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INTERMODAL AIRPORT-TO-CITY-CENTER PASSENGER TRANSPORTATION AT THE 20 LARGEST U.S. AIR CARRIER AIRPORTS: THE PAST, PRESENT, AND FUTURE

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ABSTRACT

The 20 largest U.S. air carrier airports handle close to 60 percent of all the passengers enplaned in the United States. While the intra-airport movement of these passengers has become more efficient in recent years, the most difficult and challenging airport-associated journey is still between the airport and the city-center. The root cause of this problem is likely due to the unexpected growth of air transportation following U.S. airline deregulation in 1978. Most major U.S. cities lacked a well-planned intermodal transportation infrastructure, particularly one that had an airport interface. Additionally, the automobile remains the predominant short-haul passenger transportation system in the United States (Nettey, 1995).

This paper presents an overview and analysis of the top 20 U.S. air carrier airports' efforts in the past, present, and in the future to provide intermodal passenger transportation between the airport and city-center. Airport planners, developers, and management personnel in the targeted cities were surveyed concerning these issues. These data will be used to extend the knowledge-base concerning development of the U.S. intermodal airport passenger transportation infrastructure.

INTRODUCTION

The growth of airlines as a transportation mode in the U.S. is well defined and of great importance. However, while the airports used by the certificated airlines have improved and are some of the busiest in the world, traveling between the airport and the local metropolitan area is still a difficult journey. Although the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 has focused attention on improved airport intermodal links, much work is still to be done (Transportation Research Board (TRB), 1993). Several factors make intermodal improvements and changes difficult. Airports (city/county/state public facili-

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ties) serve airlines (private enterprise) and access to the airports is over transportation links funded heavily by the federal government. These three entities can at times be at cross-purposes and are all too often heavily snarled in legislative and bureaucratic red tape.

The purpose of this paper is to attempt to determine the current status of intermodal transportation links located at the busiest U.S. airports. One area of special interest is the ease of travel between the airport and the local metropolitan area (city-center) by means other than the automobile. Another focus of the research is to determine the perceptions of key airport officials concerning the planning, funding, and scope of such transportation links. The methodology for this study will include (a) a review of the U.S. airport system and enplanement statistics, (b) a survey of airport officials, and (c) an analysis of survey data.

U.S. Airport System

The U.S. airport system is well developed and consists of approximately 18,000 facilities with over 5,400 or 30 percent of these airports open to the public (Department of Transportation, 1995). Of those 5,400 plus public-use airports, 3,584 are included in the National Plan of Integrated Airport Systems (NPIAS). Airports in the NPIAS are further divided into four classifications (Wells, 1996). The four airport classifications are (number in each classification in parenthesis):

1. Primary (417)
2. Commercial Service (149)
3. Reliever (329)
4. General Aviation (2,424)

The focus of this paper is on Primary airports which are defined as those Commercial Service airports having more than 10,000 annual enplanements (FAA, 1991). More specifically, within those primary airports, the main thrust of this research centers on the 20 airports that enplane the highest number of airline passengers each year.

Intermodal Airport Infrastructures

A major component of this research study is an investigation of the use and integration of various passenger transportation modes at the airport interface. (Any reference to transportation from the city-center to the airport implies from the airport to the city-center as well). The term intermodal refers to transportation that combines two different modes such as rail and truck (Wood & Johnson, 1993). The Transportation Research Board (1993) further differentiates between intermodal and multimodal planning. Multimodal planning refers to system choices while intermodal planning emphasizes the most efficient way of moving from point to point though the system. When considering the context of

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this research, however, the intermodal linkages are limited to the commercial airplane and the modes of transportation used to move passengers between the airport and the city-center. Specifically, this research study is interested in non-automobile types of transportation (particularly light rail, metro, dedicated bus line, and other high-occupancy-vehicles (HOV)) compared to automobile types of transportation (car, limousine, van). Landside transportation at U.S. airports has historically been dominated by the use of private automobiles. These vehicles carry on average only slightly more than one passenger per trip. The result is landside congestion. This congestion is compounded by families and friends that drive passengers to and from the airport thereby generating additional round trips. Another reason is that airport trips, especially for business travelers, frequently coincide with the hours when the roads are busy with other rush-hour traffic (Robart, 1995).

Continued reliance on non-HOVs in the airport environment as a primary transportation mode to and from the airport may in the future result in increased congestion. Of particular concern to airport planning and management personnel is increased congestion at the curbside. Indeed, curbside frontage has historically been one of the most congested areas at airports (Evans, 1995). Robart (1995) further stated that the need to balance airside and landside use of airports was clearly an issue. Reducing the landside congestion at airports requires expanding the availability and use of public ground transportation between the city-centers and their airports.

The use of multimodal or intermodal public transportation systems at U.S. airports has been somewhat slow in comparison to other parts of the world. In Europe, it is quite common to find easy access from the airport to the city-center by rapid and convenient rail or light rail service. At Amsterdam's Schipol Airport, transfer passengers that have at least four hours between flights are encouraged to secure a special exit visa, take the 20 minute train ride to Amsterdam, and enjoy the one-hour canal boat ride before returning to the airport for continuation of their journey. At London's Heathrow Airport, the underground trains of the Piccadilly line depart every five to nine minutes for the city. It seems evident that integration of the various modes of non-automobile mass public transportation has been a major thrust of these as well as other European airports' transportation planning efforts.

In the United States however, it sometimes appears that urban transportation planners in the past operated in a vacuum. Airports were designed and built by one group of people, highways by another agency, and other public transit systems by still another (Bremer, 1993). Such an operational methodology has not helped the airports to reduce their surface congestion problems or made it any easier for airport passengers to get to and from the airport by any means other than automobile. Thus integration is poor and the fragmentation is great (Nettey, 1995).

Compounding the problem of congested airport access is that not all passengers arriving at airports are transferring to another aircraft for the continuation of

their journey as most might believe. Historically, Denver's air travelers are roughly 55 percent hubbing (transfer) passengers and 45 percent origin-destination (O & D) passengers (Evans, 1995). This claim seems to be borne out when viewing Table 1. Although the data used by Hansen and Weidner are 1991 enplanement figures and all top 20 airports in the current sample population are not included, an average of over 55 percent of passengers are O & D. These O & D passengers generate the intermodal demand for both the outbound and destination legs of their trips.

Table 1
Percent of 1991 Origination and Destination (O & D) Enplanements at Selected U.S. Airports

Airport	*Enplanements*	*O & D*	*Percent O & D*
Chicago O'Hare	29,040,932	11,078,080	38.15
Dallas/Fort Worth	22,625,338	12,101,410	53.49
Los Angeles	18,069,981	12,101,410	66.97
San Francisco	14,007,424	9,130,230	65.18
Newark	9,645,295	7,197,470	74.62
Detroit	9,470,549	4,801,450	50.70
Miami	9,212,517	4,609,900	50.04
New York LaGuardia	9,121,466	7,998,160	87.69
New York Kennedy	8,207,264	3,601,360	43.88
Houston	7,805,317	3,428,090	43.92
Average			55.43

Source: Hansen & Weidner, 1995, p. 10 & 11.

Airport Demographics

The airports that were included in this study were the 20 top facilities with respect to passenger enplanements as defined by the 1996 Aviation Capacity Enhancement Plan (FAA, 1996). An enplanement is defined as domestic, territorial, and international revenue passengers who board an aircraft in scheduled and non-scheduled service of aircraft in intrastate, interstate, and foreign commerce and includes in-transit passengers (passengers on board international flights that transit an airport in the U.S. for non-traffic purposes) (Department of Transportation, 1996). The top 20 U.S. airports in terms of total enplanements are listed in Table 2.

Table 2
Enplanements at Top 20 U.S. Airport as a Percentage of Enplanements at the Top 100 U.S. Airports

Rank	*Airport*	*Identifier*	*Enplanements*	*Percent*
1	Chicago O'Hare	ORD	30,549,625	5.85
2	Dallas/Fort Worth	DFW	25,514,422	4.88
3	Atlanta	ATL	25,364,630	4.86
4	Los Angeles	LAX	24,364,630	4.66
5	San Francisco	SFO	16,146,552	3.09
6	Denver	DEN	15,755,747	3.02
7	Miami	MIA	14,561,222	2.79
8	New York Kennedy	JFK	13,627,089	2.61
9	Newark	EWR	13,564,615	2.60
10	Detroit	DTW	12,666,331	2.42
11	Phoenix	PHX	12,397,443	2.37
12	Las Vegas	LAS	12,321,672	2.36
13	Boston	BOS	11,789,385	2.26
14	Honolulu	HNL	11,425,428	2.19
15	Minneapolis/St. Paul	MSP	11,410,274	2.18
16	St. Louis	STL	11,084,346	2.12
17	Orlando	MCO	10,531,965	2.02
18	New York LaGuardia	LGA	10,192,077	1.95
19	Seattle	SEA	10,138,818	1.94
20	Houston	IAH	10,118,565	1.94
	Total		303,524,836	58.10
	Top 100 Airports' Enplanements		522,376,979	

Source: FAA, 1996: The 1996 Aviation Capacity Enhancement Plan

RESEARCH QUESTIONS

The questions to be answered by this research study are:

1. How does the United States rank as a world leader in the use of non-automobile transportation systems for the movement of passengers from the airport to city-center?
2. How easy has it been for an originating or destination passenger to get from the airport to the city-center by some means other than the automobile?
3. Would the use of light rail/electric guide way or a similar system reduce curbside vehicular congestion at airports?
4. What is the priority for airport-to-city-center non-automobile transportation as viewed by airport managers in the survey and their local city/county planning unit?
5. Who should fund future airport-to-city-center non-automobile transportation modes?

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SURVEY INSTRUMENTATION

The method of data collection selected for this research was an opinion survey. The subjects were airport management personnel at the top 20 U.S. airports based on the number of enplanements. Considered as management personnel that would have knowledge of the past, present, and future airport to city-center transportation methods and status were airport managers, directors of aviation, heads of transportation, landside directors of operations, or someone with a similar title or area of expertise at each respective airport. Individuals at each were selected as a result of telephone contact with the airport manager's/director's office. In many cases, that office referred the inquiry to another office that was more appropriate to provide the responding individual.

The survey instrument was a 13 question survey containing questions about (a) transportation from that airport to the city-center by non-automobile modes, (b) transportation planning issues, (c) use of light rail at airports, (d) local transportation emphasis, and (e) future funding responsibilities. A four-point Likert scale was used. The specific responses could be Strongly Disagree, Disagree, Agree, and Strongly Agree. The final survey was modified after a field-test with selected airports and knowledgeable aviation professionals.

The actual data collection was by telephone contact with the selected respondents. Each individual was told about the project and asked several demographics questions in addition to the specific survey questions. Each respondent was also told that all answers would be held in the strictest confidence.

DATA ANALYSIS AND DISCUSSION

In the following section, the data from selected survey questions are reviewed. In most cases, descriptive statistical methods are utilized; however, when a specific statistical test was performed, the Mini-Tab Statistical package was utilized. All tests were to the .05 level of significance.

U.S. Transportation Position

The use of city-center to airport non-automobile transportation is viewed with differing importance in various parts of the world. Meyer and Oster (1987) clearly outline the U.S. citizens' love of the automobile and the fact that reliance on that specific mode of transportation has inhibited the growth and utilization of advanced modes of public transportation. To establish a benchmark with respect to how the survey population evaluated the U.S.'s world leadership in intermodal transportation, the survey question stated, "This country is a world leader in the use of non-automobile transportation systems for movement of airport passengers between the airport and city-center." The responses to that question are contained in Table 3.

Table 3
U.S. is a World Leader in Non-Automobile Transportation

	Strongly Disagree		*Disagree*		*Agree*		*Strongly Agree*	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Responses	1	(05)	14	(70)	5	(25)	0	(00)

Fifteen of the respondents or 75 percent disagreed or strongly disagreed that the U.S. is a world leader in the use of non-automobile transportation. This result tends to mirror the findings of the Transportation Research Board (1993) concerning the state of transportation planning and expansion, particularly intermodal, in the U.S. It seems that in the U.S., each transportation professional has a strong orientation toward that individual's specific area of expertise and not enough thought is given toward the intermodal concept. Although the ISTEA made monumental strides toward development and enhancement of multimodal integration, the aviation segment of this legislation only calls for airport systems and master plans to establish planning links.

Airport Access Past/Present/Future

The importance of changing access to airports via non-automobile transportation modes in the context of past ease and current emphasis as well as future thrust was a part of several survey questions. The potential respondents were asked, "It was easy to get from the airport to the city center 10 years ago by a mode other than the automobile". Another question asked, "The movement of passengers between the airport and city-center is a high priority at my airport." The results of these two questions are contained in Table 4. The respondent from Denver was not included in Table 4 because that airport was not open ten years ago.

Table 4
Ease of Airport Access Ten Years Ago and Current Priority for Passenger Access

	Strongly Disagree		*Disagree*		*Agree*		*Strongly Agree*	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Past	4	(21)	12	(63)	3	(16)	0	(00)
Current	0	(00)	2	(11)	8	(42)	9	(47)

Concerning access to airports by non-automobile modes in the past, only 16 percent agreed with the idea that access was easy ten years ago. However, 89 percent of the respondents indicated that current (and hopefully future) access to the airport by modes other than automobile was a high priority at their airport. A Chi-square analysis ($1, N = 38) = 20.689, p .05$, found that there was a significant

difference between the responses to these two questions. Thus it would appear that the subjects are aware that access has been difficult and that the priority for improving such access is high. However, an interesting variable in an airport's willingness to reduce automobile airport access is offered by FAA spokesman John Rodgers. Rodgers suggests that airport parking for private automobiles represents millions of dollars in additional revenues each year at major airports and this may influence the willingness of airport official to promote intermodal mass transit systems that reduce their parking revenues (TRB, 1993).

Light Rail Utilization

Light rail has several definitions (Department of Transportation, 1997; Harper, 1982; Wood and Johnson, 1993; and DeVore, 1983). However, a composite description of this mode of travel is a street car-type vehicle, often electrically-driven, with semi-exclusive or exclusive rights-of-way. The survey question for Table 5 was, "The use of light rail/electric guide-way or a similar system as a transportation mode to the airport is an excellent way to reduce curbside vehicular congestion."

Table 5
Light Rail Utilization to Reduce Curbside Congestion

	Strongly Disagree		*Disagree*		*Agree*		*Strongly Agree*	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Responses	1	(05)	2	(10)	12	(60)	5	(25)

The respondents were strongly in favor of the use of light rail to reduce curbside congestion. 85 percent of those reporting agreed or strongly agreed with such implementation. During the data collection, several respondents commented that the amount of curbside available is not going to increase, dwell-time of vehicles seems to be increasing thus compounding the situation, and use of a mode such as light rail that moves arriving and departing ground passengers away from the curbside must be expanded.

Planning and Funding for Transportation Priorities

The question dealing with assigning responsibility for funding of transportation from the airport to the city-center consisted of three separate survey questions. They differed only in referencing which agency should be responsible for funding such that summarily, the question(s) stated, "Funding for future airport to city center transportation modes is the responsibility of (a) local, (b) state, or (c) the federal government." In the table below, the three differing responses are outlined.

Table 6
Funding Responsibility for Future Airport/City-Center Transportation

	No Answer		*Strongly Disagree*		*Disagree*		*Agree*		*Strongly Agree*	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Local	4	(20)	1	(05)	3	(15)	11	(55)	1	(05)
State	2	(10)	0	(00)	5	(25)	12	(60)	1	(05)
Federal	2	(10)	0	(00)	3	(25)	13	(65)	2	(10)

From 60 to 75 percent of the respondents agreed that some governmental entity such as local, state, or federal government should have responsibility for future airport to city center transportation funding. However, which of the governmental units should have primary responsibility was not clearly identified. A Chi-square analysis (4, N = 52) = .6741, p .05, of the responses to these three questions found that there was no significant difference between the responses to the quesions. It appears that some funding mechanism must be developed but the respondents appear to feel that the burden should be shared by several governmental units. There was a slight preference for federal funding with 75 percent of the respondents agreeing or strongly agreeing versus 60 percent agreement for local funding.

CONCLUSIONS

Several conclusions can be drawn from this survey of airport management and transportation officials at the top 20 U.S. airports. These conclusions are in the areas of (a) U.S. leadership in airport access by non-automobile modes, (b) past and current ease of airport access, (c) use of light rail, and (d) funding/planning responsibilities.

It was clear from the responses of the subjects to the survey that the U.S. is not a world leader in non-automobile airport access modes. Numerous respondents lamented the fact that the U.S. citizens' love for the automobile has been a barrier to the development and use of public transportation in this country. Several respondents pointed to European and Asian airports as models for intermodal transportation systems with strong airport interfaces. A frustrated transportation official at one of the largest airports summed up the issue with "nobody in this country seems to get it!"

Concerning the ease of traveling between the airport and the city-center, the respondents confirmed the experiences of seasoned airline travelers who know that such a journey is very difficult, frustrating, and usually quite expensive. However, several laudable systems (Atlanta, Chicago, and Washington, D.C.) are in place and operating well. Transportation officials at other airports not among these few exemplary situations were somewhat envious. The encouraging news though is that the issue of improving airport to city-center transit has a

high priority among governmental units as well as management and transportation officials.

Light rail appears to be seen as a viable (although rather expensive) solution to curbside congestion. The respondents strongly endorsed this mode of travel. One factor not determined by the survey was whether the respondents endorsed light rail as primarily as intra-airport or intermodal mode of travel. Several airports currently use light rail to move passengers to and from the terminal to parking lots and the JFK light rail system will connect terminals to parking areas and off-airport stations at Howard Beach and Jamaica (TRB, 1997a). The JFK system was in planning for 30 years. Additionally, the St. Louis Metrolink connecting Lambert-St. Louis International Airport with the city-center and points beyond in both Missouri and Illinois is operational and gaining strong local support (TRB, 1996).

The planning for future intermodal links is a high priority for both the subject airports and their local planning agencies. Since the advent of ISTEA, stronger and more diverse transportation partnerships are viewed more favorably for intermodal initiatives by potential funding sources. Furthermore, it seems imperative that any intermodal link to an airport must be part of a system in which the airport is not the sole beneficiary for such service. Considering funding of such projects, the current practice seems to be one of doing more with less (TRB, 1997b).

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