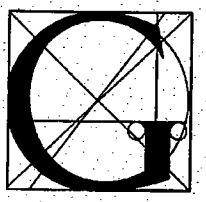

GRA, Incorporated
Economic Counsel to the Transportation Industry

ALTERNATE AIRPORTS STUDY

FINAL REPORT
April 15, 2003

Prepared for:
Office of the Assistant Secretary for Transportation Policy
Office of the Assistant Secretary for Aviation and International Affairs
U.S. Department of Transportation
Washington, DC 20590

NOTE

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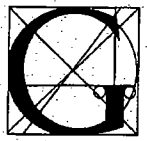

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Under Work Order 29
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EXECUTIVE SUMMARY

This project was initiated by the U.S. Department of Transportation (DOT) and coordinated with the Federal Aviation Administration. The principal objective of this project was to examine the circumstances under which alternate airports do and do not fulfill the role of serving a significant portion of the air carrier passenger demand in a metropolitan region. The study offers options for consideration that could address the impediments to the effective use of alternate airports.

The use of alternate airports is one of the approaches available to address the airfield capacity shortfalls at large hub airports. Other measures include: the construction of new runways; the installation of new technology for instrument approaches and airspace management; and the use of demand management strategies. The most significant increase in capacity is likely to result from the construction of new runways. In the past five years at the 31 large hub airports, three new runways have opened and ten more are under construction. In total, all but nine of these 31 airports have either opened a new runway in the past five years, are constructing one now, or are considering a new runway or runway configuration. However, there are several key metropolitan areas that have large hub airports that lack the physical space or the public consensus to add an additional runway (either at existing airports or through the construction of new airports). It is in these locations that the potential of alternate airports to serve air carrier passenger demand is particularly important.

The Federal Aviation Administration's Benchmark airports (the 31 large hubs except Fort Lauderdale and Portland, plus Memphis) were used to identify metropolitan areas that had capacity problems evidenced by high levels of current delay. A threshold value of 15 delays per 1,000 operations was used to indicate a congested airport. The most delay prone areas were reviewed and four case study locations were selected for more in depth analysis. These included the following:

- Boston
- Los Angeles
- New York City
- St. Louis

Figure ES-1 shows capacity and delay statistics for the airports in the case study areas.

Figure ES-1
Capacity and Delay in the Case Study Areas

Airport	Optimum Rate/Hr	Reduced Rate	Capacity Loss	% Time IFR	Delay Rate
New York LGA	81	64	21%	20%	155.9
Newark EWR	108	78	28%	19%	81.2
New York JFK	98	71	28%	14%	38.8
Boston BOS	126	88	30%	18%	47.5
Los Angeles LAX	150	128	15%	18%	21.9
St. Louis STL	112	65	42%	23%	18.2

Source: FAA Airport Capacity Enhancement Plan 2001. The optimum and reduced rate are the number of operations per hour in VFR and IFR conditions, respectively. The Delay Rate is the basis for ranking, and refers to the number of delays per 1,000 operations from FAA OPSNET, CY 2000.

The study team also reviewed prior studies of multiple airport regions and passenger choice among airports in metropolitan areas. From this literature, it was learned that a second airport is generally only viable once the principal airport in an area exceeds 10 million annual originating passengers. In general, airport choice in multiple airport regions is governed by travel costs, including access time and costs, and schedule availability in terms of the frequency and types of service.

METHODOLOGY

The study considered alternate airports as those being within 70 miles of one of the case study airports. The study team visited each selected study area and conducted interviews with metropolitan planning organizations, airport officials, and relevant FAA staff. In the examination of alternate airports to be considered, an airport had to have commercial scheduled service and at least one runway greater than 6,000 feet in length. Except for the St. Louis area, which had only one alternate airport, a number of existing and potential alternate airports were identified in each study area.

Without a detailed capacity and utilization analysis, it is not possible to determine exactly how much capacity is available at alternate airports within a region. This depends in part on the ability to overcome existing limitations on the usage of certain airports, the ability to expand existing alternate airports, and the role that such airports may play in the region's future air transportation system. The study did find, however, that airports closer to the Benchmark airports or the central business district were generally more difficult to develop because of existing limitations on the level of activity, environmental concerns or a need for access improvements that raised either environmental or community objections. In general, the airports on the periphery of the metropolitan regions had more capacity available and fewer limitations on future development. However, these airports are located farther from the current population

centers, and may need substantial access improvements before they can attract sufficient levels of traffic.

Alternate airports make use of existing infrastructure and can provide a more efficient use of limited federal funds for airport development. They can reduce demand and delay at congested Benchmark airports by serving some of the traffic demand that would otherwise be served at congested airports.

THE CASE STUDIES

Each of the four case study areas is unique in the role that alternate airports have played or could play in helping the area meet air transportation needs. They range from clear success stories such as the Boston area where alternate airports with substantial air carrier activity were developed in Providence and Manchester with the support of the proprietor of Boston's Logan Airport (Massport) to St. Louis where an alternate airport was developed in Illinois at Scott Air Force Base which has had little success in attracting and retaining scheduled service.

The case studies in New York and Los Angeles also show promise for the use of alternate airports. In both cases, these are already viable multiple airport regions. However, both areas are facing capacity limitations at existing airports and need to bring additional capacity on line. In the case of New York, it looks like the most substantial capacity will be available on the periphery of the metropolitan area including Stewart Airport in New York, Lehigh Valley International Airport in Allentown, Pennsylvania, and Trenton Mercer County Airport in New Jersey (if increased use were approved locally). Each of these airports could provide substantial additional capacity for the New York metropolitan area, but they are located at the periphery of the region. As such, access improvements may be necessary to make them attractive to the region's air travelers.

In the case of Los Angeles, the Ontario airport has considerable expansion potential. Only modest additional capacity could be made available at other close-in alternate airports were administrative limitations on aircraft operations relaxed. Los Angeles also has a number of large under-utilized airports on the periphery of the region, including Palmdale/USAF Plant 42, San Bernardino, March Air Force Reserve Base, and the Southern California Logistics Airport. These are located at a distance from the population centers and, for their development as alternate airports, they would need either more growth in the local area or access improvements to reduce the travel time to these facilities.

STRONG REGIONAL PLANNING

Each of the four case studies shows that there are unique aspects to multiple airport regions. This study also shows that strong regional planning is a key element to the development of alternate airports. In many cases, this is hampered because alternate airports are controlled by sponsors that are different from those that control the Benchmark airports that are capacity limited. While metropolitan planning organizations (MPOs) exist that can take a lead in preparing regional airport system plans, they do not have the State or local authority to implement any such development. There are also statutory and regulatory impediments such as the following:

- Single proprietor airports are limited in the ability to use revenues at another airport
- There are substantial limitations on the use of airport revenues to fund off-airport access improvements.
- Funding for intermodal links at the airport or for off-airport access is constrained generally by federal requirements placed on use of airport revenue, on eligibility of projects for passenger facility charges, and for Airport Improvement Program (AIP) project grants.

Under existing authority, FAA spends AIP discretionary funds for development at alternate airports as part of regional airport system development.

FAA also could institute a study of airports likely to have more than 10 million originations by the year 2010 in regions that are forecast to have a significant shortfall in capacity.[1] This study would examine how alternate airports might accommodate some of this demand. This study should determine the critical alternate airport regions and fund regional air transportation studies in these areas. This would allow FAA to determine the development potential and capacity contribution of critical alternate airports. Finally, FAA could facilitate development in these areas through the use of AIP discretionary funds.

Access is also a key to the use of alternate airports. However, airports typically cannot spend money raised on the airport off the airport. As such, generally FAA funding for aviation access improvements is limited to areas close in to the airport. Any additional funding for off-airport access improvements would benefit the development of alternative airports by effectively reducing access time to air travelers, thus making the alternate more attractive to passengers.

[1] Ten million originating passengers appears to be the threshold value where a second airport can be viable in a metropolitan area.

FAA should require that regional airport studies include a ground access component that is coordinated with the Federal Highway Administration and the Federal Transit Administration as well as state departments of transportation and metropolitan surface transportation, land use and development agencies. This ground access component should identify additional airport or other federal funding for access projects that are critical and which link the airport to the major highway systems. In addition, where major access improvements are needed, there should be cooperation between FAA and the surface transportation modes to encourage state and local governments to use surface transportation planning and development funds to remedy these problems.

In 1996, FAA and the FHWA jointly sponsored the development of the report "Intermodal Ground Access to Airports: A Planning Guide." The report treats ground access planning in a rigorous fashion. FAA, FHWA and the Federal Transit Administration should develop training activities to encourage the use of this guidance in airport access planning and development. FAA should encourage airport sponsors to participate with MPOs and other regional planning bodies in regional transportation studies.

POTENTIAL FEDERAL INITIATIVES

The usage of market-based solutions could improve incentives to use alternate airports. One such strategy, differential pricing, would result in higher airport fees at congested airports. Specifically, differential pricing could provide financial incentives for operators to utilize alternate airports. There are limits to use of such incentives. Currently, airports are constrained in their ability to calculate airline fees on a market basis due to the federal requirements that airline fees be "reasonable" and that excessive revenue surpluses should not be created.[2] FAA and DOT are currently reviewing these policies.

There is also a need to improve strategies for converting surplus military airports to civil use. Consideration should be given to mandatory land banking of former military airports unless studies show that use as a commercial airport is not needed within a region for the foreseeable future.

There is also a need to increase research to meet environmental challenges associated with alternate airport growth. This includes not only environmental streamlining as outlined in a recent Executive Order, but also working with airports that have pre-ANCA restrictions, which limit the level of commercial activity at an airport. It should be determined whether these could be modified to allow some traffic

[2] 49 U.S.C. §§47101(a)(13), 47107(a)(1), 47129.

growth without a total loss of grandfather status.[3] This would involve trading reduced noise exposure for increased operations and should make use of the FAR 161 process and require a benefit-cost analysis.

Finally, in those metropolitan areas where the level of traffic could support an alternate airport, FAA should require an evaluation of available alternate capacity. FAA may also consider seeking legislative authority to allow airport sponsors of the principal airport in the region to participate in planning and investments at alternate airports to make better use of existing capacity and limited federal resources.

[3] Relaxing restrictions without affecting "grandfather" status appears to be feasible. See 49 USC §47524 (d) (4).

1. INTRODUCTION

1.1 BACKGROUND

The Department of Transportation (DOT), Office of the Assistant Secretary for Transportation Policy and Office of the Assistant Secretary for Aviation and International Affairs initiated this study. It was coordinated with the Office of Airport Planning and Programming and the Office of Airport Safety and Standards of the Federal Aviation Administration (FAA).

The principal objective of the study was to examine under what circumstances alternate airports do or do not fulfill the role of serving a significant portion of the air carrier passenger demand for a region. The particular emphasis of the study is the potential for use of airports near congested airports as an alternative to (or in addition to) building new capacity at major congested airports or to building new airports. The study used the FAA Benchmark airports as locations where additional capacity may be needed.

The study investigated the following questions:

- Can alternate airports alleviate some of the capacity shortfall at selected Benchmark airports?
- For each potential alternate airport area, have any of these successfully developed an alternate airport and why?
- Are there barriers to the utilization of alternate airports within a multiple airport metropolitan region?
- Are there threshold values in terms of traffic beyond which alternate airports become viable?
- What role can regional bodies play in the development of multiple airport systems utilizing alternate airports?
- What are the potential benefits and costs of enhanced use of alternate airports?
- Are there statutory, regulatory or policy changes needed to make better use of alternate airports in congested areas?

1.2 STUDY BACKGROUND AND CURRENT INDUSTRY CONDITIONS

It was a working hypothesis of this study that the primary airports in the major metropolitan areas investigated in this study have a delay problem. Capacity is a continuing concern, even though traffic at many of the congested airports in the US is currently down as a result of the terrorist attacks on the country on September 11, 2001. Delays were taken as the principal indicator of the need for additional airport capacity. The following cities have airports with delays in excess of 15 per 1,000 operations during the year 2000; they were analyzed to select case study airports:

- Atlanta
- Boston
- Washington National
- Dallas/Fort Worth
- Detroit
- Houston
- Los Angeles
- Miami[4]
- New York City
- Chicago
- Philadelphia
- Phoenix
- San Francisco
- St. Louis

These metropolitan areas account for about one-half of the FAA Benchmark airports. A number of these cities already have multiple airports with commercial service.

The use of alternate airports is one of the approaches available to address the airfield capacity shortfalls at large hub airports. Other measures include: the construction of new runways; the installation of new technology for instrument approaches and airspace management; and the use of demand management strategies. The most significant increase in capacity is likely to result from the construction of new runways. In the past five years at the 31 large hub airports, three new runways have opened and ten more are under construction. In total, all but nine of these 31 airports have either opened a new runway in the past five years, are constructing one now, or are considering a new runway or runway configuration. However, for some of these cities, there are only limited expansion opportunities at their primary airports.

From the previously listed cities, the study sponsors selected four regions for more in-depth analysis:

[4] Miami was included in the review even though it could not technically meet the delay threshold.

- Boston
- Los Angeles
- New York
- St. Louis

A case study approach was used. It included a literature review in the areas of airport choice in multiple airport regions, the utilization of alternate airports, and existing studies of the aviation system in the four case study airports. In addition, a visit was conducted to each of the case study areas and interviews were conducted with regional planning bodies, airport planning departments and relevant FAA officials.

Figure 1-1 quantifies the optimum rate capacity in visual flight rule (VFR) operations, the instrument flight rules (IFR) capacity loss values and a reported delay rate (per 1,000 operations) at each Benchmark airport in the case study areas. This study does not provide a capacity and delay analysis for these airports, as these are adequately dealt with in other studies.

Figure 1-1
Capacity and Delay in the Case Study Areas

Airport	Optimum Rate/Hr	Reduced Rate	Capacity Loss	% Time IFR	Delay Rate
New York LGA	81	64	21%	20%	155.9
Newark EWR	108	78	28%	19%	81.2
New York JFK	98	71	28%	14%	38.8
Boston BOS	126	88	30%	18%	47.5
Los Angeles LAX	150	128	15%	18%	21.9
St. Louis STL	112	65	42%	23%	18.2

Source: FAA Airport Capacity Enhancement Plan 2001. The optimum and reduced rate are the number of operations per hour in VFR and IFR conditions, respectively. The Delay Rate is the basis for ranking, and refers to the number of delays per 1,000 operations from FAA OPSNET, CY 2000.

The most severe delay problems exist at the New York area airports, with LaGuardia and Newark experiencing the greatest delay in 2000. While Boston, Los Angeles and St. Louis had considerably lower rates of delay, delay is still a concern at these locations.

In the last year, delay at many airports has dropped considerably. This study was initiated before September 11, 2001. Subsequent to September 11, 2001, aviation industry growth patterns have been significantly altered. Industry growth, capacity needs and delay have temporarily been supplanted as top aviation issues. While industry growth is uncertain in the short run, both GRA and the study sponsors expect airline industry growth to return in the future. With that future growth, the capacity

and delay problems of the industry before September 11 will return. Airport expansion issues remain important concerns of government, particularly in view of the fact that there is such a long lead-time required for airport development. Thus, while there is a short-term respite on capacity and delay problems, it is expected that the results of this study will be applicable over the longer term.

1.3 LITERATURE REVIEW

Part of the study involved a review of the literature dealing with airport choice, multiple airport systems and the use of alternate airports. Appendix A to this report contains a summary of the literature reviewed for this study.

The existing base of research in these areas is not extensive, but it does deal with several key questions, including whether there is a size threshold that is required before a secondary airport in a large metropolitan market can be seen to be viable and serve as a valuable alternate airport to the primary airport(s) in the region. According to two studies by de Neufville, the threshold for a successful multi-airport system is 10 million originating passengers per year. Dennis completed a study that showed that in Europe secondary airports successfully expand when they offer links to major international hubs, and that low-fare carriers attract demand from a wider catchment area.

Much of the available literature deals with airport choice when more than one airport is available in a region. Briefly, airport accessibility in terms of time and cost is the dominant choice variable, while fares also are important, particularly for leisure and domestic travelers. Frequency of flights is another factor in airport choice, as it affects total travel time options, but service frequency seems not to be a major determinant after nine total flights a day are offered in a given city pair. Finally, direct flights are preferred over connecting flights or those with a stop en route.

1.4 LIMITATIONS

The current distribution of traffic among facilities in multiple airport regions is not likely optimal. Airport prices do not reflect either the full social costs or market values of the capacity provided. There also are administrative and statutory limits on how intensively certain airports can be used and, in some cases, limits on the markets that can be served (e.g., perimeter rules are one such limitation).

2. METHODOLOGY

2.1 INTRODUCTION

The focus of the study was to examine what factors lead to successful development of alternate airports and to determine what (if any) regulatory, statutory, policy or market limitations might impede the more intensive use of existing airport capacity at alternate airports. The study generally considered alternate airports within 70 miles of the FAA Benchmark airports. The particular focus of the case studies was on metropolitan areas where the primary airport(s) experienced high levels of airport congestion and delay. Also, some large hub airports, though not presently suffering significant delays, are in a situation where they have very limited opportunities for expansion because of physical limitations of the airport property or other barriers to expansion, such as environmental problems, or community opposition.

Whether delay or physical limitations are the problem at specific airports, it is appropriate for government to investigate the long-term potential solutions to airport congestion. Even though aviation industry growth may have slowed under present conditions, it is expected that growth will return at some point, and congestion with it. If existing capacity can be used to solve some of the long-term needs of metropolitan regions, it makes the provision of airport capacity simpler and hopefully less expensive to society.

In addition to using existing infrastructure to reduce the costs of developing additional capacity in delay prone areas, alternate airports may provide other potential benefits. These include the following, among others:

- Reducing demand and delay at congested Benchmark airports
- Reducing the time and cost needed to bring new capacity on line
- Alternate airports will likely be located closer to some passengers' true origins and destinations reducing access time and cost for them
- Promoting competition among carriers, especially where there is a hub airport dominated by one or two carriers

It is worth noting that many issues involved in the study areas are complex, and this project could not address all of them in detail. GRA concentrated on identifying

impediments to alternate airport use, and identifying whether there are actions that could be taken at the Federal level to overcome these.

2.2 APPROACH

This project used a case study approach for the analysis of alternate airport use. In the four cities selected for detailed study, GRA visited each selected city/region to interview regional planning organizations, local airport officials and relevant FAA officials to investigate the research questions for this project.

The interviews were structured to identify any impediments to the use or development of alternate airports in major metropolitan areas. The interviews followed an informal approach; no formal questionnaire was utilized, and thus no summary tabulations were developed from the interviews. However, the key findings of the interviews are summarized in the discussion of each study area.

2.3 THE DEFINITION OF ALTERNATE AIRPORTS FOR THIS STUDY

This review of potential alternate airports took a practical view in defining existing alternate airports to the busiest airports in the U.S. The goal was to consider the most likely alternate airports in each study area. The first step was to develop criteria for airports to be included in the study. The following discussion covers the logic used to define the alternate airports for inclusion in this study.

2.3.1 Selection of Alternate Airports

The first characteristic for an alternate airport is that it must be within some reasonable proximity to the target benchmark airport in order to be a viable substitute for some travelers. This distance in miles is debatable, but in order to capture airports that could be relevant as alternates, the study defined a distance of 70 miles from the Benchmark airports as a general limit. The distance defined is direct miles, not road miles or road time. Actual road mileage is usually higher than direct mileage. Travel time of course depends on average speed.

The second consideration concerns existing facilities. In order to be practical, we wanted to consider those existing airports that would not need major runway expansion before they could handle a significant level of commercial service. As a rule of thumb, we assume that an existing airport would be impractical if it did not have at least one hard surface runway with a length of approximately 6,000 feet. Terminal and access facilities can be more easily modified than runways, and we did not want the study to include airports that would need greatly expanded runway facilities before

they could be used for commercial service. Admittedly, the 6,000 feet is somewhat arbitrary. (Only one airport with a main runway under 6,000 feet is included, John Wayne Airport in the Los Angeles region, which has a runway length of 5,700 feet.) However, it appears to be reasonable since many models of small jet aircraft can serve medium distance markets from most airports with a 6,000-foot runway.

In addition, we eliminated as practical alternatives airports that do not currently have (or until recently had) either cargo or scheduled passenger service. This eliminates those airports that are basically general aviation airports. This assumption was made because converting a general aviation airport to one with significant scheduled passenger service involves a major change in function of the airport. This would raise issues that were beyond the scope of the present study. It would likely result in focusing on a set of problems more like that of a new airport, rather than an expanded use of an existing airport.

Finally, we include as alternate airports all military airports, whether closed or open. In practice, we did not routinely visit military airports.

Thus, the list of possible alternate airports involves military airports and present commercial airports within 70 miles of the Benchmark airports that have at least one runway with a minimum length of approximately 6,000 feet.

As noted above, each of the FAA Benchmark airports was reviewed for possible inclusion in the study, and four case study airports were selected. These were Boston Logan, Los Angeles International, New York (LaGuardia, Kennedy and Newark) and St. Louis Lambert. Figure 2-1 summarizes the complete "first cut" list of airports within the selected study areas.

Figure 2-1
Potential Airports in Case Study Areas

Boston - Logan - Potential Alternate Airports							
Airport Name	**City**	**State**		**LOCID**	**Airport/ Role**	**Miles/ Target**	**Miles/ CBD**
Hanscom Fld	Bedford	MA		BED	C	16.2	13.4
Worcester Regional	Worcester	MA		ORH	C	45	41.6
Manchester	Manchester	NH		MHT	C	45.1	43.8
T. F. Green	Providence	RI		PVD	C	49.3	47.6
Pease Intl.	Portsmouth	NH		PSM	C	50.2	51.2
Otis ANGB	Falmouth	MA		FMH	M	54.8	56.2

Los Angeles International - Potential Alternate Airports							
Airport Name	**City**	**State**		**LOCID**	**Airport/ Role**	**Miles/ Target**	**Miles/ CBD**
Long Beach	Long Beach	CA		LGB	C	17.1	16.7
Burbank-Glendale-Pasadena	Burbank	CA		BUR	C	18.1	12.3
Ontario Intl	Ontario	CA		ONT	C	46.9	38.6
Palmdale	Palmdale	CA		PMD	C	50.9	42.4
Los Alamitos AAF	Los Alamitos	CA		SLI	M	23	21.3
Point Mugu NAS	Point Mugu	CA		NTD	M	42.6	48.7
March AFB	Riverside	CA		RIV	M	66	59.2
San Bernardino Intl.	San Bernardino	CA		SBD	C	68	59.7

Kennedy/LaGuardia/Newark - Potential Alternate Airports							
Airport Name	**City**	**State**	**Close To***	**LOCID**	**Airport/ Role**	**Miles/ Target****	**Miles/ CBD****
Lehigh Valley International	Allentown	PA	EWR	ABE	C	N/A	N/A
Westchester County	White Plains	NY	E/J/L	HPN	C	N/A	N/A
Long Island Mac Arthur	Islip	NY	E/J/L	ISP	C	N/A	N/A
Stewart International	Newburgh	NY	E/J/L	SWF	C	N/A	N/A
Trenton Mercer	Trenton	NJ	E/J/L	TTN	C	N/A	N/A
Calverton Naval Weapons	Calverton	NY	J/L	CTO	M	N/A	N/A
Willow Grove NAS	Willow Grove	PA	EWR	NXX	M	N/A	N/A
McGuire AFB	Wrightstown	NJ	E/J/L	WRI	M	N/A	N/A

*Some airports are close to more than one of the three NY benchmarks.
**A single distance does not apply because of multiple benchmark airports and business centers in the New York area.

St. Louis Lambert - Potential Alternate Airports							
Airport Name	**City**	**State**		**LOCID**	**Airport/ Role**	**Miles/ Target**	**Miles/ CBD**
Scott AFB/MidAmerica	Belleville	IL		BLV	C	31.6	20.6

C = Commercial
M = Military

3. AIRLINE INDUSTRY FACTORS

3.1 INTRODUCTION

Before summarizing the results of the case studies, it is appropriate to consider fundamental factors that affect the way airlines do business, and how this might affect their propensity to serve alternate airports.

From an *a priori* understanding of the airline industry, it can be seen that there are strong reasons why airlines like to concentrate service at major airports in large metropolitan areas. The reasons for airlines eschewing service at secondary airports are complex, but fundamentally go to airline operating economies, particularly economies of scale in an airline's airport operations. Airlines find that simple operations have intrinsic efficiencies. For example, the economics of the business quickly teach that a minimum number of aircraft types are crucial to efficient operations. Likewise, marketing and sales managers see significant efficiency in single airport operations, as do airline operations managers. There are fixed costs in establishing additional airline stations at multiple airports within a region.

3.2 ECONOMIES OF SCALE AND THE S CURVE

There are clear economies of scale in an airline's airport operations. Consider aircraft servicing at an airport: a basic ground crew includes (among many things) a certain number of baggage handlers, pieces of equipment, and equipment operators. One shift of employees (and the associated equipment) at an airport may be able to handle two, three or more aircraft an hour, so a properly scheduled airport operation might use a single crew to handle more than twenty aircraft in a shift. If there are only ten operations in the shift, then there is excess capacity because the same personnel might be used to handle more operations, without an increase in the size of the basic crew or in the number of crews. Economies like this are found in many other aspects of an airline's airport operations. Ticketing crews are similar to ground service crews. The economies of scale in airport station costs are a very strong reason for an airline to want to keep its operation at one rather than two airports in a region[5]. In addition to

[5] In the example above dealing with ground operations, on the one hand, going from ten to 16 operations at one airport results in a decrease in ground cost per operation from X/10 to X/16. If these airport operations are spread over two airports, the ground cost per operation is arguably doubled to 2X/16, if the same size ground crew is required at each place. Of course, there are refinements in the cost area that make the example a little oversimplified, and this is only one cost element. However, economies of scale in an airline's airport operations is a consideration in the management of an airline. There has to be a compelling reason for an airline to split its operation between two airports.

cost factors, airline marketers see self-diversion in splitting operations between two airports in a single large metropolitan region.[6] Because of cost factors and self-diversion, airlines generally avoid breaking up what is basically perceived to be a single market so that operations are split between two airports.

Another factor reflecting airline preference for serving only one airport in a metropolitan area is the S-curve, a concept deeply embedded in airline marketing. The S-curve relates to the marketing concept that says the share of an airport-to-airport market relates to the share of frequencies in the market in such a way that at low frequency share levels, an airline obtains a lower market share than the share of frequencies, while the dominant carrier in a market obtains a market share premium. An example would be that at an airport like Philadelphia, marketers see more benefit in an added flight from Philadelphia to Orlando, (where they may already have two flights against a competitors two flights) say, than a flight to Orlando from an airport near Philadelphia (like Allentown, PA), where there might be no non-stops. The airline perceives that if they went to three flights from two at Philadelphia, they would get more than 60 percent of the local traffic as a dominant carrier (with three of five total hypothetical flights). Additionally, the airline may believe that the traffic obtained in Allentown would be at least half self-diversion, making the economics of the flight suspect, even if the load factor and revenue of the Allentown-Orlando flight were good.

3.3 SERVICE PATTERNS AT ALTERNATE AIRPORTS

3.3.1 New Carriers

Service by new entrant small carriers at secondary airports is somewhat different from an established carrier considering whether to serve a major airport and a secondary airport. New entrant carriers face two basic problems - the big fish/small pond vs. small fish/big pond question, and the related question of which option invites the most formidable competitive response from other carriers. History seems to indicate that whether the new entrant goes into a large or small airport, there will be a competitive response. Most successful small new entrants opt for the large established airport market, not the smaller airports.[7]

Eastwind, with operations centered in Trenton, NJ, was based on the approach of starting up in a new market and failed. Trenton is near two large hub airports, Philadelphia (PHL) and Newark (EWR), and thus had access to passengers in these large markets. However, Eastwind never reached a viable scale of operations at

[6] Self-diversion refers to the situation in which a carrier providing new service at one airport diverts traffic from itself at the other airport.

[7] This is not always the case as noted below for Southwest. In Europe, the low-cost Ryanair favors alternate airports.

Trenton to compete with the large level of service provided by carriers at EWR and PHL.

Pan American (in its most recent rebirth) has relied heavily on using secondary airports. However, Pan American has not been profitable, and it has a history of trying new markets and pulling out. Among other service attempts, Pan American served Gary, Indiana as a surrogate for Chicago, Allentown as a surrogate for Philadelphia and MidAmerica as a surrogate for St. Louis. Pan American is no longer serving these markets. However, Pan American still flies to some alternate airports, such as Portsmouth NH, north of Boston, and Sanford FL, near Orlando.

To be successful at an alternate airport, a carrier needs a major advantage like superior service, name recognition, and/or low fare service. The only recent example where a small new entrant has had all of these was the start up carrier, JetBlue. JetBlue is a small carrier and a new entrant, but it offers a strong product, has great name recognition, and as a low-cost carrier, it offers a low fare structure. It is successful in several alternate airport markets, including Oakland, Ontario and Long Beach, all in California. It also benefited by obtaining a large block of operational slots at Kennedy airport in New York, and at Long Beach in California.[8] In short, JetBlue has the needed competitive advantage to make alternate airport use profitable.

3.3.2 Southwest

It is important to note that Southwest Airlines is a large carrier, not a small one, and it is an exception to most standard considerations about airport use. Southwest's philosophy on airport selection has historically been to select markets that are large and that can be served without exposure to congestion. The low-fare Southwest operation has historically required relatively delay-free operations combined with simple non-hubbing routes and high aircraft utilization. For years this basic business model kept them out of delay prone markets, mostly large East Coast markets. Recently, Southwest broke into these markets by using alternate airports that gave them access to the larger East Coast markets without exposing their operation to the delays prevalent at the large airports. Southwest has gone into Baltimore, Maryland, Providence, Rhode Island, Manchester, New Hampshire and Islip, New York as a result of this approach. Of course, Baltimore is part of the larger Washington-Baltimore market area, while both Providence and Manchester are close to the large Boston market and Islip is close to the large New York City market.

Southwest also serves other alternate airports, such as Oakland and Chicago-Midway. Again, the reason for airport selection is primarily to avoid the delay at the

[8] Both airports have administrative controls over the number of flights. Some suggest that by obtaining a number of the scarce slots at each airport, JetBlue avoids a direct competitive response.

primary airports of San Francisco and Chicago-O'Hare. It also avoids the need to acquire slots at O'Hare, which is governed by the High Density Rule. Southwest is the market maker as a low cost carrier, and while it is concerned about competitive fare or service responses, it has shown the ability to compete against the major carriers at every turn.

3.3.3 Summary

In summary, there is a strong disposition on the part of existing carriers to utilize the major airports in large metropolitan markets. This is caused in large part by the economics of the airline business, particularly economies of scale associated with operational efficiency at airline airport stations. Further, history has shown that new small carriers generally start service at the major airports, not minor ones. New carriers, large or small, seem to be successful at alternate airports only when they have a very strong market position because of low-fare service and because they offer a superior product.

Of course, carriers that rely on hubbing have little incentive to use alternate airports. By their nature they concentrate service in hub banks that connect many markets over a single hub. In general, they only use service to alternate airports to compete with carriers at the alternate, by connecting the alternate to their hub network.

4. CASE STUDY SUMMARIES

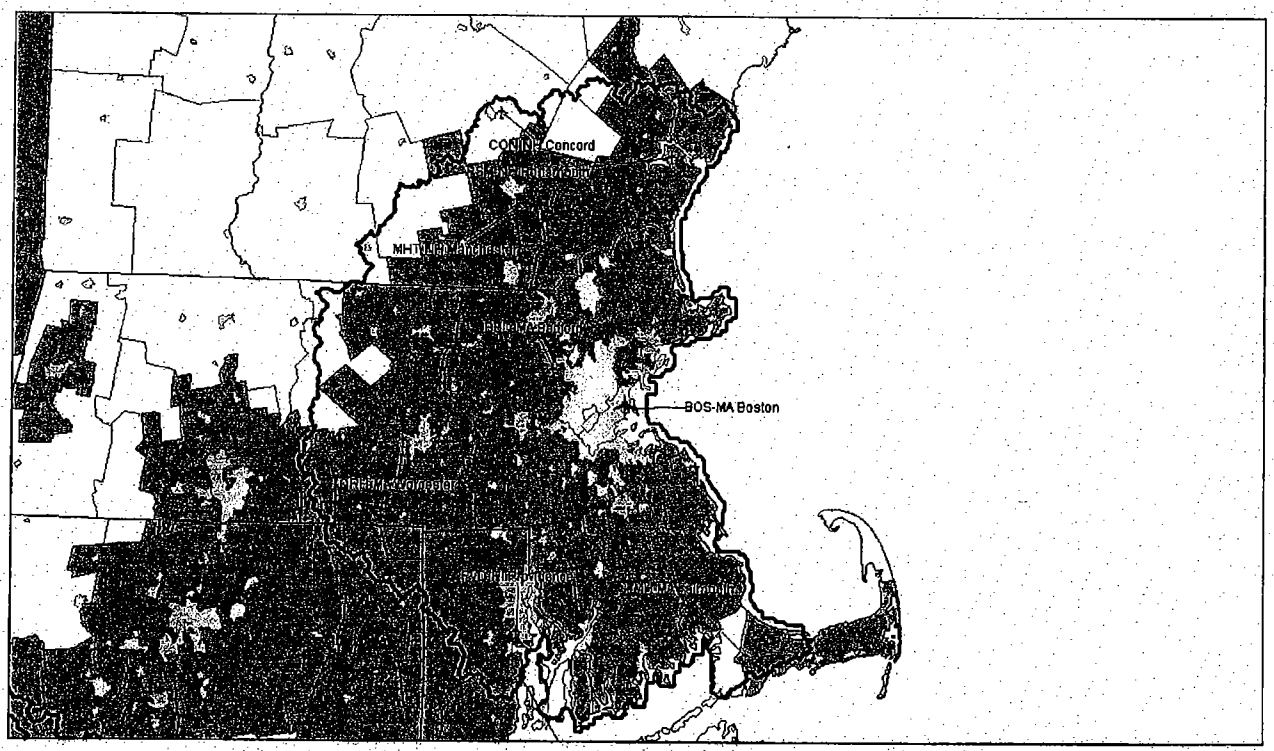
This section of the report summarizes the four case studies conducted as part of this project.

4.1 BOSTON LOGAN AIRPORT AND THE SURROUNDING REGION

4.1.1 Boston Study Area

Boston Logan airport (BOS) is the largest airport in the New England area, and the map in Figure 4-1 shows its location as well as other commercial airports within approximately a one-hour drive of BOS.

Figure 4-1
Boston Study Area



4.1.2 Alternates to Boston Logan

The list of alternates to Boston Logan Airport is shown in Figure 4-2. The alternate airports are classified by current role: Existing commercial service (C), military service (M) or no commercial service (N).

Figure 4-2
Alternate Airports for Boston Logan Airport

Boston - Logan - Potential Alternate Airports						
Airport Name	**City**	**State**	**LOCID**	**Airport/ Role**	**Miles/ Target**	**Miles/ CBD**
Hanscom Field	Bedford	MA	BED	C	16.2	13.4
Worcester Regional	Worcester	MA	ORH	C	45	41.6
Manchester	Manchester	NH	MHT	C	45.1	43.8
T. F. Green	Providence	RI	PVD	C	49.3	47.6
Pease International	Portsmouth	NH	PSM	C	50.2	51.2
Otis ANGB	Falmouth	MA	FMH	M	54.8	56.2

Massport is an independent airport authority of the Commonwealth of Massachusetts, and controls Hanscom Field, and Worcester Regional Airport, as well as Boston Logan. Manchester and Providence are in the contiguous states of New Hampshire and Rhode Island. Pease International is a former military base in New Hampshire and Otis Air National Guard Base is an active military airport in Massachusetts.

4.1.3 Recent History and Developments

In 1995, Massport and FAA regional staff developed a study of aviation demand and capacity covering the entire New England region. It was done with the cooperation of all the state authorities (Massachusetts, Maine, New Hampshire, Vermont, Connecticut and Rhode Island) and the commercial airports in the region. Massport was instrumental in getting the study started, as they were concerned about what would happen when BOS reached its operational limits, which was believed to be in the near, rather than the distant future.

The resulting study identified the future need for additional commercial service at airports in addition to service at BOS, if the demand for air travel in New England was to be satisfied. As a result of the study, there were even ad campaigns, paid for partly by Massport, aimed at making New England travelers aware of options for air travel other than Boston Logan.

While the regional aviation study indicated a need for additional facilities at alternate airports, little changed in the picture of air service in the New England region until Southwest Airlines entered two alternate airports, first at Providence in 1996 and then at Manchester in 1998. It was stated in interviews that Southwest came to serve these new points as its own decision, as part of its business plan to expand into the Northeast US. However, it was noted that the entry of Southwest was greatly facilitated by the fact that both Providence and Manchester airports had been improved and were ready for Southwest. Both airports had started improvements that were identified as a result of the regional planning study. Appendix B to this report, details the fare and service impacts that the entry of Southwest into Providence and Manchester have had on the Boston region's air service.

Southwest was successful at both Providence and Manchester because the key elements were present. First, each market had a local base of traffic. Second, the highway system provided access to these airports from most of the Boston region. Third, the airport infrastructure was adequate to support its operational needs. Finally, Southwest had a competitive product at the alternate airports to serve significant portions of the Boston market. In short, the traveling public supported it and the transportation facilities were available for its service initiatives.

4.1.4 Key Alternate Airport Concerns

Worcester—Worcester is managed by Massport, but has a serious surface transportation access problem. The approach to the airport involves vehicle travel over several miles of local roads. The road situation is a sensitive issue, since changing it would involve considerable funding requirements, but more importantly, major property taking along local streets. The local issues associated with solving the access problem are significant. In addition, PVD is very accessible to Worcester by interstate-quality roads, and Worcester is similarly very close to BOS. Service at Worcester is minimal today, and there is little prospect for change in the future without improved access.

Impediments to Development

- Local opposition to road improvements
- Market position vis-à-vis competitive service at PVD and BOS

Providence—Providence is well situated on interstate highways, and as pointed out above, has had significant growth since 1996 when Southwest entered the local market. The airport's location near major highways is beneficial, and yet creates a problem for expansion. Major highway rerouting would be required for any significant runway extension. The existing runway length is adequate for most flight segments, but long distance non-stop travel with current aircraft is limited.

Local environmental laws also pose an impediment to growth at PVD because the delegation of veto authority for a project is given to the local community. A state law provides that if any amount of wetlands is impacted by a project, the local jurisdiction can stop the project. This applies to Providence's runway development options because the airport abuts wetlands.

Funding from state sources was reported by one source to be a problem at times, because the airport competes with state projects of every variety. For example, a proposed inter-modal facility that would have brought limited rail service to the airport failed due to lack of legislative support for the state share of the project funding requirements.

Impediments to Development

- Runway expansion would result in significant costs associated with rerouting major highways
- Delegation of veto authority over projects given to local communities
- Local funding limitations

Manchester—Manchester has had significant infrastructure development in recent years, and has had high traffic growth associated with the entry of Southwest Airlines in 1998. Development of one section of a highway is still needed to keep traffic off a short distance on local roads to access the airport. It will soon have completed improvements that expand runway length to 9,000 feet, which will allow transcontinental non-stop flights.

When asked about regional concerns, one source at Manchester raised the question of distribution of the discretionary AIP funds in the region. It was felt that Manchester has had to put more of its own money into some recent improvements than the average airport, due to the fact that Boston Logan gets considerable discretionary funding. For example, there was only an 18 percent share of federal money in Manchester's new runway, compared to a 50 percent share at most larger airports. Figure 4-3 shows that there clearly has been substantial AIP discretionary funding to all airports in the Boston region over the past 15 years, and that discretionary funding as a percent of total AIP funding is fairly high for all airports. Thus, while an individual project may cause concern to managers, the overall pattern shows that Manchester has fared well in receiving AIP funds over the 15-year period, and had the highest level of discretionary funding (Discretionary/non-noise) of the airports shown, except for Pease.

Figure 4-3
AIP Funding (FY 1988-2003)

	Boston Logan	Providence	Manchester	Worcester	Pease
Entitlement	$100,568,100	$33,882,904	$27,528,664	$9,862,615	$2,382,582
Discretionary	$42,415,141*	$40,896,823	$60,860,351	$15,802,948	$30,327,022
Noise Discretionary	$84,697,459	$51,754,767	$25,774,107	$147,619	$757,471
Total Discretionary	$127,112,600	$92,621,590	$86,364,458	$15,950,567	$31,084,493
Total AIP	$227,680,721	$126,504,494	$113,893,122	$25,813,182	$33,467,075
% Discretionary	56%	73%	76%	62%	93%

*All these funds were for security-related projects; $30 million of this was in 2002.

Staff at this airport believed that there is a need for greater imagination in distribution of federal funds supporting air transportation. For example, it was suggested that, if there are demand management fees collected at congested hubs, it should be possible to redistribute these monies to other airports in the region, even if not owned by the same entity. There also should be consideration that part of any demand management fees becomes part of a national fund, so that "national" fees could be used for an expansion project in an area other than the one where they were collected.

Impediments to Development

- Highway access remains a concern

Other Airports—Other airports in the region include Pease International Airport in New Hampshire and Otis Air National Guard Base (ANGB) in Massachusetts. Pease has commercial service through Pan American. Development of additional passenger service is expected to be difficult at Pease because it is unlikely that carriers there can successfully compete with Manchester. Pease is beneficial to the regional airport system as it provides overnight aircraft parking for charter aircraft operating out of Boston Logan. Considerable AIP funding ($33.5M) has been provided for the preservation of its 12,000-foot long runway for long-term regional needs, including the potential for air cargo. Otis ANGB is unlikely to play a role in commercial passenger service in the foreseeable future.

4.1.5 Summary and Conclusions

The Boston area is by and large a success story for regional aviation planning, and for the development of viable alternate airports. However, it was the entry of Southwest into Providence and Manchester that made the service successful at those airports. Planning in 1995 helped authorities put infrastructure improvements in place so that Southwest would have what it needed to begin service at the two Boston alternate airports in 1996 and 1998. Both Providence and Manchester are now

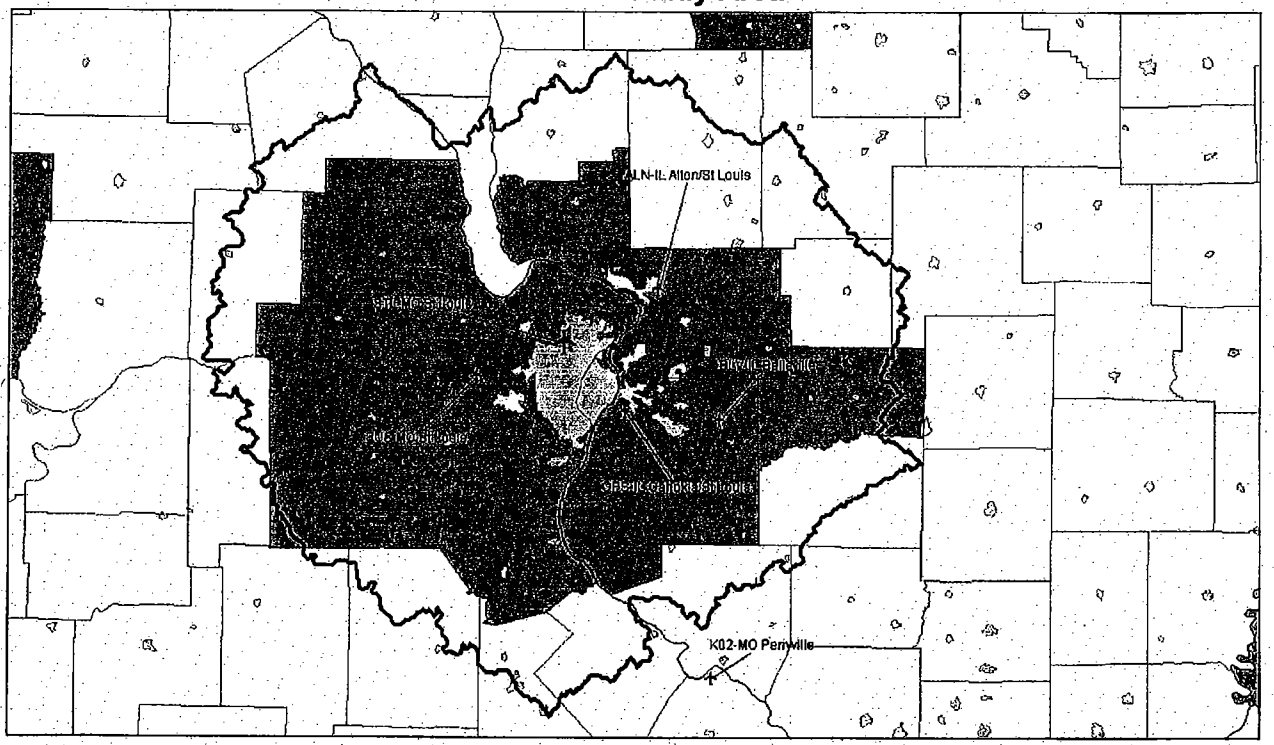
competitors to Boston for air travelers in the region. Beyond Providence and Manchester, there are additional airport resources available in the region for the long-term needs of aviation. Environmental laws restrict airport development to a significant degree and airport highway infrastructure costs (monetary and political) for improved airport access can be considerable, and not always adequately funded.

4.2 ST. LOUIS LAMBERT INTERNATIONAL AND SURROUNDING REGION

4.2.1 Study Area

St. Louis Lambert International Airport (STL) is 12 miles west of the St. Louis central business district, and St. Louis is on the border of Missouri and Illinois. The map in Figure 4-3 shows its location as well as the alternate airport at MidAmerica (BLV), and major general aviation airports in the region.

Figure 4-4
St. Louis Study Area



4.2.2 Alternates to St. Louis Lambert

There is only one alternate identified for STL, at MidAmerica (BLV) in Illinois, as shown in Figure 4-4. MidAmerica Airport is a joint-use military facility and is co-located with Scott Air Force Base.

Figure 4-5
Alternate Airports for St. Louis Lambert Airport

St. Louis Lambert - Potential Alternate Airports						
Airport Name	City	State	LOCID	Airport/ Role	Miles/ Target	Miles/ CBD
Scott AFB/MidAmerica	Belleville	IL	BLV	C	31.6	20.6

4.2.3 Recent History and Developments

The St. Louis region has history of airport planning that extends over some thirty years. A large part of the history involved determining whether a new regional airport should replace STL. Consideration was given to alternate airport sites throughout the region, including a site in Illinois and a site west of Lambert International in Missouri. Notwithstanding the results of these planning studies, however, STL remains open and is being expanded considerably, including adding a new runway that will reduce congestion and delay. This added capacity at STL will allow for additional growth into the foreseeable future.

The St. Louis region was included in this study primarily to consider the development of alternate passenger capacity at MidAmerica Airport in Belleville, Illinois. MidAmerica is located off Interstate 64 about 21 miles east of the St. Louis central business district. The airport has joint civil-military use and is co-located with Scott AFB. In the 1990's, the airport was improved by adding a second major runway and other improvements, including a commercial terminal with about 50,000 square feet of space.

The purpose of developing Scott AFB for joint use was to provide passenger and cargo service to southwestern Illinois. It is stressed that the developments at this airport also benefited military users, which include the Illinois Air National Guard. Partly because this development, the Illinois Air National Guard was able to move some activity from Chicago O'Hare Airport to this airport, thus lessening some of the congestion at O'Hare and freeing up some valuable on-airport land.

The commercial development of passenger service at MidAmerica has been unsuccessful to date. The major user of the passenger facilities was Pan American that, until 2002, operated a limited number of flights, primarily on a route between Orlando's

Sanford Airport and Gary, Indiana, near Chicago. There is no commercial passenger service at MidAmerica today.

4.2.4 Key Alternate Airport Concerns

MidAmerica—MidAmerica is struggling to find a market that will lead to more utilization of the airport and potentially more jobs in the region. Present efforts at development lean toward finding a cargo market use for the airport. The air cargo business in the region is currently centered at STL.

Regional planning did not play a major part in the development of MidAmerica's passenger facility, as it was done largely independently. However, the local Metropolitan Planning Organization approved the joint use of Scott.

Impediments to Development

- Market factors have kept MidAmerica underutilized
- The St. Louis market for domestic originations was only about 6 million passengers in the year ending 2Q2001, well below the 10 million "threshold" level for an area to sustain more than one successful passenger airport
- The centroid of passenger trip origination and termination points is west of STL and is moving further west as development of the area proceeds, thus making an Illinois airport further from the center of demand as time passes

Other Airports—The only other airports in the St. Louis region serve general aviation and were not studied as alternates.

4.2.5 Summary and Conclusions

The St. Louis area is presently adequately served by St. Louis Lambert Airport, and the addition of new runway capacity, already under construction, will keep STL out of the category of "congested" airports for many years to come. MidAmerica is a joint use facility that is working to find a market niche, particularly in the cargo arena.

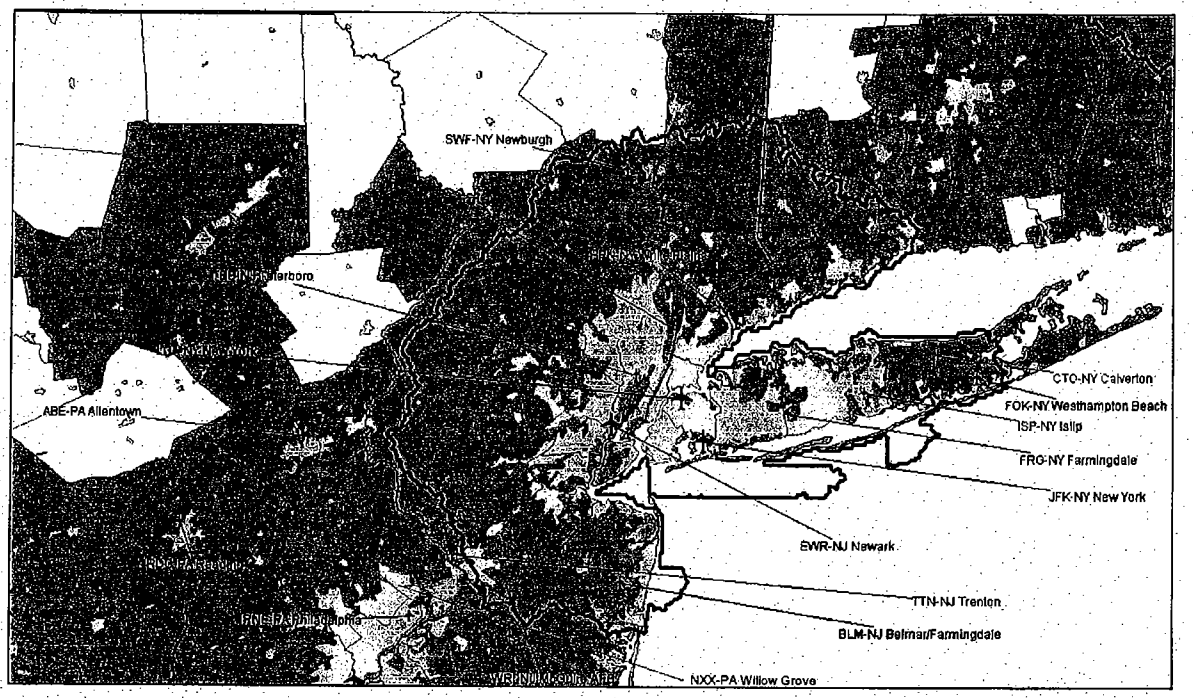
The lesson to be learned from this alternate airport is that to assure additional passenger capacity (particularly where the capacity involves a *de novo* facility) is developed appropriately, such development should result from a regional planning effort.

4.3 NEW YORK REGION AIRPORTS AND THE SURROUNDING REGIONS

4.3.1 Study Area

The New York/Northern New Jersey region is the largest metropolitan market in America, and it contains three large airports that are congested facilities on the FAA Benchmark airport list, LaGuardia (LGA), John F. Kennedy (JFK) and Newark (EWR) airports. LaGuardia and Kennedy are both on the New York side of the Hudson River, with Kennedy being primarily an international airport and LaGuardia being a domestic airport. Newark is on the New Jersey side of the Hudson River, and it is a major domestic airport as well as a growing international airport, and serves as a hub for Continental Airlines. Figure 4-5 shows a map of the region, as well as the alternate airports in the region.

Figure 4-6
New York Study Area



4.3.2 Alternate Airports

The list of alternates to the three New York airports is shown in Figure 4-6. The airports listed either have commercial service (C) or are military airports (M).

Figure 4-7
Alternate Airports for NY Airports

Kennedy/LaGuardia/Newark - Potential Alternate Airports							
Airport Name	**City**	**State**	**Close To***	**LOCID**	**Airport/ Role**	**Miles/ Target**	**Miles/ CBD**
Lehigh Valley International	Allentown	PA	EWR	ABE	C	67	76
Westchester County	White Plains	NY	E/J/L	HPN	C	22	27
Long Island Mac Arthur	Islip	NY	E/J/L	ISP	C	40	47
Stewart International	Newburgh	NY	E/J/L	SWF	C	52	53
Trenton Mercer	Trenton	NJ	E/J/L	TTN	C	60	54
Calverton Naval Weapons	Calverton	NY	J/L	CTO	M	57	64
Willow Grove NAS	Willow Grove	PA	EWR	NXX	M	62	71
McGuire AFB	Wrightstown	NJ	E/J/L	WRI	M	65	59

*Some airports are within 70 miles of more than one of the three NY benchmarks.
Distance to target airport is EWR when closest or LGA.
E = EWR; J = JFK; L = LGA

4.3.3 Recent History

The New York/Northern New Jersey region has had three busy airports for most of the last forty years. Delay has been endemic to the area's airports, and both LaGuardia and Kennedy airports have been subject to the High Density Rule (HDR) for over thirty years, a rule that limits hourly operations at the airports for selected periods of time every day. Newark, while not currently subject to HDR limits, is still subject to considerable delay. (The HDR has been in place since 1969, and while limits were set for Newark as well as Kennedy and LaGuardia, Newark is not currently subject to HDR flight limits.) Basically, the three New York area airports operate at or near capacity, and have extremely limited options for development of added physical capacity. LaGuardia is unable to expand, and Newark and Kennedy could only add to their runway facilities at considerable expense and environmental impact.

Several alternate airports ring the metropolitan area in Long Island at Islip, north in New York at Westchester and at Stewart (a former Air Force Base), south in Pennsylvania at the Lehigh Valley International Airport near Allentown, and at Trenton in New Jersey.

There has been no significant regional airport planning in the New York area in many years. The region is complicated because it involves two states in a major way, New York and New Jersey and two states in a lesser way, Connecticut and Pennsylvania. There had been a metropolitan area planning group at one time, but it no longer exists. The Port Authority of New York and New Jersey is a bi-state authority, but its charter currently limits it to an area approximately 25 miles from the center of New York City, while alternates to the three major airports are considerably beyond this distance.

Presently, the Port Authority of New York and New Jersey, the FAA Eastern Region, and several other regional or state planning agencies are working on a study to identify the travel patterns of air travelers from New Jersey, the New York area, and parts of Pennsylvania and Connecticut. This study is aimed at establishing a base for regional airport planning, as well as establishing a database for the travel patterns in the area from southern Connecticut to southern New Jersey.

4.3.4 Key Alternate Airport Concerns

Islip—The Town of Islip owns Long Island McArthur Airport. It has reasonably good highway access, and is close to the Long Island Railroad, which runs through Long Island to New York City. It has limited opportunity to add new runway capacity because it is surrounded by residential development.

Southwest Airlines recently entered the Islip market, and significant traffic growth followed their entry. Islip fits the Southwest business model for major markets, as it is close to New York, but it is not subject to the delay found at the three Benchmark NYC airports. Southwest is financing the expansion of the passenger terminal to accommodate eight additional gates.

Recent growth in traffic has created greater noise problems at the airport. Community concerns about noise are only expected to increase with future traffic growth.

Impediments to Development

- No major expansion is likely for the runways
- Growing noise sensitivity because of increased activity

Westchester—Westchester County Airport is located in White Plains, in affluent Westchester County, NY. Commercial service is limited at Westchester, and there has been longstanding opposition on the part of the community to any major air carrier development of the airport. The airport also has a substantial amount of corporate activity.

Impediments to Development

- Longstanding civic opposition to air carrier development
- Affluent residential areas surround the airport that are concerned about noise

Stewart—Stewart International Airport is north of New York, on the west side of the Hudson River. It was formerly an Air Force base. It has a limited local population base, but future growth in the area should be significant. It has good access to the local

Interstate highways, but the distance to New York over congested highways limits its development potential. Stewart is one of the airports privatized under a recent FAA pilot program. Because Stewart is privately operated under a 99-year lease with the owner, the state of New York, the law requires a larger (than standard) percentage for local matching funds if discretionary AIP funds are sought. However, passenger facility fees may be imposed and collected by a privatized airport under the FAA's pilot program. The airport is actively seeking to expand operations, and the facility is large, with few noise problems.

Impediments to Development

- To truly be an alternate airport for the New York City market, significant improvements would be required so that access time to the CBD is reasonable

- Because of privatization, the cost of capital for development at Stewart is higher than at other airports. Among the factors are the less favorable tax treatment of airport issued debt (as compared with public airports), and a high local matching percentage when using Federal discretionary funds.

Lehigh Valley International—Lehigh Valley International Airport, near Allentown, PA, is adjacent to the northern New Jersey and Philadelphia markets. It is within 70 miles of Newark with good road connections, and is within 40 miles of a large part of the Philadelphia market. It has excellent facilities and expansion options. It is working on a master plan that will recommend future development of an additional runway and the possible extension of the two existing runways. The airport today serves about 500,000 enplanements. The major need at the airport is an improved base of air service to major cities and better linkages to air carrier networks.

Impediments to Development

- Distance from the New York segment of the market and competition from the Philadelphia market

Trenton—Trenton Airport is positioned adjacent to the middle and northern New Jersey and Philadelphia markets. It is within 60 miles of New York City, with good road connections, and is within 20 miles of a large part of the Philadelphia market. There are over 10 million people residing within 50 miles of Trenton. It has good runway facilities but needs a new terminal before substantial growth in air passenger service is possible.

The airport is largely unproven as a passenger market, since large air carriers have never provided much service here. A low-fare carrier, Eastwind, was unsuccessful

in attracting passengers at Trenton, and failed after a few years. Presently, USAir provides regional service with commuter aircraft in only one market, Bedford, MA.

The airport is situated near residential areas that have already voiced considerable opposition to airport expansion plans.

Impediments to Development

- A major terminal investment is required
- New carrier service might require a major environmental study before the terminal expansion can be approved.

Other airports—Other general aviation and military airports exist in the New York area. However, conversion of the general aviation airports to fill a major air carrier role is unlikely. As an example, Teterboro, owned by the Port Authority of New York and New Jersey, is a major general aviation airport, and operates near capacity already. It and other GA airports are in very busy airspace, where major air carrier facilities would be hard to locate. Conversion of any of the GA airports to air carrier use would trigger major environmental studies that would take an extended period of time, with limited likelihood of success.

Military airports in the area offer some long-term possibilities for development. While it may be a long time before a need is seen for an airport like McGuire AFB, in central New Jersey, it is a large property with potential for development. Development of this airport as joint use or civil use would require considerable time, expense and associated infrastructure development. However, the New York area has limited opportunities for new airports, as it is the most highly developed region of the country.

4.3.5 Summary and Conclusions

New York City and the surrounding region is probably the largest aviation market in the world, and its aviation facilities have suffered congestion for many years. Studies in the past have looked for a fourth airport site, with no success. By default, there will either be a major spillover effect on many of the alternate airports discussed above, or aviation demand will be held back because of the increased costs of air travel (including the cost of congestion and delay) at the three New York area airports resulting from the scarcity of capacity. FAA, however, is funding a multi-state study to get baseline data on air travel patterns in the New York region. This could be the beginning of a more extensive regional airport planning effort.

Regional airport planning is needed for this large four-state area, and it may be difficult to achieve, as no regional body appears to be in place to accomplish it. Land is

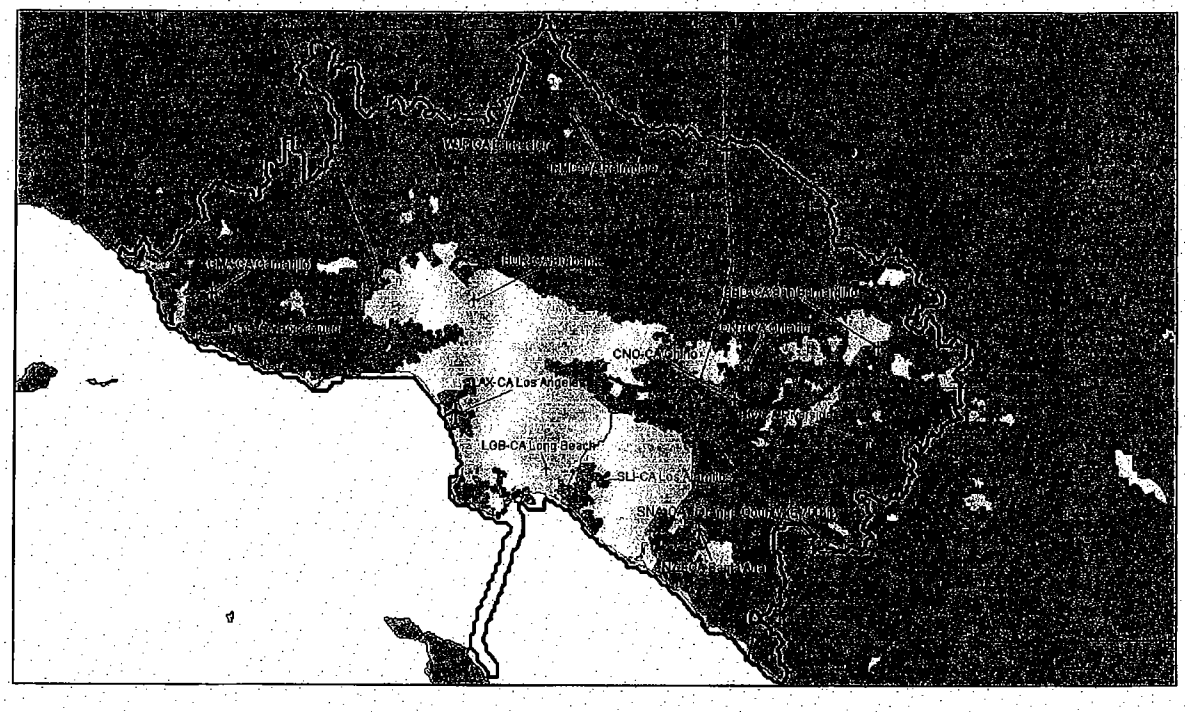
scarce for airport development or expansion, making it very important to find ways to effectively use existing capacity.

4.4 LOS ANGELES AND THE SURROUNDING AIRPORTS

4.4.1 Study Area

Los Angeles International Airport (LAX) is the key airport in the sprawling Los Angeles basin market. Figure 4-7 shows the location of LAX and the alternate airports in the region.

Figure 4-8
Los Angeles Study Area



4.4.2 Alternate Airports

There are seven airports identified as potential alternates to Los Angeles International Airport (LAX) as shown in Figure 4-8, along with three military facilities, one of which (March Air Force Reserve Base) is currently approved for joint civil use. The first four airports listed currently have a significant level of air carrier service. All airports either have or have had commercial service (C) or are current or prior military (M) facilities.

Figure 4-9
Alternate Airports for Los Angeles International Airport

Los Angeles International - Potential Alternate Airports						
Airport Name	City	State	LOCID	Airport/ Role	Miles/ Target	Miles/ CBD
Long Beach	Long Beach	CA	LGB	C	17.1	16.7
Burbank-Glendale-Pasadena	Burbank	CA	BUR	C	18.1	12.3
Orange County-John Wayne	Santa Ana	CA	SNA	C	41.9	38.8
Ontario International	Ontario	CA	ONT	C	46.9	38.6
Palmdale/USAF Plant 42	Palmdale	CA	PMD	C	50.9	42.4
San Bernardino International	San Bernardino	CA	SBD	C	68	59.7
Los Alamitos AAF	Los Alamitos	CA	SLI	M	23	21.3
Point Mugu NAS	Point Mugu	CA	NTD	M	42.6	48.7
March AFB	Riverside	CA	RIV	M	66	59.2
Southern California Logistics	Victorville	CA	VCV	C	70+	70+

Note: Southern California Logistics Airport is outside the 70-mile perimeter used for this study, but is mentioned below as a possible cargo airport for the area.

4.4.3 Recent History

The major factor that makes the Los Angeles area different from the other cases studied above is that there has been a significant level of regional planning in the region. The Southern California Association of Governments (SCAG) has completed several regional air transportation plans, most recently in August 2001. (*Regional Aviation Plan for the 2001 Regional Transportation Plan (RTP), August 2001*) The SCAG aviation plan for 2001 forecasts a total year 2025 demand of 167 million annual passengers (MAP), up from 89 million in 2000. It also projects a demand for 9.5 million tons of cargo, up from 2.9 million tons. Los Angeles World Airports (LAWA) is a regional aviation authority, as it has control not only of LAX but also Ontario (ONT) and Palmdale/USAF Plant 42 (PMD) airports. SCAG is also working on a regional airspace study for the Los Angeles area.

SCAG is a complex regional body, made up of representatives from Imperial, Los Angeles, Orange, Riverside, San Bernardino and Ventura Counties. While SCAG can plan for a future transportation system, it has no authority to implement plans. It must rely on the counties or other entities to develop the aviation system. Another regional organization, the Southern California Regional Airports Authority (SCRAA), was authorized some 20 years ago to develop airports for the region. However, it was dormant for most of those years, and may be lapsing into dormancy once again, as several member agencies have withdrawn or chosen not to appoint representatives. SCRAA, while it would have the authority to develop and operate airports is not independent, since it must get local backing should it wish to actually operate an airport.

The Los Angeles basin is a sprawling area connected by interstate highways and other freeways, as well as a few toll roads. Many roads are heavily congested, especially at rush hour. Access is a major problem for all airports.

Alternate airports at Long Beach, John Wayne and Burbank are subject to significant local limitations, with Long Beach and John Wayne subject to noise limits, and Burbank subject to terminal expansion problems. John Wayne airport has a maximum capacity limit of 10.8 million passengers (enplaned and deplaned in 2011) and Long Beach has a noise budget, which sets their air carrier operations capacity at a low level. Burbank has very limited expansion capability, and the community of Burbank is restricting development of a new terminal, thus effectively limiting growth opportunities.

The restrictions and limitations imposed on airports in the Los Angeles area are due in large part to their limited size, and local community environmental concerns related to aircraft noise, ground traffic and air quality. Figure 4-9 illustrates the size of the area airports. By comparison, Chicago O'Hare has 7,700 acres, Orlando has 14,700 acres, Dallas-Ft. Worth has 18,000 acres and Denver has the largest acreage of any U.S. commercial airport with 24,000 acres.

Figure 4-10
Airport Size for Los Angeles Area Airports

Airport	Acres
Burbank	440
John Wayne	500
Long Beach	1,100
Los Angeles	3,500
Ontario	1,460
Palmdale/USAF Plant 42	17,750
March Air Force Reserve Base	4,500
San Bernardino	2,003
Southern California Logistics	5,073

Source: SCAG Regional Aviation Plan, 2001

It is notable that several airports are in the so-called Inland Empire, a term applied to the eastern portions of the Los Angeles basin. These airports are all former (or current) military airports, and include San Bernardino, Southern California Logistics and March Air Force Reserve Base. All of the Inland Empire airports are over 60 miles from LAX, but in the long-term, they offer considerable additional capacity for commercial service in the region.

The 2001 SCAG study incorporated a regional demand distribution estimate for the area airports in 2025, as summarized in Figure 4-10.

Figure 4-11
Southern California Regional Aviation Plan Demand Estimates (2025)

Airport	Passengers in Millions	Air Cargo Thousands of Tons
Burbank*	9	73
El Toro	30	1,694
John Wayne*	8	25
Los Angeles Intl.*	78	2,976
Long Beach*	3	63
March Air Force Reserve Base	2	1,079
Ontario	30	2,246
Palm Springs	3	20
Palmdale/USAF Plant 42	2	124
San Bernardino Intl.	2	879
Southern California Logistics	1	320

*Indicates airport legally or physically constrained. Passengers are enplaned plus deplaned.
Source: SCAG Regional Airport Plan, August 2001.

El Toro MCAS is a former military airfield that had closed and was recommended for reuse as a civilian airport in the SCAG August 2001 RTP. SCAG is currently updating the RTP and El Toro MCAS will not be included. The facility is in Orange County, and opposition to development of the airfield as a commercial airport has been substantial. A recent voters' initiative has decided that the property should be used as a park, and not for aviation.

Revision of the SCAG plan will likely involve a new forecast of demand, as well as the likely distribution of future traffic among airports. Demand at LAX has been hard hit by the events of September 11, 2001, and the recent economic slowdown. Sources at LAX indicated that their passenger traffic is down some 20 percent, and recovery of traffic may be slower than previously anticipated.

We note that the SCAG aviation plan is part of a regional transportation plan that includes other modes of travel. The regional plan incorporates a proposed Intra-Regional Magnetic Levitation (maglev) high-speed rail system, designed to link subregions and strategic multi-modal facilities including major airports. This plan is presently unfunded, and there is no timetable at present for development of such a system. This type of airport access improvement could change airport choice considerations for passengers in the region.

The full story of the Los Angeles area airports is a complex situation, and it is well beyond the scope of the present study to describe it in detail. We remain focused on the general problems implied by the regional airport conditions, and whether there might be solutions to some of the alternate airport problems.

4.4.4 Key Alternate Airport Concerns

Burbank—Burbank has the smallest land area of the airports in the area, as shown in Figure 4-9. It is located north of LAX, and is owned by a joint airport authority. This authority comprises the cities of Burbank, Glendale, and Pasadena. Attempts to restrict operations because of noise have been a problem at the airport since the 1970's, and some of the associated litigation has gone to the US Supreme Court. The City of Burbank has been opposing airport expansion for a number of years.

The terminal is approximately 300 feet from an active runway, which is below the current FAA design standards for such separation. The airport authority has been trying to move and expand its terminal for a number of years, and has proposed to move it to a new piece of property. The City of Burbank has zoning authority over the property containing the airport and would not issue building permits for the construction of relocated terminal facilities unless the airport authority and FAA agreed to certain airport noise and access limitations proposed by the city. The FAA would not accept these conditions for policy and legal reasons.

Impediments

- Limited size restricts expansion
- Failure to obtain cooperation with the local government on airport terminal building relocation and modernization

John Wayne—John Wayne airport is heavily constrained as to development, due to the small size of the airport, high levels of general aviation activity, and heavy residential development near the airport. Noise limitations were established before national noise legislation and are therefore grandfathered. The limits were recently revised and limit the airport to a maximum capacity of 10.8 million annual passengers (enplaned and deplaned in 2011). The current traffic level is 8 million annual passengers, so significant growth is only possible if the agreement is modified further.

Impediments

- The noise limitations in place limit significant air carrier growth

Long Beach—Like John Wayne, Long Beach is heavily constrained as to development of air carrier activity. It has a long-standing noise limitation similar to John Wayne, but it involves a noise budget, rather than a passenger cap. Large air carrier departures are limited to 41 per day and smaller commuter departures are limited to 25 per day. SCAG estimates that Long Beach capacity is limited to 3 to 3.5 million annual passengers with these departure limitations. Long Beach may be able to

increase daily departures to some degree within the existing noise budget if quieter aircraft are introduced.

Impediments

- The noise limitations in place limit significant air carrier growth

Ontario—Ontario Airport is owned and operated by LAWA. Uniquely for the area, at present there is no major community opposition to expansion of air carrier service; the Ontario area welcomes the economic stimulus it would gain from greater airline activity. The airport is self sufficient, but significant improvement would require funding from LAWA, or additional federal or state resources. The California Air Resources Board presently limits Ontario to 12.5 million annual passengers and 125,000 air carrier operations yearly. However, it is expected that these limits can be modified upward, as future demand develops. The ultimate capacity of Ontario will be constrained by the existing runway configuration (two closely spaced parallel runways). The current master plan estimates the ultimate runway capacity as 33 million annual passengers, which is considered adequate through 2030.

Impediments

- Possible future environmental concerns, as traffic builds

Palmdale/USAF Plant 42—Palmdale/USAF Plant 42 is a joint-use airport. Los Angeles World Airports is the civilian airport sponsor. The facility is located over 50 miles from Los Angeles. Palmdale/USAF Plant 42 has a limited local market, and access through a mountainous area would have to be considerably improved to make it attractive to the remainder of the region. Palmdale/USAF Plant 42 has a large acreage, and significant capacity expansion capability.

Impediments

- Distance from the travel generation centers and poor access to these areas

San Bernardino—San Bernardino is a former military airport, and currently it has no scheduled airline service. It is about 20 miles east of Ontario airport, which has good airline service. The airport is currently trying to develop general aviation, the manufacturing and overhaul business, and other markets, rather than air carrier service. It has a terminal that is available for use, and has had recent inquiries about the ability to handle passenger flights.

Impediments

- Distance from the center of the air passenger and cargo market areas is significant, and most air travelers would be passing Ontario on the way to San Bernardino

- Potential airspace conflicts with Ontario

Other Airports

March Air Force Reserve Base—March is a joint-use airport owned and controlled by the USAF. The civil sponsor, the March Joint Powers Authority, is attempting to market their facilities for cargo and corporate operations. Impediments include distance from the center of the cargo market areas and competition from Ontario and San Bernardino International Airports.

Southern California Logistics Airport—This airport, located in the high desert east of the Los Angeles area in Victorville, is a former military base that is trying to develop a niche as a cargo airport for the region. It is located over 70 miles from LAX and the central business district of Los Angeles, and is thus beyond the range of this study. At the present time the airport is very isolated from any significant base of development, and its potential as an alternate to LAX for passenger service is limited.

Other Military Airports—There are two other military airports at Los Alamitos and Point Mugu, but these facilities are not expected to be useful alternates for commercial service at this time.

4.4.5 Summary and Conclusions

The situation with respect to airports in the Los Angeles basin area is extremely complicated because of environmental factors and existing legal decisions affecting the use of a number of airports. Existing airports have relatively small land areas, which exacerbates noise problems with neighbors. The air quality in the basin is among the worst in the nation, adding additional state regulatory limitations on aviation (as well as on other modes of transportation). The "not in my back yard" (NIMBY) movements militate against substantive airport developments, including almost all airports but the distant "Inland Empire" airports.

Regional planning is strong, but implementation of plans has been very limited. Of the alternate airports discussed above, only Ontario has both existing air service and significant expansion capability. Other airports at March, San Bernardino and Palmdale/USAF Plant 42 have significant expansion capability but are far from the population centers and are limited in being able to support significant levels of passenger service today. However, these airports (Ontario and the other three) seem to be where future expansion will occur. It will take time for a local market to become

established and will be primarily as a result of residential and other development in these areas. It will also take time for passenger demand to recover in the Los Angeles area. The spillover from congested airports like LAX could have the effect of shifting demand eastward. The only thing that might alter this market evolution is to make the distant facilities "closer" to demand by greatly improving infrastructure for airport access, such as by implementation of the high-speed rail maglev system, discussed above.

5. ANALYSIS

5.1 INTRODUCTION

As noted in the prior chapter, the four case studies show a range of outcomes on the use of alternate airports to relieve traffic congestion in major metropolitan areas. Clearly, Boston could be viewed as a success in that the development of Manchester and Providence as viable alternatives to Boston Logan Airport has succeeded. On the other end of the scale, the development of MidAmerica Airport in St. Louis, which has attracted no sustained commercial traffic, has not played a role in the St. Louis regional air transportation system. In fact, expansion of the existing St. Louis Airport will probably provide sufficient capacity for the foreseeable future. Thus the development of an alternate airport in this region has not yet been a success.

In the case of the remaining two regions, Los Angeles and New York, these were already viable multiple airport systems. The major questions are how to accommodate future growth and where such growth can be accommodated in each of these large metropolitan areas. In both cases, the large airports that can handle additional activity are located at the periphery far from the population centers. Access becomes a key issue in travel time, travel distance, highway congestion, and so forth. Close-in airports tend to be ones that have limited capacity, raise environmental concerns with additional growth, or otherwise may be unsuitable to handle any significant proportion of a region's future traffic.

In this section of the report, we discuss the institutional issues and the role that the airlines and the federal government could play in stimulating increased usage of alternate airports. Once the industry recovers from the downturn in traffic after September 11, 2001, there will be needs for capacity increases that could be met by alternate airports.

5.2 ROLE OF THE AIRLINES

As can be expected, airlines have mixed incentives regarding the usage of alternate airports. The large incumbent carriers within a metropolitan area tend to view an alternate airport in the following ways:

- Potentially added competition

- A facility that they will not serve because it would divert traffic from their operations at the primary airport, and result in duplication of station costs
- They would only serve such a facility as a competitive response to others unless there is a distinct catchment area identified with the alternate airport
- They would likely have incentives to oppose the use of primary airport revenue to develop alternate airports

Many of the smaller new entrants have focused service on the Benchmark airports within a region hoping to gain small shares of fairly large markets that would permit them to grow.

Niche carriers such as Southwest and JetBlue have had success in using alternate airports to serve major metropolitan areas to gain a competitive advantage. Other carriers, such as American Trans Air, Spirit and others also serve selected alternate airports as part of a broader pattern of air service that includes both primary and alternate airports. These carriers tend to choose alternate airports to gain a competitive advantage in a specific metropolitan area. However, they may use primary airports elsewhere.

Carriers generally will not establish service at airports where major developments are needed. They prefer to operate at a facility where such development has taken place.

5.3 STATUTORY AND REGULATORY IMPEDIMENTS

The governance structure for a multiple airport region has a large influence on what can be done to develop alternate airports. Generally, there are two cases to consider: one where airports are each operated by a single proprietor or sponsor, and one where a single sponsor controls multiple airports within a region. Single proprietor airports could use money raised at one airport to support another airport only if that expenditure can be considered a cost of operation of the first airport, or if the two airports are considered a "system."

Under state or local law, metropolitan planning organizations (MPOs) can act for individual airport proprietors in a multiple airport region during the planning phases, but they have no ability to implement or effect change in airport roles or utilization. The money needed to make any significant physical changes at an airport is generally not under the control of the MPO. Federal policy encourages the development of intermodal connections on airport property and, to carry out such a policy, encourages

airport sponsors to integrate airport master and system plans with the MPO. Federal policy also encourages MPOs to establish membership positions for airport operators.[9]

Multiple jurisdiction airport sponsors can plan and invest for the system overall without the limitations faced by single proprietor airports. However, their ability to fund access improvements with airport revenues is constrained (if the improvement extends far from the airport boundary) by limitations on the use of airport revenue raised at an airport.

FAA should consider seeking legislative authority that would make it easier for individual sponsors to jointly participate in planning and investments at alternate airports that result in more efficient use of existing capacity and limited federal resources. This is most important where traffic levels are sufficient to support multiple airports within a region.

5.4 FUNDING OPTIONS

Airport development is generally funded in one of three ways, either through the Airport Improvement Program, Passenger Facility Charges or charges to airport users. Figure 5-1 shows the ability to fund other airports depending on their ownership status.

Figure 5-1
Ability to Fund Other Airports

Status	AIP Entitlement	AIP Discretionary	PFC	Airport Revenues	Rates & Charges
Owned-Primary	Yes	FAA	Yes	Yes	Yes
Owned Alternate	Yes	FAA	Yes	Yes	Yes
Not Owned/ No Agreement	No (Unless FAA approval)	FAA	No (Unless ownership or control agreement)	Limited. Could be diversion unless part of local airport system; determined by role, e.g., designated reliever for A	Yes If carriers agree and consistent with revenue use rules

Note: Yes means that funds can be raised at one airport and spent at another.

We assume that there are three kinds of airports:

- The owned primary airport in a major metropolitan area;

[9] See: 49 U.S.C. § 47101(a)(5), (g).

- An owned alternate airport by the same authority or body that owns the primary airport; there could be multiple airports in this category

- An airport that is not owned by the proprietor of the owned primary or alternate airport and has no current agreement with them except as modified in the discussion below

Owned means operated and controlled as part of the multiple airport system under a single sponsor. Examples include Los Angeles World Airports: LAX, ONT and PMD; Massport: BOS, BED, and ORH; PANY/NJ: EWR, JFK, LGA, and TEB; and the City of Philadelphia: PHL and PNE.

AIP Entitlement—AIP Entitlement funds can be used at any owned airport, and they can go to a non-owned airport with FAA approval.

AIP Discretionary—It is assumed that FAA can make discretionary grants to any airport without consideration of ownership or control conditions. The limitations on FAA's ability to do so would be that it complies with its own laws and regulations regarding AIP. Therefore, there is no issue of moving money among airports.

Passenger Facility Charges—PFCs raised at one owned airport can be spent at another owned or controlled airport. They may not be spent at an airport that is not part of the system unless there is an ownership or control agreement in place. The Chicago Gary Regional Airport Authority created such an agreement where PFC funds raised at O'Hare and Midway airports could be spent at Gary. It is possible to spend PFC money raised at a carrier airport at an airport that is a designated reliever as long as it is under common ownership or control with the air carrier airport.

An airport may use PFC funds for an intermodal surface transportation project at an airport under certain restrictions. The airport must adequately justify the project, demonstrate that the ground access project preserves or enhances the capacity of the national air transportation system and may use a PFC of a value greater than $3.00 only if it has adequately provided for financing the airside needs of the airport. Additionally, the PFC-financed portion of the ground access project must be for the exclusive use of airport patrons and employees, be constructed on airport-owned land or right of way acquired or controlled by the airport and be connected to the nearest public access facility.[10]

[10] See: FAA Order 5500.1.

Airport Revenues/Rates and Charges – Airport revenues (that is, its airline rates and charges as well as concession fees) raised at one airport can be spent at another owned or operated airport and at an airport within the local airport system, such as a designated reliever airport. They also can be spent at other local facilities owned or operated by the airport and directly and substantially related to the air transportation of passengers or property. The ability to spend money raised at one airport also depends on airport use agreements. Even if a regional airport system was established, however, current federal policies require airline fees to be "reasonable" (apparently by use of a cost-based methodology), and airports may not create excessive surplus revenue. Accordingly, federal policies may present impediments to an airport's ability to charge market-based fees and use that revenue for development at another airport.

An airport may use airport revenue for capital or operating costs of an intermodal link at an airport. There are some restrictions on this use: the intermodal link must be an airport capital project; the revenue must be used only for that part of a local facility the airport owns or operates and only that portion which is directly and substantially related to the air transportation of passengers or property.

The funds raised under Rates and Charges can be spent at any of the owned airports as long as the airports are in use, and the costs of the other airports to be included in the first airport's rate base are reasonably related to the aviation benefits that the other airports provide or are expected to provide. Airlines can agree to rate-basing fees to support another airport in the local system that is not in use and that does not currently provide them with reasonable aviation benefits. Carriers may agree where they expect the other airport to provide benefits for operations at the airport where the money is raised.

5.5 FUNDING INITIATIVES

As noted above, FAA does have some ability to use AIP funds to support development of alternate airports in a region. In the case of PFCs and airport revenues, the initiative for airport use lies with the airport proprietor.

FAA could consider modifications to the AIP program to provide more flexibility with funding where alternate airports are identified as necessary to accommodate future growth. This should be limited to those areas that meet the test of being able to support an alternate airport (greater than 10 million originating passengers) and where the ability to expand the primary airport to accommodate increased demand is limited. If so, FAA might consider waiving matching funds where new capacity is consistent with regional needs even if a private airport is involved. But the merits of this need to be weighed carefully because the provision of matching funds is often "the acid test" in determining projects that are worthwhile, i.e., those that sponsors are willing to pay for.

Even with restrictions on where such flexibility could be employed, sponsors still have an incentive to develop projects that otherwise would not be justified.

FAA can elect to use discretionary funds to support alternate airport development. Apparently, this was used successfully to improve Manchester and Providence in the Boston region. It may have applicability elsewhere.

FAA currently has the authority to allow a sponsor to spend entitlement money at other airports that it does not own or control, or has under an agreement.

5.6 SUPPORTING REGIONAL PLANNING

The case studies have shown that solid regional transportation planning is a must to make better use of alternate airports. FAA sponsored a regional planning initiative in New England and this was instrumental in the development of Providence and Manchester as alternates to Boston's Logan Airport. On the other hand, it is understood that the development of MidAmerica Airport did not involve region-wide planning and, as a result, alternate airport facilities were developed for which there seems to be little current demand.

Regional planning is made more difficult in multi-state or other multi-jurisdiction areas unless a broad-based planning organization is in place (or a surrogate for one is created). FAA is attempting to do so in the New York City area by funding a series of related studies with different sponsors to develop a regional airport passenger database, which might be the foundation of a regional airport system plan. In any case, planners cannot affect the developments needed for alternate airports. Here the role of the airport sponsor is paramount and it is more difficult to develop coordinated action when airports within a region have different sponsors.

The review of the literature has pointed out that alternate airports appear to become viable once the primary airport has at least 10 million originating enplanements. FAA should first determine which airports will likely have 10 million originating enplanements by the year 2010 and which of these are critical alternate airport regions. Presumably, this would be in those areas where expansion of the existing primary airport or airports is not feasible. In these areas, FAA could fund regional air transportation studies aimed at identifying planning and development needs at alternate airports critical to the long run needs of the region. FAA could require that regional air transportation studies funded with AIP for areas that have over 10 million originating enplanements evaluate alternate airport capacity and its potential to meet capacity needs.

Once such airports are identified, FAA could facilitate development by providing discretionary grants or approving the use of entitlement funds at non-owned or controlled airports. These needs are most critical where airports are controlled by different proprietors and cannot act as a single body in terms of funding development at alternate locations. FAA's work in Boston and New York has shown that it can make use of coordinated planning grants to allow planning on a regional basis to take place.

As metropolitan areas grow and become more congested and complex, FAA needs to promote strong regional planning of airport systems. In the Los Angeles area, communities are now looking at how many air passengers come from each community versus what the airports of that region can serve. They are raising the question of whether it is unjust if a community does not expand its available airports to meet the travel needs of its own passengers. FAA should monitor developments such as this and their potential impacts on airport development.

Ground access to airports is also a key issue raised in the literature and the interview program. Therefore, regional airport studies should have a ground access component that is coordinated with the Federal Highway Administration (FHWA), Federal Transit Administration (FTA) and the state departments of transportation. FAA needs to examine how additional airport or other federal funds can be made available for access projects to link airports to the major highway networks in the region. It is also recommended that FAA, FHWA and the FTA use guidance in the "Intermodal Ground Access to Airports: a Planning Guide" to encourage airport access planning and development on a regional basis. All three agencies should coordinate training activities for field staff and state and local planning managers to incorporate improved airport access planning in metropolitan and regional transportation plans.

The Department of Transportation should work to effect additional cooperation between FAA and surface transportation bodies to encourage multi-modal planning. In addition, DOT should encourage state and local governments to use surface transportation planning and development funds to provide additional airport access where access problems preclude the development of alternate airports. Further, the FAA should strongly encourage airport sponsors to actively participate on MPO and other regional planning and development agency policy and planning committees.

5.7 ADDITIONAL FEDERAL INITIATIVES

Currently, there are few incentives for carriers to use alternate airports other than service differentiation. Market-based solutions such as differential pricing of primary and alternate airports could stimulate the use of alternate airports. Other FAA and DOT studies are examining economic and administrative means for demand management, and the role of alternate airports should be considered in these.

There is also a need to improve upon the strategies for converting surplus military airports to civil use. In some cases, these airports are located so far from the population base of a region, it is difficult to attract viable passenger or cargo service. In other cases when airports are located close in, there may be environmental constraints or opposition to further development of military airfields as civil airports. Once a decision is made to convert an airport to non-airport use it is generally irreversible. Therefore, consideration should be given to mandatory land banking of military airports if there is no current aviation use planned unless it can be shown that there is no need for this facility as a commercial airport within the region for the foreseeable future.

There is also a need for research into how to best meet the environmental challenges raised by growth at alternate airports.

5.8 SUMMARY

Each multiple airport region is unique both in the structure of its aviation system and in the availability of alternate airports to meet capacity needs. This study shows that alternate airports have played a role in meeting regional capacity needs. This is normally the case when the level of traffic in an area is sufficient to support multiple airports. In some cases airport roles have evolved over time while in others there was a conscious effort to make use of multiple airports. The usage of alternate airports can make more efficient use of existing resources and better use of limited funds for airport development.

Some alternate airports can play only a limited role in adding to capacity. Many of the close-in alternate airports have one or more of the following problems:

- Administrative limits on capacity
- Community opposition to further development
- A need for better access to the alternate airport

Alternate airports on the periphery of the metropolitan region often have more capacity to offer. However, they tend not to be located near the centers of population and may have access problems. The needed improvements are likely to extend well beyond the airport's domain. In these cases, there is a need for coordination and cooperation with surface transportation modes in improved access.

The case studies show that alternate airports can play a role in meeting capacity needs once the demand grows to levels that will support more than one airport in a region. In some cases, such as Los Angeles and New York, the multiple airports that handle commercial traffic have evolved over time. In other areas, such as Boston, an

explicit choice was made to rely more on alternate airports to meet regional air transportation demand. As the demand for air travel continues to grow, alternate airports can help meet some capacity needs and conserve on airport development resources.

APPENDIX A
LITERATURE REVIEW

1.1 BACKGROUND

As a result of increased business, tourism, and shipping, air traffic worldwide is increasing and it is inevitable that at some point airports become congested and unable to handle higher levels of air traffic without considerable delays. Some of the major metropolitan airports in the U.S. have already reached this point or are approaching it at a rapid rate. The *FAA Airport Capacity Benchmark Report 2001* analyzed capacity at 31 busiest U.S airports.[11] Honolulu International Airport is the only delay-free airport in the study. Of these, 8 airports have been designated as "pacing" airports for having the highest delay rates. For these airports, more than 30 percent of flights have an average delay of 15 minutes or more per 1000 operations. One obvious solution to the airport congestion would be to build new runways and facilities at the existing airports or to build new airports. While some new runways are coming on line, this may be a time consuming and expensive option at some airports. It may take a decade to plan and complete new runways and facilities. In certain cases, for example at New York's LaGuardia airport, the airports have no room for expansion.

An alternative solution to airport capacity enhancement is the development of additional airports near congested airports or alternate airports in the same region. The purpose of this review is to examine the relevant literature on passenger's and airline's choices of airports, the economics of airline hub airports, the utilization of airports within metropolitan areas and related subjects which underlie why airlines choose to serve certain airports and the economic incentives that cause them to do so, and what factors influence a passenger's choice among airports.

In the sections below, each literature source is discussed separately. Page numbers for citations are noted in parentheses.

[11] Of course, delays have been reduced subsequent to the drop in traffic due to the aftermath of the terrorist attacks of September 11, 2001. These traffic decreases lowered the level of delay at airports, but the traffic is expected to continue the secular growth patterns, returning delay to the airports.

1.2 LITERATURE SOURCE 1

Author: Richard de Neufville
Title: *Planning Multi-Airport Systems in Metropolitan Regions in the 1990s*
Published: Prepared for the US Federal Aviation Administration, May 11, 1994

The main focus of this study is the development of additional airport capacity at the existing congested airport or at a second airport in a metropolitan region. One of the possible long-term solutions is distribution of traffic between the existing major airport and any secondary airports in the same area. This study presents guidelines for determining when is it desirable to invest in a second airport in a metropolitan area.

Geographic Definitions of a System

It is important to note that from the users' perspective, the ownership of the airport is not important and a multi-airport system includes all the airports that serve a specific region. Therefore, airports associated with different cities and jurisdictions can belong to the same multi-airport system (i.e., Baltimore and Washington). In this report, a multi-airport system is considered to be comprised of airports that are as close to the metropolitan region as one of the existing major airports (about an hour of travel to/from the airport to the commercial and residential centers), or if they are officially designated and operated as a part of the multi-airport system by local authorities.

Threshold of Significance for Second Airport

"Above a certain level of originating traffic from a metropolitan region, a second airport (and thus a multi-airport system) is significant. Below this level it is not." (29) The threshold for significant development of second airports is reached when the total traffic for the region is greater than 25 million total passengers a year. If the primary airport is a transfer hub, then the threshold is not reached until the traffic at the primary airport is much higher.

Distribution of Traffic—Natural Concentration of Traffic

The secondary airports generally have 50 percent or less of the traffic at the primary airport. Traffic is correspondingly lower for the third, fourth and fifth airports. This trend is apparent even when a secondary airport is a preferred airport for a significant fraction of the passengers. For example, the Oakland airport in the San Francisco Bay Area is closest to about 40 percent of passengers yet it only has about 17 percent of the market.

Reasons for Concentration

Whenever market economies are present, competitive markets are formed and the concentration of airline traffic is just another example.

> "Consumers flock to where the service is the best; Providers install themselves preferentially where there are the most customers. Competition reinforces the tendency of traffic to concentrate. Providers recognize that customers will go preferentially to the site with the widest, the best array of services, and thus strive to match the level of services provided by their competitors. They thus are reluctant to provide services at secondary sites." (32)

The level of competition is a significant factor in explaining the degree of concentration of activity at a single airport. While an increase in competition increases concentration at a primary airport, a monopolistic environment encourages the use of secondary airports. The main counteracting tendency to airport concentration is an increase in congestion.

One of the factors affecting the level of runway congestion is the size of the aircraft. Using larger aircraft would decrease runway congestion. Over the longer term, the average size of aircraft has stayed about the same as airlines try to provide greater frequency of service using more flights as opposed to using larger aircraft. Recently, however, the shift of flying by mainline carriers to regional airlines likely will reduce average aircraft size.

The relative allocation of passengers is influenced by the level of hubbing or transfer operations. "Passengers transferring between aircraft do not switch airports, and should be excluded from consideration when thinking about the traffic that promotes a multi-airport system[...]." (34)

Transfer Hubs Reinforce Concentration

When the primary airport in the region is a major transfer hub, it is less likely that the traffic will be split between that airport and its secondary airports.

Limitations on Government Interference

Most of the time governments are unable to counteract the market's natural tendency toward concentration at the primary airports by directing the traffic towards the secondary airports in the region.

Traffic Volatility at Secondary Airports

Traffic at secondary airports is specialized, making them more vulnerable to shifts in traffic from one airport to another. The volatility of traffic at an airport is a percentage change around the long-term trend and its formula is:

Volatility = [(Actual Traffic – Trend Traffic)/Trend] x 100

Planning Multi-Airport Systems

Aviation traffic does not follow a stable, long-term growth trend. It depends on numerous innovations (technological, marketing, work rules, etc.) and it is a derived good. Both characteristics make it hard to forecast aviation traffic accurately.

Dynamic strategic planning is used when the future cannot be forecast accurately. It is dynamic because it anticipates that the plans will need to be adjusted in order to be coordinated with the actual events. It is strategic because it is long-term planning. Dynamic strategic planning is often used in the development of multi-airport systems.

> "Insofar as airport traffic can be expected to double every 10 to 15 years[...], and insofar as the time between planning and implementation of major projects is also about a decade or more, this means that regions which currently have 10 to 15 million total passengers a year should anticipate and plan for the possibility of some kind of second airport." (51-52)

1.3 LITERATURE SOURCE 2

Author: Richard de Neufvulle
Title: "Management of Multi-Airport Systems"
Publication: *Journal of Air Transport Management Vol. 2, No. 2*, pp. 99-110, 1995

In order to avoid over-investing in second airports it is important to understand how the traffic develops at these airports. Secondary airport and multi-airport systems are more likely to be justified in metropolitan areas with high levels of air traffic. However, high levels of air traffic in themselves are not sufficient to justify development of a secondary airport. A secondary airport must be sufficiently attractive in comparison with the primary airport to draw a sizable business. It is attractive when it provides convenient access to desired air services. Originating air passengers consider two main factors when looking for air service location: the geographic accessibility of an airport and the frequency of departures.

Airlines, on the other hand, try to optimize the use of their aircraft. When allocating flights to secondary airports the airlines have to consider

> "not only whether they can achieve competitive load factors in the secondary market, but whether there is sufficient additional traffic that will compensate for the loss in the airline's market share in the major market. [...] This competitive dynamic that leads airlines to match flights on routes also leads them to allocate flights to the primary airports rather than provide service to second airports. [...] When airlines have a choice, they tend to allocate flights to secondary airports when their primary airport either is heavily congested or has so much frequency that there is little penalty for allocating a flight elsewhere." (101)

Pattern of Concentration

Evidence suggests that the second busiest airport in a multi-airport system has about a third of the busiest airport's traffic. Only significant technical or political constraints to the concentration of traffic at a primary airport would cause second airports to have more than 50 percent of the traffic of the busiest airport. The threshold for a successful multi-airport system is 10 million originating passengers. Traffic volatility at a smaller airport is significantly higher than at a larger airport and at airports with less than one million total annual passengers traffic can be expected to be most highly variable.

Incremental Investments

If future demands are uncertain, it is risky to build secondary airports. When risk is involved, managers may opt for building facilities incrementally, according to the demand. Unfortunately, economies of scale are lost when this option is chosen and higher costs per unit of capacity are realized. At the same time, significant savings are realized when capital is not wasted on capacity that turns out to be unnecessary. When deciding on the optimal level of insurance, expected value should be maximized by weighting the consequences of possible future by their estimated probability.

Dynamic Strategic Plan

In order to identify the risk of investing in a secondary airport, data should be collected on similar facilities, in similar circumstances, over the previous 10 to 20 years.

1.4 LITERATURE SOURCE 3

Author: Nigel P.S. Dennis
Title: "The Competitive Role of Secondary Airports in Major Conurbations"
Date: 1995
Publication: *Airport Planning Issues: Proceedings of Seminar J held at the PTRC European Transport Forum*, University of Warwick, England, from 11-15 September 1995, pp. 53-70

The purpose of this study is to assess the interaction between the primary and the secondary airports at Europe's main airports. The term "secondary airport" is used loosely to include small airports that provide some scheduled service and are less than 70 km or about 1 hour away from the major airport. As is the case with the United States, a number of Europe's major airports are at their capacity limits while secondary airports in their area have significant excess capacity. Another role of the secondary airports is to provide domestic services where its location is more attractive than the location of the main airport. Some secondary airports develop cross-water services as their competitive edge because, geographically, they avoid a backtrack to the major airport. By minimizing the length of the trip, the costs are kept down. Finally, secondary airports may have an important function for short haul carriers that do not require the facilities of the larger airports.

Impact of Secondary Airports on Passenger Demand

Secondary airports can stimulate new air travel demand, share the existing demand with a primary airport, or reduce demand by preventing the development of the critical mass of air service at one location.

Surface Access and Catchment Areas

The secondary airports often allow the passengers to fly out of a more conveniently located facility. Construction of public transport links to a secondary airport is rarely justified because of low passenger throughputs. Therefore, for passengers without a car, it is often easier to reach a primary airport though it is significantly further away than a secondary airport. As for the passengers that live closer to a primary airport, they are unlikely to use a secondary airport, especially for scheduled services.

> "Public transport usage often seems to be higher amongst people further from the airport, if they have a direct link. Public transport usage is generally higher amongst scheduled passengers than charter passengers. This is surprising at the first sight but is likely to be because

there is more inbound traffic on scheduled services and scheduled passengers generally have less luggage." (no page number, section 5.1)

One way of stimulating business at a secondary airport is by undercutting the major airport on airport charges. However, the reduction in charges would have to be significant in order to influence an airline's decision to change airports.

Conclusion

Many secondary airports in Europe could play a more important role in meeting the demand for air travel. Operations at secondary airports can be expanded through more links to major international hubs and by offering low cost services that can attract demand from a wider catchment area by competing on price. Airport charges at secondary airports should be competitive to those at primary airports.

1.5 LITERATURE SOURCE 4

Author: Mark A. Bradley
Title: "Behavioral Models on Airport Choice and Air Route Choice"
Publication: *Travel Behaviour Research: Updating the State of Play*, Amsterdam: Elsevier, 1998, pp. 141-159

The purpose of this study is to provide models of air travel route choices because it is crucial for airport planning. It describes a study done by Hague Consulting Group for the Netherlands Civil Aviation Authority. Stated preference surveys are used in designing the models for analyzing future demand for Amsterdam Schiphol airport and for regional airports in the Netherlands.

Background

A person traveling from origin O to destination D has a choice among possible routes of type OXYZD where:

- X is the departure airport
- Y is the transfer airport
- Z is the arrival airport

The choice of flying a direct route or using a transfer airport depends on the following variables:

- Air fare
- Modes available to/from the airport
- Travel time to/from the airport

- Frequency/timing of flights
- Congestion/punctuality of flights
- Extra journey time for transfer
- Airlines serving the route
- Parking facilities
- Check-in facilities
- Lounge/restaurant/shopping facilities
- Transfer facilities
- Baggage/customs/immigration facilities

The Stated Preference Survey

Three types of passengers were surveyed (144):

- Residents for whom Schiphol is the current or the potential departure airport (X)

- Passengers with destinations in the same area but residing outside this area, for whom Schiphol is the current or a potential arrival airport (Z)

- Passengers on long flights with both origins and destinations outside this area, but for whom Schiphol is the current of a potential transfer airport (Y)

The interview was composed of the following parts:

1. "General Information about the type of trip and flight taken
2. Details of the flight(s) taken (airline, flight number, times, etc.)
3. Information about the ticket price and method of booking
4. Details of the trip origin and the trip to the airport (mode, travel time, etc.)
5. Questions about the most likely alternative airport and travel to that airport
6. The SP choice experiment, offering different routes at different prices
7. Information about the respondent and his or her household." (146)

Results

The most significant variable explaining the air route choice is the ticket price. "A 100% improvement in frequency, for example, is worth about 15% of fare for business travelers within Europe, but only about 2-5% of fare for the other segments." (156) The second most significant variable is the access time to the airport. "A one hour difference in travel time is worth 20-40% of fare for the business segments and 10-20% for the other segments, with the highest value for the shorter trip segments." (156)

1.6 LITERATURE SOURCE 5

Author: Norman Ashford and Messaoud Benchemam
Title: "Passenger's Choice of Airport: An Application of the Multinomial Logit Model"
Publication: *Airport Planning, Operation, and Management, Transportation Research Record 1562,* Washington, DC: Transportation Research Board, 1987, pp. 1-5

This study describes an airport choice model that can be used for more reliable planning of airport systems. This model was based on the microeconomic theory of consumer choice. The independent variables used in this model were surface access time, frequency of flight service, and airfare. Each passenger used in a sample was asked to provide the following data: Surface origin, flight destination, age, day of the week of each on which trip was made, trip purpose, selected airport, travel time from surface origin to all competing airports, number of flights from the competing airport to the selected destination in that particular day of the week, and air fare from the competing airports to the selected destination.

Central England was selected as the area of the study, and airports considered were Manchester, Birmingham, East Midlands, Luton, and London's Heathrow. There were three categories of destinations included in this study:

1. Domestic: Belfast, Jersey, Glasgow, and Aberdeen
2. International: Dublin, Amsterdam, Frankfurt, and Brussels
3. Inclusive tours: Palma, Alicante, and Ibiza

Passengers were classified into four trip-purpose categories:

1. Domestic
2. International business
3. International leisure
4. International inclusive tours

Data used in this study pertained to both the chosen and the rejected airports. That is to say, if a passenger originating in Nottingham traveled from Manchester Airport to Amsterdam (on Thursday, for example), the following was computed:

1a. Travel time from the point of origin in Nottingham to Manchester airport.

1b. Number of flights from Manchester Airport to Amsterdam on Thursday, and the economy airfare.

2a. Travel times from Nottingham to alternative airports: Birmingham Airport, East Midlands Airport, and Heathrow Airport.

2b. The number of flights on Thursday to Amsterdam from each alternative airport and the respective economy air fares.

The Multinomial logit model was used:

$$P_{gk} = e^{V_{gk}} / \sum_{r=1}^{G} e^{V_{rk}}$$

where:

P_{gk} = probability that alternative g will be chosen by individual k
$V_{gk} = a_1 X_1 + \ldots + a_n X_n$ = representative function of the utility where $a_0, a_2 \ldots a_n$ are parameters to be estimated and $X_1, X_2 \ldots X_n$ are explanatory variables

Separate models were calculated for business, leisure, inclusive tour, and domestic air passengers. The utility function of the model is:

$$V = a_1 x\ TT + a_2 x\ FREQ + a_3 x\ FARE$$

where:

TT = travel time to the airport,
$FREQ$ = number of flights per day,
$FARE$ = air fare, and
a_1, a_2, a_3 = coefficients to be estimated in the calibration

The following conclusions were made based on the results of the model:

- "A fare policy would give the best results in the attraction of more passengers if it were applied at Manchester Airport for domestic passengers and at East Midland Airport for leisure passengers.

- An Access improvement policy would give the best results if the attraction of more passengers if it were applied at Manchester Airport for domestic and inclusive tour passengers and at East Midland Airport for business and leisure passengers.

- A frequency of flights policy would give the best results in attracting more passengers if it were applied at Manchester Airport for business, inclusive

tour, and domestic passengers and at East Midland Airport for leisure passengers." (4)

As we can see, the multinomial logit model used for airport choice had good explanatory ability and predicted choices actually made. In this study, elasticity analysis was also done and it showed that access time, flight frequency, and airfare cannot be viewed as equal determinants of airport choice. In other words, airport choice was not equally responsive to changes in its determinants. The accessibility was more important than frequency of flights, and the fare variable was significant only for leisure and domestic travelers. The model can be useful in forecasting the redistribution of passengers between primary and secondary airports in a multi-airport system.

1.7 LITERATURE SOURCE 6

Author: Greig Harvey
Title: "Airport Choice in a Multiple Airport Region"
Publication: *Transportation Research–A Vol. 21A, No. 6*, pp. 439-449, 1987

Airport utilization is a result of choices made by airlines and passengers. Airlines chose an airport based on their anticipated operational efficiencies. This paper analyses characteristics of an airport that affect passengers' airport choice. When deciding on a trip, an air passenger is presented with several decisions including: whether to make the trip or not, destination, date and time of travel, airline, airport, location of departure airport, fare category, mode of access, parking option. Significant differences in airport choices are made between a) residents vs. nonresidents (residents are assumed to have more information about the available airport options); and b) business vs. non-business travelers (business travelers are relatively insensitive to cost compared to non-business travelers). Therefore, four different models should be developed for: resident business travelers, resident non-business travelers, nonresident business travelers, nonresident non-business travelers. This paper only focuses on two of these models: resident business travelers and resident non-business travelers.

For this study, a sample data was obtained from air passengers in all three major Bay Area airports: San Francisco International (SFO), Oakland International (OAK), and San Jose Municipal (SJC). The passengers were asked for origin address and trip purpose. Nonresidents were excluded from data sample. The survey allowed the passengers to chose from the following trip purpose categories: convention, business, school, personal emergency, vacation, military leave, and other. Further, survey respondents were asked a reason for airport choice:

1. Chosen by travel agent
2. Closest airport to home
3. Closest airport to work
4. Only flight/most convenient flight
5. Easier to get to/from
6. More convenient/cheaper parking
7. Less crowded airport
8. Always use this airport

Two variables were used in this model: airport access time and flight frequency to the chosen destination. Results suggest significant differences between resident business and resident non-business travelers. Access time is less important to non-business travelers as is direct flight frequency, though relative frequency has a similar coefficient. These conclusions are consistent with previous notions of the differences between business and non-business travelers: non-business travelers value time less than business travelers, and non-business travelers use private funds so to them cost is more influential on airport choice. Finally, non-business travelers may simply be less experienced or informed about the existing airport options.

The analysis led to additional conclusions:

1. Given nine or more flights to a destination at each of two competing airports, the closest one is almost always chosen.

2. "Beyond a threshold level, additional direct flights to a specific destination do not appear to make an airport more attractive. In the Bay Area data, this threshold is nine flights per day for both business and non-business travelers. The marginal contribution of each additional direct flight decreases up to nine flights per day." 448

3. Departure airport with direct service is chosen over an airport offering commuter and connecting flights.

4. There was no distinguishing between nonstop versus multi-stop direct flights.

5. The marginal disutility of access time appears to decrease with total time.

6. The response to access time varies with the length of flight.

7. Airport choice and access mode choice do not appear together.

1.8 LITERATURE SOURCE 7

Author: Robert Windle and Martin Dresner
Title: "An Empirical Analysis of Airport Choice in a Multiple-Airport Region"
Publication: *Journal of Transport Engineering Vol. 121, No. 4*, 1995, pp. 332-337

In order to make effective operational decisions, airport managers and transportation planners need to understand the criteria used by passengers in their airport selection. Numerous papers have already been written on this subject. Most of them used binomial or multinomial logit approach to assess the criteria passengers use in selecting an airport. The binomial logit model explains the difference in utility between two choices and multinomial logit model allows for *n* number of choices. Explanatory variables most often used in previous studies are a measure of travel time to the airport and airline service at the regional airports. This paper extends previous studies by incorporating a new variable for airport experience.

Data used in this study is gathered on passenger airport preference in Washington/Baltimore region. The destinations used in this study were the 30 most popular destinations from the region and the only domestic destinations with over 100,000 annual passengers in 1987. The passengers from National, Dulles and Baltimore/Washington International airports were asked questions about their air trip (e.g., destination, purpose), ground access to the airport (e.g., origin of trip, ground access mode), airport choice (e.g., reason for choosing the airport, other airports considered), and about themselves (e.g., permanent residence, income).

Similarly to Harvey's study (described above), the data cases were divided into four groups because each group may place different value on some of the explanatory variables. These are the four groups in question:

1. Resident business travelers
2. Resident non-business travelers
3. Visitor business travelers
4. Visitor non-business travelers

Choice-specific variables used were: airport access time, weekly flight frequency, and average ticket price. Chooser-specific variables were the dummy variables for National and Dulles airports and the base case variable for BWI.

Airport access time was important to all passengers but relatively more important to resident business and resident non-business passengers. Weekly flight frequencies were significantly important to all passengers but the most important to non-resident business passengers. Average airline ticket price was significantly

important to all passengers but in an unexpected way, it appears that passengers were attracted to higher prices. Bad price data may explain this unexpected result and hence, the price variable was excluded from further estimation.

A revised base case (without price variable) was considered under three scenarios. Under the first scenario, it is assumed that a passenger has a 30-minute commute to all three airports that have the same flight frequency. Thirty-eight percent of the resident business passengers would choose BWI under those conditions. If the access time to BWI decreases to 20 minutes but all the other assumptions stay the same, the percentage of resident-business passengers choosing BWI increases to 57 percent. If, however, the access time to all airports is to stay at 30 minutes, but the flight frequency at BWI increases from 14 to 28 per week (flight frequency at the other two airports stays at 14), the number of passengers choosing BWI will be 42 percent. Similar calculations are done for the other three groups of passengers.

The next step was to use the results from the revised base case in addition to chooser-specific variables for passenger experience with National and Dulles airports (BWI was the base case). The chooser specific variables show how many times the passengers included in the survey used National or Dulles airports. The results indicate that passengers' experience with National is a negative factor in choosing BWI. In all cases, National and Dulles users do not tend to use BWI.

The revised base case with the airport experience variables is then redone using the data for only the passengers who arrived at the airport by motor vehicles as it was thought that automobile travel times may not be a good indication of the actual travel time for the passengers that arrived at the airports using different means of transportation. However, the results of this specification are similar to the results of the previous estimation (without excluding non-automobile arrivals).

Finally, an estimation case was done for the revised base case from aviation zones that were not dominated by one airport. The zones dominated by one airport are defined as the ones in which seventy five percent or fewer passengers chose only one of the three airports. This was done in order to include only the competitive zones because it is assumed that some passengers live so close to one of the three airports that for them there is no real airport choice. The hypothesis was that the passengers in these competitive zones were not as influenced by the access travel time. The hypothesis was only true for non-resident travelers, especially for non-resident, non-business travelers.

In conclusion, airport access time and flight frequencies were important determinants of airport choice and more so for business than non-business travelers. A passenger experience with an airport was also an important determinant of airport choice. And finally, in "competitive airport zones," airport access time was still a

significant determinant of airport choice (except for non resident, non-business travelers).

1.9 LITERATURE SOURCE 8

Author: Mark Hansen and Tara Weidner
Title: "Multiple Airport Systems in the United States: Current Status and Future Prospects"
Publication: *Airport Planning, Operation, and Management, Transportation Research Record 1562,* Washington, DC: Transportation Research Board, 1995, pp. 8-17

This study examines the existing multi-airport systems (MASs) and the possibilities for the new MASs in the United States using FAA and other data. In the United States, 14 MAS regions were identified. They are found in urban areas and their advantage over single-airport systems is that the access costs are reduced (travelers may chose a closer airport) as well as some social coasts such as congestion and emissions. Finally, a multi-airport system increases competition between airport services. Despite these advantages, a multi-airport system has its downside as well. One of the services most valued by passengers is the frequency of flights leaving an airport, a condition that clearly favors all flights leaving from a single airport. Airlines are encouraged to serve only one airport in the region because of a certain fixed station costs. Economies of hubbing are another reason for favoring single airport systems.

Once the MAS regions were identified, the Herfinhahl concentration index (HCI) was used as a measure of the degree of a passenger activity concentration at a single airport in the region. It is a sum of the squared traffic shares of each airport. A single airport system has the HCI of 1, while an airport in MAS with a low enplanement concentration has the HCI closer to zero. In other words, the HCI index tells us how a MAS differs from a single airport system. MAS systems used in this study were selected based on the following criteria:

1. Each airport is in the same community (as designated by FAA), or within 30 miles of the primary airport, or each airport is in the same Metropolitan Statistical Area (MSA) or Consolidated MSA (CMSA).

2. The HCI for the airport is less than 0.95.

Determinants of MAS Concentration

The MAS concentration is an important characteristic of an airport and considerable effort was given to understanding the factors that influence it. At a micro

level these factors are: location and accessibility, capacity, use restrictions, traveler and travel agent awareness, and other factors that influence traveler's airport choice. At a macro level, level of concentration is affected by three factors. The first factor is a decrease in local traffic (O&D traffic). A high level of local traffic signifies a reduced frequency advantage of a primary airport and more airlines are willing to serve more than one airport in the same region. The second factor is the connecting traffic. As connecting traffic increases, so does the concentration level because it is very costly and inconvenient to transfer passengers from one airport to another for a connecting flight. Finally, an increase in the land area of the MAS should cause a decrease in concentration level.

The models developed to represent MAS concentration level take the following form:

$$\ln(HCI/(1-HCI)) = \alpha + \beta * \ln(ODPAX) + 5 * \ln(ENP) + \lambda * \ln(AREA) + \varepsilon$$

where:

HCI + Herfindahl concentration index;
ODPAX + total MAS O&D passengers in the year 1991 (millions);
ENP + total MAS enplaned passengers in the year 1991(millions);
AREA + land area of the region, in square miles;
ε = a stochastic error term;
α, β, δ, and λ = coefficients to be estimated.

Determinants of MAS Status

The data collected suggests that there is a strong correlation between hub class and MAS status. "Of the 51 regions (taking into account our consolidations) defined as 'large' or 'medium hubs' by the FAA (that is, with enplanements of 0.25 percent of more of the national total), all those with 20 million enplanements and 50 percent of the 'hubs' with 10-20 million enplanements are MAS regions, whereas 90 percent with under 10 million enplanements are served by single airports." (1506) A model developed for analyzing the MAS status takes the following form:

$$Pi(MAS) = e^{\theta_k X_{jk}} / (1+e^{\theta_k X_{jk}})$$

where:

$Pi(MAS)$ = probability that region *I is a MAS region*
X_{jk} = a vector of regional characteristics;
θ_k = a vector of coefficients to be estimated.

Potential Multiple Airport Systems

A potential for development of additional multi-airport systems was investigated using the two models described above: a model for determining MAS concentration and a model for analyzing a MAS status. The MAS probability of each of the 40 large and middle hubs currently served by a single airport was calculated. The probabilities were calculated for 1990 and using FAA forecasts for 2000. They were then compared to the calculated probabilities for existing MASs. Based on the results for 1990, Atlanta is a single airport system most likely to be a MAS. MAS probability estimates for 2000 see six regions as potential MASs: Atlanta, Denver, Phoenix, Boston, Las Vegas, and Orlando. However, different models show different probabilities for the same airports mainly due to the differences in assumptions about whether the distribution of traffic between connecting and O&D passengers affects the probability of being MAS. Finally, a total of 13 single airport systems were identified as having a potential of developing into a MAS. These 13 areas are:

1. Atlanta, GA
2. Denver, CO
3. Phoenix, AZ
4. Boston, MA
5. Las Vegas, NV
6. Orlando, FL
7. St. Louis, MO
8. Philadelphia, PA
9. Minneapolis/St.Paul, MN
10. San Diego, CA
11. Seattle, WA
12. Pittsburgh, PA
13. Charlotte, NC

1.10 LITERATURE SOURCE 9

Author: Eric Pels, Peter Nijkamp and Piet Rietveld
Title: "Substitution and Complementarity in Aviation: Airports vs. Airlines"
Publication: *Transportation Research – E, Vol. 33, No. 4*, pp. 275-286, 1997

This paper begins with guidelines for determining when a hub-spoke (HS) or a fully connected (FC) network will be optimal. A model was developed in order to analyze how airports compete for transfer passengers and how airport decisions influence airline networks. Following are some conclusions reached through this study. Airlines compete on flight frequency, fare and capacity. An airline may be considered

to be a firm selling seats in different fare classes with the ability to adjust the number of seats in each class. An airline with low marginal cost per passenger and low fixed cost per link will tend to operate a fully connected transportation network with n ($n \geq 3$) nodes (3 node network offers the following O&D locations: AB, BA, AC while a hub-spoke network offers AB and BC connections).

When an airline prefers to operate a hub-spoke network, hubs will be located in airports with the highest demand. Price competition between airports is not very effective and a larger hub is preferred even if its taxes[12] are higher. One of the observations concerning airport pricing is that a monopoly airline is a rent seeker and demand decreases as the airline increases prices to capture extra rents. The airport must increase taxes in order to break even and an increase in the tax level causes airline prices to fall, demand to increase and finally, airport tax to decrease. If an equilibrium between airline and an airport exists then the airport tax is a tax on airline monopoly profits and if an airport is private, it may signify an increase in welfare gain.

1.11 LITERATURE SOURCE 10

Author:	Eric Pels, Peter Nijkamp, and Piet Rietveld
Title:	"Airport and Airline Competition for Passengers Departing from a Large Metropolitan Area"
Publisher:	*Journal of Urban Economics 48*, pp. 29-45, 2000

In this paper, a nested multinomial logit model was used to develop an airport and airline choice model. This model was used in analyzing both airport and airline competition in a multi-airport system, and the model can also be used in determining the optimal passenger charges. It is shown that if the frequency elasticity of demand is smaller than 1, an equilibrium exists between airfare-frequency and passenger-charges.

The Passenger Discrete Choice Model

While formulating the passengers' choice model, it was assumed that there was a market with different departure airports and a single destination. It was also assumed that airlines were restricted to operate from only one airport. The passenger could chose a flight based on the price and the departure time. The utility of the passenger using one airport as opposed to a different one depends on the passenger charge, the access time to the airport, and the maximum expected utility of the alternatives in the choice set of airlines available from each departure airport.

[12] In this study, airport taxes are actually landing fees.

The Airlines' Maximization Problem

An airline chooses to operate a route from a particular airport if its profits are not negative, that is to say, if the fare price is greater than the marginal cost. Their profits are calculated as follows:

$$\pi_j = (p_j - c_j)\, NP_{(j,i)} - k_j f_j - K_j, \qquad i \in D, j \in L(i)$$

where:

N = total number of passengers in the system,

$P_{(j,i)}$ = probability that of departure airport i and airline j is chosen,

p_j = the price of airfare,

c_j =marginal cost per passenger,

f_j = frequency on that route,

k_j = marginal cost per flight,

K_j = fixed cost.

A response function was formulated for maximizing profits with respect to the airfare yields and with respect to the frequency of service yields. It was concluded that if the frequency of demand is smaller than 1, there is an equilibrium between airfare and frequency. If the elasticity was greater than one than an increase in frequency would cause disproportional increase in demand. Each increase in frequency would, therefore, result in additional frequency increase. Because of this, the study assumes the frequency elasticity less than one.

Determination of Optimal Airport Passenger Charges

If cost recovery is a requirement then the optimal passenger charge at an airport i is:

$$tax_i = mc_i + (rK_i)/(NP_{(i)})$$

where:

mc_i = the constant marginal cost per passenger, and
rK_i = the capacity cost (K_i is the capacity of airport i).

It was further concluded from the analysis that an airport with better accessibility may charge higher taxes compared to an airport with a lower accessibility.

"A larger improvements of the accessibility could create a natural monopoly for one of the airlines. Also, if the increase in the airfare outweighs the increase in frequency and decrease in the competitor's airfare, an increase in an airport's accessibility may even lead to a decrease of the airport's market share (the 'winning' airline cashes in on the improved accessibility)." (43)

The conclusions reached in this study have significant implications in deciding whether to build a new airport in a region. While an investment in accessibility or capacity may increase attractiveness of the airport in question, it may also increase the passenger charge in order to provide the funding for that investment. An increase in the passenger charge would decrease attractiveness of the airport. Therefore, "by determining the optimal level of investment or capacity of airports, it is also possible to determine if (or at what value of N) a new airport has to be built." (43)

1.12 LITERATURE SOURCE 11

Author: J. David Innes and Donald H. Doucet
Title: "Effects of Access Distance and Level of Service on Airport Choice"
Publication: *Journal of Transportation Engineering, Vol. 116, No. 4*, July/August 1990

The purpose of this paper is to examine the importance of airport proximity relative to other level of service aspects. The study area is the province of New Brunswick, Canada. It is a rural area with the population of about 250,000 residents. Residents have three airport options with respect to scheduled air service: Charlo and Chatham on the east side of the study area and St. Leonard on the west. The first two airports offer a single daily flight to and from Montreal. St. Leonard offers flights to Fredericton, New Brunswick, and Quebec City, Quebec. Montreal is a hub whereas Fredericton and Quebec City are not.

The airport choice decision was evaluated using a disaggregate choice model that examined the importance of distance issue in relation to other service issues. It was assumed that in choosing an airport, the airport chosen would be one alternative and the second alternative would be the airport not chosen that is the closest to the trip origin. This choice mechanism was further analyzed using a binary logit model. Data sample consisted of 1,934 travelers' responses.

The most appropriate distance variables to be used were chosen from a group of 12 different distance variables. Based on the results of the goodness of fit of the models, three distance variables have been selected: Var3 = farthest - nearest, Var5 = var3 * farthest, and Var9 = var3 * (farthest +nearest)/2. The non-distance explanatory variables used in this paper are: TTYPE (ticket type), TPAID (ticket buyer), STAY

(length of stay), PURPOS (trip purpose), PLANEDIF (describes if there is a difference in aircraft types between the two airports), DIRDIFF (availability of direct flights), and FLYDIFF (difference in flying times).

"The LOGIST[13] procedure calibrated the binary logit model as follows:

$P_A = i/(1 + exp\ [-\alpha - (V_A - V_B)]$

where:

$V_A - V_B$ = a vector of differences between the choice alternatives A and B; and P_A is the probability of choosing A.

The independent variables are thus expressed as differences in values. In this study, A was the farther airport while B was the nearer." (511-512) The results of regressions show that the coefficient of the distance variable is negative, suggesting that the probability of choosing an airport increased with its distance, which is contrary to what was expected. The data were reviewed and it was concluded that the data were biased because an extremely high proportion of the data sample indicated that farther airport was used.

New models were developed not using the distance variables. The single most important variable was shown to be the type of aircraft variable as travelers were willing to travel significant distance in order to reach an airport with jet service. Flying time difference and availability of direct flights were other significant variables. It was concluded that discrete choice models are good at analyzing the airport choice process and should be used in airport system planning.

1.13 LITERATURE SOURCE 12

Author: Eric Pels, Peter Nijkamp and Piet Rietveld
Title: "Airport and Airline Choice in a Multiple Airport Region: An Empirical Analysis for the San Francisco Bay Area"
Publication: *Regional Studies, Vol. 35.1*, pp. 1-9, 2001

In this paper a nested logit model was used in order to analyze passenger choice of airports in relation to their choice of airlines. Its main purpose is "to determine:

1. Which variables are the most important (significant) determinants of the passengers' airport choice;

[13] The Statistical Analysis System (SAS)-LOGIST procedure.

2. The preferred specification of the statistical model; and

3. How these results (and the statistically preferred model) can be used to analyze airport competition in a multi-airport context." (2)

An air passenger has to make two decisions when deciding on air service. First, he/she has to choose an origin airport and second, the passenger needs to choose an airline. Looking from a different viewpoint, an airline competes with other airlines at the same airport but also with airlines at other airports in the same region. These choices are based on the maximum utility of using departure airport (*d*) and airline (*l*). The main factors affecting the average systematic utility of alternative airlines are determined by the airfare and frequency while the utility of using airport (*d*) depends on the access time to the airport. Passenger characteristic data were obtained from 1995 Airline Passenger Survey conducted by the Metropolitan Transportation Commission (MTC), Oakland, California. One of the main conclusions is that "for both business and leisure travelers, a nested multinomial logit model is statistically preferable over the multinomial logit model[14], with nests determined by the departure airport." (7)

1.14 LITERATURE SOURCE 13

Author: Ana Beatriz Figueiredo Monteiro and Mark Hansen
Title: "Improvements to Airport Ground Access and Behavior of Multiple Airport System: BART Extension to San Francisco International Airport"
Publication: *Airport Planning, Operation, and Management, Transportation Research Record 1562*. Washington, DC: Transportation Research Board, 1996, pp. 38-47

This study develops two airport choice models that evaluate influences of an improvement in ground access to one airport on the multiple airport system. In the first model, airport choice and ground access mode were combined in a two-level nested logit model. The higher level represents the airport alternative and lower level is formed by the ground access mode. "The second model was a multinomial logit model in which the ground access attribute was included in the utility function of an airport as

[14] The main difference between a multinomial logit model and a nested multinomial logit model is that a multinomial logit model is used to model discrete choices, with the choice to be made treated as a function of the various characteristics affecting the choice, such as which airport, fare, nonstop or one-stop flight, and so forth. It may also include characteristics of the individual making the choice, such as age, gender, income, etc. Sometimes the characteristics affecting the choice have a hierarchical, or "nested" structure and nested multinomial logit model is used. For example, when choosing between airports, a passenger chooses a flight to a desired destination then an airline providing the service. When the same airline is serving more than one airport in the region, the passenger next has to decide which airport to use.

the expected value of the maximum utility associated with the mode choice model. In either model, the choice attributes include ground access characteristics, daily direct flight frequency, and average air fare." (38) A model for each types of a passenger (business/non-business, resident/visitor) was estimated separately. The area of study is the San Francisco Bay Area formed by three airports: San Francisco International (SFO), Oakland International Airport (OAK), and San Jose International Airport (SJC).

Similarly to many of the previous studies, it was concluded that the airport choice is strongly affected by ground access characteristics. Disutility derived from not having a direct flight option is stronger for residents. The results implied that for nonresident business travelers, the effect of the ticket price on utility was positive probably due to the fact that they generally do not have to pay for their ticket and often have frequent flier discounts. It was further concluded that improvements to SFO ground access would strengthen it as the dominant airport in the Bay Area. Most of the additional passengers would come from OAK while the SJC market share would stay unchanged. The results also imply that if BART (rail link) is extended to SFO, nonresidents would be more responsive and it would be the second most likely mode of access transportation to be chosen. The improvements to ground access, however, would probably have different affects on different regions and case-specific studies should be conducted in order to determine the effects that improvements in ground access would have in different regions.

1.15 CONCLUSION

In order to effectively plan and develop a multi-airport system, it is very important that the main factors affecting airlines' and passengers' choice of an airport are considered. The reviewed studies focused on determining the factors influencing airport choice.

Variables most often cited as being significant in determining the passengers' airport choice are:

- The price of the flight ticket
- Accessibility of an airport
- Frequency of flights
- Direct flights

A few studies further indicated that different categories of passengers place different value on these variables. The four passenger categories are:

1. Resident business passengers
2. Resident non-business passengers

3. Non-resident business passengers
4. Non-resident non-business passengers

Some of the general findings are that airport access time, flight frequency, and availability of direct flights were important determinants or airport choice and more so for business than non-business passengers.

De Neufville also concluded that the threshold for significant development of secondary airport is reached when the total traffic for the region is greater than 25 million total passengers a year. He also found that the secondary airports generally have 50 percent or less of the traffic level as at the primary airport. He also noted that the airport type will affect the split of traffic between the primary and the secondary airports. In other words, a major transfer hub is less likely to split its traffic with a secondary airport as, for example, is the case with St. Louis International Airport.

As for the airline's choice of airports, airlines tend to allocate flights to secondary airports when their primary airport is heavily congested or has so much frequency that there is little penalty for allocating a flight elsewhere. More airlines are willing to serve more than one airport in a region with high levels of O&D traffic. However, as connecting traffic increases, so does the concentration level because passengers do not change airports for a connecting flight.

APPENDIX B
FARE AND TRAFFIC IMPACTS OF SOUTHWEST ENTRY INTO PROVIDENCE AND MANCHESTER

Southwest began service to Providence, RI (PVD) in December 1996 with flights from Baltimore (BWI), Nashville (BNA), Chicago-Midway (MDW), Tampa (TPA) and Orlando (MCO). Similar service to Manchester, NH (MHT) was begun in June 1998 with flights from these same cities (except for Tampa, whose service was added in March 2001). The catchment areas for both Providence and Manchester include Boston and surrounding suburbs (primarily to the South for Providence and to the North and West for Manchester).

SHORT-TERM EFFECTS ON FARES AND PASSENGERS

One way to look at Southwest's impacts in the Boston area is to analyze O-D market data over time from each of the three airports (PVD, MHT and BOS). As an initial step, we have looked at the five destinations listed above that Southwest served on a nonstop basis; a more refined analysis would consider beyond markets that connect via Southwest through these airports.

Since both BWI and MDW face competition from neighboring airports in their respective locales, we also incorporated O-D data from the DCA and IAD airports in Washington, and from ORD in Chicago. To assess how Southwest has affected fare levels, we looked at average fares in the year prior to Southwest's entry and the year after their entry. The results for PVD are shown below in Exhibit B-1; results for MHT are shown in Exhibit B-2.

Looking first at Exhibit B-1, we can see a dramatic decline in fares at Providence after Southwest entered in June 1996, averaging 45% in the nonstop O-D markets entered by Southwest. This includes some significant effects in the PVD-DCA/IAD/ORD markets even though Southwest did not enter these markets directly. However, fare effects in the corresponding markets served from Boston-Logan were much more restrained overall (-3%), although still quite significant in the BOS-BWI market (-26%). This suggests that service from PVD did not have a substantial impact on fares at Boston-Logan.

A similar outcome occurred at MHT after Southwest entered in December 1998 (Exhibit B-2). Fares at MHT fell 45% in Southwest's nonstop markets in the year following entry, although the indirect effects at DCA and IAD were quite small while those at ORD were much larger. Fare effects at Boston-Logan were again limited (perhaps because any effects were already induced by the earlier entry into PVD).

Another way to look at the impact of entry into PVD and MHT is to consider the effects on overall traffic levels. Results for the year before and after Southwest's entry are shown in Exhibits B-3 and B-4. The results from Exhibit 3 for PVD show large increases in traffic across the board, suggesting that Southwest's entry induced a large rise in overall passenger demand, i.e., Southwest was not just stealing traffic from competitors at PVD. This is consistent with the large drop in fares from PVD shown in Exhibit B-1.

The impacts on traffic at Boston-Logan were mixed. It appears that sizable portions of the BOS-MDW and BOS-BNA markets were diverted to PVD; on the other hand, traffic from BOS to BWI, MCO and TPA rose over the same time period. Overall, traffic at BOS increased by a modest 4%.

As shown in Exhibit B-4, the results at MHT were broadly similar. Traffic at MHT increased substantially across the board (except for MHT-DCA), while the effects at BOS were quite modest (except for BOS-IAD). Again, these results are generally consistent with the fare effects shown in Exhibit B-2.

LONGER-TERM GROWTH PATTERNS

The longer-term effects of Southwest's entry into PVD and MHT can be assessed by looking at the trend in traffic levels for Southwest vs. other carriers on a market-by-market basis. These results are shown below in Exhibits B-5 through B-9.

In Boston-Nashville (Exhibit B-5), Southwest's traffic grew quickly for about three years after initial entry at Providence in 1996, but has since leveled off; meanwhile, traffic from Boston-Logan to BNA has slowly eroded. In the Boston-Washington markets (Exhibit B-6), Southwest has shown steady growth over the years; overall traffic has leveled off since the second quarter of 2000.

A similar steady growth pattern for Southwest has occurred in the Boston-Orlando markets (Exhibit B-7), while the traffic for other carriers has been relatively stagnant. The pattern in the Boston-Chicago markets (Exhibit B-8) is somewhat similar to what has happened in Boston-Nashville: both Southwest's traffic and the overall passenger count has leveled off over the last few years, but in this case traffic to and from Logan airport has remained fairly constant. Finally, the results for Boston-Tampa (Exhibit B-9) show that both Southwest at MHT/PVD and other carriers at Boston-Logan have experienced steady increases in traffic over time.

Exhibit B-1
FARES BEFORE AND AFTER SOUTHWEST ENTRY INTO PVD

AVGFARE			TIMEPERIOD		
DEPCITY	ARRMKT	ARRCITY	YE1998Q3	YE1997Q4	%Change
PVD	BNA	BNA	$223	$113	-49%
	BNA Total		$223	$113	-49%
	BWI/DCA/IAD	BWI	$178	$53	-70%
		DCA	$190	$145	-23%
		IAD	$154	$128	-17%
	BWI/DCA/IAD Total		$185	$73	-61%
	MCO	MCO	$131	$95	-28%
	MCO Total		$131	$95	-28%
	MDW/ORD	MDW	$166	$103	-38%
		ORD	$217	$149	-31%
	MDW/ORD Total		$217	$138	-36%
	TPA	TPA	$125	$101	-19%
	TPA Total		$125	$101	-19%
PVD Total			$169	$93	-45%
BOS	BNA	BNA	$173	$161	-7%
	BNA Total		$173	$161	-7%
	BWI/DCA/IAD	BWI	$189	$140	-26%
		DCA	$187	$197	6%
		IAD	$91	$98	8%
	BWI/DCA/IAD Total		$144	$140	-1%
	MCO	MCO	$118	$108	-9%
	MCO Total		$118	$108	-9%
	MDW/ORD	MDW	$141	$151	7%
		ORD	$222	$213	-4%
	MDW/ORD Total		$216	$211	-2%
	TPA	TPA	$130	$123	-5%
	TPA Total		$130	$123	-5%
BOS Total			$156	$151	-3%

Exhibit B-2
Fares Before and After Southwest Entry Into MHT

AVGFARE			TIMEPERIOD		
DEPCITY	ARRMKT	ARRCITY	YE1998Q1	YE1999Q2	%Change
MHT	BNA	BNA	$209	$114	-46%
	BNA Total		$209	$114	-46%
	BWI/DCA/IAD	BWI	$190	$56	-71%
		DCA	$171	$168	-2%
		IAD	$162	$157	-3%
	BWI/DCA/IAD Total		$174	$66	-62%
	MCO	MCO	$117	$112	-4%
	MCO Total		$117	$112	-4%
	MDW/ORD	MDW	$132	$109	-17%
		ORD	$237	$175	-26%
	MDW/ORD Total		$237	$144	-39%
MHT Total			$170	$93	-45%
BOS	BNA	BNA	$165	$164	-1%
	BNA Total		$165	$164	-1%
	BWI/DCA/IAD	BWI	$139	$145	4%
		DCA	$202	$202	0%
		IAD	$93	$84	-9%
	BWI/DCA/IAD Total		$142	$128	-10%
	MCO	MCO	$114	$122	6%
	MCO Total		$114	$122	6%
	MDW/ORD	MDW	$145	$149	2%
		ORD	$216	$211	-2%
	MDW/ORD Total		$214	$209	-2%
BOS Total			$155	$148	-4%

Exhibit B-3
O-D TRAVEL LEVELS BEFORE AND AFTER SOUTHWEST ENTRY INTO PVD

PAX DEPCITY	ARRMKT	ARRCITY	TIMEPERIOD YE1998Q3	YE1999Q4	% Change
PVD	BNA	BNA	19,657	90,365	360%
	BNA Total		19,657	90,365	360%
	BWI/DCA/IAD	BWI	77,275	709,533	818%
		DCA	156,673	188,771	20%
		IAD	3,014	4,521	50%
	BWI/DCA/IAD Total		236,962	902,825	281%
	MCO	MCO	229,482	453,090	97%
	MCO Total		229,482	453,090	97%
	MDW/ORD	MDW	1,595	119,724	7406%
		ORD	152,449	229,614	51%
	MDW/ORD Total		154,044	349,338	127%
	TPA	TPA	75,955	190,157	150%
	TPA Total		75,955	190,157	150%
PVD Total			716,100	1,985,775	177%
BOS	BNA	BNA	164,010	141,724	-14%
	BNA Total		164,010	141,724	-14%
	BWI/DCA/IAD	BWI	341,264	410,047	20%
		DCA	772,222	770,044	0%
		IAD	920,172	823,922	-10%
	BWI/DCA/IAD Total		2,033,658	2,004,013	-1%
	MCO	MCO	1,007,721	1,130,360	12%
	MCO Total		1,007,721	1,130,360	12%
	MDW/ORD	MDW	86,009	36,036	-58%
		ORD	1,086,756	1,180,883	9%
	MDW/ORD Total		1,172,765	1,216,919	4%
	TPA	TPA	466,389	543,290	16%
	TPA Total		466,389	543,290	16%
BOS Total			4,844,543	5,036,306	4%

Exhibit B-4
O-D TRAVEL LEVELS BEFORE AND AFTER SOUTHWEST ENTRY INTO MHT

PAX DEPCITY	ARRMKT	ARRCITY	TIMEPERIOD YE1998Q1	YE1999Q2	% Change
MHT	BNA	BNA	10,373	60,566	484%
	BNA Total		10,373	60,566	484%
	BWI/DCA/IAD	BWI	14,146	584,078	4029%
		DCA	74,778	56,573	-24%
		IAD	3,333	4,246	27%
	BWI/DCA/IAD Total		92,257	644,897	599%
	MCO	MCO	111,012	226,457	104%
	MCO Total		111,012	226,457	104%
	MDW/ORD	MDW	242	105,996	43700%
		ORD	77,033	119,834	56%
	MDW/ORD Total		77,275	225,830	192%
MHT Total			290,917	1,157,750	298%
BOS	BNA	BNA	130,570	113,905	-13%
	BNA Total		130,570	113,905	-13%
	BWI/DCA/IAD	BWI	392,106	372,955	-5%
		DCA	727,694	652,751	-10%
		IAD	868,461	1,241,823	43%
	BWI/DCA/IAD Total		1,988,261	2,267,529	14%
	MCO	MCO	1,092,476	1,032,801	-5%
	MCO Total		1,092,476	1,032,801	-5%
	MDW/ORD	MDW	35,354	35,750	1%
		ORD	1,118,447	1,125,267	1%
	MDW/ORD Total		1,153,801	1,161,017	1%
BOS Total			4,365,108	4,575,252	5%

Exhibit B-5
BOSTON-NASHVILLE O-D TRAFFIC

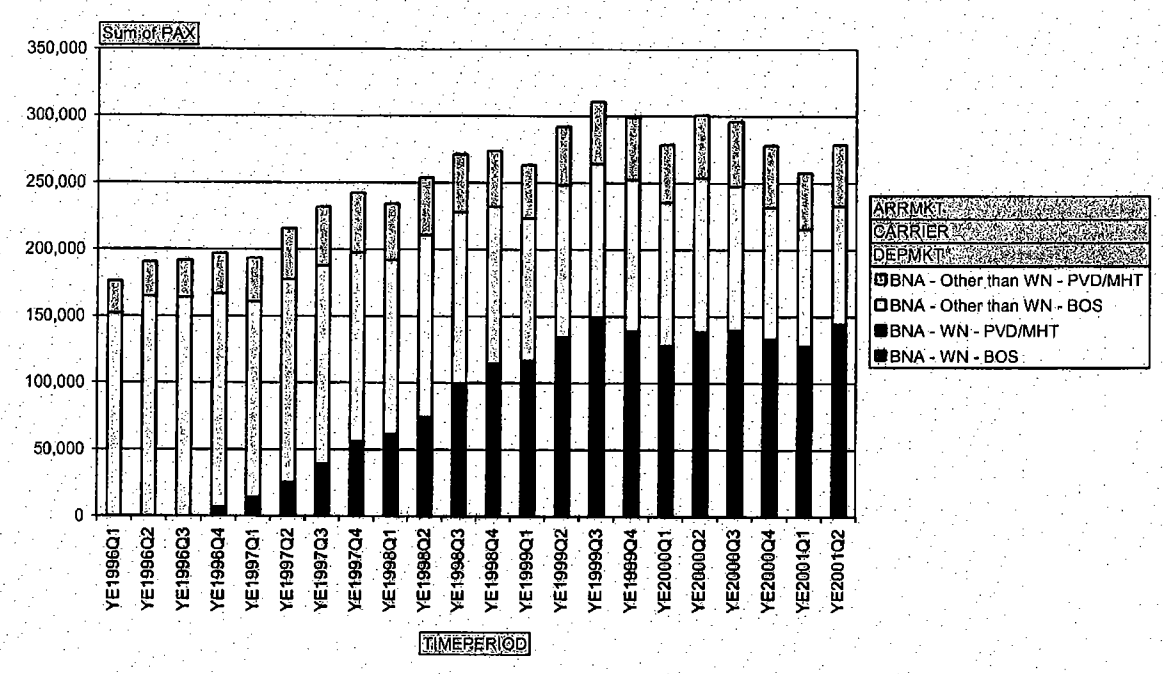


Exhibit B-6
BOSTON-WASHINGTON O-D TRAFFIC

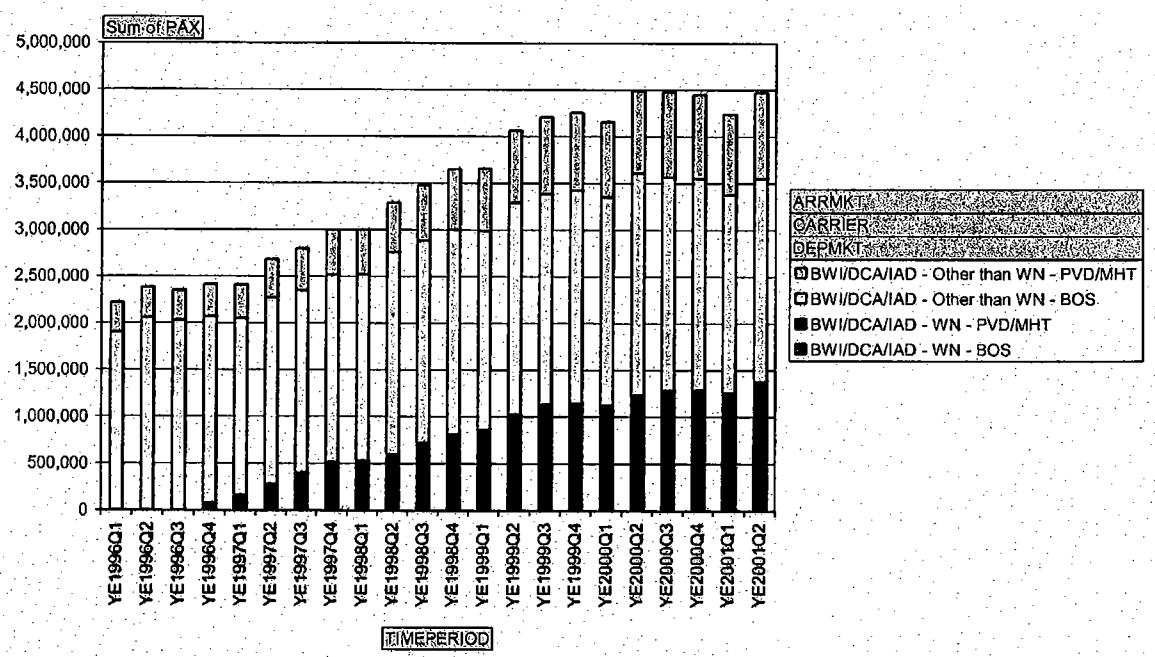


Exhibit B-7
BOSTON-ORLANDO O-D TRAFFIC

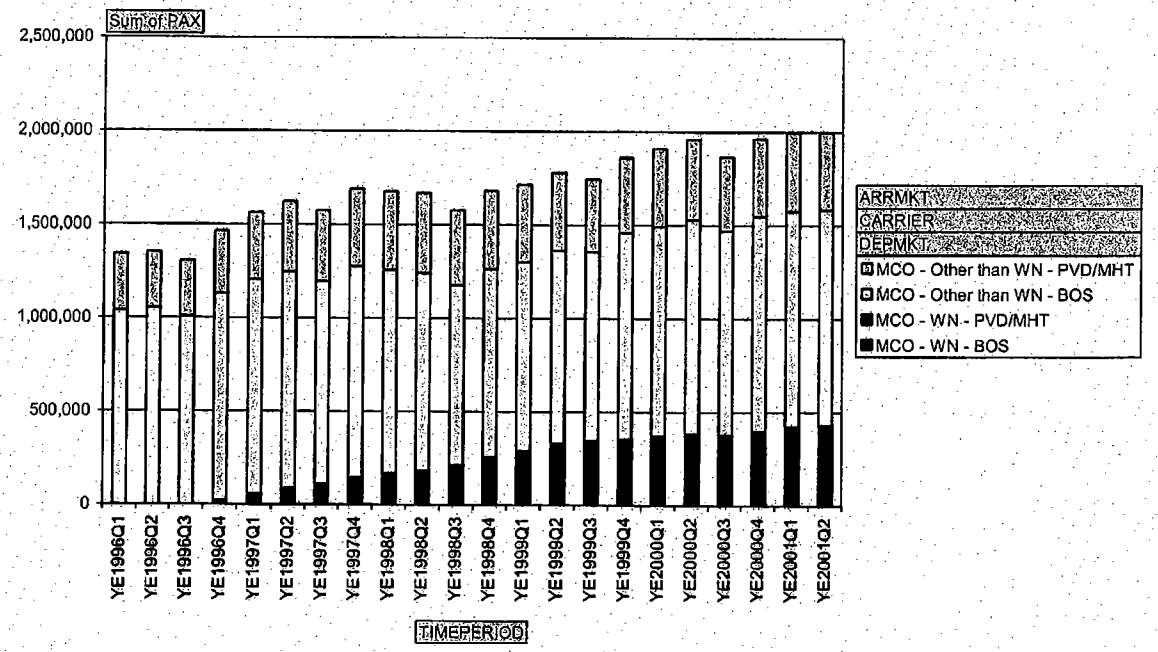


Exhibit B-8
BOSTON-CHICAGO O-D TRAFFIC

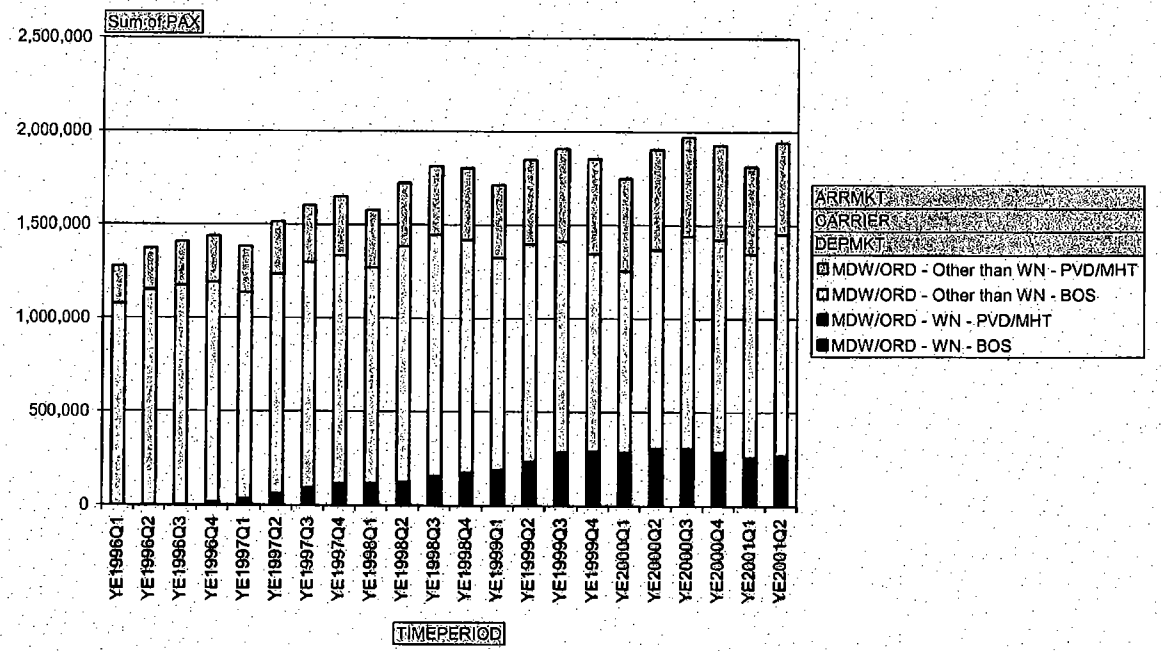


Exhibit B-9
BOSTON-TAMPA O-D TRAFFIC