Rail's Share of Airport Access
Examining the Data

GREGORY NEWMARK

Currently, many U.S. cities are exploring the possibility of constructing rail connections to their airports. The perceptions of rail's role in serving ground-access needs may not be in accordance with what is actually experienced at existing airport rail systems. Data from these existing systems could help planners forecast ridership at proposed new systems. The data from existing systems is not always reported in a consistent manner that facilitates the useful comparison of airport rail systems. This lack of information is addressed. Comparable data on current ridership at eight airport rail stations are provided, and a standard method for collecting these data is presented, along with common sources of error that can lead to misrepresentations of airport station rail ridership. In addition to this discussion of the data collection process and its pitfalls, cross-checking techniques and suggestions for improved future data generation are detailed. Current ridership trends are also included. The findings show that most airport rail connections serve less than 6 percent of air passenger needs and between 8 and 14 percent of airport employee ground-access needs. Furthermore, the examination of the published data demonstrates the many ways in which error can affect the calculations and subsequent presentation of these statistics.

As the number of people flying in the United States increases, so does the traffic congestion on the roads to the airports. To mitigate this congestion without building more roads and parking lots, cities from New York to San Francisco are considering building fixed-rail transit connections to their airports. However, the forecasted ridership rates at proposed airport rail systems are often higher than what is currently reported at existing systems. This finding suggests that the perception of airport rail ridership may not be consistent with the reality experienced in other U.S. cities.

The impetus for this project came during the course of collecting data on existing airport rail systems to assess the reasonability of forecasts for a proposed system at a major U.S. airport. It was discovered that the existing data are limited and not necessarily compiled in a consistent way. Due to these inconsistencies, it is often misleading to compare reported data from different airport rail connections. As a result, the valuable experience of existing systems may not be used properly in developing new ground-access alternatives. The intent of this paper is to further the improved collection of data from existing systems by outlining a standard approach to collecting information and highlighting common pitfalls that have led to inconsistent data presentation.

This paper first reviews the challenges of collecting comparable data from existing systems. After discussing common errors in handling this data and illustrating techniques to improve data consistency, a table of the latest comparative information on existing airport rail connections is then presented. It is hoped that this research might lead to a better understanding of current ground-access trends and encourage the improved forecasting of ridership for new systems.

Cambridge Systematics, Inc., 150 Cambridge Park Drive, Suite 4000, Cambridge, MA 02140.

CHALLENGES OF COLLECTING COMPARABLE DATA

The first step to collecting comparable data on airport rail connection ridership is to define the types of data that are important. A simple study would collect only the total number of people boarding and alighting at an airport rail station. This simple approach does not provide the more specialized ridership information necessary to compare systems or develop forecasts. Such specialized data must come from a more detailed consideration of the types of people who have ground-access needs at an airport.

The data needed for understanding rail ground access are distinct from those needed to analyze roadway ground access. Road access concerns the vehicular trips generated by air passengers; airport employees; air cargo; and airport maintenance, service, and supply activities. Rail access, in contrast, concerns the actual person-trips made by those people whose ground-access needs can be served by rail. Therefore, people involved in air cargo or airport maintenance, service, and supply activities are not considered because the transportation demands of these activities are not often met by rail.

This paper divides potential rail riders into three groups: air passengers, airport employees, and "others." Others are defined as those persons, such as welcoming family members or airport job interviewees, who might use an airport rail connection while not being themselves either air passengers or airport employees. Typically, there are little data directly collected on others; instead, rail studies often focus on the first two rider categories and infer information about the third.

Airport and transit surveys are the major sources of this information. Airport administrations can supply data on air passengers and airport employees. Transit agencies can provide data on rail ridership at the airport station. The difficulty and challenge of understanding this information is in combining the two streams of data to accurately reflect the airport rail connection activities of a typical day. The methodology presented in Figure 1 is used to address these impediments and compile the important information in Table 1.

AIRPORT DATA

Air Passengers

Air passengers constitute an important group of potential riders on an airport rail connection. Because such connections provide ground access, it is essential to determine the number of air passengers whose air travel begins or ends at a given airport on a typical day. This air passenger ground-access measure is not counted directly but can be calculated by multiplying two counts that are

Airport Data
  Primary Tasks
    Determine the total number of air passengers (A) on a typical day with enplanement data
    Determine total number of airport employees (E)
  Secondary Tasks
    Determine airport's origin and destination ratio (B)
    Determine airport's ratio of daily trips per total employment (F) (if possible)
  Tertiary Tasks
    Calculate the number of air passenger ground access trips on a typical day (C)
      Equation: A x B = C
    Calculate the number of airport employee trips on a typical day (G) (if possible)
      Equation: E x F = G
Transit Agency Data
    Determine the rail ridership at the airport station on a typical day (R)
    Determine rail ridership breakdowns (if possible)
Relating Airport Activity to Rail Ridership
  Primary Tasks
    Determine the air passenger rail mode shares (D) (if possible)
    Determine the airport employee rail mode shares (H) (if possible)
  Secondary Tasks – Cross Checking
    Calculate the percentage of airport rail riders who are air passengers (J)
      Equation: [(C x D)/R] x 100 = J
    Calculate the percentage of airport rail riders who are airport employees (K) (if possible)
      Equation: [(G x H)/R] x 100 = K
    Compare these percentages to rail surveys, percentages collected at other airports, and anecdotal observation
    Reevaluate and revise data collection if discrepancies appear

FIGURE 1 Standard methodology used.

TABLE 1 U.S. Airport Rail Connections

	Air Passengers					Rail Mode Shares		
Airport	Total Daily[1]	Requiring Ground Access[2]	O&D Percentages[3]	Airport Employees[3]	Boardings and Alightings at Airport Rail Station[3]	Air Passenger (%)[3]	Airport Employee (%)[4]	Calculated Percentage of Airport Rail Ridership (Composed of Air Passengers)
Atlanta	182,192	74,699	41	38,000	12,000	6.0	N/A	37.3%
Boston	68,216	60,030	88	16,000	8,150	5.7	11	42.0%
Chicago (Midway)	24,254	21,829	90	4,700	13,200	8.1	N/A	13.4%
Chicago (O'Hare)	180,479	84,825	47	50,000	14,900	5.4	14	30.7%
Cleveland	31,290	21,903	70	5,000	1,650	3.0	N/A	39.8%
Philadelphia	59,054	41,338	70	13,000	3,450	2.0	N/A	24.0%
St. Louis	76,796	40,702	53	19,000	4,600	5.0	8	44.2%
Washington (National)	41,299	39,235	95	11,000	8,000	9.0	N/A	44.1%

N.B.: Rail ridership numbers have been rounded to the nearest 50.

[1] Total Daily Air Passengers are based on FAA DOT/TSC CY 1997 ACAIS Database enplanement statistics. The FAA numbers were doubled to estimate deplanements and then divided by 365 to arrive at a daily average.

[2] Calculated from Total Daily Air Passenger and Air Passenger O&D Percentage.

[3] Information for these columns is the latest available. It was compiled through phone interviews conducted in February/March 1998 of airport, transit, and MPO officials from the organizations listed in Table 4. The air passenger mode shares represent a combination of the historical survey data and professional judgment of the interviewees and the author of this paper. Those mode shares from airports in Boston and Chicago come directly from passenger surveys conducted in 1996 and 1995 respectively. **N.B.**: The airport rail connection at Washington National has historically had a higher air passenger mode share. This paper was written as the air terminal and its connection to the rail station were newly reopened after a lengthy construction process. It is expected that mode shares have increased since then.

[4] Employee rail mode shares are more difficult to obtain as little research has been done. The Boston Logan number was reported in a Massport printout of 1995 Logan Employee Commute data. The O'Hare Chicago number comes from research done by Peter J. Foote, Senior Transit Research Analyst at the CTA. The St. Louis Lambert number comes from research conducted by Michael Greenwood of the Lambert Airport Properties Department.

collected: the average daily number of enplanements/deplanements and the passenger origin and destination (O&D) percentage.

Enplanements refer to the number of people who fly out of an airport. Enplanement counts are usually made for a discrete period of time, such as a year or a month. A few airports also count *deplanements,* or the number of people who fly into an airport. To approximate the amount of air passenger activity on a typical day, the number of enplanements and deplanements during a given time period should be added together, and that total should be divided by the number of days in that time period. In the absence of a distinct deplanement count, the number of enplanements may be doubled without introducing a significant amount of error.

Inaccuracies can be introduced if researchers rely on enplanement counts from a time span that is not representative of air passenger traffic levels throughout the year. Because air passenger traffic varies by season at many airports, year-long statistics provide the best sample. In the absence of a year-long statistic, counts taken during different seasons should be combined. Airport officials can provide assistance in gauging whether the times for which those data are available are representative of the yearly enplanement average.

A very consistent source of air passenger enplanement data is the FAA Air Carrier Activity Information System (ACAIS) Database. The ACAIS database, established in 1979 and maintained by the Volpe National Transportation Systems Center, collects and analyzes commercial enplanement data from all U.S. airports. Because this information is used to apportion funds as part of the Airport Improvement Program, the data are very rigorously compiled and validated. As a result, ACAIS provides a large degree of consistency in presenting data collected from multiple airports. Table 1 uses these data to present the average daily number of air passengers at the eight U.S. airports with rail connections.

Airport officials also can provide assistance in establishing an airport's O&D percentage. This ratio is typically generated through ticketing information released by the airlines to the U.S. Department of Transportation (DOT) or the airport itself; however, the analysis of this information varies. For example, airport administrations might employ their knowledge of the air carriers to develop their calculations. Hartsfield Atlanta, a major Delta Airlines hub, requests the O&D percentage from Delta and its associated commuter carrier, ASA, and then assumes that passengers on all other flights begin or terminate their trips in Atlanta (Amy Wintermeyer, Hartsfield Atlanta International Airport, Bureau of Planning and Development, unpublished data). The U.S. DOT, Bureau of Transportation Statistics, in contrast, combines all the information from a 10 percent sample of issued tickets to determine O&D ratios (Don Bright, U.S. DOT, Bureau of Transportation Statistics, Office of Airline Information, unpublished data, 1998). Although, in theory, the process of the Bureau of Transportation Statistics is extremely accurate, it may be prone to error if the data set is incomplete.

For example, in the course of conducting the research for this paper, the Bureau of Transportation Statistics reported an O&D ratio for San Juan Luis Munoz Marin International Airport that is significantly larger than the ratio reported by the Puerto Rico Port Authority, which operates the airport (Don Bright, U.S. DOT, Bureau of Transportation Statistics, Office of Airline Information, unpublished data, 1998; Augustin Mercado, Puerto Rico Ports Authority, unpublished data, 1998). The latter ratio is believed to be accurate, based on anecdotal observation and additional analysis. Discussions with the Bureau of Transportation Statistics suggest that the agency is currently in the process of developing its data collection protocols and is not yet receiving comparable information from all airports. Therefore, regional nuances may still affect the Bureau of Transportation Statistics data. In the case of San Juan, it is possible that the local carriers, who shuttle passengers between Puerto Rico and the nearby islands, might not be linking ticketing information with the larger carriers. As a result, a pair of connecting flights in San Juan might register as two O&D trips. Examining the distinctions between the generation of divergent O&D ratios can prove very helpful in ultimately achieving comparable ground-access numbers.

A third source of O&D information, which may be useful in sorting through such dichotomous data reports, is any of the several private companies that analyze and supplement DOT data to sell to customers. Table 1 presents O&D ratios and the average number of daily O&D air passengers at the airports with rail service connections.

Airport Employees

Airport employees include all people whose work is based at an airport complex. Airport administrations track employment and can provide the total number of employees. Table 1 presents this employment for the airports under consideration. As is the case for air passengers, a ratio needs to be applied to determine the daily employee ground-access needs from total airport employment. Similar to the O&D ratio, this conversion multiple is airport-specific; however, unlike the O&D ratio, its range of variance between airports is smaller. Also unlike the O&D ratio, this information is not necessarily collected. One simple method of estimating this ratio is to assume that, because the airport operates around the clock, but most employees work only 5 days a week, roughly five-sevenths of the total workforce comes to work on a typical day. The preferred method for determining this ratio is to conduct a survey.

A survey enables a more precise accounting of the unusual work patterns of airport employees. For instance, an employee survey at Boston's Logan Airport showed that only 60 percent of the airport workforce is at work on a typical day, and only a quarter of these arrive during the morning peak period (*1*,p. 79). Although most airport employees make at least two trips per day, one arriving and one departing, members of flight crews may make only one ground-access trip and then fly away. Other employees may make more than two trips a day due to a midday errand. The frequency of employee off-airport trips varies due to the location of the airport and surrounding services and possibly also by ground transportation mode options (*2*,p. 37). These unusual travel patterns can complicate an understanding of the contribution of airport employees to rail-access ridership.

TRANSIT AGENCY DATA

Rail ridership refers to the total number of people who board or alight the rail-transit vehicle at a given station. Table 1 presents estimated ridership figures at the eight airport rail stations. Ridership reflects the usage and therefore the success of a station. Care must be taken to make an accurate count of the ridership. The easiest way to count ridership is to use data collected by turnstiles. The accuracy of this method depends to a large extent on the design of the turnstile. Rail systems such as the Washington Metro, which require a passenger to pass a fare card through a turnstile both to enter and to exit, are able to use this method very effectively. In other cities such as Boston, where tokens and or passes are used, such counts can underestimate ridership if some of the turnstiles are not equipped to collect data. In these situations a hand count is preferred; however, this labor-intensive method is expensive and therefore can be conducted only a few days a year. Such a limited sample may not be representative of typical ridership.

Awareness of the context of an airport rail station is critical to fully understanding and processing the relevant ridership data. For example, there are several airport rail stations that also serve the surrounding nonairport community. In such cases, it may be useful to distinguish which rail riders are actually traveling to or from the airport complex. A particularly good illustration of this concern is Chicago's Midway Airport station, the area's major park-and-ride and bus transfer station. There, less than a third of the ridership is related to the airport (*3*,pp. 3 and 8). Although these nonairport riders point to the success of a station, such statistics may lead people who are unaware of the station's context to falsely assume that the airport is generating all of the ridership.

A common source of error in compiling ridership figures is comparing numbers that refer to different kinds of counts. For example, as with airport and enplanement counts, transit agencies often count only boardings. Extrapolating total ridership may require doubling boardings. Researchers may collect boarding data and inadvertently refer to it as a total (boardings and alightings) ridership count. Such an oversight occurred in a recent periodical, which reported Boston's "Airport Station Weekday Ridership (Boardings and Alightings)" as 4,500 people, or roughly half of the total ridership. The fact that this periodical, renowned for its collection of interesting and useful statistics, made these oversights attests to the ease of mishandling this type of data (*4*,p. 8). Doubling the total ridership under the assumption that it refers only to boardings is the corollary error and also should be avoided.

Raw ridership numbers provide a set of parameters for likely ridership at an airport station, although, as with Chicago Midway, those numbers may include passengers who are not drawn by the airport itself. A more complete understanding of the airport rail connection requires relating the ridership data to the information on air passengers and airport employees.

RELATING RAIL RIDERSHIP TO AIRPORT ACTIVITY

After the required data have been identified and collected, it becomes possible to achieve a more precise understanding of the rail-ridership patterns among airport users. This can be accomplished by using ratios to connect information on air passengers and airport employees to rail-transit ridership.

Ratios

Ratios can be used effectively to analyze and compare information from airport rail connections regardless of the size of the airport. However, when constructing ratios, it is important to narrow the focus of the comparison to factors that relate to a single group's rail ridership and airport activity. If the items used in the comparison are too broadly defined, the resulting ratios may not be very useful.

Vague ratios are commonly presented because acquiring more precise data is expensive. These ratios often prove deceptive. For example, a table appearing in a 1997 journal presented a ratio labeled "Daily Airport Station Ridership per 1,000 Enplaned Passengers" (*4*). Such a ratio attempts to use an airport's air passenger counts as a gauge of that airport's overall ground-access needs. However, this ratio does not discern between those passengers who do and those who do not have ground-access needs. Cleveland Hopkins, a medium-sized hub (70 percent O&D), had a ratio of 42, which was within 2 percentage points of the 43 earned by St. Louis, a major hub (53 percent O&D) (*4*). If the author of the article had applied these O&D ratios to the enplanement counts to eliminate connecting air passengers with no ground-access needs, the two airport rail systems would fare quite differently. St. Louis, whose rail system attracts a larger proportion of O&D air passengers, would score 33 percent higher than Cleveland.

This adjustment is not wholly prudent because both quantities being compared refer to more than one ridership group. Rail ridership is not composed only of air passengers, but of airport employees whose ground-access needs do not necessarily vary in proportion to those of the air passengers. In this case, adjusting the above ratio for O&D passengers is misleading because this adjustment inflates the ridership contribution of the additional employees that is generated by the connecting passengers.

The most useful ratios avoid the pitfalls of ambiguity by comparing items as narrow in focus as the data allows. Two particularly useful and focused ratios are the ground transportation mode shares for air passengers and airport employees.

Rail Mode Shares

Rail mode shares are a specific ratio that refers to the percentage of air passengers and airport employees who select rail for airport ground access. Determining mode shares requires a focused survey. The available rail mode share information is presented in Table 1 and is expressed graphically in Figure 2. Information gleaned from systemwide transit passenger surveys may not provide a sufficient level of airport-specific detail to be useful for making this determination. For example, the *1994 Metrorail Passenger Survey* asked Washington Metro riders in stations throughout the system to classify their rail trips as work, job-related business, home, shopping or meal, sightseeing or recreation, school, or personal trips. Although such a survey is useful for understanding Metrorail ridership patterns, it is very difficult to extrapolate who among the respondents might be air passengers. Although the survey may provide a rough estimate of airport employee ridership under the category of work, the survey report lacks the detail to verify that air passengers traveling for work did not consider it a work trip as opposed to a job-related business trip (*5*).

Airport authorities commission periodic passenger and airport employee ground-access surveys. In some locations, such as the Washington, D.C., area, the metropolitan planning organization (MPO) may undertake such surveys for the airports. Occasionally, a transit agency, such as the Chicago Transit Authority, will also study air passenger and airport employee ground access at the airport.

It is important to design and administer such surveys very thoroughly to avoid nonrepresentative findings. For example, a June 1997 survey of 1,226 air passengers at Hartsfield Atlanta revealed that 9 percent of O&D passengers used rail transit to arrive at the airport. The table, contained in the appendix, is dated June 20, 1997 (*6*). A 9 percent mode share (assuming air-passengers used rail to depart the station at the same rate as to arrive) is high but is not out of the range reported at other airports. However, given the large number of O&D passengers accessing the airport on a typical day,

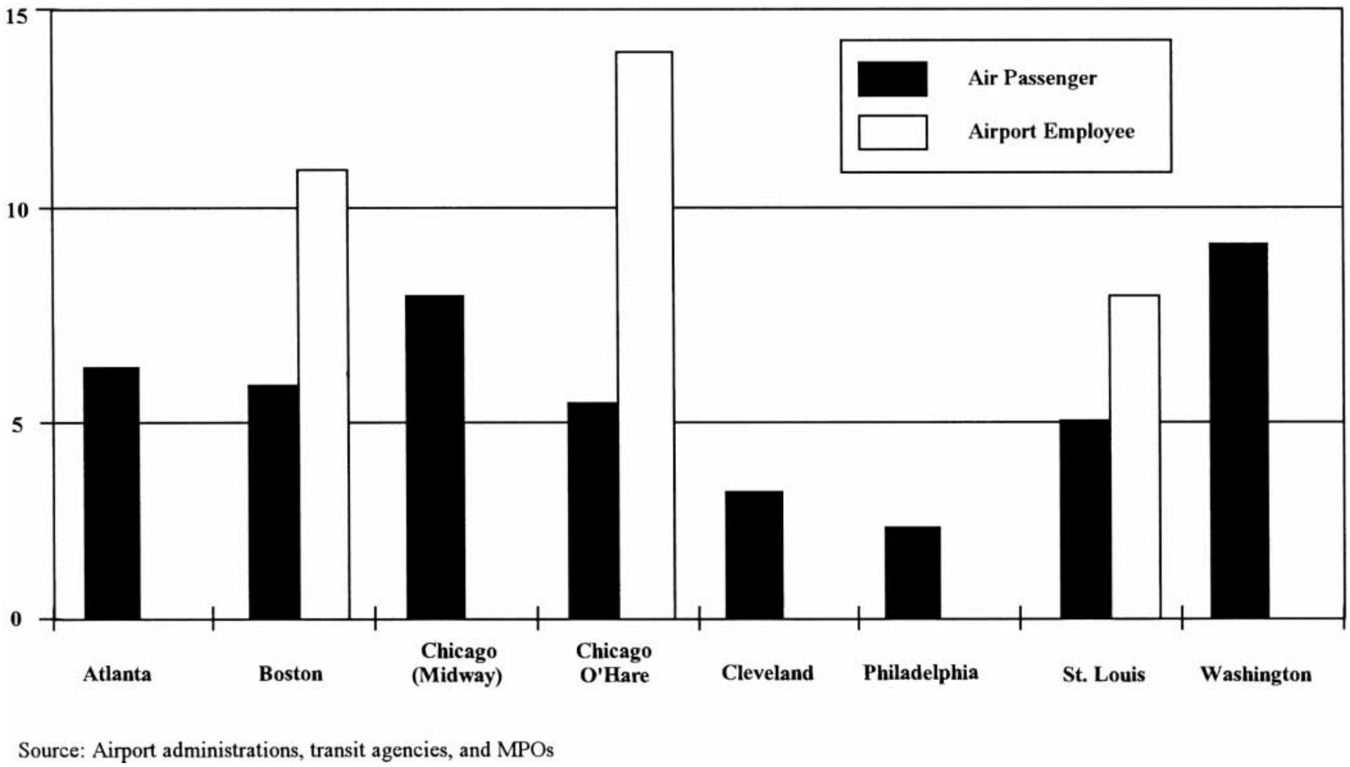

FIGURE 2 Rail mode shares—air passengers and employees.

such a high mode share would suggest that 56 percent of rail ridership at the airport station would be air passengers. Table 1 shows that this percentage would be higher than for other airports. When queried, the airport's Bureau of Planning and Development reviewed this data against a May 1996 Metropolitan Atlanta Rapid Transit Authority survey of 314 rail riders at the airport station. The survey reported that air passengers comprised only 42 percent of rail ridership. The airport's Bureau of Planning and Development then reassessed the mode share to be roughly 6 percent (*7,* shown in survey table). This example illustrates the need to use cross-checking techniques to verify reported information.

CROSS-CHECKING

Relating data provides a means for cross-checking for consistency. Even with a small amount of data, cross-checking can serve to assess the accuracy of that information. As illustrated above, a major cross-checking tool for airport rail ridership studies is to multiply the typical daily number of O&D air passengers by their rail mode share to determine the average number of daily air passengers who use the airport rail connection. From this number, the percentage of the rail ridership that is composed of air passengers can be calculated. Then this percentage can be compared to values reported at other airports. Unaccountable variation would require a reexamination of the data.

However, this information need not be compared to other systems to flag an error. Researchers may be alerted to data collection problems by an incongruity between the calculated percentage of air passenger patronage on the rail system and anecdotal observation. For instance, if the data suggests that more than 50 percent of rail riders are air passengers, but researchers witness fewer than half of the rail riders carrying luggage, that dichotomy also may trigger a reevaluation of the data.

The most useful cross-check would be to compare air passenger and airport employee surveys with surveys conducted in airport rail stations, as in Atlanta. Unfortunately, there appear to be few rail studies that segment riders into the same air passenger and airport employee categories used by airport studies. Airport rail station surveys could provide not only excellent corroborative information for airport access surveys, but also would enable a better understanding of the "other" people who ride rail transit to airports.

Cross-checking may introduce confusion into the data analysis of airport employee information. Because airport employment is not equivalent to the number of employee trips made on a typical day, the mode share cannot be directly applied to employment to determine the number of employees using rail. Attempts to do so lead to error.

More effort needs to be made on an airport-by-airport basis to estimate a ratio of daily airport access trips per airport employee. This multiple would facilitate the creation of a standard measure of employee trips on a typical day. A standard measure would be particularly useful for better cross-checking.

NEED FOR NEW DATA AND CONSISTENT COLLECTION

The somewhat hazy picture presented by the limited data currently collected could be clarified through the generation of additional kinds of data and the use of consistent compilation methods for existing data. As noted above, a standard means to generate the average daily number of employee trips would be useful, as would more attention to other passengers. Furthermore, segmenting air passengers and airport employees by initial local origins or final destinations would provide a much more detailed understanding of how the rail system is used. Such information would enable a more nuanced knowledge of the ways rail connections can be successful and should focus their development efforts. Studies incorporating these ideas have been undertaken in Chicago and Boston; however, a more thorough market segmentation needs to be employed. This type of study would assist in the improvement, not only of rail connections, but in deploying other shared ride services that may better fulfill the needs of airport users.

The establishment of ongoing and consistent data collection programs coordinated among airports and transit agencies would enable rigorous examination of the role of rail and other forms of transit on airport ground access. This examination would require complementary surveying both inside the airport rail stations and inside the airport, an emphasis on the same measures of air passenger and airport employee ground-access trips, and the development of a consistent survey and compilation technique.

BEST ESTIMATES OF CURRENT RIDERSHIP AT AIRPORT RAIL STATIONS

In the absence of such consistency, it is difficult to compile comparable airport station ridership data. Nonetheless, by recognizing possible sources of error and undertaking steps to minimize them, comparative data on ridership at airport rail stations were compiled in March 1998. This information is presented in Table 1, along with level-of-service comparisons (Table 2), airport metropolitan area comparisons (Table 3), and data from airport, transit, and MPO officials (Table 4). The mode shares for air passengers and, where available, for airport employees show that rail attracts only a small portion of these potential riders. Nonetheless, the few reported airport employee mode shares, although still low, are on average more than twice that of air passengers. This dichotomy suggests that, although rail transit services are not particularly attractive to either group, the causes for the low ridership vary between air passengers and airport employees.

Factors Affecting Air Passenger Ridership

Rail transit does not serve the airport access needs of most air passengers because most air passengers come from or return to areas that are not serviced by the rail system. For example, in Boston, fewer than a third of air passengers leaving the airport are destined for areas in the inner suburbs, where most of the rail transit system is located (*8,* p. 6-2). Conversely, air passengers who can use rail services do so at higher rates than the overall mode share. However, the fact that even these rates are typically less than 15 percent suggests that rail transit is an inconvenient option for air passengers (*9*,pp. 3–13;*3*).

Rail access entails several inconveniences. Transporting luggage via rail transit can be frustrating, not only while on the rail system but also at either end as well. This concern was often cited by patrons on the now-discontinued express train service to New York's JFK (*10*,p. A27). The unreliability of rail transit times, typically due to the need for transfers en route and at the airport, is a concern to air passengers rushing to catch a plane. In some cases, such as Philadelphia, where on-airport transfers are unnecessary, the lengthy (half-hour) headways reduce the reliability of the service. Given these impediments and, in some cases, the perceived uncertainties about using an unfamiliar rail system, many travelers are willing to pay for airport parking, taxis, rental cars, and other private vehicle services.

Rail transit is most successful in areas such as Washington, D.C., and Chicago, where many of the air passengers are traveling to or from downtown areas directly served by rail. Given the traffic congestion in both of these cities, the rail alternative is competitive in overall time and reliability with private vehicles. Such rail services attract travelers who are carrying little baggage and are familiar with the city's transportation situation (*1*).

Factors Affecting Airport Employee Ridership

Based on the preceding constraints, it would appear that rail connections would be appealing for airport employees. Employees have little, if any, baggage and are familiar with the local transportation situation. They are less sensitive to time constraints and more sensitive to price constraints than air passengers. Furthermore, in some cities, a greater percentage of airport employees than

TABLE 2 Levels of Service for Airport Access Modes

Airport	Travel Time by Rail (minutes)	Travel Time by Taxi (minutes)	Cost on Rail	Cost of Taxi	Rail Headways (minutes)
Atlanta	16	15-20	$1.50	$15	8
Boston	20	15-30	$0.85	$12-20	7-11
Chicago (Midway)	30	15-30	$1.50	$18	7-14
Chicago (O'Hare)	35-40	25-60	$1.50	$25-30	10-15
Cleveland	22-25	15-30	$1.50	$17	12
Philadelphia	25-30	15-30	$5.00	$20	30
St. Louis	25-30	20	$1.00	$20	8-10
Washington (National)	11-15	15	$1.25	$9-16	7-12

Source: Intermodal Ground Access to Airports and February/March 1998 phone interviews with the agencies listed in Table 4.

TABLE 3 Comparison of Airport Metropolitan Areas

Airport	Distance from the CBD in km	Population CMSA (1990)	Central City Density (1990) Persons/Sq. km
Atlanta	14.5	2,833,511	1,154
Boston	4.8	3,783,817	4,579
Chicago (Midway)	17.7	8,065,633	4,730
Chicago (O'Hare)	29.0	8,065,633	4,730
Cleveland	16.1	2,759,823	2,535
Philadelphia	11.3	5,899,345	4,530
St. Louis	16.1	2,444,099	2,473
Washington (National)	4.8	3,923,574	3,816

Source: Official Airline Guides (OAG) Business Travel Planner. Spring 1994. Volume 36. Number 1., and 1990 U.S. Census.

air passengers live within areas served by rail transit. However, it seems that the unusual work hours of airport employees make rail services, which are most reliable during normal peak hours, less appealing. Conversely, off-peak-time roadway commutes encounter little traffic delay (*2*).

Benefits of this Method of Data Collection

The standard methodology presented in this paper can improve the consistency of the collection and assessment of airport rail ridership. Identifying the kinds of data that are relevant can focus the data-gathering efforts on useful quantities. Defining those quantities and the ratios used to compare them may help to enable the compilation of comparable information. The awareness of common sources of error and the use of cross-checking techniques also help to increase the accuracy of airport rail ridership estimates.

Although the use of the method outlined in this paper may reduce the inaccuracies of data collection efforts, it does not free them from error. This method is designed to better utilize existing data. As noted earlier, improving the generation of this basic information will contribute significantly to improving understanding of the interplay of airports and their rail access connections.

CONCLUSIONS

Extending rail lines to serve airports entails significant costs to a community. The current system of data collection at existing airports is not conducted in a manner that leads to clear, consistent information. As a result, planners, policy makers, and the public at large are unable to assess the benefits and costs of constructing airport rail connections. The application of a consistent and rigorous method of data collection and analysis will facilitate the pru-

TABLE 4 Transit Agencies, Airport Administrations, and MPOs Contacted

Airport	Transit Agency	Airport Administration	Metropolitan Planning Organization
Atlanta	Metropolitan Atlanta Rapid Transit Authority	Atlanta Department of Aviation	Atlanta Regional Commission
Boston	Massachusetts Bay Transit Authority	Massachusetts Port Authority	Central Transportation Planning Staff
Chicago (Midway)	Chicago Transit Authority	Chicago Department of Aviation	Chicago Area Transportation Study
Chicago (O'Hare)	Chicago Transit Authority	Chicago Department of Aviation	Chicago Area Transportation Study
Cleveland	Greater Cleveland Regional Transit Authority	Cleveland Department of Port Control	
Philadelphia	Southeastern Pennsylvania Transit Authority	Philadelphia Division of Aviation	Delaware Valley Regional Planning Commission
St. Louis		St. Louis Airport Director's Office	East-West Gateway
Washington (National)	Washington Metropolitan Area Transit Authority	Metropolitan Washington Airports Authority	Metropolitan Washington Council of Governments

dent development of ground-access alternatives that best serve the community.

ACKNOWLEDGMENTS

The author would like to acknowledge the helpful guidance of Zale Anis of the U.S. Department of Transportation Volpe National Transportation Systems Center and Christopher Porter and Kevin Tierney of Cambridge Systematics, Inc.

REFERENCES

1. Bellomo-McGee, Inc. *Intermodal Ground Access to Airports: A Planning Guide.* Final Report. U.S. Department of Transportation, Dec. 1996.
2. Access to Denver International Airport: A Detailed Look at Air Passenger and Airport Employee Travel to Denver's New Airport in 1995/1996. Denver Regional Council of Governments, May 1997.
3. Foote, P. J., S. J. LaBelle, and D. G. Stuart. Increasing Rail Transit Access to Airports in Chicago. In *Transportation Research Record 1600,* TRB, National Research Council, Washington, D.C., 1997, pp. 1–9.
4. Statistics: Airport Rail Station Ridership. *The Urban Transportation Monitor,* June 7, 1997.
5. Table of Station of Origin-by-Origin Trip Purpose and Table of Station of Origin-by-Destination Trip Purpose. *1994 Metrorail Passenger Survey.* Washington Metropolitan Area Transit Authority, p. 6.
6. Table 31: How Arrived at Airport—Passengers. *AIR Index of Airport Performance.* Spring 1997, Update July 1997.
7. *Trip Purpose.* One-Week Survey by the Metropolitan Atlanta Rapid Transit Authority, May 1996.
8. Coogan, M. A. *The Peer Airport Analysis Report.* Cambridge Systematics, Inc., Cambridge, Mass., April 1997.
9. *Boston Logan International Airport: Airport Intermodal Transit Connector—Environmental Assessment.* Rizzo Associates, Inc., Jan. 1998.
10. Rhode, D. Giuliani Threatens to Block Kennedy Airport Rail Link. *The New York Times,* April 17, 1998.

Publication of this paper sponsored by Committee on Airport Terminals and Ground Access.