.S. downtowns today). Although its overall public mode share is very high at 35 percent, its mode share to downtown is only about 26 percent, virtually the same as the public transportation share between Logan and Boston's central business district. The emerging pattern indicates that the unusually high market share for rail service to the Zurich airport is attributable not to its rail connection to the Zurich metropolitan area, but to its connection to the exceptional nationwide rail service (4).

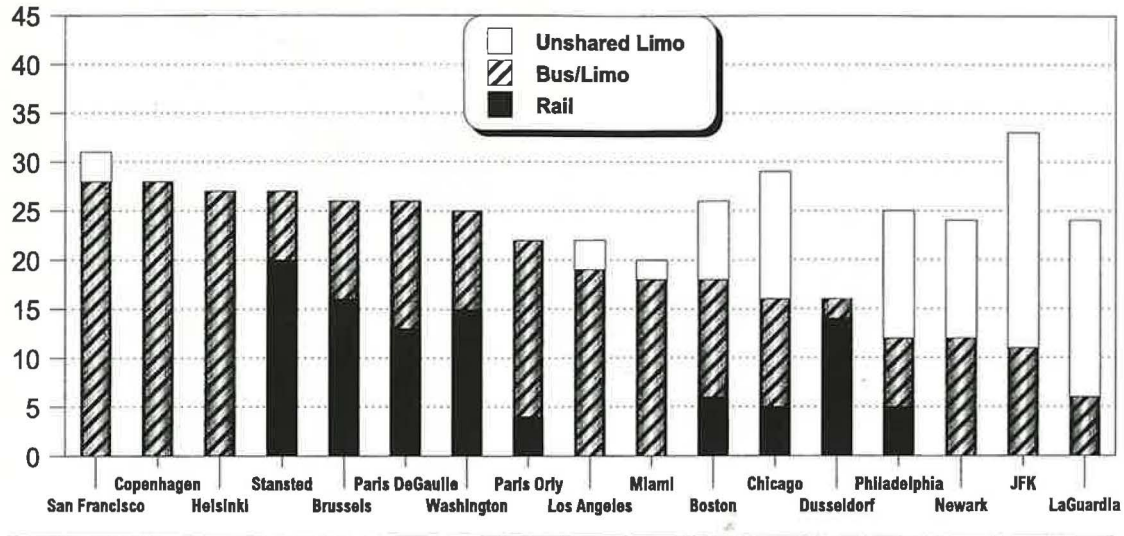
Most of the successful European airport rail services can be characterized as being well connected to a wider regional and national rail system; in many cases the strength of the rail ridership coming to the airport is based largely on the contribution of the longer-distance intercity system, not from the traditional downtown

MUNICH AIRPORT

In addition to baggage check-in services at each gate, Munich Airport offers centralized facility for public transportation users.

regional market usually served by American rapid transit networks. In Zurich, about two-thirds of the riders on the airport rail system are not coming from the Zurich area, but from connections on the national system. Early data from Munich suggests that although the rail line runs directly through the center of the city, approximately 80 percent of the riders on that line have transferred from other more distant services. Similarly, the Netherlands railroad system is a national net of intercity services with schedules resembling those of commuter rail lines, allowing Schipol Airport to serve Rotterdam residents almost as directly as it serves Amsterdam residents. Frankfurt's airport is served both by national intercity rail service and by an extensive regional S-Bahn that covers several cities in an expansive metropolitan area. Finally, London Gatwick is also located on a national trunk line, with direct service to southwestern England in addition to London (4).

This pattern of close interconnection with longer-distance services is being emphasized in ongoing planning efforts. In Paris most of the new rail investment is going toward connecting Charles de Gaulle Airport with an entirely new Train à Grande Vitesse high-speed rail system that will provide highly competitive travel times throughout much of France. Last winter, TGV service from the airport to more distant cities began; this will evolve into a major national system of access. In Germany, an entirely new high-speed right-of-way is being built to connect with Frankfurt/Main Airport, where the ground access plan projects that nearly two-thirds of the rail riders will approach the airport from national services, and one-third from the traditional metropolitan system.



Rail	0	0	0	20	16	13	15	4	0	0	6	5	14	5	0	0	0
Bus/	28	28	27	7	10	13	10	18	19	18	12	11	2	7	12	11	6
Uns	3								3	2	8	13		13	12	22	18

FIGURE 1 Access modes for U.S. and European airports (incorporating the second tier of European airports, with public mode splits of less than 30 percent).

COMPARISON OF TWO CITIES

Comparing the best-performing transportation services to a U.S. airport, those in San Francisco (Figure 1), with the strongest of the European rail-to-airport operations, in Zurich (Figure 2), demonstrates how two different systems serve specific geographic markets within their respective overall strategies. In San Francisco, rail, bus, and shared limousine account for 28 percent of travel to the airport, whereas in Zurich about 35 percent of all ground travel is accounted for by these modes. Approximately 33 percent of air travelers from SFO to the City of San Francisco use these modes, compared with about 26 percent of air travelers to the City of Zurich. This suggests that in the market most U.S. cities would serve by rail—the downtown area—the San Francisco market penetration is somewhat stronger than that in Zurich (2,5).

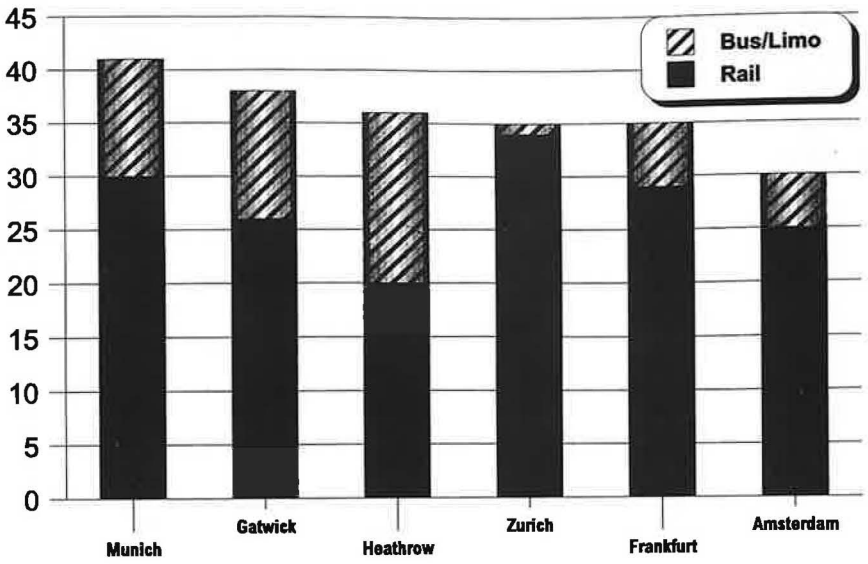
The difference between the Swiss rail-based strategy and the flexibly routed bus strategy of the Bay Area becomes evident in an examination of the suburbs surrounding the central city. Less than 9 percent of Zurich's suburban air passengers come by public mode, compared with just under 20 percent of SFO's suburban passengers (the Bay Area market shares range from a high of 36 percent from Marin County to a low of about 7 percent from Santa Clara County) (6).

A study of areas outside of the metropolitan area reveals that SFO attracts about 9 percent of air travelers to shared-ride modes; Zurich captures more than 50 percent from those areas. The contribution of Bay Area public transportation to the airport is greatest for the high-density center city, less for the low-density suburbs, and least for the market beyond the metropolitan area, a pattern found in Boston and other U.S. cities as well. By comparison, Zurich's public transportation share to its airport is high for the center city, low for the residential suburbs, and highest for the connecting cities on the Swiss National Railway network. Given the fact that most U.S. cities (with the possible exception of New York) do not have comparable intercity rail networks, these European examples may not represent the most realistic models for U.S. planners to emulate.

CATEGORIZING AIRPORT ACCESS SYSTEMS

The examination of the most successful airport rail systems in Europe—Munich, London Gatwick, London Heathrow, Zurich, Frankfurt/Main, and Amsterdam—can tell U.S. planners about the attributes needed to attain these extraordinarily high market shares for rail; but the focus on these systems to the exclusion of other systems in Europe could lead to a false set of conclusions about the predominant European access patterns. To accurately compare European with U.S. airport access, it is necessary to look at all public modes, including rail, bus, and limousine. Figure 1 shows the combined role of rail, bus, and limousine services in European and U.S. cities. To improve the opportunity to transfer results, we have separated the top six rail systems from the rest of the data, labeling them the Advanced Intermodal Connectors, in Figure 2. Figure 1 shows the second tier of European airports, each of which attains a public mode share of 30 percent or less; these examples may provide the most appropriate range of comparisons for U.S. cities studying airport access improvements. In Figure 1 the U.S. category of bus/lim-

FIGURE 2 Advanced intermodal connectors (airports with public mode split of more than 30 percent).



Rail	30	26	20	34	29	25
Bus/Limo	11	12	16	1	6	5

ousine has been divided into two categories to provide the most meaningful comparison with the European data. Specifically, the U.S. category of unshared limousine has been broken out from the general category of bus/limousine and presented as a separate mode. The airports are ranked according to the level of travelers' use of public shared-ride service.

The data presented in Figure 1 may be used to define strategies for high-occupancy modes and observe the market for all modes. These data indicate significant variations in the performance of each system at attracting passengers to shared-ride modes—from SFO at 28 percent to LaGuardia at 6 percent. There appears to be little difference in this respect between European and U.S. airports: Washington, D.C.'s National Airport and SFO have attracted shared-ride patrons as well as most European airports do, whereas other U.S. airports seem to fare less well. The key difference does not seem to be the presence or absence of rail service. The first six European airports in Figure 1 have essentially the same mode share, although three are served by rail and three are not. Analysis of the second tier of European airports along with the U.S. airports highlights the importance of rubber-tired public modes as part of an integrated public strategy for airport access. In Boston and Chicago, for example, for every one air traveler approaching the airport by rail transit, two air travelers take buses or shared-ride vans. Similarly strong roles for rubber-tired transit at airports served by rail are shown at the two Paris airports and London Heathrow.

When considering the propensity to choose public modes (defined as rail, bus, and all limousines), market behavior is similar in Europe and the United States, with all of the major U.S. airports displaying a public mode share of between 20 percent and 30 percent. At most European and U.S. airports, up to 30 percent of air travelers choose to purchase some kind of transportation other than rented cars and taxis. In New York and Chicago this market is served by one-party limousine service; in Copenhagen and Helsinki it is served by traditional airport bus services; in San Francisco it is served by shared-ride direct services. At the airports served by advanced intermodal connectors, a public mode share higher than 30 percent is possible by virtue of the rail systems into which these are integrated, and often because of the longer-distance intercity stops offered by those systems.

The available evidence suggests that increasing public mode use to airports significantly above 30 percent may be quite challenging. In London, even with its high urban density and the extensive London Underground system, the resistance to increasing the public mode share has been strong. Before the opening of the subway service to the airport, the airport bus system attained about a 32 percent mode share; after the opening, the combined rail plus bus mode split was about 33 percent. In San Francisco between 1985 and 1990, shared-ride vans (both public and private) accounted for a nearly five-fold increase in market share; yet the total mode share for bus and nonprivate limousines was remarkably steady, with about 25 per-

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Victoria Station in London accommodates passenger check-in services to London Gatwick.

cent in 1975 and the same in 1990. The concept of a ceiling of resistance to further market penetration is worthy of additional research.

A Better Way To Look at Airport Access

As the data from Figure 1 reveal, overall mode share cannot be predicted on the basis of whether a particular airport is served by rail. In each travel decision the user considers the relative times and costs of transportation options. It could be argued that comparative times and costs are the only necessary input for the analysis, and that design decisions are of secondary importance. But design and service planning decisions directly affect the relative times and costs experienced by the traveler choosing a ground-access mode. And times can be further subdivided into various categories: time spent walking with luggage with no assistance would be valued more highly than time in an air-conditioned, comfortable vehicle, for example.

The airport access planner needs to influence the comparative travel times in each of the three distinct segments of the trip—transfer between air and ground mode, ground travel, and the experience at the non-airport end of the trip. An airport laid out with four, five, or as many as ten separate airline terminals will cause delays on public modes of between ten minutes and one hour even before departure from the airport on the next segment of the trip. Concerning the comparative travel times in the ground segment of the trip, several of the systems studied are illustrative. In Zurich, for short trips in which the train offers little or no travel time advantage over the taxi and other drop-off modes, the rail share was low. For longer trips in which rail offers significant time advantages over the

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New MetroLink service in St. Louis connects directly to main terminal at St. Louis airport.

car, the mode share was more than 60 percent. Similarly high mode shares are reported between London Gatwick and central London (7) where the in-vehicle time for the London Gatwick trip is about 30 minutes by rail versus 60 minutes by automobile. Throughout Europe, planners are working to connect airports to longer distance intercity high speed rail networks. In the United States, by contrast, attempts to systematically integrate airport buses and vans into specially designed high-occupancy vehicle systems are rare to nonexistent.

Finally, concerning strategies to assist passengers, although the top performers did have full airline check-in on their public systems, the available data suggest that some lower level of assistance in multiple places in the system is also an effective strategy. From both Paris airports, buses specifically designed to carry baggage to major destinations play a significant role in attracting the air traveler who otherwise would have used rail services designed primarily for commuters. The same is true of London Heathrow, where buses with baggage capability travel directly to loops of hotels, in a service similar to that offered in San Francisco.

Conclusions

The early conclusions of this work suggest that airport design does matter. Attaining good short on-airport transfer times will be an easier task for airports that were either originally built to be centralized (such as Tampa and Orlando, Florida), completely rebuilt to be centralized (Atlanta, Georgia, and Pittsburgh, Pennsylvania), or retrofitted during expansion (Las Vegas, Nevada) than for airports continuing to operate many separate unit terminals. Airports that can tie into high-occupancy vehicle preferential schemes (such as that designed for Boston's third harbor tunnel) will give their passengers a comparative advantage in vehicle times. Airport services that are designed for the special needs of the air passenger, such as those at SFO, will help overcome the problems with baggage and transfers. Creating a strategy that addresses all three elements will require a level of intermodal commitment that rivals the most advanced European systems.

The overwhelming implication of the study is that European ground access patterns can be characterized more by their similarity to U.S. patterns than by their dissimilarity. The public-mode share from the Zurich airport to downtown Zurich is remarkably like the public-mode share from Logan airport to downtown Boston. The overall mode shares from the Helsinki and Copenhagen airports are indistinguishable from that of San Francisco, and public-mode share to the two Paris airports is similar to that of Washington National Airport. The performance of the best European ground access operations can be profitably studied to better understand which service characteristics and attributes attract unusually high market shares to higher-occupancy services.

U.S. airport ground access planners should work to bring their systems to overall mode shares above 30 percent, to emulate the ridership levels attained by the most completely interconnected systems in Europe. But getting to that point will require the creation of strategies that build on the resources and address the limitations of the U.S. market. By combining the strengths of the innovative services in areas such as San Francisco with a determination to achieve some of the functional attributes of Europe's best systems, planners in many U.S. cities should be able to significantly increase the use of public modes to airports and to contribute to regional efforts to address congestion, air quality, and energy. The congestion management system and intermodal management system should help create the environment in which this can happen.

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