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Guidebook on Landside Freight Access to Airports





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GUIDEBOOK ON LANDSIDE FREIGHT ACCESS TO AIRPORTS

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DISCLAIMERS

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The United States Government and the State of Texas do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

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LIST OF ABBREVIATIONS AND SYMBOLS

1118/1119	National Corridor Planning and Development Program/Coordinated Border Infrastructure Program
AAF	Army Air Field
AFB	Air Force Base
AIP	Airport Improvement Program
AIR-21	Wendell H. Ford Aviation Investment and Reform Act for the 21st. Century
ALP	Airport layout plan
ARRA	American Recovery and Reinvestment Act
AVN	TxDOT Aviation Division
AWOS	Automated weather observing system
CMAQ	Congestion Mitigation Air Quality
DOT	State department of transportation
FAA	Federal Aviation Administration
FedEx	Federal Express
FHWA	Federal Highway Administration
FTZ	Foreign Trade Zone
FY	Fiscal year
GR	General revenue
GR-D	Dedicated general revenue
LCL	Less-than-container load
LTL	Less-than-truckload
MPO	Metropolitan planning organization
NAVAIDS	Navigational aids
NHS	National Highway System
NPE	Non-Primary Entitlement Funds
NPIAS	National Plan of Integrated Airport Systems
NVOCC	Non vessel operating common carrier
PAPI	Precision approach path indicator

PFC	Passenger Facility Charge
Proposition 12	general obligation bonds
Proposition 14	State Highway Fund bonds
REIL	Runway end identifier lights
RMA	Regional Mobility Authority
SHF	State Highway Fund
SIB	State Infrastructure Bank
STP	Surface Transportation Program
TASP	Texas Airport System Plan
TIA	Traffic impact analysis
TIFIA	Transportation Infrastructure Finance and Innovation Act
TIP	Transportation improvement plan
TMF	Texas Mobility Fund
TSTC	Texas State Technical College
TTI	Texas Transportation Institute
TxDOT	Texas Department of Transportation
UPS	United Parcel Service
USDOT	U.S. Department of Transportation
USEDA	U.S. Economic Development Administration
UTP	Unified Transportation Program

PROJECT PURPOSE AND BACKGROUND

The purpose of this project was to identify challenges and solutions to providing landside freight access to airports. Depending on where an airport is located (e.g., innercity, suburban, or rural), airports face various challenges to providing safe and efficient freight access routes to and from the airport. Access routes include adequately designed roadways and/or rail lines to and from the airport area that serve all airport cargo movement needs. The cargo requirements of airports may vary greatly, based on either small packages carried in the belly of passenger airliners or specialized air cargo operations requiring palletized loading of cargo-only aircraft. Cargo operations can take place around the clock, necessitating properly planned transportation access to ensure that these activities can take place.

This guidebook provides cities, counties, regional planning agencies, metropolitan planning organizations, state agencies, shippers, and airport operators with a discussion of the issues and solutions related to landside freight access to airports. It is a result of numerous case studies developed from surveys and interviews of airport and freight industry personnel across the state and nation. It provides recommendations and examples of techniques to plan for and provide safe and efficient landside freight access to airports.

This guidebook represents product 0-6265-P1 of TxDOT research project 0-6265, Landside Freight Access to Airports—Challenges and Solutions. In comparison to the full 0-6265-1 research report, this document is intended to serve as a quick reference guide.

The objective of this guidebook is to identify the issues, barriers, physical bottlenecks, and solutions, including potential funding mechanisms, concerning landside access to airports in Texas and to propose a methodology for identifying and evaluating existing access performance from a freight perspective.

ORGANIZATION OF GUIDEBOOK

Following this introductory chapter, this guidebook is organized into the following chapters:

- Chapter 1: Introduction and Purpose;
- Chapter 2: Air Cargo Activity and Operations in Texas;
- Chapter 3: Planning for Landside Freight Access;
- Chapter 4: Funding Air Cargo Access Improvements;

- Chapter 5: Landside Freight Access Issues, Guidance, and Solutions;
- Chapter 6: Conclusions and Recommendations; and
- References and Bibliography.

Chapter 1 provides an introduction to the topic and explains why it is an important issue today. It describes the purpose and objectives of the research and provides background information on the air cargo industry. This provides a foundation for the discussion of landside freight access that follows throughout the guidebook.

Chapter 2 provides information on air cargo activity in Texas and describes the level and location of activity in the state. Chapter 3 addresses the planning issues associated with landside freight including the stakeholders, while Chapter 4 addresses funding issues including existing programs and opportunities for funding landside freight access improvements. Chapter 5 discusses in detail the landside freight access issues and corresponding solutions identified throughout the research process. This process included interviews, surveys, and case studies of several airports and airport/industry officials.

Chapter 6 provides conclusions and recommendations for future research related to landside freight access to airports.

CHAPTER 1. INTRODUCTION AND PURPOSE OF GUIDEBOOK

OVERVIEW

The largest airports in Texas play a vital role in the movement of goods by air intrastate, nationally, and internationally. However, as freight demand grows, other, smaller airports will need to accommodate the additional demand.

Properly planned transportation infrastructure is critical to ensure the vitality of airport freight operations. Time-sensitive air freight requires high levels of operational efficiency; airports must optimize both freight and passenger roadway access within airport boundaries. Connections with regional highways near the airports and the design features of those highways are no less important because they provide access to these important economic generators.

The objectives of this guidebook are to:

- identify the issues, barriers, physical bottlenecks, and solutions, including potential funding mechanisms, concerning landside access to airports in Texas; and
- propose a methodology for identifying and evaluating existing access performance from a freight perspective.

BACKGROUND

Texas airports play a large role in the movement of goods within the state, across the country, and internationally to several continents. Most of this air cargo operation occurs at the largest of airports in Texas. However, as demand grows, additional airports, existing and yet to be built, may need to accommodate future demand.

Type and Value of Air Cargo

Air cargo predominantly serves markets requiring time-sensitive and value-sensitive goods (*1*). Time-sensitive products include perishables, animals, emergency items such as drugs, and machinery parts. Value-sensitive products include medicines, electronics, chemicals, and fragile goods. The airport serves as an interface between aircraft and trucks as they exchange cargo. Shipments must fluidly travel to and from airports, especially due to the value- and time-sensitive nature of air cargo goods.

In 2002, the latest available data from the *Commodity Freight Survey*, air cargo accounted for a small amount of overall commercial freight activity. Air cargo accounted for 7.4 percent of the value of shipments, 0.1 percent of the weight, and 0.3 percent of the ton-miles (*2*).

Economic Importance of Air Cargo

Overall progress in air cargo has resulted in overnight express service being possible to almost every zip code in the country. In turn, the speed of transporting items by air has allowed small communities to participate more aggressively in the global economy.

Passenger airlines may play a lesser role in transporting small packages, but they still carry a significant amount of other freight in the bellies of aircraft. Recent estimates by the Air Transport Association indicated that belly cargo was approximately 43 percent of all cargo flown (*3*). According to Kasarda et al., an estimated 75 percent of international air cargo is belly cargo, with 15 percent flown by all-cargo carriers (*4*).

The Boeing World Air Cargo Forecast predicted an annual growth rate in world cargo of 5.8 percent for the next two decades (*5*). This rapid and continuous growth strongly indicates that airports should consider cargo more than just a side business, and communities should see air cargo as an economic development resource.

Required Airside/Landside Facilities

The bulk of air cargo in Texas is handled at the largest passenger service airports. Cargo operations typically benefit from having a large amount of physical space in which to operate. Ultimately, the space required depends on the type and volume of cargo being processed. Air cargo facilities generally fall into the category of single-tenant, multitenant, or shell facilities (*6*). The first two are self-explanatory, but a shell facility is typically built on speculation to attract a tenant who would be a limited and prized commodity to the airfield.

Airports are typically divided into two areas—airside and landside. The airside areas include those accessible to the aircraft such as runways, taxiways, and ramp areas. Landside areas include access roads, parking lots, passenger drop-off/circulation routes, and public transportation stations.

Required airside features typically include the aircraft operating areas, ramp space (size and strength), lighting, drainage, and processing space. These vary depending on the size of the operation. The runway length and strength and airfield design should meet the operational

requirements of the aircraft being used. If the cargo operation is at an airport with scheduled passenger service, the location of the cargo area should not conflict with the passenger area or the ends of runways. Proper placement of the cargo area minimizes delays and operational costs.

On the landside, roadway access and parking are critical. Since cargo transport primarily uses the roadway system, suitable access to the road network is of prime importance. Adequate parking space for both employee and customer cars is also a necessary feature. Other landside factors to consider are utilities, ceiling heights, lift capabilities, interior lighting, refrigeration capabilities, and office space (*3*). Additionally, the airport or surrounding area should have adequate space for not only the cargo operations but also any affiliated businesses. This includes related governmental agencies that may need to be involved, including customs, agricultural inspection, and security facilities. Foreign Trade Zone (FTZ) designations are also a consideration in cargo developments.[1] FTZ designations offer a mechanism for companies to reduce operating costs. FTZs provide an incentive in favor of an airport because products are not subject to the typical customs and duty processes and payments.

THE PLAYERS

A wide variety of suppliers generate air cargo, which is usually high-value and/or time-sensitive. Typically, trucks transport supplies to the airport or a nearby consolidator or forwarder. Aircraft then transport the supplies for the long-haul leg of the trip. Finally, trucks ship the supplies to another consolidator or consignee. The flowchart in Figure 1 illustrates this general trend.

The companies involved in the movement of goods in the air cargo business include:

- combination carriers,
- all-cargo carriers (integrated or traditional/line-haul carriers), and
- freight forwarders.

Table 1 summarizes air cargo service providers.

[1] A Foreign Trade Zone is outside of U.S. Customs Territory for the purpose of customs duty payment. Goods entering FTZs are not subject to customs tariffs until the goods leave the zone and formally enter into U.S. Customs Territory. Merchandise that is shipped to foreign countries from FTZs is exempt from duty payments. Source: http://ia.ita.doc.gov/ftzpage/tic.html (accessed June 16, 2010).

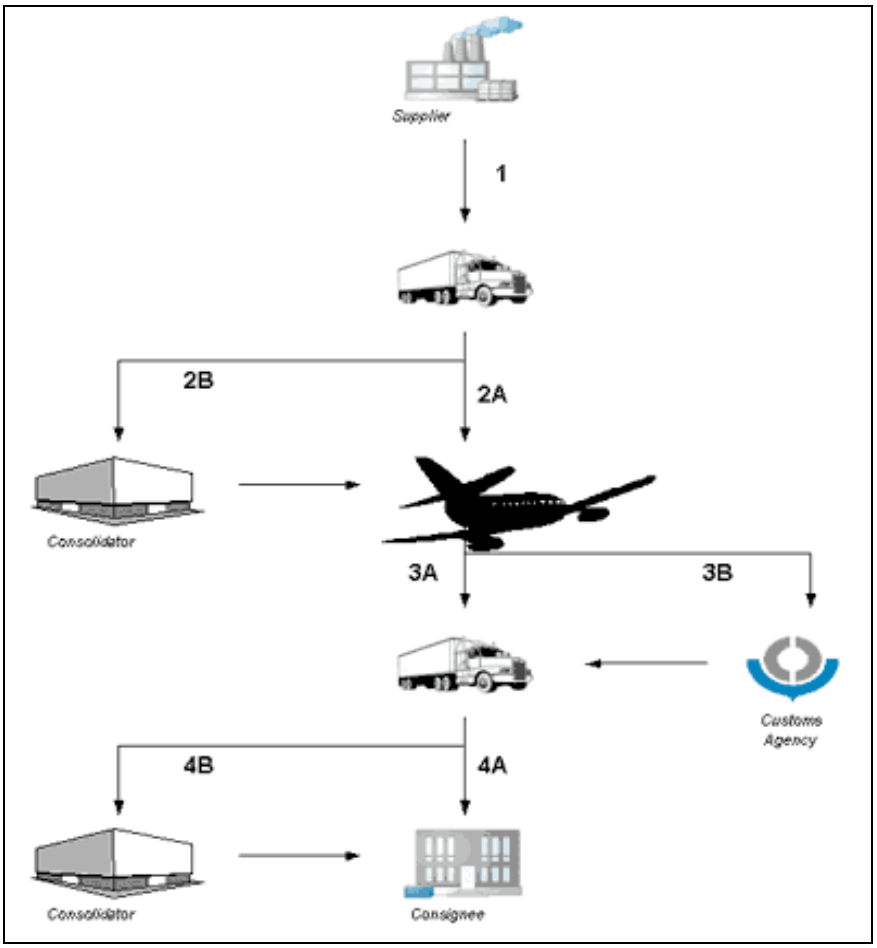


Figure 1. Simplified Depiction of Physical Freight Flow for Time-Sensitive Freight (*7*).

Table 1. Types and Characteristics of Air Cargo Carriers.

Type of Carrier	Example of Carrier	Characteristics	Customers	Market/Movement	Type of Cargo
Combination carrier	Most passenger airlines	Baggage hold of passenger aircraft	Wholesale, mail, retail	Airport to airport	Mail, freight
Integrated carrier	United Parcel Service (UPS), Federal Express (FedEx)	Main decks of all-cargo aircraft	Retail	Door to door	Packages, express
Traditional/ line-haul carrier	Polar, Kalitta, World Airways, BAX Global	Main decks of all-cargo aircraft	Wholesale	Airport to airport	Larger, specialized freight
Freight forwarders	Panalpina, Forward Air	All-cargo and passenger aircraft	Wholesale	Feeder services (pickup and delivery)	Ocean and air freight pickup and delivery

Source: Air Transport Association and International Air Cargo Association (compiled by the Texas Transportation Institute [TTI])

Combination Carriers

Combination carriers are passenger airlines that transport cargo below the main deck; they are also called "belly cargo" carriers.

All-Cargo Carriers

The growing demand for air cargo has created a strong market for more all-cargo carriers (*5*). Unlike the combination carriers that carry both passengers and belly freight, all-cargo carriers transport only cargo on the main deck of the aircraft.

All-cargo carriers can be further classified as integrated carriers or traditional/line-haul carriers. Integrated carriers provide door-to-door service such as UPS and FedEx. Traditional/line-haul carriers typically provide airport-to-airport service and include carriers like Polar Air Cargo and World Airways.

Freight Forwarders

Freight forwarders are companies that assemble or consolidate freight for shipment by air transport; they are also called consolidators. While forwarders and consolidators are often considered synonymous, there are distinctions. Consolidators and forwarders handle many of the same functions, but forwarders may offer the additional service of transporting the cargo between some points (*8*).

Air freight forwarders act as agents on behalf of air carrier shippers (manufacturers or suppliers). Manufacturers and suppliers sell their merchandise to consumers located all over the world. To do this, their products have to be prepared and shipped in a timely manner. The freight forwarder has to provide transportation to the air bridge and ensure that the cargo is properly loaded, that all tariffs are paid, and that all paperwork is properly filled out.

Freight forwarders often prepare documentation and provide for customs clearance on international flights. Forwarders can be considered indirect air carriers or can operate like integrated carriers. These companies may operate their own fleets of trucks and aircraft but more typically act as third-party agents in moving cargo. They may also purchase capacity on other carriers, including passenger carriers, to accommodate their customers. They provide a seamless process for those needing to move a variety of items ranging from bulky items and perishables to live animals and automobiles.

Freight forwarders can clear and deliver cargo to consignees and shipping consultants for import and export access to bonded off-dock warehouses. Some freight forwarders include less than container (LCL)/less than truck load (LTL) cargo agents for steamship lines/non-vessel operating common carriers (NVOCCs).

CHAPTER 2. AIR CARGO ACTIVITY AND OPERATIONS IN TEXAS

OVERVIEW

This chapter provides an understanding of air cargo activity and operations in Texas. This includes the airports in Texas where air cargo activity occurs and the air carriers that are operating at these airports. Such an examination can indicate where agencies should focus air cargo access planning and improvements.

Knowing the operators involved can be helpful in understanding travel patterns. For example, while passenger airlines (belly cargo) fly throughout the day, integrated carriers (all cargo) may operate overnight. Such overnight air cargo movement may indicate that truck activity interfacing with air cargo operations may occur in the evening and early morning hours. These temporal patterns vary at the airport according to the particular operators and the level of activity. Seasonal variations may also occur, depending on the type of goods being shipped and the origins/destinations of such goods.

Airports serving air cargo markets receive and distribute goods from a broad market area that extends beyond the airport and the city it serves. Surveys from airports in Texas indicate that such markets extend to a radius of 100 to 200 miles from an airport. In one case, inbound and outbound freight movement extended beyond the airport by 1,000 miles. This is not surprising because some of the integrated carriers have developed and are utilizing more extensive truck networks to more efficiently and effectively serve their customers (*9*). Much of this service competes with air cargo, but some may also interact with it. Nevertheless, this requires a roadway network and links to the airport that are suitable to accommodate truck activity. This is particularly important in the area surrounding the airport where different types of traffic converge.

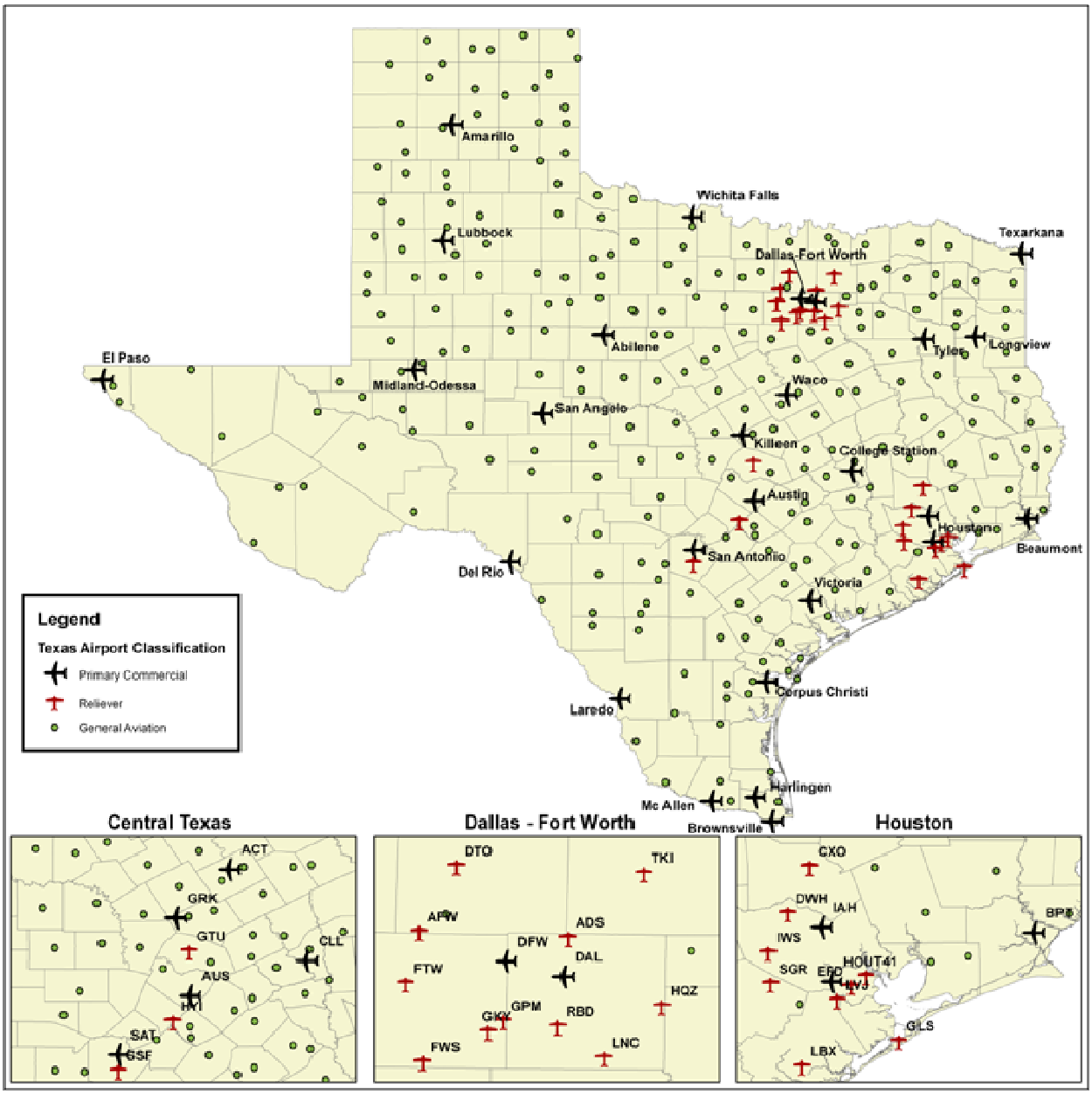
Those accessing the airport typically include passengers, employees, and auxiliary commercial vehicles, which include the terminal and cargo area supply/delivery trucks. Air cargo–related truck activity occurs at locations distinct from the passenger terminal. Passenger airlines typically locate their own cargo centers away from the passenger terminals to provide for a more efficient transfer of goods without interfering with passenger terminal traffic. Air cargo–related truck activity may share some of the same primary access roads as passenger traffic, especially interstates/controlled-access major arterials.

The types of trucks accessing airport air cargo centers may vary from small delivery trucks to large tractor-trailers. The number of truck trips to and from the cargo centers varies according to the level of activity at each airport and the size of the service trucks. Data on truck trips received from airports for this research have ranged from 15 to 50 trucks per day, with some defining a typical truckload as 44,000 lb. This does not include truck trips to/from freight forwarders located in the airport vicinity.

Larger airports serving international markets attract freight forwarders to the area. This increases the truck activity at the airport both in terms of truck size and trip frequency to accommodate the demand. It also increases activity on the local road network since freight forwarders are typically located within close proximity of the airport. With international air cargo markets being served by a limited number of airports, the demand is drawn from a much larger region beyond the airport. TTI-compiled data from airport surveys and interviews show it may also extend beyond state borders (*10*). Consequently, shippers frequently use larger trucks to make the operation more efficient. Freight forwarders and consolidating companies receive cargo by truck and then repackage it for shipment by air. Whether these companies decide to locate in the airport vicinity largely depends on available access to their facilities and from those facilities to the airport cargo centers via the local network.

TEXAS AIRPORTS

The Texas airport system consists of more than 300 airports, which range in size from small community airports serving agricultural purposes to large urban airports serving millions of passengers and international destinations. Figure 2 shows airports that are diverse in both size and function.



Source: Texas Transportation Institute

Figure 2. Texas Airports by Classification.

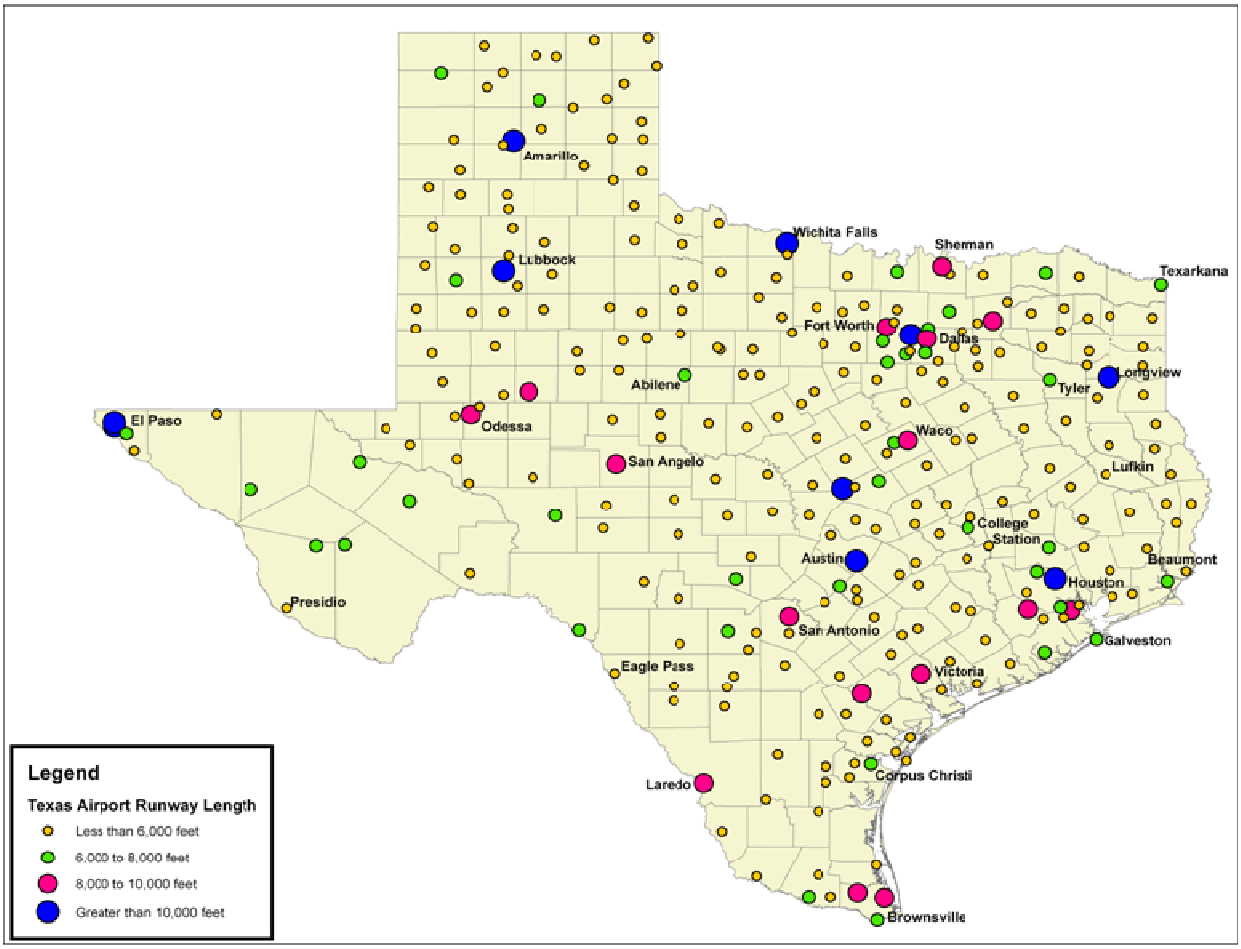
Not all of these airports, however, cater to all kinds of air cargo activities. Some cargo aircraft require very long runways with substantial ramp space, while others can utilize much shorter runways and existing ramp spaces. International air cargo activities are indicative of the former, while smaller feeder cargo services are indicative of the latter.

The length of available runway at an airport is the most obvious sign of suitable accommodations for existing air cargo demand. In some cases, airports are able to extend their

existing runway. In other cases, the airport does not control or is not able to control the land to make necessary airport improvements. Furthermore, other development may encroach on airports and preclude any improvements. While individual airports have their own unique sets of circumstances, the Texas airport system as a whole has a number of facilities capable of handling increased air cargo demand.

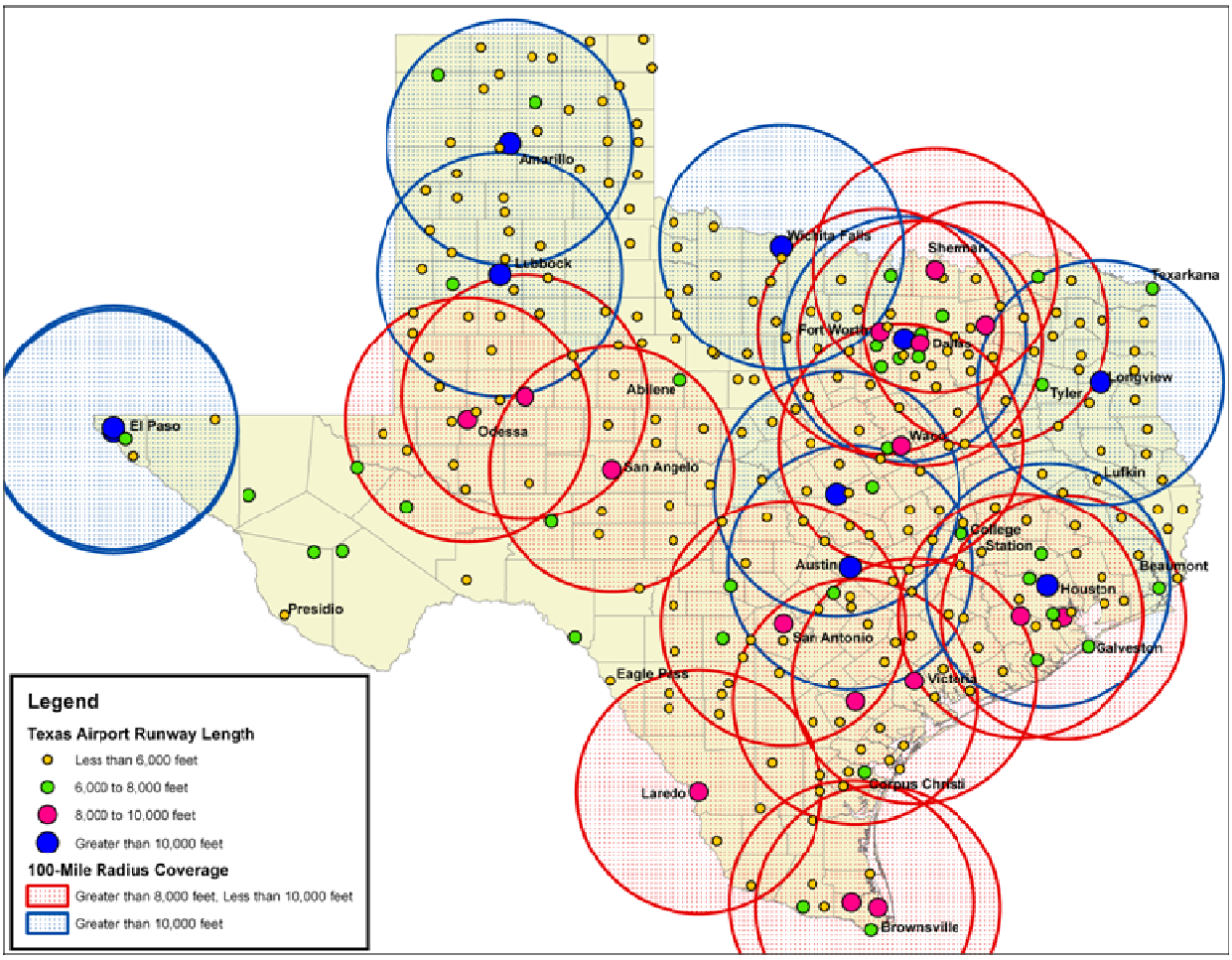
Existing runway length at an airport can indicate the facility's overall design standard is adequate to handle aircraft requiring such length. Using this criteria, Texas is well positioned to capitalize on any new demand in air cargo. While this assumption may not always hold true, it is reasonable to expect that runways designed to accommodate aircraft needing such length also have the requisite pavement strength. Efforts to strengthen the pavement of a particular runway would probably prove less expensive than building a new facility; very few new airports are now being built. Figure 3 shows Texas Airport System Plan (TASP) airports across the state and the runway facilities they offer. Runway length is not the only criterion used to establish the suitability of a runway for a particular aircraft or use. Airport planners use many criteria in establishing takeoff and landing requirements including aircraft weight, airport elevation, and outside temperature. All of these can affect the operating characteristics of aircraft and must be taken into account.

Texas has nine geographically diverse facilities with runways of 10,000 ft or longer. Another 16 airports have runways between 8,000 and 10,000 ft. These facilities are distributed across the state covering the economic and population centers. Every major population center is accommodated by an airport offering at least 8,000-ft runways within a 100-mile radius. The vast majority of the state has great accessibility to these facilities. Figure 4 shows this combined coverage.



Source: Texas Transportation Institute

Figure 3. Texas Airports Classified by Runway Length.



Source: Texas Transportation Institute

Figure 4. 100-Mile Radius Coverage for Texas Airports with Runways Greater than 8,000 Ft.

The sparsely populated border region, running from north of Laredo along the Rio Grande River west to Lajitas and then north to the New Mexico border, along with some pockets in north-central Texas and east Texas, are the only parts of the state not within 100 miles of an airport with a runway of 8,000 ft or more. This statewide coverage, or available access to air cargo–capable airports, provides significant opportunities for locating businesses dependent or reliant on air cargo within the state. The Texas airport system, as it currently stands, meets the air cargo needs of its residents and businesses. Table 2 shows the airports in Texas having at least one runway 8,000 ft or longer.

Table 2. Texas Airports by Runway Length (Longest).

City	Airport Name	Longest Runway
Amarillo	Rick Husband Amarillo International	13,502
Dallas-Fort Worth	Dallas/Fort Worth International	13,401
Wichita Falls	Sheppard Air Force Base (AFB)/Wichita Falls Municipal	13,101
Austin	Austin-Bergstrom International	12,248
El Paso	El Paso International	12,020
Houston	George Bush Intercontinental/Houston	12,001
Lubbock	Lubbock Preston Smith International	11,500
Fort Hood/Killeen	Robert Gray Army Airfield (AAF)	10,000
Longview	East Texas Regional	10,000
Fort Worth	Fort Worth Alliance	9,600
Midland/Odessa	Midland International	9,501
Victoria	Victoria Regional	9,101
Houston	Ellington Field	9,001
Sherman/Denison	Grayson County	9,000
Big Spring	Big Spring McMahon-Wrinkle	8,802
Dallas	Dallas Love Field	8,800
Waco	Texas State Technical College (TSTC) Waco	8,600
San Antonio	San Antonio International	8,502
Harlingen	Valley International	8,301
Laredo	Laredo International	8,236
San Angelo	San Angelo Regional/Mathis Field	8,049
Greenville	Majors	8,030
Berclair	Goliad County Industrial Airpark	8,000
Houston	Sugar Land Regional	8,000
Port Isabel	Port Isabel-Cameron County	8,000

Source: Texas Transportation Institute

AIR CARGO ACTIVITY IN TEXAS

While most of the air cargo activity in the state occurs at the largest airports, many other airports have some air cargo activity. Approximately 65 percent of the existing cargo activity takes place at Dallas/Fort Worth International Airport and Houston George Bush Intercontinental Airport. Table 3 shows the inbound and outbound air cargo tonnage (including mail) for all 39 airports in the state that had air cargo activity. The source of these activity data is the T-100 Databank/Form 41 obtained from the Bureau of Transportation Statistics. Both commercial service and general aviation airports are included. The data are shown for inbound cargo, outbound cargo, total cargo, and the percent state market share for each airport.

Table 3. Texas Airports Air Cargo (Including Mail) Activity—2007 (Market Data, Tons).

Rank	ID	City/Airport	Inbound	Outbound	Total	Percent Market Share
1	DFW	Dallas/Fort Worth International	468,527.6	382,221.9	850,749.5	41.53
2	IAH	Houston Intercontinental	231,731.5	248,075.8	479,807.3	23.42
3	AFW	Dallas/Fort Worth (Alliance)	107,993.3	115,504.6	223,497.9	10.91
4	SAT	San Antonio International	87,773.7	59,605.4	147,379.2	7.19
5	AUS	Austin-Bergstrom International	57,199.8	55,826.8	113,026.6	5.52
6	ELP	El Paso International	41,538.9	44,231.4	85,770.3	4.19
7	HRL	Harlingen/San Benito	18,710.9	17,371.5	36,082.4	1.76
8	DAL	Dallas Love	15,940.3	14,900.8	30,841.1	1.51
9	LBB	Lubbock	19,499.4	8,605.8	28,105.2	1.37
10	LRD	Laredo International	17,804.9	9,265.4	27,070.3	1.32
11	HOU	Houston Hobby	6,987.2	9,296.1	16,283.3	0.79
12	MAF	Midland/Odessa	1,981.0	1,515.8	3,496.8	0.17
13	ABI	Abilene Regional	716.9	423.7	1,140.6	0.06
14	DRT	Del Rio International	400.9	675.4	1,076.3	0.05
15	MFE	Mission/McAllen/Edinburg	630.8	356.4	987.2	0.05
16	SJT	San Angelo Regional	483.7	271.4	755.1	0.04
17	AMA	Amarillo International	295.1	148.1	443.1	0.02
18	FTW	Dallas/Fort Worth Meacham	389.1	12.5	401.6	0.02
19	GRK	Killeen/Gray AAF	13.5	319.9	333.4	0.02
20	CRP	Corpus Christi	244.4	66.1	310.4	0.02
21	BWD	Brownwood Regional	161.0	128.3	289.3	0.01
22	BRO	Brownsville/South Padre	56.7	216.0	272.7	0.01
23	DTO	Denton Municipal	172.4	3.5	175.9	0.01
24	BIF	El Paso (Fort Bliss)	19.3	132.0	151.3	0.01
25	ADS	Dallas/Fort Worth Addison	61.0	22.6	83.6	0.00
26	CLL	College Station/Bryan	15.6	35.2	50.8	0.00
27	FWH	Dallas/Fort Worth (Hicks)	0.0	42.6	42.6	0.00
28	JZT	Arlington Municipal	5.9	14.8	20.7	0.00
29	TX3	Port Isabel-Cameron County	0.0	17.2	17.2	0.00
30	SPS	Wichita Falls/Sheppard AFB	11.6	3.7	15.3	0.00
31	CNW	Waco (TSTC)	12.3	0.0	12.3	0.00
32	TYR	Tyler Regional	2.5	8.7	11.2	0.00
33	COT	Cotulla-La Salle County	9.5	0.0	9.5	0.00
34	ACT	Waco (Regional)	3.6	1.0	4.5	0.00
35	EFD	Houston (Ellington)	0.0	3.3	3.3	0.00
36	BPT	Beaumont/Port Arthur	0.0	2.7	2.7	0.00
37	GGG	Longview/Kilgore/Gladewater	2.0	0.4	2.4	0.00
38	SWW	Sweetwater/Avenger Field	1.0	0.0	1.0	0.00
39	UVA	Uvalde/Garner Field	0.7	0.0	0.7	0.00
Total			**1,079,397.9**	**969,326.8**	**2,048,724.8**	**100.00**

Source: Bureau of Transportation Statistics

To differentiate between freight and mail, Table 4 shows freight excluding mail, and Table 5 shows mail activity only. Table 4 shows freight tonnage (inbound and outbound) for all airports in Texas. Dallas/Fort Worth International Airport and Houston Intercontinental Airport account for nearly 64 percent of the total state air freight activity. Table 5 shows the total mail carried (inbound and outbound) in tons. Most of the mail is flown to/from Dallas/Fort Worth International Airport and Houston Intercontinental Airport. Together they account for 91 percent of the state total. The top five airports account for 89 percent of the state's total air cargo.

Table 6 lists the top 20 air cargo carriers as measured by total inbound and outbound cargo in 2007. Not surprisingly, FedEx and UPS lead the way with a combined market share of nearly 54 percent of total tonnage. These data may prove useful in the future because they could provide some insight on future activity levels and markets. Since airlines make substantial investments in their facilities and are prone to hub operations (e.g., FedEx and UPS), knowing which carriers are involved could help determine where future activity may exist.

Additionally, both of these integrated air cargo carriers have been building truck networks that carry both cargo and mail. A Wilbur Smith Associates report notes that trucking distances now extend to 800 miles, up from 500 miles previously (*9*). Trucks have become a bigger part of the air cargo network, further underscoring the necessity for airport-highway linkages.

Several passenger airlines are among the most active air cargo carriers (belly cargo), including the three passenger airlines based in Texas. Many international carriers are also in the top 20, making up more than one-fifth of the list. The top 10 airports account for approximately 81 percent of the total air cargo activity in the state.

Table 7 shows the top 20 air cargo carriers ranked by the mail tonnage they carry. American Airlines and Continental Airlines, both headquartered in the state, account for nearly 83 percent of the total mail carried in the state. UPS, at almost 11 percent, is the only other carrier with a market share greater than 10 percent.

Table 4. Total Freight (Excluding Mail)—2007 (Inbound and Outbound in Tons).

Rank	ID	City	Total (Tons)	Market Share	Cumulative Share
1	DFW	Dallas/Fort Worth International	801,733.78	40.90	40.90
2	IAH	Houston Intercontinental	448,112.55	22.86	63.76
3	AFW	Dallas/Fort Worth (Alliance)	223,497.95	11.40	75.16
4	SAT	San Antonio International	142,646.04	7.28	82.44
5	AUS	Austin-Bergstrom International	110,803.27	5.65	88.09
6	ELP	El Paso International	84,977.15	4.34	92.43
7	HRL	Harlingen/San Benito	36,082.39	1.84	94.27
8	DAL	Dallas Love	30,840.21	1.57	95.84
9	LBB	Lubbock International	28,104.94	1.43	97.27
10	LRD	Laredo International	27,070.29	1.38	98.65
11	HOU	Houston Hobby	16,275.96	0.83	99.49
12	MAF	Midland/Odessa	3,496.74	0.18	99.66
13	ABI	Abilene Regional	1,140.55	0.06	99.72
14	DRT	Del Rio International	1,076.30	0.05	99.78
15	MFE	Mission/McAllen/Edinburg	972.42	0.05	99.83
16	SJT	San Angelo Regional	755.08	0.04	99.86
17	AMA	Amarillo International	443.11	0.02	99.89
18	FTW	Dallas/Fort Worth (Meacham)	401.61	0.02	99.91
19	GRK	Killeen/Gray AAF	333.25	0.02	99.92
20	CRP	Corpus Christi International	305.80	0.02	99.94
21	BWD	Brownwood Regional	289.33	0.01	99.96
22	BRO	Brownsville/South Padre	272.75	0.01	99.97
23	DTO	Denton Municipal	175.93	0.01	99.98
24	BIF	El Paso International	151.26	0.01	99.99
25	ADS	Dallas/Fort Worth (Addison)	83.63	0.00	99.99
26	CLL	College Station/Bryan	49.93	0.00	99.99
27	FWH	Dallas/Fort Worth (Hicks)	42.57	0.00	99.99
28	JZT	Arlington Municipal	20.70	0.00	100.00
29	TX3	Port Isabel-Cameron County	17.23	0.00	100.00
30	SPS	Wichita Falls/Sheppard AFB	15.27	0.00	100.00
31	CNW	Waco Regional	12.32	0.00	100.00
32	TYR	Tyler Regional	11.25	0.00	100.00
33	COT	Cotulla-La Salle County	9.50	0.00	100.00
34	ACT	Waco Regional	4.49	0.00	100.00
35	EFD	Houston (Ellington Field)	2.80	0.00	100.00
36	BPT	Beaumont/Port Arthur	2.50	0.00	100.00
37	GGG	Longview/Kilgore/Gladewater	2.42	0.00	100.00
38	SWW	Sweetwater/Avenger Field	0.97	0.00	100.00
39	UVA	Uvalde/Garner Field	0.72	0.00	100.00
Total			**1,960,234.96**	**100.00**	**100.00**

Source: Bureau of Transportation Statistics

Table 5. Total Mail—2007 (Inbound and Outbound in Tons).

Code	City	Total (Tons)	Percent
DFW	Dallas/Fort Worth International	49,015.75	55.39
IAH	Houston Intercontinental	31,694.74	35.82
SAT	San Antonio International	4,733.11	5.35
AUS	Austin-Bergstrom International	2,223.30	2.51
ELP	El Paso International	793.17	0.90
MFE	Mission/McAllen/Edinburg	14.77	0.02
HOU	Houston Hobby	7.33	0.01
CRP	Corpus Christi International	4.65	0.01
DAL	Dallas Love	0.93	0.00
CLL	College Station/Bryan	0.83	0.00
EFD	Houston (Ellington Field)	0.47	0.00
LBB	Lubbock International	0.27	0.00
BPT	Beaumont/Port Arthur	0.19	0.00
GRK	Killeen/Gray AAF	0.13	0.00
ABI	Abilene Regional	0.05	0.00
MAF	Midland/Odessa	0.05	0.00
ACT	Waco Regional	0.02	0.00
LRD	Laredo International	0.02	0.00
Total		**88,489.78**	**100.00**

Source: Bureau of Transportation Statistics

Table 6. Top 20 Air Cargo Carriers in Texas, Freight Carried, and Market Share—2007.

Rank	Air Carrier	Freight (Tons)	Percent Market Share
1	Federal Express Corporation	638,247.52	34
2	United Parcel Service	377,374.08	20
3	Continental Air Lines, Inc.	101,740.13	5
4	American Airlines, Inc.	98,123.17	5
5	ABX Air, Inc.	84,098.81	4
6	Eva Airways Corporation	55,254.65	3
7	China Airlines Ltd.	48,050.10	3
8	Korean Air Lines Co. Ltd.	47,005.04	3
9	Singapore Airlines Ltd.	44,113.43	2
10	Southwest Airlines Co.	37,260.23	2
11	Lufthansa German Airlines	35,663.41	2
12	Southern Air, Inc.	33,079.18	2
13	Air Transport International	28,592.11	2
14	British Airways PLC	27,633.51	1
15	KLM Royal Dutch Airlines	25,867.13	1
16	Cathay Pacific Airways Ltd.	22,591.92	1
17	Compagnie National Air France	20,962.88	1
18	China Cargo Airline	19,947.64	1
19	ASTAR Air Cargo, Inc.	19,084.92	1
20	Cargolux Airlines International S.A.	18,225.44	1
Other Texas Activity		96,710.52	5
Total		**1,879,625.80**	**100**

Source: Bureau of Transportation Statistics

Table 7. Top 20 Air Cargo Carriers/Mail—2007.

Air Carrier	Mail (lb)	Mail (Tons)	Percent Market Share
American Airlines, Inc.	77,094,688.00	38,547.34	46.12
Continental Air Lines, Inc.	60,981,636.00	30,490.82	36.48
United Parcel Service	18,005,020.00	9,002.51	10.77
America West Airlines, Inc.	3,782,611.00	1,891.31	2.26
US Airways, Inc.	3,627,435.00	1,813.72	2.17
Midwest Airline, Inc.	2,855,318.00	1,427.66	1.71
United Air Lines, Inc.	568,046.00	284.02	0.34
JetBlue Airways	110,345.00	55.17	0.07
Mesa Airlines, Inc.	61,675.00	30.84	0.04
Northwest Airlines, Inc.	17,381.00	8.69	0.01
Skywest Airlines, Inc.	16,341.00	8.17	0.01
Delta Air Lines, Inc.	15,808.00	7.90	0.01
American Eagle Airlines, Inc.	11,778.00	5.89	0.01
PSA Airlines, Inc.	7,705.00	3.85	0.00
Atlantic Southeast Airlines	2,549.00	1.27	0.00
Continental Micronesia	825.00	0.41	0.00
Mesaba Airlines	422.00	0.21	0.00
ATA Airlines d/b/a ATA	26.00	0.01	0.00
Horizon Air	13.00	0.01	0.00
Chautauqua Airlines, Inc.	7.00	0.00	0.00
Total	**167,159,629.00**	**83,579.81**	**100.00**

Source: Bureau of Transportation Statistics

Collectively, the 11 largest air cargo airports represented over 99 percent of all the 2007 cargo activity in Texas by tonnage, shown in Table 8. Only the top five airports exceed the federal designation of 100 million landed pounds, making them eligible for federal cargo entitlement money (a potential access funding source). In Table 3, Houston Hobby (number 11) represents 0.79 percent, while Midland/Odessa (next on the list at number 12) represents just 0.17 percent, a significant drop-off.

Table 8. Top 11 Texas Airports by Total Air Cargo Activity—2007 (Tons).

Rank	Code	City	Inbound	Outbound	Total	Percent
1	DFW	Dallas/Fort Worth International	468,527.60	382,221.93	850,749.53	41.53
2	IAH	Houston Intercontinental	231,731.54	248,075.75	479,807.29	23.42
3	AFW	Fort Worth Alliance	107,993.32	115,504.63	223,497.95	10.91
4	SAT	San Antonio International	87,773.71	59,605.44	147,379.15	7.19
5	AUS	Austin-Bergstrom International	57,199.80	55,826.76	113,026.56	5.52
6	ELP	El Paso International	41,538.93	44,231.39	85,770.32	4.19
7	HRL	Rio Grande Valley International	18,710.92	17,371.47	36,082.39	1.76
8	DAL	Dallas Love Field	15,940.32	14,900.82	30,841.15	1.51
9	LBB	Lubbock International	19,499.44	8,605.77	28,105.21	1.37
10	LRD	Laredo International	17,804.87	9,265.44	27,070.31	1.32
11	HOU	Houston Hobby	6,987.19	9,296.11	16,283.30	0.79
Remainder of Texas			5,690.29	4,421.30	10,111.59	0.49
Total Texas Activity			**1,079,397.93**	**969,326.82**	**2,048,724.75**	**100.00**

Source: Bureau of Transportation Statistics

A more detailed analysis of each of these airports is included in the project's final research report and provides a more complete profile of the activity levels and role of air cargo in Texas (*10*). For each of the 11 airports in Table 8, the report provides the following information:

- the 12-year trend (1996 to 2007) in the inbound, outbound, and total tons of air cargo moved at the airport;
- the distribution of the total cargo activity in 2007 at each airport by Federal Aviation Administration (FAA) Form 41 service class definitions (scheduled passenger/cargo service, scheduled all-cargo service, nonscheduled civilian passenger/cargo service, and nonscheduled civilian all-cargo service); and
- the top five international markets (countries) served by air cargo carriers at each airport in 2007.

CHAPTER 3. PLANNING FOR LANDSIDE FREIGHT ACCESS

The planning process for landside freight access can include several public agency stakeholders, depending on the geographic location. Stakeholders represent various interests and include:

- city planning and public works,
- county engineering,
- the airport authority or city aviation department,
- the Texas Department of Transportation (TxDOT), and
- metropolitan planning organizations (MPOs).

Airport master plans typically include areas in which the airports desire to develop or add freight areas. As airports develop or update airport master plans, they should coordinate with other regional transportation planning agencies surrounding the airport (e.g., the city, MPO, TxDOT, etc.). This coordination will ensure that all agencies are aware of potential freight activity at the airport and that the plan considers the type and level of involvement of each agency. For instance, while an airport may desire to have a future freight area on one side of the airport, certain roadway access issues may make a different location a better choice overall. Access issues may relate to potential right-of-way and construction costs, as well as environmental concerns, that may make one area of the airport more feasible for freight activity than other areas.

The various agencies involved may operate on different schedules for updating plans and related documents, but all agencies benefit from group discussions regarding transportation issues before any of them finalize plans. The initial group meeting may be the most beneficial, particularly if it includes a brainstorming session in which any agency representative may initiate discussion on any transportation-related topic. Even if the brainstorming session is geared primarily toward landside freight access at the airport, additional transportation issues can arise, and early awareness benefits all participants.

This project conducted a prototype brainstorming session, which included representatives from two cities, an MPO, an airport, and TxDOT. The session began with discussion regarding hypothetical freight movement between an activity center in one city and the airport, which is located in and operated by the other city. Participants discussed transportation issues at the airport proper and at locations many miles away from the airport. The brainstorming session

produced significant benefits, such as additional discussions, identification of related issues, and an exchange of viewpoints. Participants shared information about their specific agency concerns and requirements to plan and program projects. Furthermore, the group identified issues and improvements related to potential increases in freight traffic on roads at various distances from the airport. Issues identified included the fact that one potential off-site freight center would generate truck traffic that would need to cross an existing rail line. This issue was important because both the railroads and government entities wanted to reduce the number of at-grade highway-rail crossings. Figure 5 shows an example of a rail line running parallel to a highway and separating it from adjacent land with existing or proposed industrial development where freight traffic could originate.

Figure 5. Railroad Separating Highway and Potential Freight Traffic Origination.

The group also identified a road segment where high numbers of truck-turning movements, due to high levels of truck traffic and high driveway density, could be an issue with increased freight traffic to the airport (Figure 6). Discussion of potential solutions included access management treatments on the segment, such as a raised median.

Coordination among several agencies also provides for coordination of their individual plans and related documents. Consistency among all of the affected plans (e.g., city thoroughfare, MPO metropolitan transportation plan, and TxDOT statewide plan) should be the goal in providing efficient landside freight access to the airport. This consistency facilitates project prioritization and resolution of funding issues.

Figure 6. Road Segment Identified as Potentially Needing Improvements if Freight Traffic to Airport Increases.

Even though each agency has its own area of authority, overlap frequently occurs. Cities and counties are responsible for off-state-system roads within their respective jurisdictions, TxDOT is responsible for state-system roads, an airport authority may be responsible for roads on airport property, and the MPO provides overall planning coordination. Consider the following scenario:

- City A has plans to accommodate heavy truck traffic on an arterial adjacent to a developing warehouse center.
- City B operates an airport approximately 10 miles away and is planning an airport freight center on the northeast side of the airport.
- TxDOT has project priorities related to roads that do not provide access to the airport or the developing freight center.

All of the agencies, including the MPO, need to be brought together to discuss the potential needs for landside freight access in order to prevent miscommunication, which could lead to differing interests escalating to competing interests. Discussions regarding the proposed landside freight access could possibly evolve into beneficial discussions about additional issues, helping all agencies understand the overall regional priorities and how landside freight access can fit in them. During the planning process, any proposed freight activities should be included in any travel demand models used in the area. The discussions and new understanding among the participants may also provide opportunities for consideration of alternative ideas by all. Coordination of planning efforts also benefits a coordinated project programming process.

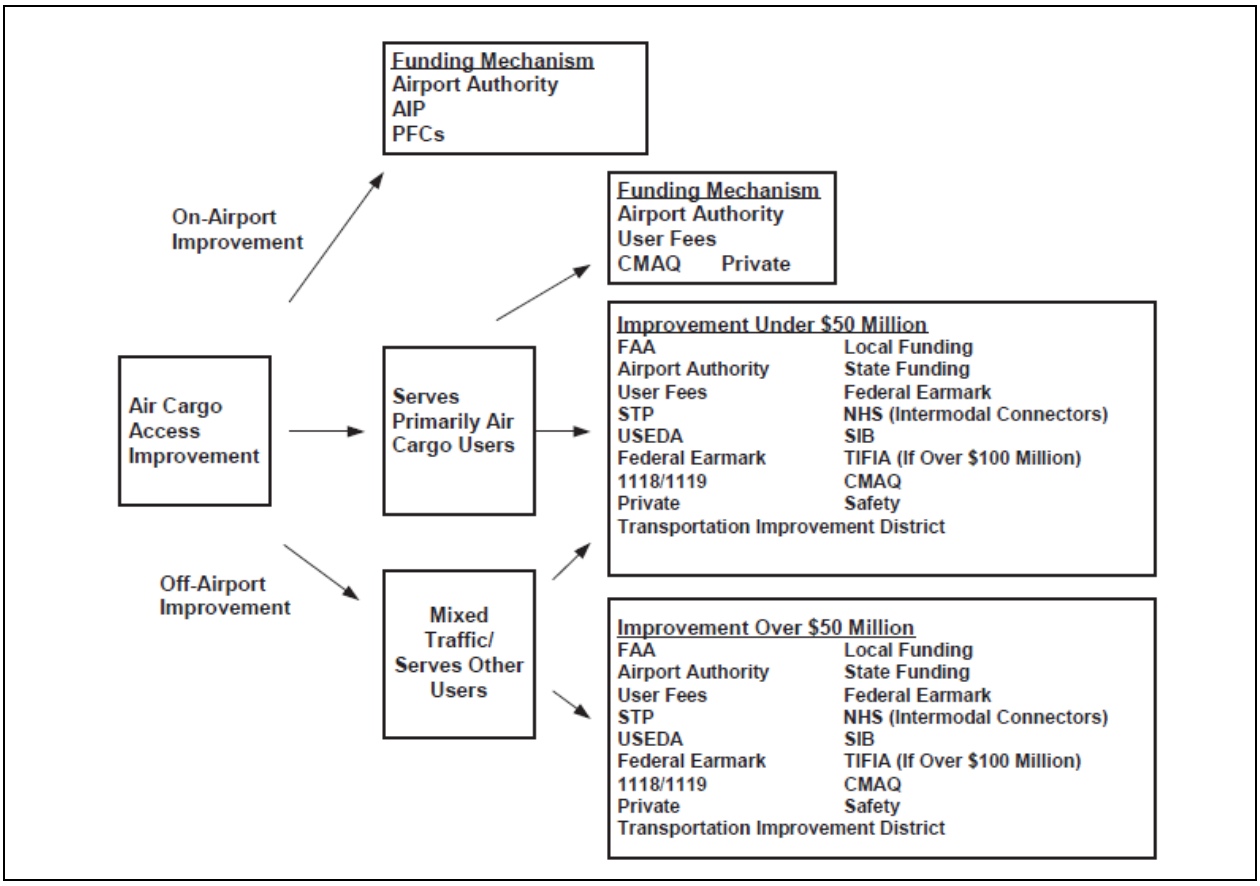
CHAPTER 4. FUNDING AIR CARGO ACCESS IMPROVEMENTS

INTRODUCTION

The ability to fund airport access improvements is critical for airports to alleviate or address airport access issues. The source and means of funding depend on the type and location of the project as well as the type and location of the airport. Airports across Texas have varying abilities to fund projects based upon the roles they play in the Texas airport system and the levels of service they provide to their users. In addition, the movement of goods by air involves many stakeholders in both the public and private sectors. This chapter addresses various funding mechanisms that are available to airports to improve landside freight access.

AIR CARGO FUNDING FRAMEWORK

The National Cooperative Highway Research Program produced a useful funding framework to address air cargo access improvements in a report entitled *Financing and Improving Land Access to U.S. Intermodal Cargo Hubs* (*11*). Although the federal funding programs noted here change periodically, the document provides insight into the sources that may be available and should be explored when examining funding options for access improvements. Figure 7 shows this framework. It provides a simple illustration of effective funding options based on whether the access improvement is located on or off airport property and whether or not it serves air cargo users exclusively. The list of funding mechanisms offers an opportunity to determine the applicability of a source to a specific project. These sources include a variety of federal and state programs as well as local sources. Some of the more common funding sources are discussed in detail below.



Source: *Financing and Improving Land Access to U.S. Intermodal Cargo Hubs,* NCHRP 497, 2003

Note: FAA = Federal Aviation Administration, AIP = Airport Improvement Program, PFC = passenger facility charge, CMAQ = Congestion Mitigation Air Quality, STP = Surface Transportation Program, USEDA = U.S. Economic Development Administration, 1118/1119 = National Corridor Planning and Development Program/Coordinated Border Infrastructure Program, NHS = National Highway System, SIB = State Infrastructure Bank, TIFIA = Transportation Infrastructure Finance and Innovation Act.

Figure 7. Air Cargo Access Funding Framework.

To address funding needs related to air cargo access, airports, cities, regional planning agencies, and counties all need to work together in conjunction with state and federal officials in identifying appropriate funding alternatives. In addition, the private sector may have a role to play in funding improvements, and that avenue should be explored as well. The following discussion of funding options provides a means to better understand existing programs. This discussion is not exhaustive but provides a foundation of the largest and most commonly used sources. The most prominent sources currently include state and federal funding programs administered through the state, the Federal Highway Administration (FHWA), and the FAA.

STATE AND FEDERAL FUNDING PROGRAMS

A variety of state and federal funding programs is available to address freight access needs at airports. While most of these funding sources are general roadway development funds, others are related to airport development. Additional opportunities exist for both local funding options and public-private partnerships as well.

Texas Department of Transportation

TxDOT has a variety of funding sources that include the use of both state and federal money available for transportation projects. TxDOT works closely with local officials to determine project priorities and potential sources of funds. In addition, TxDOT can provide cost and timeline information as well.

TxDOT currently has a number of different funding sources appropriated as noted in the 2010 Unified Transportation Program (UTP). These include:

- the State Highway Fund (SHF),
- federal reimbursements,
- federal stimulus funds from the American Recovery and Reinvestment Act (ARRA),
- general revenue (GR),
- dedicated general revenue (GR-D),
- Texas Mobility Fund (TMF) bonds,
- State Highway Fund bonds (Proposition 14),
- general obligation bonds (Proposition 12),
- SH 121 toll project revenue, and
- SH 130 concession funds.

Each of these funding sources has its own project eligibility requirements that must be met in order to use those funds. In addition, in *Texas: Open for Business*, TxDOT published five categories of funding tools for major highway improvements (*12*). These include:

- regional mobility authorities (RMAs),
- toll roads,
- pass-through financing,
- State Infrastructure Bank, and

- comprehensive development agreements.

While these programs are not necessarily suitable for all projects, they nonetheless provide options for communities to consider once the type of project/need has been established in sufficient detail. Airports are specifically mentioned as eligible for projects under RMAs, which should be explored for potential use.

Airport Improvement Program

The primary source of federal funding for airport development is the FAA under the Airport Improvement Program. Under this program, grants are made to public agencies for the planning and development of public-use airports that are included in the National Plan of Integrated Airport Systems. Table 9 shows examples of eligible and ineligible projects.

Table 9. Examples of Eligible and Ineligible AIP Projects.

Eligible Projects	Ineligible Projects
Runway construction/rehabilitation	Maintenance equipment and vehicles
Taxiway construction/rehabilitation	Office and office equipment
Apron construction/rehabilitation	Fuel farms (may be eligible)
Airfield lighting	Landscaping
Airfield signage	Artworks
Airfield drainage	Aircraft hangars (may be eligible)
Land acquisition	Industrial park development
Weather observation stations (AWOS)	Marketing plans
NAVAIDs such as REILs and PAPIs	Training
Planning studies	Improvements for commercial enterprises
Environmental studies	Maintenance or repairs of buildings
Safety area improvements	
Airport layout plans (ALPs)	
Access roads only located on airport property	
Removing, lowering, moving, marking, and lighting hazards	
Glycol recovery trucks/glycol vacuum trucks	

Source: Federal Aviation Administration AIP Guidance

These grant programs are available to all airports, whether commercial service or general aviation. As with surface funding programs, the airport funding program comes with a set of eligibility requirements. Access roads located on airport property are an eligible item under the

grant program. Airports must also abide by grant obligations if taking grant money. Additional information on this program is available at http://www.faa.gov/airports/aip/overview/.

Texas is a block grant state. This means the state assumes responsibility for administering AIP funds for general aviation airports and any nonprimary commercial service airports. It also administers the nonprimary entitlement (NPE) funds allocated to these airports. NPE funds are available to nonprimary airports that are in the National Plan of Integrated Airport Systems (NPIAS), and the amount of funds is based on the amount of development the airport has identified in the NPIAS. The maximum amount is $150,000 per airport per year, with the airport allowed to retain three years' worth of money to apply to a larger project if desired.

While the state primarily funds general aviation airports through both state and federally funded programs, the FAA directly funds commercial service airports in Texas and around the country. Commercial service airports are defined as those having scheduled passenger service of at least 2,500 enplanements per year. These airports are further classified into primary and nonprimary. Primary airports have scheduled enplanements of 10,000 or more and are broken down into large hub, medium hub, small hub, and nonhub according to additional criteria. Nonprimary airports have scheduled enplanements of 2,500 to 10,000.

AIP funding is apportioned by formula for primary commercial service airports and cargo airports based on passenger boarding and landed cargo weight, respectively. Funding for primary commercial service airports is referred to as "primary entitlements." Under current law, these airport entitlements range from $1 million to $26 million per airport. As prescribed by the authorizing statute, the FAA calculates individual airport annual entitlement funds as follows:

- $7.80 for each passenger boarding, up to 50,000 passengers;
- $5.20 for each additional passenger boarding, up to 100,000 passengers;
- $2.60 for each additional passenger boarding, up to 500,000 passengers;
- $0.65 for each additional passenger boarding, up to 1,000,000 passengers; and
- $0.50 for each additional passenger boarding, from 1,000,001 passengers or more.

In providing funding for airports with cargo operations, the FAA allocates 3.5 percent of AIP to cargo service airports. Each cargo service airport receives funds in the same proportion as its proportion of landed weight of cargo aircraft to the total landed weight of cargo aircraft at all qualifying airports. In fiscal year (FY) 2008, there were 115 airports that qualified as cargo service airports, which shared the 3.5 percent of funding, totaling $118.8 million (*13*).

Specifically, cargo entitlement money is available for airports with 100 million pounds of cargo measured by gross landing weight. In FY 2008, Texas had nine airports meeting these criteria. Amounts ranged from to $201,984 to $2,682,264. Table 10 shows the airports and the funds they received. The AIP is funded through a series of taxes on passengers, freight, and aviation fuel. Figure 8 shows the current tax structure.

Table 10. Cargo Entitlement Funds for Texas Airports, FY 2010.

Loc. ID	Airport Name	City	Sponsor Name	Calendar Year 2008 Landed Weight (lb)	FY 2010 Cargo Entitlement
DFW	Dallas/Fort Worth International	Fort Worth	Cities of Dallas and Fort Worth	3,228,104,260	$ 2,682,264.00
IAH	George Bush Intercontinental/ Houston	Houston	City of Houston	1,508,589,067	$ 1,253,502.00
AFW	Fort Worth Alliance	Fort Worth	City of Fort Worth	898,471,054	$ 746,549.00
SAT	San Antonio International	San Antonio	City of San Antonio	823,130,548	$ 683,947.00
AUS	Austin-Bergstrom International	Austin	City of Austin	591,466,066	$ 491,455.00
ELP	El Paso International	El Paso	City of El Paso	447,841,040	$ 372,116.00
HRL	Valley International	Harlingen	City of Harlingen	289,338,650	$ 240,414.00
LRD	Laredo International	Laredo	City of Laredo	285,788,862	$ 237,465.00
LBB	Lubbock Preston Smith International	Lubbock	City of Lubbock	243,087,132	$ 201,984.00
TOTAL				8,315,816,679	$ 6,909,696.00

Source: Federal Aviation Administration

Aviation Taxes	Comment	Tax Rate
	PASSENGERS	
Domestic Passenger Ticket Tax	Ad valorem tax	7.5% of ticket price (10/1/99 through 9/30/2007)
Domestic Flight Segment Tax	"Domestic Segment" = a flight leg consisting of one takeoff and one landing by a flight	Rate is indexed by the Consumer Price Index starting 1/1/02 $3.00 per passenger per segment during calendar year (CY) 2003 $3.10 per passenger per segment during CY2004. $3.20 per passenger per segment during CY2005. $3.30 per passenger per segment during CY2006 $3.40 per passenger per segment during CY2007
Passenger Ticket Tax for Rural Airports	Assessed on tickets on flights that begin/end at a rural airport. Rural airport: <100K enplanements during 2nd preceding CY, and either 1) not located within 75 miles of another airport with 100K+ enplanements, 2) is receiving essential air service subsides, or 3) is not connected by paved roads to another airport	7.5% of ticket price (same as passenger ticket tax) Flight segment fee does not apply.
International Arrival & Departure Tax	Head tax assessed on pax arriving or departing for foreign destinations (& U.S. territories) that are not subject to pax ticket tax.	Rate is indexed by the Consumer Price Index starting 1/1/99 Rate during CY2003 = $13.40 Rate during CY2004 = $13.70 Rate during CY2005 = $14.10 Rate during CY2006 = $14.50 Rate during CY2007 = $15.10
Flights between continental U.S. and Alaska or Hawaii		Rate is indexed by the Consumer Price Index starting 1/1/99 $6.70 international facilities tax + applicable domestic tax rate (during CY03) $6.90 international facilities tax + applicable domestic tax rate (during CY04) $7.00 international facilities tax + applicable domestic tax rate (during CY05) $7.30 international facilties tax + applicable domestic tax rate (during CY06) $7.50 international facilties tax + applicable domestic tax rate (during CY07)
Frequent Flyer Tax	Ad valorem tax assessed on mileage awards (e.g., credit cards)	7.5% of value of miles
	FREIGHT / MAIL	
Domestic Cargo/Mail		6.25% of amount paid for the transportation of property by air
	AVIATION FUEL	
General Aviation Fuel Tax		Aviation gasoline: $0.193/gallon Jet fuel: $0.218/gallon
Commercial Fuel Tax		$0.043/gallon

Source: Federal Aviation Administration (*14*)

Figure 8. Current Aviation Excise Tax Structure.

Additional AIP money is available for smaller airports, including general aviation airports and small commercial service airports. The TxDOT Aviation Division (AVN) administers the State of Texas grant program for general aviation airports. Its funding has been fairly constant over recent years at $15 million annually (*15*).

While these programs provide a great source of funds for projects, they also come with a matching requirement. For large and medium hub airports, this match percentage is 75 percent federal and 25 percent local. For all other airports, it is 95 percent federal and 5 percent local (*16*).

Impact of Passenger Facility Charges

Many primary airports have pursued passenger facility charges to increase revenue at the airport. The passenger facility charge program allows the collection of PFC fees up to $4.50 for

every enplaned passenger at commercial airports controlled by public agencies. Airports use these fees to fund FAA-approved projects that enhance safety, security, or capacity; reduce noise; or increase air carrier competition. Airports were given this authority by Congress in 1990 and must apply to the FAA for authority to do so. Initially, the charge per enplaning passenger was $1 to $3. AIR-21, the FAA funding legislation at the time, changed this and allowed airports to charge $4 or $4.50 per enplaning passenger. When airports do this, they are subject to AIP (federal airport funding) reductions (Section 47114[f] of Title 49 of the United States Code) (*16*). For airports designated as large or medium hubs, the FAA reduces entitlement funds by 50 percent if the airports impose a $1, $2, or $3 passenger facility charge. They lose 75 percent if they impose more than $3. In FY 2008, 64 of the 68 large and medium hub airports had a PFC in place, and all were subject to these reductions. Of these 61 airports, the following applied:

- 9 airports were subject to the 50 percent reduction in entitlements, and
- 55 airports were subject to the 75 percent reduction in entitlements.

Airport Revenue Sources

Other than state and federal grant programs, airports may have other sources of revenue. This is especially true for the larger commercial service airports, less so for smaller general aviation airports. The availability of such funds for access improvements is highly dependent on the airport and its financial situation. Airports may have aeronautical revenue, nonaeronautical revenue, and nonoperating revenue sources. Examples of aeronautical operating revenue include landing fees, terminal rents, apron tie-down charges, hangar rentals, and fuel-flow fees. Nonaeronautical operating revenue includes rents from land and nonterminal facilities, rental cars, and parking. Nonoperating revenues include interest income, grants, and passenger facility charges.

Local Funding Sources

In addition to designated state and aviation facility revenue sources, local entities may opt to participate in project funding. Cities and counties may use funds to pay for new roads or road improvements related to providing landside freight access to airports. Just as with other transportation projects, local funds may be comingled with other sources to leverage the various types of funding available. Economic development corporations and similar agencies are

allowed to use their funds for transportation projects related to economic development activities. Again, these funds may be comingled with other sources.

Public-Private Partnerships

If a private company is developing a freight center at an airport, public-private partnerships can comingle and leverage public funding sources. The partnership with Hillwood in the development of Fort Worth Alliance Airport and the surrounding infrastructure (roadway) is an example. The Hillwood Development Company, LLC, is a subsidiary of the Perot Company. It was the developer of Alliance Airport and the surrounding industrial complex. "It is a 17,000-acre master-planned mixed-use development located north of Fort Worth, Texas. Anchored by the inland port known as the Alliance Global Logistics Hub, AllianceTexas is home to 240 companies, 28,000 employees, and more than 7,300 single-family homes" (*17*). Other potential sources of such partnerships could come from private trucking firms, financial firms, real estate companies, or manufacturers located near the airport.

Additional Funding Options and Coordination

For projects on airport property, AIP, NPE, and state grants administered by TxDOT AVN provide funds for landside access improvements. For improvements located off airport property, airport officials should work closely and coordinate with state and local officials including MPOs and local TxDOT staff to determine the most suitable funding mechanism available to them based on the project type, cost, and location.

Resources

The following resources provide additional information on these issues:

- *2010 Unified Transportation Program*, ftp://ftp.dot.state.tx.us/pub/txdot-info/tpp/2010_final_utp_0503.pdf.
- *Texas: Open for Business*, http://www.txdot.gov/txdot_library/publications/open_for_business.htm, ftp://ftp.dot.state.tx.us/pub/txdot-info/library/pubs/bus/open4biz/open_for_business.pdf.
- State Infrastructure Bank, http://www.txdot.gov/business/governments/sib.htm.

- Financing Freight Improvements, FHWA, U.S Department of Transportation, January 2007 (Federal Funding Programs Table 2.1), http://ops.fhwa.dot.gov/freight/publications/freightfinancing/freightfinancing.pdf.
- Federal Aviation Administration AIP, http://www.faa.gov/airports/aip/.
- Bulletin 1: Best Practices—Surface Access to Airports, www.faa.gov/airports/.../bulletin_1_surface_access_best_practices.pdf.
- A Guide to Transportation Funding Options, Texas A&M University, TTI, and the University Transportation Center for Mobility, http://utcm.tamu.edu/tfo/about/.
- Financing and Improving Land Access to U.S. Intermodal Cargo Hubs, http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_497.pdf.
- Funding Options for Freight Transportation Projects, http://onlinepubs.trb.org/onlinepubs/sr/sr297.pdf.

CHAPTER 5. LANDSIDE FREIGHT ACCESS ISSUES, GUIDANCE, AND SOLUTIONS

The research project identified nine major issues related to landside freight access to airports:

- system/roadway design,
- comingling of freight and passenger traffic,
- wayfinding,
- adjacent land uses along connector roads,
- traffic control,
- cargo facility site location,
- business decisions,
- truck queue storage and backing, and
- performance management and needs identification.

The following subsections discuss each of these issues and include the following topics:

- issue,
- obstacles,
- solutions, and
- resources.

Some of the discussions refer to areas of influence in the vicinity of an airport. The research team developed the areas of influence to differentiate the locations and types of roads used to access airports. This guidebook refers to four areas of influence:

- Area of Influence 1—the controlled-access highway(s) located nearest to the airport, where a mix of freight and passenger traffic exists.
- Area of Influence 2—surface streets that intersect with the highways in Area of Influence 1, where a mix of freight and passenger traffic exists.
- Area of Influence 3—primary access roads into the airport from the connecting surface streets in Area of Influence 2; typically, access points for freight centers lie along these roads. In some cases, there may be completely separate access roads for passenger terminals and freight centers.

- Area of Influence 4—the roads providing circulation through the passenger terminal areas. Almost no freight traffic exists here; therefore, this guidebook does not explicitly discuss this area. The term is used for reference purposes.

SYSTEM/ROADWAY DESIGN

Issue

Both roads and pavements function better and last longer if they are properly designed for large trucks. The most common geometric design issue at airports visited relates to turn radii. In the design of roadways, intersections, and driveways, corner radii and turning paths should accommodate trucks with 48-ft trailers (WB-62 trucks—a typical interstate semitrailer or 18-wheeler) (*18*). Deficiencies with short right-turn radii at driveway and highway intersections are evident through broken pavement edges at short-radius intersection corners and along narrow tangent sections. In general, corner radii should be a minimum of 30 ft for right-angle intersections. Using concrete on all truck driveways and at all intersections under heavy truck use is one way to avoid scouring, rutting, and broken edges.

Obstacles

Airport authorities, TxDOT, and local transportation agencies sometimes do not properly communicate and coordinate. Agencies often develop or update airport, state, and local transportation master plans and improvement plans independently and/or on different time schedules. As a result, these agencies often overlook truck-specific issues that need to be addressed, preferably at the planning stage or at least at the operational stage.

The vicinity of an airport sees a higher concentration of truck traffic in comparison to other urban areas, particularly when the economy is doing well. This issue warrants particular attention.

Solutions

The TxDOT *Roadway Design Manual* and *Access Management Manual* offer the following treatments as potential solutions to truck traffic issues on roads (*19*):

- Driveways:
  - Traffic: estimates of peak-hour inbound and outbound truck volumes by driveway.

- Width: 30-ft minimum (with 30-ft radius for right turns).
- Pavement: concrete recommended to the edge of the highway pavement.
- Inbound:
  - One two-way driveway or two one-way driveways unless additional driveways are needed to serve separate areas.
  - Right-turn radius from the highway: 30-ft minimum.
  - Right-turn deceleration lane: required on highways with 30 or more trucks making inbound right turns during the inbound peak hour; see TxDOT *Roadway Design Manual* Tables 3-13 and 3-14 for length and taper.
  - Inbound left-turn lane: see TxDOT *Roadway Design Manual* Table 3-11 for threshold volumes for left-turn lanes; multiply truck volumes by 1.5 in using the table; see TxDOT *Roadway Design Manual* Tables 3-13 and 3-14 for length and taper.
  - Queue distance between the gate and right-of-way line to accommodate the peak inbound peak-hour queue (estimated above).
- Outbound:
  - Two outbound lanes (one left-turn and one right-turn) are recommended if 30 or more trucks are making left turns during the peak hour.
  - Right-turn radius of at least 30 ft.
  - Provide a right-turn acceleration lane if right turns exceed 25 trucks per outbound peak hour; see TxDOT *Access Management Manual* Table 2-3 for length and taper.

- Spacing between driveways: see TxDOT *Access Management Manual* Tables 2-1 and 2-2.
- Spacing from ramps: see TxDOT *Roadway Design Manual* Chapter 3.
- Airport-grounds circulation:
  - All movements within and between on-site parking lots and service bays must be accommodated on airport grounds; avoid the need for on-street circulation.
  - All on-site circulation should be able to accommodate WB-62 trucks (or larger if required) through all turns and other movements on site without

maneuvering or undue conflicts with other vehicles; no queues should be likely to extend into the adjacent highway.

- Separate airport access for cargo and passenger traffic.

- Interchange ramps:
  - Design for WB-62 minimum.
  - Use concrete pavement if radii are less than 30 ft.
- Adjacent highway intersections:
  - Right-turn radii: design for WB-62 minimum; 30-ft radius minimum.
  - Pavement: concrete within 200 ft of the stop bar if trucks are to be stopped by traffic control.
  - Turn-lane storage per projected traffic volumes from traffic access/impact analysis.
- Safety:
  - In addition to sight distances, check for any high crash-rate locations that may be affected by increases in large trucks.
  - Check necessary traffic control.
  - Confirm that all traffic signs and signals along access routes are adequately visible from behind or across from tractor-trailer combination trucks, e.g., signs with truck route designation.
  - Check that emergency access is available without creating undue congestion on a state highway.

Resources

The following resources provide additional information on these issues:

- *Roadway Design Manual,* Texas Department of Transportation, Austin, Texas, March 2009, http://onlinemanuals.txdot.gov/txdotmanuals/rdw/rdw.pdf.
- *Access Management Manual*, Texas Department of Transportation, Austin, Texas, December 2009, http://onlinemanuals.txdot.gov/txdotmanuals/acm/acm.pdf.
- *Policy on Geometric Design of Highways and Streets*, American Association of State Highway and Transportation Officials, Washington, D.C., 2004.

COMINGLING OF FREIGHT AND PASSENGER TRAFFIC

The contents and recommendations in this section are based on confidential surveys and discussions with representatives of the freight industry and airports.

One of the most significant issues for landside freight access from the trucking perspective is that of comingling freight and passenger traffic. Drivers of large trucks on airport access roads need to be as free as possible from interaction with passenger automobile traffic. Truck drivers expect a mixture of automobile and truck traffic in Areas of Influence 1 and 2, since roads in those areas serve many types of traffic in addition to airport traffic. However, once truck drivers enter Area of Influence 3, they benefit when they comingle as little as possible with automobile traffic. Problems occur when airport access roads have numerous intersections, entrances, and exits and when traffic weaves among lanes to enter and/or exit the access roads. Many automobile and truck drivers may also be unfamiliar with the routes, needing to pay attention to the directional signage and increasing the opportunities for crashes.

The best opportunity for addressing comingling of traffic exists when a new airport is being planned and designed. As in any situation, when starting with a clean slate, planners and engineers have the opportunity to design exits, entrances, other intersections, and related signage along the access road to provide the clearest access routing to freight areas. The best option is to have a dedicated freight access road that is completely separate from the passenger traffic access road. One example is Austin-Bergstrom International Airport, which has a separate exit along SH 71 (Area of Influence 1) for exclusive access to the freight area (see Figure 9).

Figure 9. Separate Freight Exit at Austin-Bergstrom International Airport from SH 71.

Significant development along access roads in Area of Influence 3 at older airports creates potential obstacles when airports retrofit access road exits, entrances, and intersections to provide improved weaving distances. These potential limitations make it even more important to install directional signage providing maximum advance notice of directions to freight areas.

The development of new airports offers greater opportunities to provide adequate weaving distances and advance signage directing traffic toward freight areas and passenger terminals. Figure 10 provides an example from Houston George Bush Intercontinental Airport of signage that directs traffic toward freight areas and passenger terminals in Area of Influence 3. This sign is located along JFK Boulevard, soon after it expands to four lanes. It provides advance notice to truck drivers that they will need to be in one of the two left lanes to access the freight area. One potential improvement at IAH would be to indicate that the freight area will have a left-lane exit on at least one of the previous signs that provide information about which airlines are in each passenger terminal.

Figure 10. Freight Area Directional Signage at George Bush Houston Intercontinental Airport.

At least one interviewee mentioned a large airport in another state as a poor example of comingling automobile and truck traffic and related signage. With very little advance notice of the exit to the freight area from the access road, truck drivers who are unfamiliar with the surroundings can easily miss the exit and drive into Area of Influence 4, directly in front of the passenger terminal. This situation presents hazards to pedestrians and all types of traffic in that

area of influence. The examples discussed above offer options to help prevent or alleviate this type of situation.

WAYFINDING

Issue

Wayfinding, the system of providing directional information signage for motorists, is an important element of overall access to airports, including freight access. This section discusses wayfinding as it applies to freight access overall, and as it applies to each area of influence. Truck and automobile drivers may be unfamiliar with the routes to an airport. Therefore, good signage is necessary to provide accurate directions with enough advance notice to allow drivers to make necessary lane changes in advance of exits and intersections. This is particularly true for large, semitrailer trucks.

While Area of Influence 1 has been primarily defined as the controlled-access highways in the immediate vicinity of the airport, wayfinding to the airport sometimes also occurs on highways and surface streets throughout the metropolitan area. Wayfinding is an issue that applies beyond Area of Influence 1 and the immediate controlled-access highways; all of these applications are included within the Area of Influence 1 discussion.

Solutions

The solutions for this issue are discussed according to the area of influence.

Area of Influence 1

Wayfinding is necessary beginning in Area of Influence 1 and becomes more important in each area of influence as motorists approach the airport. Signage in Area of Influence 1 typically contains general information on controlled-access highways regarding exits for the airport within 2 miles or less of the exit. However, in some instances signage outside the metropolitan area may be necessary. One example is near Van Alstyne, Texas, along southbound US 75 near the FM 121 interchange. A sign informs motorists that this exit is not the one to take for DFW International Airport, due to the potential confusion with the exit for SH 121, almost 30 miles farther south. This sign is approximately 55 miles northeast of DFW International Airport.

An application much closer to the airport than the previous example, but still outside the typical Area of Influence 1, is on surface streets near downtown Austin. Figure 11 shows a placard sign on northbound Congress Avenue at the intersection with Riverside Drive. This sign is important because Riverside Drive becomes SH 71 several miles to the east at IH 35. Farther east of IH 35, SH 71 is a controlled-access highway in the immediate vicinity of Austin-Bergstrom International Airport.

Figure 11. Airport Placard Sign near Downtown Austin.

Larger metropolitan areas that have multiple airports often have signs for different airports throughout the area. For example, many signs in various locations in the Houston area include directional information for both Hobby Airport and George Bush Houston Intercontinental Airport. Figure 12 presents an example of this signage along southbound US 59 at the IH 610 interchange, southwest of downtown Houston. This particular signage is on a road segment headed away from both airports, recognizing the need to distinguish between the two Houston airports, which are a significant distance from one another.

Figure 12. Directional Signs to Both Houston Airports.

Signage in Area of Influence 1 does not typically distinguish between freight and passenger traffic. The types of traffic that signs are geared to are usually separated in the other areas of influence. One exception is Austin-Bergstrom International Airport, which has separate exits on SH 71 for freight and passenger traffic, as shown in Figures 13 and 14. Though SH 71 is not completely access-controlled between the airport and IH 35, it does have interchanges for the airport and fits the criteria to be in Area of Influence 1.

Figure 13. Cargo Exit Sign for Austin-Bergstrom International Airport (SH 71).

Figure 14. Signs Distinguishing Freight and Passenger Traffic at Austin-Bergstrom International Airport (SH 71).

Area of Influence 2

As the motorist enters Area of Influence 2 (the surface streets), signage may begin to distinguish between freight and passenger access at airports that have separate areas. Signage in Area of Influence 2 varies between placards and signs with text. All signage should be of adequate size and placed a sufficient distance ahead of the airport in order to allow traffic to prepare for turning movements and associated lane changes. Small placards, as seen in Figures 15 and 16, appear to work well for directional information at intersections, but agencies should consider larger signage in advance of the intersection when possible.

Figure 15. Placard Sign for Dallas Love Field on Southbound IH 35E Frontage Road.

Figure 16. Close-Up View of Placard Sign at Intersection.

Figure 17 presents an example of a sign directing traffic in Area of Influence 2 toward the cargo area of an airport. Additional signs with passenger terminal information appear in the background. The difference between the placard seen in Figures 15 and 16 and the larger directional sign in Figure 17 is pronounced.

Figure 17. Freight Access (and Passenger) Signs on Airport Boulevard at Houston Hobby Airport.

Area of Influence 3

As traffic enters Area of Influence 3, signage for freight areas becomes even more important, particularly as efforts are made to prevent freight traffic from entering Area of Influence 4—the passenger terminal circulation roads. Figures 18 and 19 provide an example of effective sequential signage at Dallas Love Field. The sign in Figure 18 provides advance notice of which lane exits toward the cargo area. Figure 19 provides the subsequent exit information.

Figure 18. General Signage in Area of Influence 3 at Dallas Love Field.

Figure 19. Air Cargo Exit Sign at Dallas Love Field.

From this point on, freight traffic is separated from passenger traffic as the passenger traffic enters Area of Influence 4—the passenger terminal circulation roads. Another effective example of signage in Area of Influence 3 is at the Midland International Airport, as seen in Figure 20. Field observations indicate that the sign is large enough to provide adequate notice of

the turn-off for cargo traffic prior to traffic entering Area of Influence 4. Another observation is that the signs are consistent in size, background, and the amount of information presented.

Figure 20. Consistent Signage with Minimal Information.

The Midland International Airport example of large signs with minimal information contrasts with the example shown in Figure 21 from another airport. This sign contains information for multiple uses, has relatively small lettering, and uses multiple backgrounds on one sign. The unfamiliar driver may find it difficult to quickly identify the information needed to get to the proper location.

Figure 21. Sign with Multiple Uses and Backgrounds.

ADJACENT LAND USES ALONG CONNECTOR ROADS

This issue is comprised of two components related to truck traffic and land use along connectors. The first is related to truck traffic compatibility, and the second is related to left turns on arterial streets.

Truck Traffic Compatibility

Issue

According to survey and interview responses, truck drivers prefer to travel on roads with as few intersecting access points as possible. Significant truck volumes can pose problems on roads with frequent intersections, especially those used by pedestrians. Older, innercity airports have road connections to access-controlled highways that are typically abutted by a variety of land uses. Such land uses can include residential (high and low density), retail, office, industrial, and hotel. While few conflicts may have occurred between truck traffic and adjacent land uses when the airports were originally constructed, decades of land use evolution can result in land uses that conflict with truck traffic. Over time, as newer airports are built farther from the innercities, freight traffic at the innercity airports typically decreases. Two examples are the decrease in freight traffic at Love Field with the development of the Alliance and Dallas/Fort Worth International Airports and the decrease in freight traffic at Houston Hobby Airport with

the development of Houston George Bush Intercontinental Airport. The primary lesson learned in these cases, which is applicable to new or expanding airports, is to limit land uses and the number of access points on roads connecting airports and controlled-access highways to those that are most compatible with truck traffic.

Obstacles

The primary obstacle to improving compatibility of land use with truck traffic near airports is the inability to manage the existing land uses along the approaching roadways. Another potential obstacle is the lack of adequate alternative truck routes.

Solutions

One solution to this type of problem is to designate truck routes along certain roads and to prohibit truck traffic on others. Some cities, such as El Paso, have posted signs prohibiting trucks from entering specific neighborhoods and directing them through designated truck routes. Figures 22 and 23 provide examples of such signs. Figure 24 provides an example of a designated truck route sign near the Laredo International Airport.

Figure 22. Commercial Traffic Sign near El Paso International Airport.

Figure 23. Sign Prohibiting Truck Traffic near El Paso International Airport.

Figure 24. Designated Truck Route Sign near Laredo International Airport.

Left Turns on Arterial Streets

Issue

Another issue that can arise as truck traffic increases along with freight activity at an airport is left turns onto arterial streets. The airport and the agency responsible for an adjacent arterial street may need to work together to identify such problems and address them.

Obstacles

One potential obstacle to addressing left-turn issues is finding an acceptable means to facilitate orderly left-turn operations. This could ultimately include median treatments to physically prohibit such maneuvers. Another potential obstacle is a lack of funding.

Solutions

Solutions include signalized intersections, where warranted, and median treatments at other locations to prohibit left turns. Figure 25 shows a raised median installed on US 59 in Laredo to prevent traffic leaving the airport freight area on Airpark Drive from turning left onto US 59.

Source: Bing Maps (Bing.com, accessed May 3, 2010)

Figure 25. Raised Median on US 59 at Airpark Drive in Laredo.

TRAFFIC CONTROL

Issue

High levels of unprotected left turns by trucks at intersections between airport-grounds driveways and arterials on the surrounding roadway network can create serious traffic problems not only for truck traffic entering or exiting the driveway but for through passenger car traffic on the arterial as well. Queues may form, resulting in delays, wasted fuel, higher emission levels, higher noise levels, and higher safety risk, while hindering commercial vehicle operations.

Obstacles

Traffic control signals are often considered a panacea for all traffic problems at intersections. They may address some concerns while leaving others unaffected—possibly even creating new issues. At the same time, various stakeholders—including airport authorities, TxDOT, and local transportation agencies—can face a lack of communication and cooperation.

Agencies often develop or update airport, state, and local transportation master plans and improvement plans independently. As a result, these agencies often overlook truck-specific issues that need to be addressed, especially at the planning stage or at least the operational stage. The vicinity of an airport sees a higher concentration of truck traffic in comparison to other urban areas, particularly when the economy is doing well. This issue warrants particular attention.

Solutions

The *Texas Manual on Uniform Traffic Control Devices* (*20*), which was derived from the *U.S. Manual on Uniform Traffic Control Devices* (*21*), applies to airports, and agencies should adhere to it when addressing traffic control issues on airport grounds or in the vicinity of airports. Traffic control signals, when properly used, are valuable devices for the control of vehicular and pedestrian traffic. They assign right-of-way to the various traffic movements and thereby profoundly influence traffic flow. According to the *Texas Manual on Uniform Traffic Control Devices*, traffic control signals that are properly designed, located, operated, and maintained have one or more of the following advantages:

- They provide for the orderly movement of traffic.
- They increase the traffic-handling capacity of the intersection if:
  - proper physical layouts and control measures are used, and
  - the signal operational parameters are reviewed and updated (if needed) on a regular basis (as engineering judgment determines that significant traffic flow and/or land use changes have occurred) to maximize the ability of the traffic control signal to satisfy current traffic demands.
- They reduce the frequency and severity of certain types of crashes, especially right-angle collisions.
- They are coordinated to provide for continuous or nearly continuous movement of traffic at a definite speed along a given route under favorable conditions.
- They are used to interrupt heavy traffic at intervals to permit other traffic, vehicular or pedestrian, to cross.

Many consider traffic control signals a panacea for all traffic problems at intersections. This belief has led to traffic control signals being installed at many locations where they are not

needed, adversely affecting the safety and efficiency of vehicular, bicycle, and pedestrian traffic. Traffic control signals, even when justified by traffic and roadway conditions, can be ill-designed, ineffectively placed, improperly operated, or poorly maintained. According to the *Texas Manual on Uniform Traffic Control Devices,* improper or unjustified traffic control signals can result in one or more of the following disadvantages:

- excessive delay,
- excessive disobedience of the signal indications,
- increased use of less-adequate routes as road users attempt to avoid the traffic control signals, and
- significant increases in the frequency of collisions (especially rear-end collisions).

Since vehicular delay and the frequency of some types of crashes are sometimes greater under traffic signal control than under STOP sign control, agencies should consider providing alternatives to traffic control signals even if one or more of the signal warrants has been satisfied. Widening the major roadway, the minor roadway, or both roadways can often reduce the delays inherent in the alternating assignment of right-of-way at intersections controlled by traffic control signals. Widening the minor roadway often benefits the operations on the major roadway because it reduces the green time that must be assigned to minor-roadway traffic.

The *Texas Manual on Uniform Traffic Control Devices* provides detailed instructions regarding the selection and use of traffic control signals. Decision makers should base their decisions on an engineering study of roadway, traffic, and other conditions. An engineering study of traffic conditions, pedestrian characteristics, and physical characteristics of the location can determine whether installation of a traffic control signal is justified at a particular location. Investigation of the need for a traffic control signal includes an analysis of factors related to the existing operation and safety at the study location and the potential to improve these conditions, and the applicable factors contained in the following traffic signal warrants:

- Warrant 1: Eight-Hour Vehicular Volume,
- Warrant 2: Four-Hour Vehicular Volume,
- Warrant 3: Peak Hour,
- Warrant 4: Pedestrian Volume,
- Warrant 5: School Crossing,
- Warrant 6: Coordinated Signal System,

- Warrant 7: Crash Experience,
- Warrant 8: Roadway Network, and
- Warrant 9: Intersection near a Grade Crossing.

A traffic control signal should not be installed unless one or more of the warrants described are applicable. However, the satisfaction of a traffic signal warrant or warrants does not in itself require the installation of a traffic control signal. Decision makers should always use engineering judgment to ensure that the installation of a traffic signal is the best solution and that the signal does not result in unintended consequences, e.g., disruptions in progressive traffic flow.

Resources

The following resources provide additional information on these issues:

- *Texas Manual on Uniform Traffic Control Devices 2006,* Texas Department of Transportation, Austin, Texas, http://www.dot.state.tx.us/txdot_library/publications/tmutcd.htm.
- *Manual on Uniform Traffic Control Devices,* 2009 Edition, Department of Transportation, Federal Highway Administration, December 2009, http://mutcd.fhwa.dot.gov/pdfs/2009/pdf_index.htm.
- *Traffic Signals Manual*, Texas Department of Transportation, Austin, Texas, November 1999, http://onlinemanuals.txdot.gov/txdotmanuals/tff/index.htm.

CARGO FACILITY SITE LOCATION

Issue

The location of freight facilities relative to existing or future road access is an important consideration for all airport planners and managers. As briefly discussed previously in this guidebook, the location of freight facilities at an airport may face competing interests. Considering just the airport property and not off-airport access issues, certain locations at the airport may appear to be best suited for a freight center but, when considering the bigger picture and existing and planned roadways, another parcel may actually be a better choice. Failing to consider such issues can adversely affect air operations due to conflicting traffic on and off the airport.

Obstacles

Issues related to selecting the most appropriate site for a freight center may include land availability on airport property, surrounding land uses, and the provision of safe and efficient landside access. In some cases, an airport may have only one parcel that can realistically be used to locate a freight center. Funding availability may present an obstacle to effectively addressing roadway and other access needs once a freight location is selected on the airport property.

Solutions

As with most issues related to landside freight access, good planning and coordination among affected agencies is the best overall solution. Discussions with transportation planning agencies can identify which roads may realistically be improved or extended to serve freight traffic in specific areas. Roadway characteristics for consideration include intersection geometrics, lane widths, requirement for turns across traffic lanes, and pavement structure. Airports that have limited amounts of land available may consider developing smaller facilities on the airport property and encouraging shippers to use larger facilities at nearby off-site locations. If encouraging offsite locations, airports must take into account adjacent land use/development patterns.

BUSINESS DECISIONS

Issue

While an airport may have a strategic plan to develop freight facilities, ultimately the marketplace determines what types of activities actually occur at a given airport. Because of their inherent airside infrastructure, most major commercial airports with passenger service serve at least some level of freight activity. Some airports, such as Fort Worth Alliance, are built primarily to serve freight traffic. Still other airports, typically in smaller cities, are attempting to bring in freight activity as a way to increase revenues and overall economic development in the community. Finally, regardless of why an airport seeks new or increased freight activity, the private sector ultimately determines if a particular airport meets its criteria to serve as a freight center.

Obstacles

A potential obstacle is a lack of overall planning, as well as a lack of coordinated efforts among all the private- and public-sector entities involved.

Solutions

The airport and the private sector need to work together cooperatively when developing freight centers, bringing the other transportation agencies in early in the process to facilitate efficient and effective road infrastructure planning that will result in optimal freight operations. This includes economic development officials and chambers of commerce that provide a forum for discussion. Public-private partnerships often develop from this group of stakeholders.

TRUCK QUEUE STORAGE AND BACKING

Issue

As freight activity and truck volumes increase, truck queues and storage can pose challenges. If no regulatory controls or physical alternatives are in place, shippers may store trailers on public roads. Figure 26 shows an example of trailers being stored on a street in a freight area. In addition, trucks might use the public roads to perform backing maneuvers not physically possible on the company site.

Figure 26. Trailers Stored on Street.

One freight shipper at a smaller airport is reportedly planning to expand its facility but will need to reconfigure its driveway, parking area, and docking area to allow trucks to

completely enter the facility before needing to turn around and back up to the loading docks. At the time of the interview, larger trucks needed to use the adjacent road for at least part of these maneuvers. Such maneuvers on the public road can cause safety and congestion issues.

Obstacles

Small, landlocked freight centers that have no room for expansion or modifications present obstacles to providing adequate space for truck queuing and storage, as well as turning and backing maneuvers necessary for accessing loading docks.

Solutions

With proper planning and design, facilities can provide adequate space for on-site turning and backing maneuvers. Figure 27 provides an example from the east freight area at Harlingen International Airport where such on-site space is provided.

Figure 27. Freight Facility with Space for Truck Backing Maneuvers.

In some cases freight shippers use a relatively smaller facility on the airport grounds and have a larger transfer facility at a nearby location. An example is UPS at Will Rogers World Airport in Oklahoma City. Only smaller single-unit trucks typically access the airport facility, while larger tractor-trailer trucks access the off-airport facility. When this process is used, the volume of larger trucks accessing the airport decreases.

A related issue is the proximity of intersections and facility access roads relative to arterial streets. Figure 28 provides an example of how a facility access road at Houston Hobby

Airport is configured to allow most trucks to straighten before they approach the intersection of Airport Boulevard.

Figure 28. Facility Access Road That Allows Trucks to Straighten Before Approaching Intersection With Street.

PERFORMANCE MANAGEMENT AND NEEDS IDENTIFICATION

Issue

Dedicated airport staff or outside sources should measure performance of airport freight ground transportation systems – periodically at a minimum, though a continuous or regular cycle is preferable. Little evidence exists that Texas airports currently conduct performance measurement of the freight ground transportation system in such a manner.

Obstacles

Agencies often develop airport, state, and local transportation master plans and improvement plans independently. As a result, these agencies often overlook truck-specific issues that need to be addressed, especially at the planning stage or at least at the operational stage. Studies of freight or passenger airport ground transportation systems are typically not routine procedures. These studies tend to be conducted by state and local planning authorities or MPOs on an as-needed basis, sometimes through external contracts with private consulting firms in the form of traffic impact analyses (TIAs) to assess access requirements for a specific proposed development. Stakeholders such as shippers, receivers, freight forwarders, and airport personnel may not be involved consistently, thoroughly, or early enough in the planning process.

However, they can offer valuable information and insight to improvements in airport freight ground transportation systems, which help make an airport more competitive and attract new air cargo–related business.

The idea of freight performance management is a relatively new topic. Development of freight performance measures is an emerging field at the local, state, and national levels. MPOs, state departments of transportation (DOTs), and the U.S. Department of Transportation (USDOT), which employ dedicated transportation engineers, are currently implementing freight indicators. Airport authorities, however, typically do not have transportation engineers or similar professionals on permanent payroll, which can cause communication and cooperation gaps between airport authorities, TxDOT, and local transportation agencies.

Solutions

Traffic Impact Analyses

TIAs are used to verify both need and the most effective types of improvements. Third parties such as state and local planning authorities or MPOs often prepare TIAs on an as-needed basis, sometimes through external contracts with private consulting firms. TIAs provide objective analyses of traffic impacts and needs, which can help assess access requirements for a specific proposed development. TIAs should be requested in conjunction with any major access improvement request. TxDOT and the applicable local agency should participate in the scoping of the TIA to ensure it covers the necessary elements and in interim meetings about tentative findings prior to completion of the TIA report. The completed TIA benefits all parties by determining at least:

- what access is needed,
- the best location for access,
- necessary improvements to adjacent and other off-site roadways and their recommended configuration,
- recommended traffic controls, and
- other conclusions or recommendations responding to issues or requests raised by the tenants or participating agencies.

If airport authorities need or desire any off-site roadway improvements, they should request a TIA. The TIA scoping and review should involve TxDOT if the TIA will probably

recommend an improvement or access to a state highway. The TIA can be used for several purposes but should only include actions needed such as:

- comparing accessibility and/or improvement costs of alternatives;
- identifying the best access configuration for a site;
- assessing traffic impacts on nearby streets and highways;
- determining what roadway improvements are needed to maintain the current level of service;
- evaluating any traffic safety concerns or nearby locations with high accident rates;
- developing and addressing the effectiveness and feasibility of alternative improvements;
- exploring funding strategies for requested highway improvements; or
- addressing other issues, needs, or options of interest to the airport, cargo tenants, or transportation agencies.

The TIA preparer, airport authority, cargo tenants, local transportation agencies, TxDOT, and other stakeholders should meet to initiate the TIA and determine existing conditions and concerns, programmed or planned roadway improvements, and requirements associated with any improvements that may be recommended.

Performance Management

A comprehensive, objective, and consistent set of metrics to gauge performance of airport freight ground transportation systems is important for assessing the condition of the system, identifying problems, and prioritizing actions to resolve those problems. Freight system performance measures are vital to decision making about investments, operations, and policies by a range of stakeholders such as the airport authority, TxDOT, the local transportation agency, and the private sector (e.g., shippers, carriers, receivers, and freight forwarders). Performance measures for airport freight ground transportation systems also help educate planners, decision makers, and the public about the importance of freight ground transportation at airports to the economy and quality of life.

Areas of emphasis of performance measurements should include but not be limited to efficiency, effectiveness, capacity, safety, security, infrastructure condition, congestion, energy, and the environment. The set of performance measures chosen at each airport depends on several

factors such as airport characteristics, types of operations, objectives of performance measurement, and data availability. FHWA presents general freight performance measures on its dedicated Performance Measurement website and can provide guidance for developing airport-specific performance measures (*22*). These include:

- cost per ton-mile,
- fuel consumption of heavy trucks per ton-mile,
- cargo insurance rates,
- on-time performance,
- point-to-point travel times on freight-significant highways,
- hours of delay on freight-significant highways,
- incident delay on freight-significant highways,
- ratio of peak travel time to off-peak travel time,
- travel time,
- ratio of variance to average for peak trip times,
- annual miles per truck,
- conditions on intermodal connectors, and
- customer satisfaction.

TxDOT is participating in the performance measurement movement and has recently developed 27 key general performance measures and indicators to gauge agency and system performance. TxDOT Tracker is the new, one-stop web application for viewing the ongoing performance of the department in areas of safety, construction, pavement and bridge condition, finance, design, right-of-way, and more.

Agencies can develop and adapt performance measures specific to airport freight ground transportation operations on the basis of the above examples. They can also develop additional measures to address specific areas of emphasis at airports such as adequacy of facilities through metrics such as cargo area truck queues, intra- and intercargo area travel times, bay maneuvering space, etc.

The airport itself or the owner city/county should dedicate transportation professionals at airports to develop, execute, and monitor comprehensive freight ground transportation performance measurement. Although freight performance measurement is still a work in progress, development- and application-wise, the FHWA website dedicated to the subject is a

core resource. Near-future national transportation policy will emphasize performance measurement as a means for project selection, prioritization, funding, and post-project evaluation. Identification and selection of performance measures can also benefit from private-sector involvement that has a longer history and better understanding through measuring performance of its operations. Institutionalizing performance measurement can facilitate consistent, thorough, and early involvement of all stakeholders; facilitate seamless communication and cooperation with state and local transportation agencies; and ultimately support decisions to implement solutions and improvements more readily, reliably, and effectively.

Resources

The following resources provide additional information on these issues:

- *TRB Access Management Manual*, Transportation Research Board of the National Academies, 2003, http://www.accessmanagement.info/manual.html.
- *Access Management Manual*, Texas Department of Transportation, Austin, Texas, December 2009, http://onlinemanuals.txdot.gov/txdotmanuals/acm/acm.pdf.
- Performance Measurement, U.S. Department of Transportation, Federal Highway Administration, Office of Operations, Freight Management and Operations, http://ops.fhwa.dot.gov/freight/freight_analysis/perform_meas/index.htm.
- TxDOT Tracker, Texas Department of Transportation, http://apps.dot.state.tx.us/txdot_tracker/.

CHAPTER 6. CONCLUSIONS AND RECOMMENDATIONS

Survey and interview responses, as well as field observations, indicate that good planning and coordination among involved agencies lead to the best landside freight access to airports. When an airport is planning to expand existing freight facilities or develop new ones, it should conduct a brainstorming session with all agencies that may be involved in transportation issues. Airports should invite agencies that have responsibilities in airport Areas of Influence 1 through 4 and encourage them to participate.

Wayfinding is a vital element of good landside freight access to airports. Wayfinding begins in Area of Influence 1 (the nearest controlled-access highways). Some larger metropolitan areas actually provide wayfinding signage beyond the nearest controlled-access highway, particularly when there is more than one major airport in the area. Wayfinding also helps address the issue of comingling truck and automobile traffic. Reducing comingling of these vehicles can reduce hazards and improve on-road navigation to airports and freight centers.

Proper roadway design is vital to the process, particularly related to intersection geometrics, lane width, and pavement structure. All of these roadway characteristics need to accommodate the largest tractor-trailer trucks that will potentially access the freight centers on a regular basis.

Airports and other involved agencies should develop performance measures in order to allow regular monitoring, evaluation, needs/deficiencies identification, and inclusion in updated transportation improvement plans (TIPs), long-range plans, and other related documents. Again, coordination among all involved agencies is vital to success.

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8 Ahoy Cargo Trade and Transport Hub, http://www.ahoycargo.com/freight-support/air-freight-forwarders/500-air-freight-forwarders-definition-terminology.html (freight forwarders) and http://www.ahoycargo.com/freight-support/freight-consolidators/804-freight-consolidators-definition-terminology.html (freight consolidators). Accessed September 27, 2010.

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