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16. Abstract

Texas' airports play a large role in the national and regional movement of goods by air. This includes goods moved within the state, across the country, and internationally to several continents. Most of this movement of goods is accomplished at the largest airports in Texas. However, as freight demand grows, a time will come when other airports will need to be utilized to accommodate additional demand.

Properly planned transportation infrastructure is critical to ensure the vitality of an airport's freight operations. Time-sensitive air freight requires high levels of operational efficiency, which is generally optimized by taking steps to ensure both freight and passenger roadway access within the airport boundaries. Connections and design features of regional highways near the airports are no less important because they allow access to these important economic generators.

This research report identifies the issues, barriers, physical bottlenecks (e.g., infrastructure needs), and solutions (including funding mechanisms) concerning landside access to airports in Texas. Inner city airports in large metropolitan areas sometimes face roadway geometric challenges, but typically have relatively low cargo activity levels. Shipping representatives stated that wayfinding is a key characteristic in providing good landside freight access to airports. Signage needs to be visible and informative in advance of necessary turns or lane changes. Efforts need to be taken to minimize comingling of freight and passenger traffic in areas near the passenger terminals. A variety of funding opportunities exist through public, private, and shared sources to improve access to airports.

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LANDSIDE FREIGHT ACCESS TO AIRPORTS: FINDINGS AND CASE STUDIES

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DISCLAIMER

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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	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

CHAPTER 1. INTRODUCTION

TEXAS AIR CARGO

Texas airports play a significant role in the movement of goods by air, not only in Texas but also the across the country and internationally. Most of this movement of goods is accomplished at the largest airports in Texas. Dallas/Fort Worth International Airport and Houston Intercontinental Airport rank highly among all U.S. airports in terms of freight value and weight. The all-cargo Fort Worth Alliance Airport ranks third in the state in overall cargo activity.

Air cargo has played an increasingly important role over the past couple of decades in the shipment of goods around the world. Texas assets of seaports, international border crossings, and major industrial and distribution centers, along with major population growth, set up the state as a major player in the movement of goods within the state, throughout the United States, and internationally. As these demands in air cargo continue to grow in Texas markets, existing cargo airports will need to continue to facilitate efficient movement of goods into and out of their air-cargo facilities, and a time may come when other airports will need to be utilized to accommodate some of that demand.

AIR-CARGO ACCESS

The air-cargo industry largely caters to time-sensitive, high-value, and specialty cargo, such as packages and medical equipment, with destinations to almost every zip code in the country. Because of these types of operations, properly planned transportation infrastructure is critical to ensure the vitality of airport freight operations. Especially considering that air cargo ultimately needs to be delivered using the roadway system, suitable access to the road network is of prime importance.

Time-sensitive air freight requires high levels of operational efficiency, which is generally optimized by taking steps to ensure both freight and passenger roadway access within the airport boundaries. Connections and design features of regional highways near the airports are no less important because these roads allow access to these important economic generators.

REPORT OBJECTIVES

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

RESEARCH APPROACH

In order to accomplish the stated project objectives, the research team utilized the following approach:

- Reviewed existing literature and practices across the state and country.
- Assessed current and recent cargo activity at Texas airports.
- Performed a preliminary air-cargo access evaluation at Texas airports and developed a list of airports for more in-depth case-study evaluations.
- Made site visits and conducted case studies.
- Developed a methodology for identifying and evaluating landside freight-access performance.
- Developed a guidebook for landside access to air-cargo facilities aimed at TxDOT staff and local agencies.
- Produced final documentation—a research report and a project summary report.

REPORT ORGANIZATION

This final project report provides cities, counties, regional planning agencies, state agencies, shippers, and airport operators with a discussion of the issues facing Texas airports, an in-depth evaluation of current air-cargo volumes at Texas airports, and solutions related to landside freight access to airports.

Chapter 1 provides an overview of the problems addressed, objectives, and study approach. Chapter 2 presents a thorough background of the air-cargo industry and stakeholders, overall trends, and factors affecting air-cargo activity. Chapter 3 states detailed air-cargo activity at Texas airports and examines characteristics favorable to air-cargo activity.

Chapter 4 portrays the preliminary evaluation of air-cargo access at Texas airports and presents a categorization of air-cargo facility types utilized to determine the case studies presented in Chapter 5. As indicated, Chapter 5 presents the in-depth case studies performed during this research project. Chapter 6 identifies the major cargo access issues and challenges observed during the case studies and interviews, and presents guidance to available solutions.

The report closes with Chapter 7, which presents the final conclusions and recommendations of the project. An annotated bibliography of relevant literature is also included.

CHAPTER 2. INDUSTRY BACKGROUND AND LITERATURE REVIEW

BRIEF HISTORY OF AIR CARGO AND AIR FREIGHT

Air freight began as an industry in 1925 through the Airmail Act. World War II established the critical value of aircraft for hauling cargo efficiently and in a timely manner. Air cargo was the first air-transportation component to be deregulated in 1977. This set in motion the ability for airlines to charge the rates they determined and the routes they selected. In the years following, many airlines stopped all-cargo service, while a few commenced services. This was followed by the emergence and growth of all-cargo airlines, many of which continue to flourish today (*1*). Air cargo is faster than other modes of transport, and there have been dramatic improvements in aircraft technology: "Just after WWII, it would have taken a DC-3 carrying 6000 lb of cargo almost 24 hours and four stops to make it across the U.S. Now those trips can be accomplished in a 747 flying non-stop in about four hours and carrying over 200,000 lb of cargo" (*2*).

The main transcontinental route in 1926 spanned from New York to San Francisco with limited connection to the southern states. One feeder route to the Dallas/Fort Worth area was used for air mail (*3*). The American Railway Express Company realized the potential for air cargo and began to launch air express services. After failed attempts, in 1927 air express service began to provide door-to-door shipping of urgent small and medium-sized packages (*3*). This kicked off an industry that continues to grow today.

Though air mail was the catalyst for transporting air cargo in general, the increased role of freight in air cargo was noted by the 1950s. This is shown in Table 1 in revenue ton-kilometers (RTKs). In the 1960s, the advent of jet propulsion and containers began to double the capacity of airplanes to transport more goods and passengers (*3*).

Table 1. Comparative Development of Mail and Freight Traffic (in Million RTK).

Year	Mail	Freight	Total	Relative Percentages	
				Mail	Freight
1938	36	17	53	68	32
1946	100	120	220	45	55
1950	200	770	970	21	79
1951	230	870	1,100	20	80

Source: (*3*).

AIR-CARGO INDUSTRY

Operations and Trends

Air cargo is generated by a wide variety of suppliers and is used to describe items that must be delivered on a timely basis and/or are high in value. Typically supplies are shipped in by truck to the airport or to a nearby consolidator or forwarder, transported by air for the long-haul leg of the trip, and finally shipped out by truck to another consolidator or consignee. The flow chart in Figure 1 prepared by the FHWA illustrates this general trend.

The air-cargo industry has seen growth in air-cargo activity, but this growth has been tempered recently with down years in both 2008 and 2009 (*4*). This has been the result of several factors including the elevated security standards for carrying cargo on passenger flights and the recent decision by the U.S. Postal Service to use all-cargo carriers for transporting mail. Global trade has been another. This had resulted in an increase in expected growth for the all-cargo carriers. The recent economic downturn is possibly at the root of the recent air-cargo activity decline since it is historically related to gross domestic product (*4*). Additionally, the Federal Aviation Administration (FAA) reports other changes that have contributed to air-cargo industry challenges. These include a modal shift away from air cargo for some domestic cargo movements, the implementation of fuel surcharges, and an increased use of mail substitutes such as email. Activity trends are discussed later in this chapter.

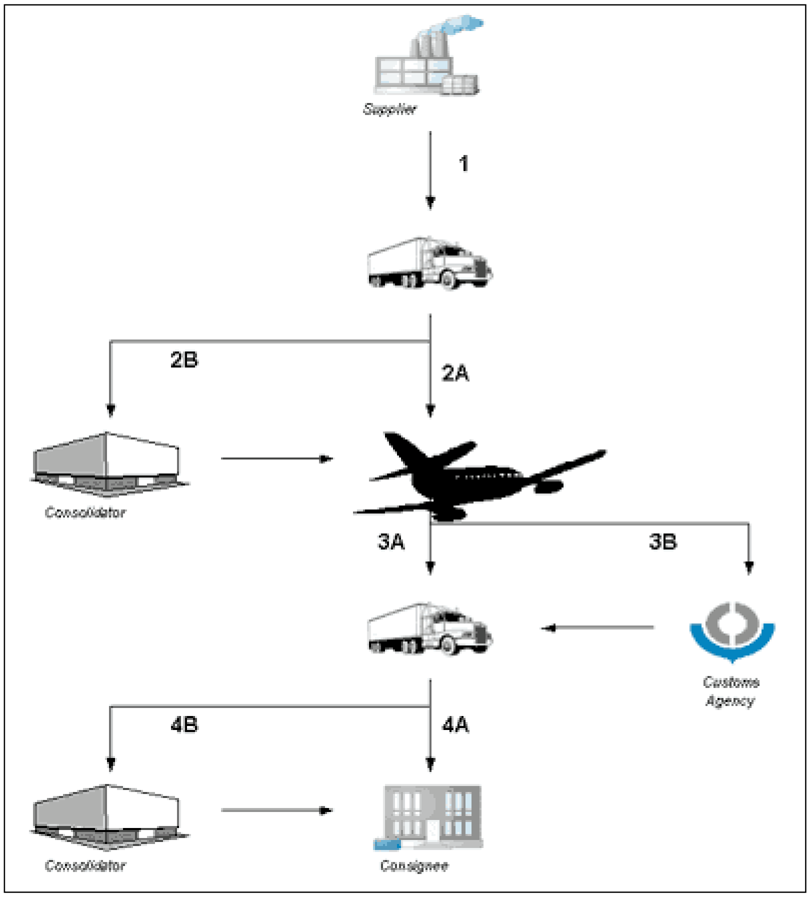


Figure 1. Simplified Depiction of Physical Freight Flow for Time-Sensitive Freight (5).

As part of operations, air-cargo carriers must have good connections with their suppliers. Shippers and forwarders evaluate the performance of an air carrier based on their statistics for "flown as booked" (*6*). This entails both keeping entire shipments together as well as being on time. Some shippers expect 100 percent performance, or they will shift to another carrier. This has implications on operations given that suppliers may bring their product at the last minute or bring less tonnage than originally promised. In order to stay on time, air-cargo carriers may be forced to fly with only partially full aircraft.

Air cargo provides a necessary element to the transportation system because of the time savings compared to other modes. Beyond these, issues related to the value of goods are also addressed by air cargo with increased security and less time in warehouses. Air-cargo operations continue to be influenced by five factors:

- Proximity of a particular airport to the market.

- Transportation connections from the airports to those markets (trucks, rail, and a good roadway system).
- Labor.
- A favorable tax structure for shippers.
- Overall business costs at that location (*1*).

These factors are perhaps even more important within the context of a global-based economy.

According to the FAA Aerospace Forecasts, air-cargo activity is expected to grow (revenue ton-miles) 4.1 percent in 2010 and 5.1 percent per year from 2011 to 2025 (*4*). This follows a 7.6 percent drop in 2009. These numbers represent the total market. Domestically, air cargo is expected to grow 2.5 percent in 2019 and 2.4 percent per year from 2011 to 2025. This is following a drop that is expected to be 8.3 percent in 2009. International growth is expected to be much more robust with a 2009 through 2025 growth rate of 6.1 percent per year following an expected decline in 2009 of 7.2 percent.

The Players

The companies involved in the movement of goods in the air-cargo business include combination carriers, all-cargo carriers, and freight forwarders. All-cargo carriers can be further classified as integrated carriers or traditional/line-haul carriers. These air-cargo service providers are described below and summarized in Table 2.

Table 2. 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 TTI.

Combination (Belly-Cargo) Carriers

Combination carriers are defined as passenger airlines that transport cargo below the main deck. They are also referred to as belly-cargo carriers. After September 11, 2001, belly cargo significantly declined due to restrictions on what could be carried on passenger flights (*7*). However, 33.1 percent of all revenue ton-miles were carried by passenger carriers in 2004, showing an increase of 9.8 percent from 2003 (*8*). Belly cargo is the lowest-cost form of air-cargo transportation and remains competitive as overall demand continues to increase (*9*). The majority of air cargo is shipped as belly cargo. In 1995, belly cargo represented 59 percent of all air-cargo revenue ton-miles; "combi" aircraft shipped 7 percent, and all-cargo aircraft shipped 34 percent (*10*). The trend appears to be shifting to more all-cargo aircraft, and it is predicted that by the year 2025 the all-cargo share in terms of revenue ton-miles will be 88.4 percent (*4*).

Some forwarders are paying close attention to Southwest Airlines and their limited belly cargo as both a model for point-to-point efficiency, reliability, and avoidance of "gridlocked airports" as well as financial stability compared to other airlines (*11*). As Karp stated, "The bottlenecks (at major airports) are certainly an issue. But a lot of smaller and medium sized airports, like Indianapolis, are becoming major distribution points. We see a shift in the market going to the smaller airports and that has helped us. More and more distribution centers are not tied to hub areas" (*11*).

Also, some airlines have separate operations that move cargo on the main decks of all-cargo aircraft in addition to the bellies of their passenger-service aircraft. These carriers are sometimes referred to as mixed carriers.

All-Cargo Carriers

The growing demand for air cargo has created a strong market for more all-cargo and integrated carriers. Unlike the combination carriers that carry both passengers and belly freight, all-cargo carriers transport only cargo on the main decks of the aircraft. All-cargo carriers can be further classified as integrated carriers or traditional/line-haul carriers. Integrated carriers are those that provide door-to-door service, such as UPS and FedEx. Traditional/line-haul carriers are those that typically provide airport-to-airport service and include carriers like Polar and BAX Global.

These carriers, especially those providing express service, account for a significant portion of the air-cargo industry and have spurred market growth significantly in the last 10 years (*10*). Express carriers provide "guaranteed or time-definite" service and utilize passenger/cargo aircraft, all-cargo aircraft, and integrated carriers (*12*). FedEx, UPS, DHL, and others continue to provide express service and have been a catalyst for improved cargo services at specialized airports, such as Alliance Airport in the Dallas/Fort Worth area.

In 2005, 70.9 percent of total revenue ton-miles were carried by all-cargo carriers (*13*). In order to remain competitive, airports that want to maintain or increase their cargo activity will have to adapt and be able to provide good access to distribution centers and truck connections (*7*). Integrated carriers may have a "one-stop shop" approach and provide air and trucking services under one company. Providing seamless shipping gives them a competitive advantage over other carriers.

Air cargo is engaged in a balancing act with the trucking industry. The ability of trucking to compete at a fraction of the air rates means air cargo has to look at methods to provide new services and competitive rates. All-cargo and integrated carriers are beginning to pull shipments off long-haul trucking routes: " 'There is a shift that has been happening, particularly on the short-haul,' said Donald Broughton, an investment analyst in St. Louis with A.G. Edwards, Inc. 'But that is really part of the normal ebb and flow of business in a recession. What is happening, if you really look at the data from the truckers and the air carriers, is that the airlines have lost traffic, yes. But they have lost it to the integrated guys. These are not air shipments that are going less-than-truckload (LTL) now. The long-haul LTL truckers are actually showing dramatic declines" (*14*).

All-cargo and integrated carriers can offer speed that trucking alone cannot provide and the dedicated service focus that belly-cargo carriers are unable to provide. Additionally, the ability of air cargo to bypass distribution centers and move products directly from the manufacturer to the retail store is becoming more common as savings in handling costs offset air-transport costs. This is the area where integrated carriers may surpass all other types of carriers (*15*).

Freight Forwarders

Air-freight forwarders operate a business that assembles items for shipment by air transport. Forwarders can be considered an indirect air carrier or can operate like an integrated carrier. The forwarder coordinates connections between "point of receipt to point of destination," which may involve air and trucking transport. The forwarder may utilize its own aircraft and trucks or connect with other air or trucking providers (*12*). It is important for airports to provide good connections to the forwarders in order for the shipments to efficiently reach their final destinations. These companies operate their own fleets of trucks and aircraft. They may also purchase capacity on other carriers, including passenger carriers, to accommodate their customers.

Aircraft

There are three types of aircraft typically used for air cargo: passenger, "combi," and freighter. Passenger aircraft use their belly area for cargo and can transport approximately 8–12 metric tons depending on distance and passenger load. Combi aircraft are certified and configured to carry both passengers and cargo on the main deck (*16*). Combi aircraft can hold approximately 25–35 metric tons, and freighters can carry approximately 100 metric tons (*9*).

Aircraft are further categorized by the size of the body of the plane and the number of engines. In 2007, narrow-body aircraft accounted for 56 percent of the cargo fleet, and wide-body aircraft accounted for the remainder. The aircraft that are forecasted to be used for air cargo in 2025 are broken down by number of engines and body type (see Table 3).

Table 3. Projected Growth in Number of Air-Cargo Aircraft by Type (2005–2025).

Number of Engines	Narrow Body		Wide Body	
	2007	2025	2007	2025
Two engines	167	606	274	818
Three engines	186	60	212	228
Four engines	79	0	90	238
Total	432	666	576	1,284

Source: FAA Aerospace Forecasts, 2009–2025.

The most significant growth in the fleet is in two-engine aircraft. This is reflective of the move toward more fuel-efficient aircraft in the industry. In addition, as more two-engine passenger aircraft come into service, more will be available for cargo service. For example, the much-anticipated Boeing 787 has yet to be delivered for service but will be made available for conversion and use as a freighter when it does. Airbus has had major backlogs for its A330 freighter, also a two-engine wide-body aircraft. These trends will push the two-engine wide-body fleet higher in the coming years. The expected growth in four-engine wide-body freighters is partly due to the Airbus A380, which has yet to see widespread deployment. The wide-body fleet currently has 44 percent of the market, and this percentage is expected to increase to 66 percent in 2025 (*13*). The shift to wide-body aircraft will help address the projected shortfall of capacity for air cargo in the future, and growth is expected be robust. The fleet-mix change is largely a result of economics. Higher fuel prices force older aircraft out of the system sooner. Additionally, newer aircraft will be larger since the payload is higher, making their economic efficiency higher as well.

Figure 2 shows the gap in passenger airline traffic and cargo. This is relevant because belly-cargo capacity will not keep up with the demand for air cargo, and flying empty passenger compartments to transport cargo below is not an efficient practice. This will possibly further the trend for air-freight operators to increase the size of aircraft to reduce unit costs (*9*).

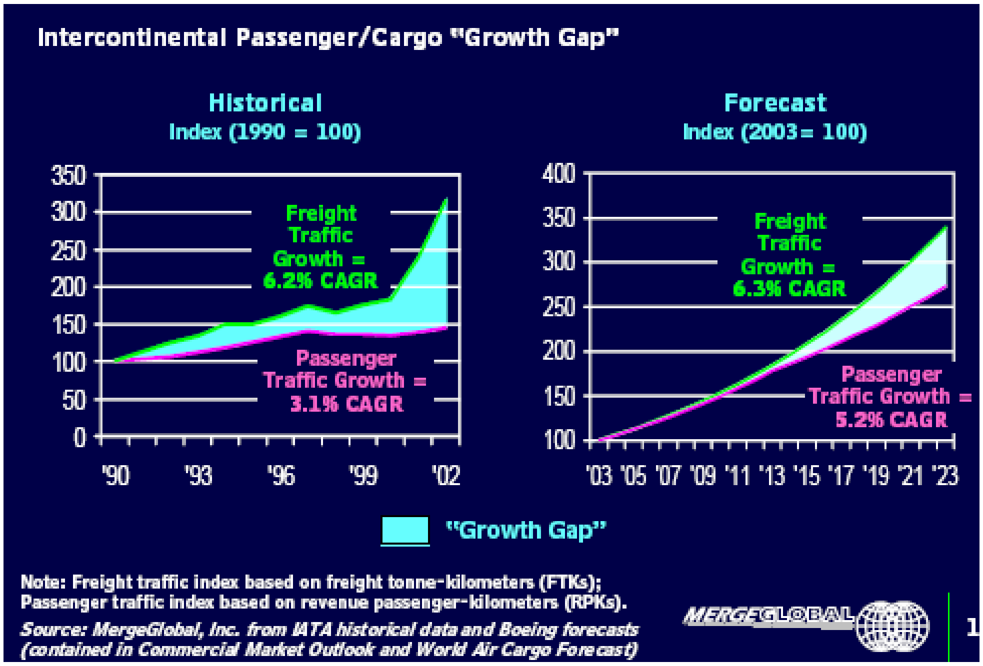


Figure 2. Passenger/Cargo Growth Gap.

OVERALL NATIONAL TRENDS AND GROWTH RATES

The economic fate of air cargo is tied to that of the nation and the world. Air cargo is a result of derived demand driven by economic activity around the world. In addition, the FAA notes in its forecast that "the freight/express segment of domestic air cargo is highly correlated with capital spending" (*4*). Overall progress in air-cargo operations has resulted in the possibility of overnight express service to almost every zip code in the country. The speed of transporting items has allowed small communities to participate more aggressively in the global economy. In 2008, the air-cargo activity of U.S. carriers decreased by 2.8 percent from 2007, in terms of revenue ton-miles (RTMs). Domestic activity dropped by 9.5 percent, and international activity increased by 1.7 percent (*13*). Given the onset of the global recession and the direct link between air-cargo activity and economic health, these decreases are not surprising. All-cargo carriers flew 71.3 percent of total revenue ton-miles, while passenger carriers flew the remaining 28.7 percent (*13*).

Boeing's Current Market Outlook has predicted an annual growth rate in world cargo of 5.8 percent from 2008 to 2027 (*16*), not too different from the 5.1 percent annual growth noted earlier forecast by the FAA through 2025 (*13*). The growth rates for the same period for North American markets to/from Latin America, Europe, and Asia are 5.6, 5.1, and 6.7 percent, respectively (*13*). This rapid and continuous growth is a strong indicator that airports consider cargo more than just a side business. Despite the current global economic downturn, air cargo is expected to rebound and remain a vital part of the aviation industry and critical to the overall economy. According to the U.S. Department of Transportation, air cargo represents the smallest share of domestic freight, as measured by freight ton-miles, at 0.3 percent. However, it comprises 25.3 percent of its value.

Air-Cargo Security Screening

Following recommendations of the 9/11 Commission, air cargo shipped on passenger airlines needs to undergo 100 percent inspection. Legislation carrying out these recommendations (Implementing Recommendations of the 9/11 Commission Act of 2007 [9/11 Commission Act]) calls for the Transportation Security Administration (TSA) to perform these inspections at the same level that passenger baggage is screened. This legislation required TSA to develop a system to screen 50 percent of the air cargo that originates in the United States by February 2009 and 100 percent by 2010. Cargo not screened cannot be flown. According to the TSA, they currently screen 100 percent of the cargo flown on 96 percent of the flights originating in the United States. All of the cargo flown on narrow-body aircraft is screened (*17*). The 100-percent goal has been met for domestic flights; however, “the agency can only screen about two-thirds of international cargo due to a combination of technical challenges and difficulty in securing diplomatic agreements” (*18*).

These additional screening requirements may alter the air-cargo landscape. Passenger airlines may curtail their cargo operations depending on costs associated with this screening requirement. It is yet to be seen what, if any, impact these new security procedures will have on air-cargo operations. Airlines with the physical space and manpower to accommodate the procedures will possibly continue to do so, and those without may be forced to alter their operations. This could include increased/additional activity in all-cargo operations, which are the focus of this analysis.

Trends in Volume and Commodity Type

No national data pertaining to the items shipped by air exist because those data are known only by the shipper. The U.S. Department of Transportation records only the weight, not the contents, of air shipments. Consequently, other sources are needed to determine what exactly is shipped by air. In general, however, this is known. Air cargo is dominated by high-value and high-priority goods that include electronic products, clothing, flowers, emergency replacement parts, and others. The commodity types that are typically shipped via air cargo require fast shipping, such as perishables or items requiring refrigeration, electronics, and some machinery (see Figure 3).

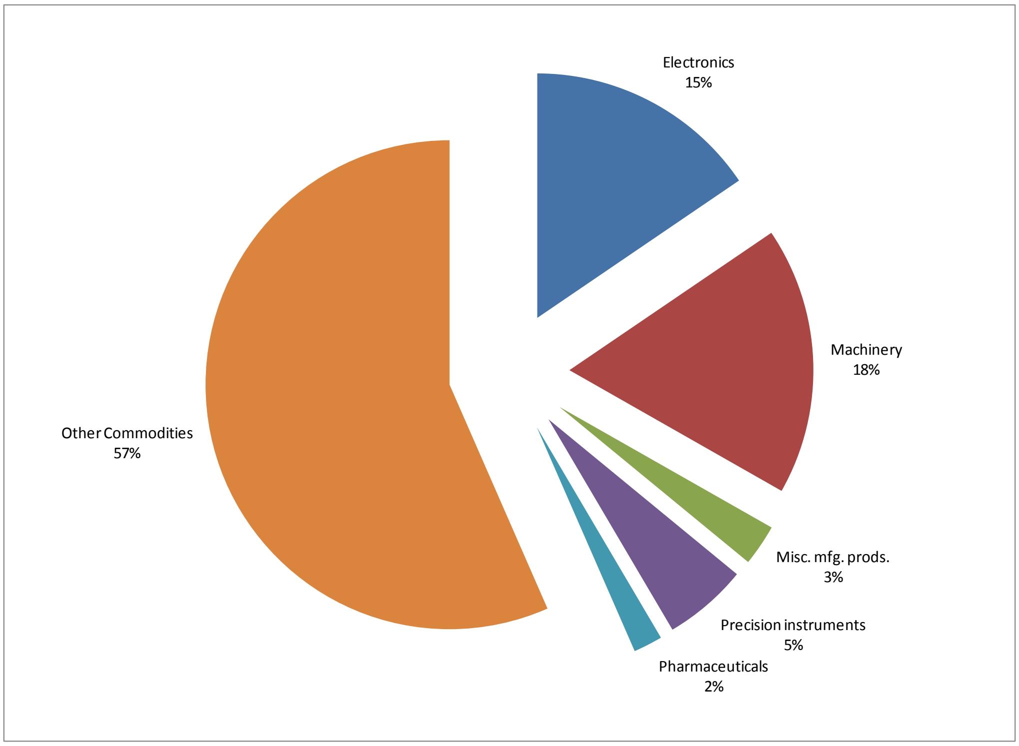


Figure 3. Worldwide Distribution of Time-Sensitive Commodities by Weight (*19*).

Figure 3 illustrates that the "other commodities" that often have time-definite delivery requirements represent 57 percent of the market, in terms of weight (*19*). However, manufacturing also utilizes air cargo.

It is the manufacturing sector that, perhaps above all others, needs air cargo. High-technology components and goods meet all the key criteria for cargo that absolutely has to move by air: high value, fragile and requiring fast, time-definite delivery. Experts say trends in high tech manufacturing and the continuing economic explosion in Asia portend rapid growth in technology air shipping (*20*).

Just-in-time delivery, in which parts are delivered to an assembly plant as they are needed, has become the standard operating procedure for many assembly plants around the world. Computers and technology in general move at such a rapid pace, and very little stock is kept on hand at the assembly plant. Air-cargo operators become parts of the “high-tech assembly line” getting goods to manufacturers who begin to fill orders for their products. Air cargo is ideal for these types of goods because they are of high value and take up less space and weight than some cargo. However, the down sides are that the materials must be protected from inclement weather, and security must be stringent due to government standards and the high value of the products. As generally understood and stated in reports by the FAA and the Boeing Company, demand for air-cargo services is largely a function of economic conditions and the gross domestic product (GDP). Table 4 shows the forecasted growth in gross domestic product and inflation. The long-term outlook for the economy and thus air-cargo services appears positive according to the most recent FAA forecast. The economic output is expected to decrease only for 2009 before resuming rising to levels above those in 2008 in 2010. Risks to the forecast include the rising price of fuel, which has already dampened some of the previously expected growth in air cargo.

Table 4. Historical and Forecasted Gross Domestic Product and Consumer Price Index, 2000–2025.

Fiscal Year	Gross Domestic Product (Billion Dollars, 2000)	Consumer Price Index (1982 to 1984=100)
Historical		
2000	9,762.8	170.75
2001	9,885.1	176.25
2002	10,002.4	178.88
2003	10,208.3	183.10
2004	10,593.4	187.32
2005	10,917.1	193.45
2006	11,227.3	200.60
2007	11,457.8	205.31
2008E	11,676.6	214.43
Forecast		
2009	11,517.9	213.59
2010	11,790.7	216.63
2011	12,238.9	220.27
2012	12,792.6	224.60
2013	13,350.4	229.31
2014	13,780.6	234.13
2015	14,139.6	239.05
2016	14,507.8	244.06
2017	14,885.5	249.19
2018	15,272.8	254.42
2019	15,670.4	259.77
2020	16,077.8	265.22
2021	16,495.9	270.79
2022	16,924.7	276.48
2023	17,364.8	282.28
2024	17,816.3	288.21
2025	18,279.5	294.26
Average annual growth 2008–2025	**2.7%**	**1.9%**

Source: FAA Aerospace Forecasts, 2009–2025; Note: E=Estimate.

While economic activity is the major force in air-cargo demand throughout the country and world, other factors and forces play a role. The Boeing Company has illustrated these forces and constraints, shown in Figure 4. Boeing further identifies specific favorable and unfavorable factors affecting the industry. These are shown in Figure 5 and will impact air-cargo activity in Texas as well.

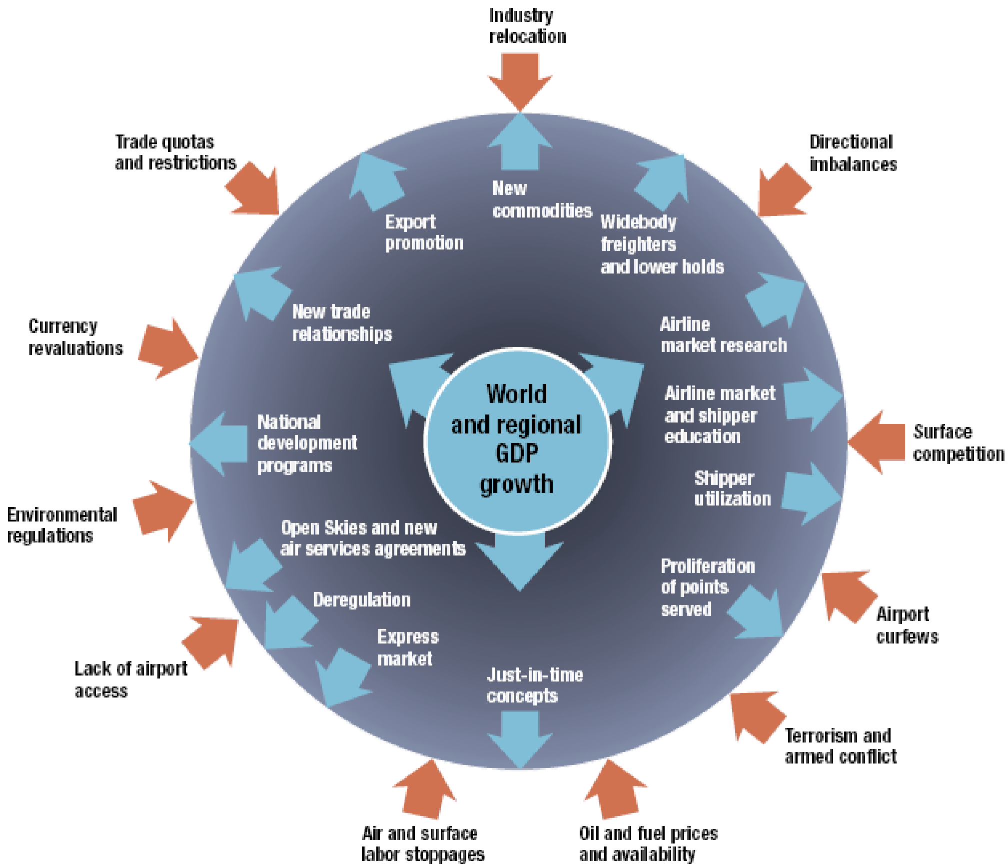
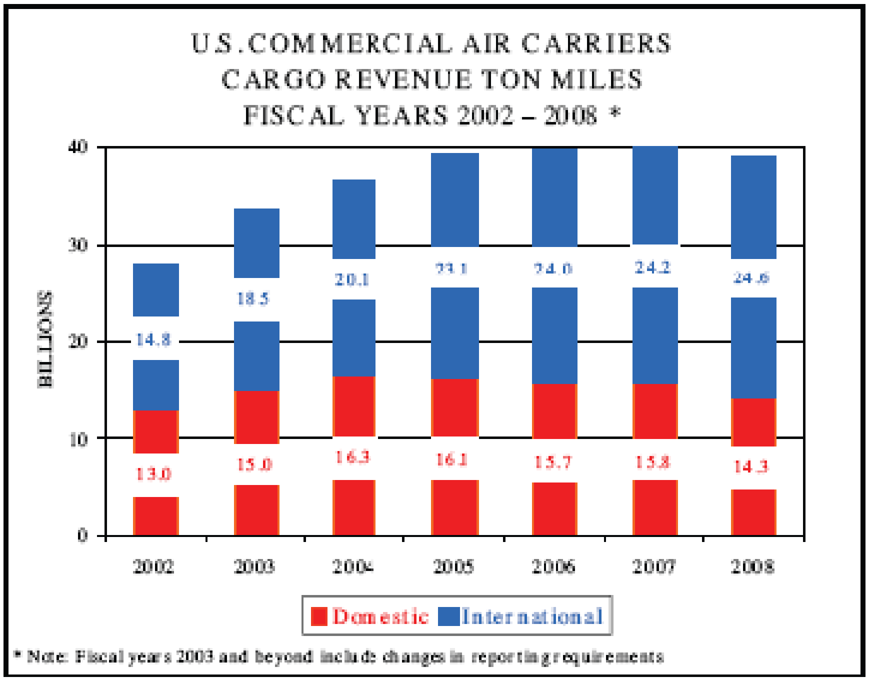


Figure 4. Forces and Constraints for Air-Cargo Growth (*21*).

Favorable	Unfavorable
Asia's market expansion	Trading blocs and protectionism
Currency strength	Terrorism and armed conflict
Middle East stability	Political volatility
National debt management plans	Rising jet fuel prices
Oil marketing agreements	High interest rates
Easing interest rates	Debt burdens

Figure 5. Favorable and Unfavorable Factors Affecting Air-Cargo Growth (*22*).

Figure 6 shows the domestic and international cargo revenue ton-miles for 2002 through 2008. International activity has been growing at a faster pace than domestic, as one would expect due to the emerging global economies. This is expected to continue because opportunities abound in overseas markets.



Source: FAA Aerospace Forecasts, 2009–2025.

Figure 6. Cargo Revenue Ton-Miles for U.S. Air Carriers, 2002–2008.

Synopsis of Air-Cargo Activity in the United States

In the United States, the top 25 airports have had some fluctuation in the total tonnage transported. Table 5 shows the 25 airports with the top volumes in 2009. Air cargo increasingly captured more of the value and tonnage of freight movement compared to other modes from 1993 to 2002. From 2002 to 2007, this growth has turned slightly negative, reflecting a more mature market following several years of growth as well as the economic downturn early in the decade. These shifts can be seen in the modal changes shown in Table 6.

Table 5. Top 25 Airports in North America in Cargo Traffic in 2009 and Percent Change from 2008.

City (Airport Code)	2009 Total Cargo (Metric Tons)	2008 Total Cargo (Metric Tons)	Percent Change from 2008
Memphis, Tenn. (MEM)	3,697,054	3,695,438	0.0
Anchorage, Alaska (ANC)*	1,994,629	2,339,831	−14.8
Louisville, Ky. (SDF)	1,949,528	1,974,276	−1.3
Miami, Fla. (MIA)	1,557,401	1,806,770	−13.8
Los Angeles, Calif. (LAX)	1,509,236	1,629,525	−7.4
New York, N.Y. (JFK)	1,144,894	1,450,605	−21.1
Chicago, Ill. (ORD)	1,047,917	1,332,123	−21.3
Indianapolis, Ind. (IND)	944,805	1,039,993	−9.2
Newark, N.J. (EWR)	779,642	887,053	−12.1
Dallas/Fort Worth, Texas (DFW)	578,906	658,544	−12.1
Atlanta, Ga. (ATL)	563,139	655,277	−14.1
Oakland, Calif. (OAK)	491,138	622,009	−21.0
Toronto, Ontario, Canada (YYZ)	439,130	483,975	−9.3
Philadelphia, Pa. (PHL)	433,439	506,680	−14.5
San Francisco, Calif. (SFO)	408,102	493,628	−17.3
Honolulu, Hawaii (HNL)	387,566	410,725	−5.6
Houston, Texas (IAH)	372,662	412,217	−9.6
Ontario, Calif. (ONT)	354,691	436,525	−18.7
Washington, D.C. (IAD)	292,769	333,845	−12.3
Seattle, Wash. (SEA)	269,689	290,653	−7.2
Boston, Mass. (BOS)	247,782	281,752	−12.1
Toledo, Ohio (TOL)	241,472	354,469	−31.9
Denver, Colo. (DEN)	224,375	250,994	−10.6
Phoenix, Ariz. (PHX)	223,664	250,491	−10.7
Vancouver, B.C., Canada (YVR)	198,422	208,987	−5.1
Top 50 airports	21,147,673	23 648 286	−10.6
Top 100 airports	23,136,109	25,825,099	−10.4
Total **	23,408,760	26,167,826	−10.5

* Includes transit freight.

** Does not include Anchorage.

Source: Airports Council International—North America, Traffic Reports 2009.

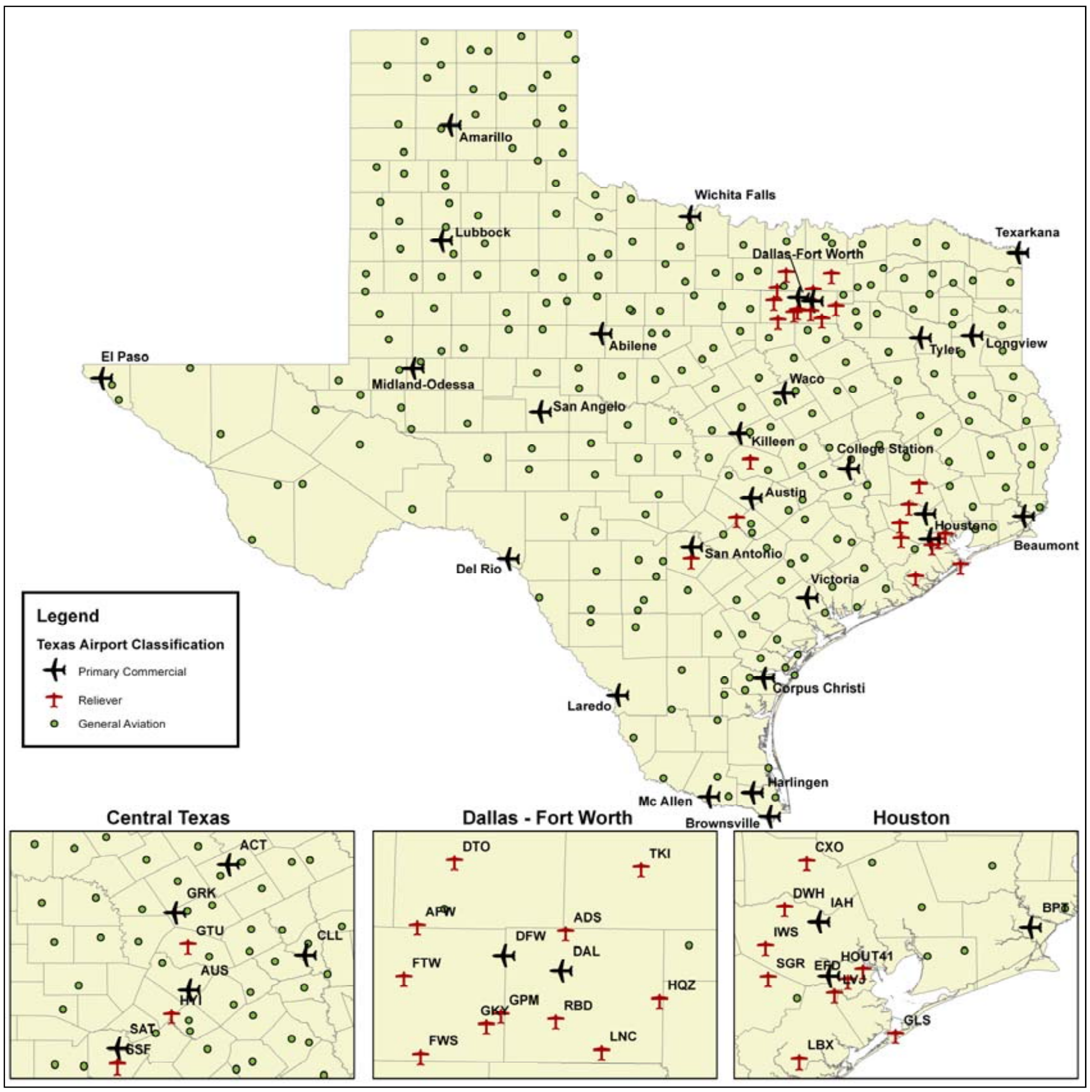
Table 6. Annualized Modal Change in Value, Tonnage, and Ton-Miles between 2002 and 2007 (*23*).

Transportation Mode	Annual Percentage Change between 1993 and 2002 & 2002 and 2007					
	Value (Real)		Tons		Ton-Miles	
	1993–2002	2002–2007	1993–2002	2002–2007	1993–2002	2002–2007
Air (includes truck and air)	9.7	−1.0	4.6	−0.8	6.3	−4.5
Truck	4.2	6.7	2.6	2.4	5.6	1.4
Rail	3.9	8.1	2.0	−0.1	3.0	1.3
Water	4.0	5.7	1.0	−8.1	−1.7	-8.9
Pipeline	−0.9	33.6	0.4	−1.0	2.7	N/A
Multimodal combinations	6.7	14.6	−0.8	33.0	3.7	16.9
Other/unknown	5.3	0.8	−0.8	−5.1	−1.7	−4.7

CHAPTER 3. EXISTING AND PROJECTED AIR-CARGO ACTIVITY IN TEXAS

INVENTORY OF TEXAS AIR-CARGO FACILITIES

The Texas airport system consists of 294 airports, which range in size from small community airports serving agricultural purposes to large urban airports serving millions of passengers and international destinations. These airports are diverse in size and function and are shown graphically in Figure 7.



Source: Texas Transportation Institute.

Figure 7. Texas Airports by Classification.

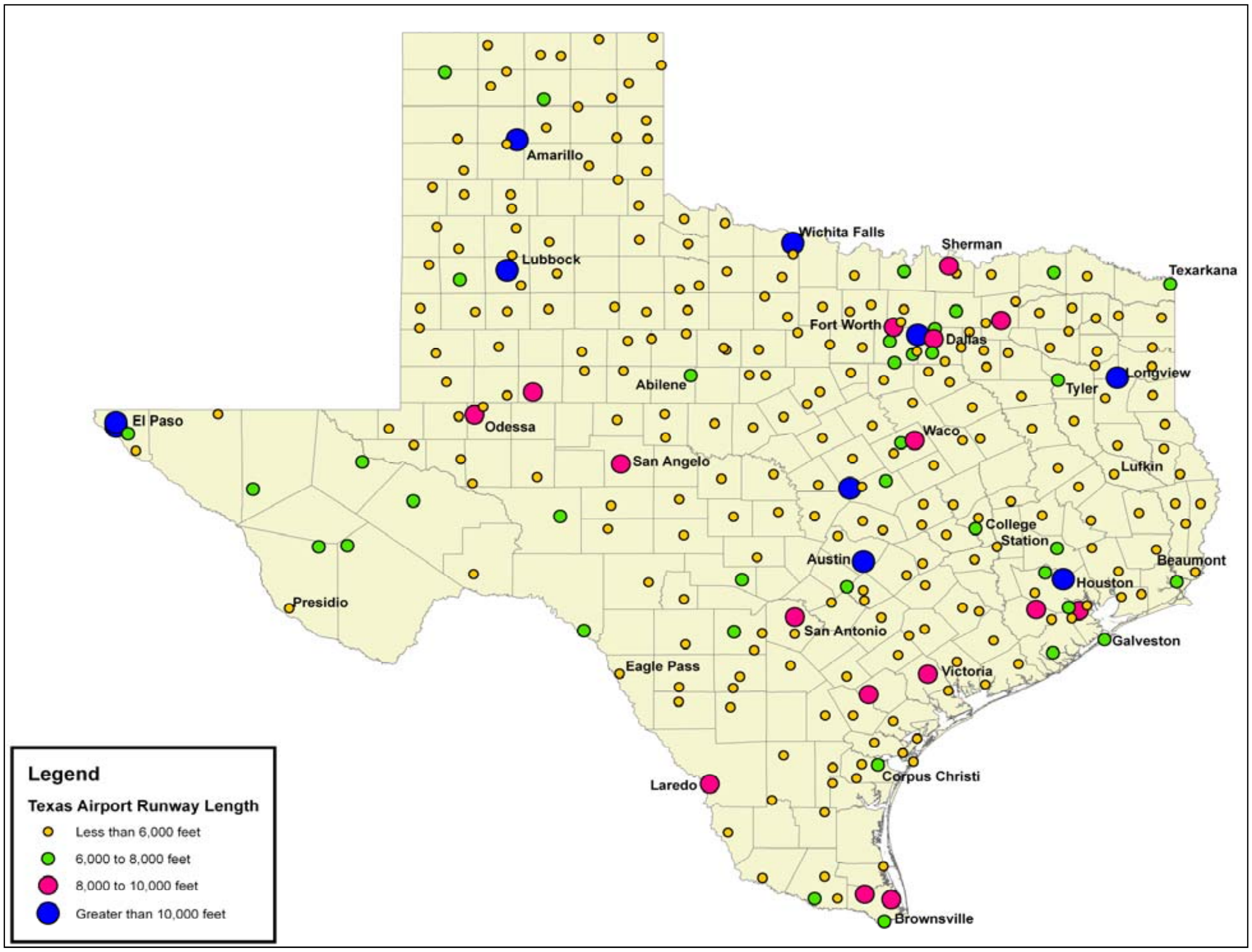
Not all of these airports, however, are suitable for air-cargo activities. This largely depends on the nature of air-cargo activities desired or ongoing at a particular airport. Some air-cargo activity requires very long runways with substantial ramp space, while others can utilize much shorter runways 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 the available runway is the most obvious sign of an airport's suitability for accommodating air-cargo demand, should it exist. In some cases, airports are able to extend an existing runway. In other cases, the airport does not control or is not able to control the land to make necessary airport improvements. Further, some airports may be sufficiently encroached by other development, precluding any improvements. While individual airports have their own unique set of circumstances, the Texas airport system as a whole has a number of facilities capable of handling air-cargo demand of a varying nature.

Assuming the existing runway length is indicative of the airport's ability to handle aircraft requiring such length in terms of overall design standards, Texas is well positioned across the state to capitalize on any demand in air cargo. Figure 8 shows Texas airports across the state and the runway facilities they offer.

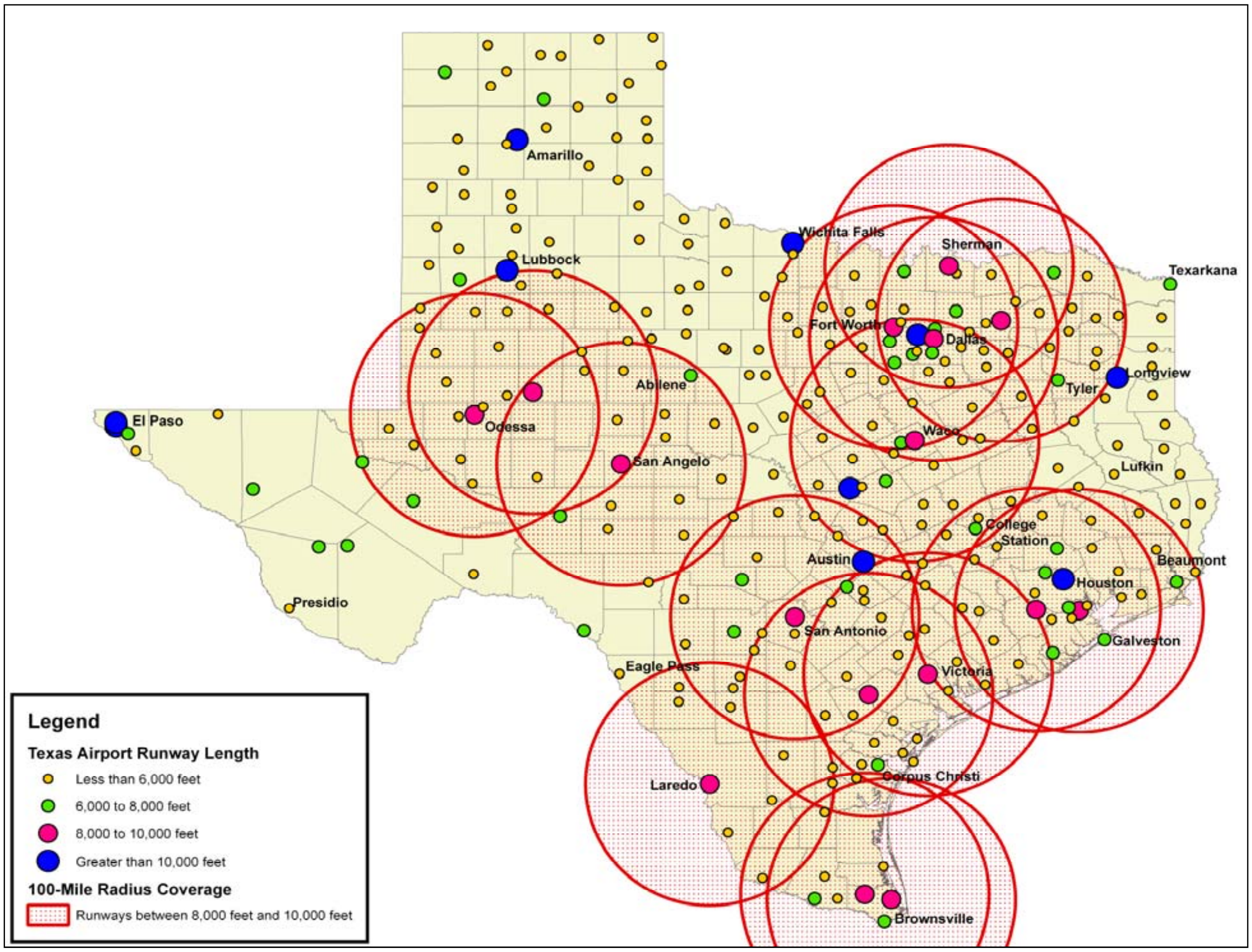
The state has nine geographically diverse facilities with runways of 10,000 ft or longer. Another 16 airports have runways of between 8000 and 10,000 ft. These facilities are also spread out across the state, covering the economic and population centers of the state. This is shown visually in Figure 9 and Figure 10. The vast majority of the state has great accessibility to these facilities. Every major population center is within a 100-mile radius of an airport offering at least 8000-ft runways. The combined coverage is shown in Figure 11. Table 7 lists Texas airports by runway length.

The sparsely populated border region north of Laredo and 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 8000 ft or more. This provides significant opportunities for locating businesses dependent or reliant on air cargo across the state. The Texas airport system, as it currently stands, meets the air-cargo needs of its residents and businesses.



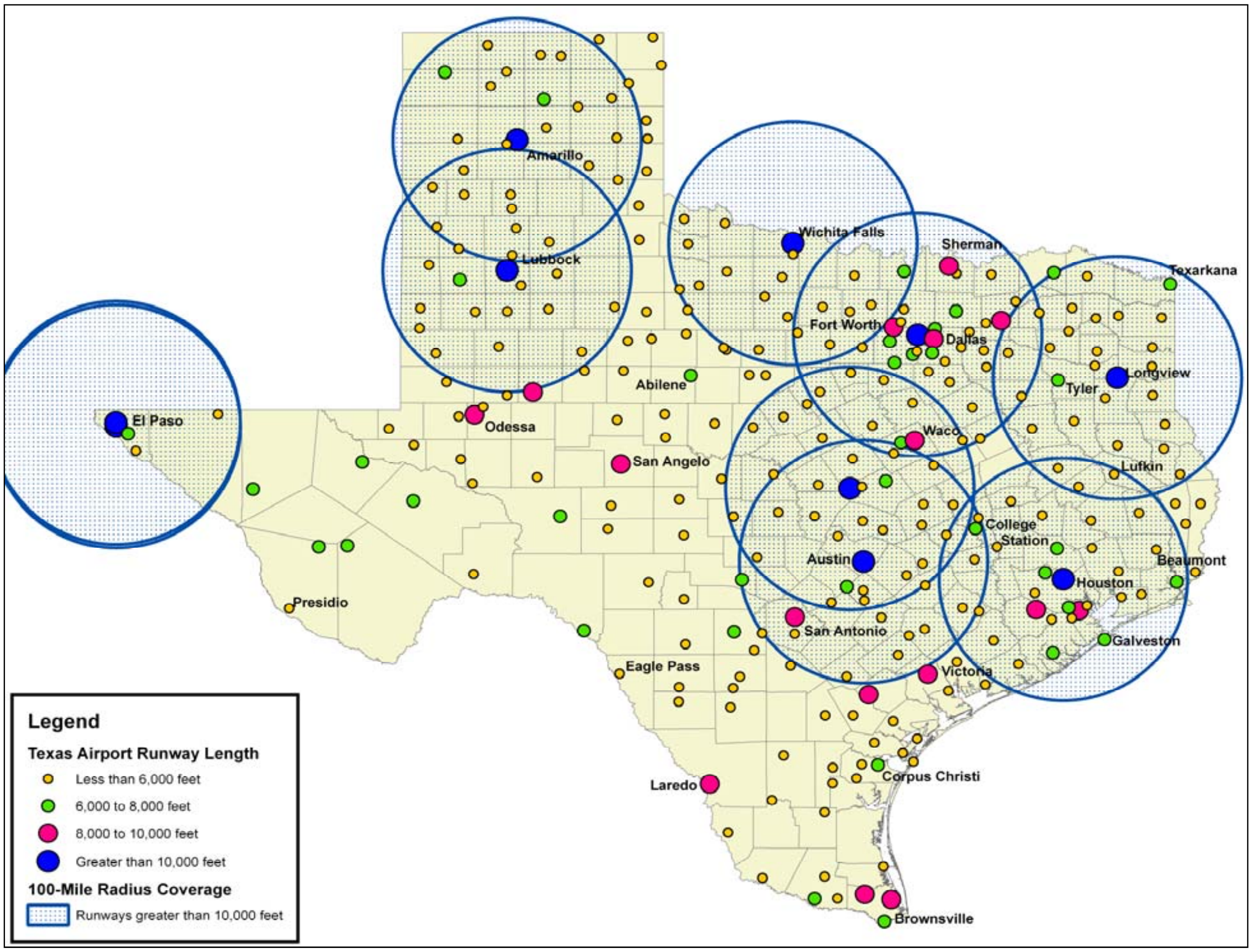
Source: Texas Transportation Institute.

Figure 8. Texas Airports Classified by Runway Length.



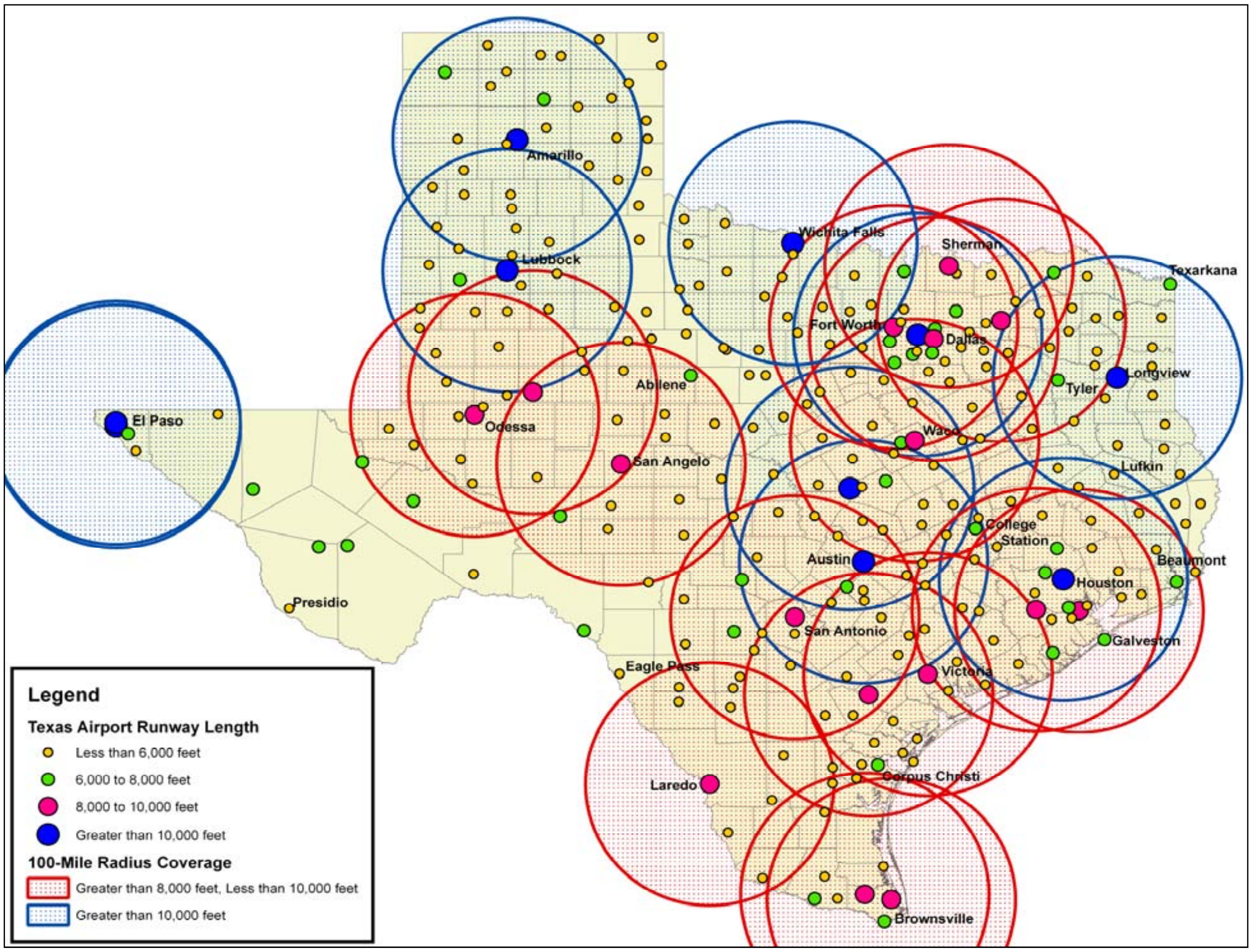
Source: Texas Transportation Institute.

Figure 9. 100-Mile Radius Coverage for Texas Airports with Runways between 8000 Ft and 10,000 Ft.



Source: Texas Transportation Institute.

Figure 10. 100-Mile Radius Coverage for Texas Airports with Runways Greater than 10,000 Ft.



Source: Texas Transportation Institute.

Figure 11. 100-Mile Radius Coverage for Texas Airports with Runways Greater than 8000 Ft.

Table 7. Texas Airport System Plan 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	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 and TxDOT Aviation Division Data.

AIR-CARGO ACTIVITY IN TEXAS

This section focuses on air-cargo activity in Texas and where it is taking place. It includes data for the commercial service airports in Texas and the top states and countries the cargo is going to and coming from. The source of the data is the T-100 Databank/Form 41 obtained from the Bureau of Transportation Statistics. This chapter provides a good snapshot of activity using 2007 data, the last year available. The top air-cargo carriers in the state are also included. The origins or destinations of air cargo at Texas airports can be classified as intrastate, domestic (not including Texas), or international.

Table 8 shows air-cargo activity in the state. Both commercial-service and general-aviation airports are included. The data are shown for inbound cargo, outbound cargo, total cargo, and the airport's market share in the state. Table 9 shows the change from 2006 to 2007 for the 39 airports with air-cargo activity. Of the 26 commercial service airports (Texarkana is not included in these data), 15 experienced increases over the period, while 11 realized decreases in activity.

In an effort to differentiate between freight and mail, Table 10 and Table 11 show freight and mail activity, respectively. In Table 10, freight tonnage (inbound and outbound) is shown for all airports in Texas. Dallas/Fort Worth International Airport and Houston Intercontinental Airport account for nearly 64 percent of the total air-freight activity in Texas. Table 11 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's total. The top five airports account for 88.57 percent of the state's total.

Table 8. Texas Airports All-Cargo Activity, 2007 (Market Data Tons).

Rank	ID	City/Airport	Inbound	Outbound	Total	Percent
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.

Table 9. Texas Airports All-Cargo Activity, 2006–2007 (Market Data Tons).

Rank	ID	City/Airport	2006	2007	Change	Percent Change
1	DFW	Dallas/Fort Worth International	889,602.2	850,749.5	−38,852.7	−4.57
2	IAH	Houston Intercontinental	450,729.3	479,807.3	29,078.0	6.06
3	AFW	Dallas/Fort Worth (Alliance)	237,930.0	223,497.9	−14,432.0	−6.46
4	SAT	San Antonio International	145,396.0	147,379.2	1,983.2	1.35
5	AUS	Austin-Bergstrom International	119,085.7	113,026.6	−6,059.1	−5.36
6	ELP	El Paso International	74,704.5	85,770.3	11,065.9	12.90
7	HRL	Harlingen/San Benito	32,135.5	36,082.4	3,946.9	10.94
8	DAL	Dallas Love	34,588.3	30,841.1	−3,747.2	−12.15
9	LBB	Lubbock International	25,090.5	28,105.2	3,014.7	10.73
10	LRD	Laredo International	23,670.5	27,070.3	3,399.8	12.56
11	HOU	Houston Hobby	20,451.7	16,283.3	−4,168.4	−25.60
12	MAF	Midland/Odessa	3,518.4	3,496.8	−21.6	−0.62
13	ABI	Abilene Regional	861.4	1,140.6	279.2	24.48
14	DRT	Del Rio International	288.3	1,076.3	788.1	73.22
15	MFE	Mission/McAllen/Edinburg	1,243.6	987.2	−256.5	−25.98
16	SJT	San Angelo Regional	757.2	755.1	−2.1	−0.27
17	AMA	Amarillo International	785.6	443.1	−342.5	−77.30
18	FTW	Dallas/Fort Worth (Meacham)	15.0	401.6	386.6	96.26
19	GRK	Killeen/Gray AAF	250.7	333.4	82.7	24.80
20	CRP	Corpus Christi International	387.1	310.4	−76.6	−24.68
21	BWD	Brownwood Regional	288.6	289.3	0.7	0.24
22	BRO	Brownsville/South Padre	55.2	272.7	217.6	79.77
23	DTO	Denton Municipal	39.9	175.9	136.0	77.32
24	BIF	El Paso (Fort Bliss)	129.0	151.3	22.2	14.70
25	ADS	Dallas/Fort Worth (Addison)	69.8	83.6	13.8	16.52
26	CLL	College Station/Bryan	3.1	50.8	47.7	93.97
27	FWH	Dallas/Fort Worth (Hicks)	0.0	42.6	42.6	100.00
28	JZT	Arlington Municipal	166.4	20.7	−145.6	−703.49
29	TX3	Port Isabel-Cameron County	26.2	17.2	−8.9	−51.86
30	SPS	Wichita Falls/Sheppard AFB	15.0	15.3	0.3	2.01
31	CNW	Waco (TSTC)	1,033.9	12.3	−1,021.6	−8291.86
32	TYR	Tyler Regional	1.7	11.2	9.6	84.92
33	COT	Cotulla-La Salle County	21.7	9.5	−12.2	−128.48
34	ACT	Waco (Regional)	49.6	4.5	−45.1	−1000.38
35	EFD	Houston (Ellington)	250.7	3.3	−247.4	−7567.94
36	BPT	Beaumont/Port Arthur	0.7	2.7	2.0	74.64
37	GGG	Longview/Kilgore/Gladewater	9.2	2.4	−6.8	−278.93
38	SWW	Sweetwater/Avenger Field	0.0	1.0	1.0	100.00
39	UVA	Uvalde/Garner Field	0.0	0.7	0.7	100.00
Total			**2,063,651.9**	**2,048,724.8**	**−14,927.1**	**−0.73**

Source: Bureau of Transportation Statistics.

Table 10. Total Freight, 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**	**100**

Source: Bureau of Transportation Statistics.

Table 11. 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**

Source: Bureau of Transportation Statistics.

To this point, the analysis has focused on airports in Texas and their levels of air-cargo tonnage but not on the airlines that fly the cargo. Table 12 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. 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 (FedEx and UPS), knowing which carriers are involved could help determine where future activity may exist.

Several passenger airlines are among the most active, 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 account for approximately 81 percent of the total air-cargo activity in the state.

Table 12. Top 20 Air-Cargo Carriers in Texas, Freight Carried, and Market Share, 2007.

Rank	Air Carrier	Freight (Tons)	Market Share (Percent)
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 SA	18,225.44	1
Other Texas activity		96,710.52	5
Total		**1,879,625.80**	**100**

Source: Bureau of Transportation Statistics.

Table 13 shows the top 20 air-cargo carriers ranked according to the mail that 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. United Parcel Service, at 10.77 percent, is the only other carrier with a market share above 10 percent.

Table 13. Top 20 Air-Cargo Carriers/Mail, 2007.

Air Carrier	Mail (Lb)	Mail (Tons)	Market Share (Percent)
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		**83,579.81**	**100**

Source: Bureau of Transportation Statistics.

TEXAS AIR-CARGO ACTIVITY

Collectively, the 11 largest air-cargo airports represented 99.51 percent of all the 2007 cargo activity in the state of Texas by tonnage. Shown in Table 14, only the top five airports exceed the federal designation of 100 million landed lb, which is the threshold for federal cargo entitlement money. The largest 11 airports by total cargo tons in 2007 represent 99.51 percent of all the cargo activity in the state of Texas by tonnage. Houston Hobby (number 11) represents 0.79 percent, while Midland-Odessa (next on the list at number 12) represents 0.17 percent, a significant drop-off.

Table 14. 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 reveals a more complete profile of the activity levels and role of air cargo in the state of Texas. For each of these 11 airports, the following information is provided:

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

Analysis in this chapter is based on air-cargo tonnage data obtained from the FAA and Bureau of Transportation Statistics (BTS) for each year between 1996 and 2007 and compiled into a large database. For each airport, this database was queried to gain additional insights into potential trends in air-cargo activities around Texas.

Dallas/Fort Worth International Airport—Dallas/Fort Worth

Dallas/Fort Worth International Airport (DFW) was Texas' most dominant airport in terms of total tons of cargo activity in 2007, accounting for 41.53 percent of all air-cargo movements in the state. Between 1996 and 2006, growth in air-cargo activity at DFW has been steady, averaging almost 12 percent over the 11-year period (see Table 15).

Table 15 also shows an increase in activity of 46 percent between 2000 and 2001, due in large part to the establishment of a UPS Airlines operations hub at DFW in 2001. Slightly more air-cargo tons travel inbound than outbound. In 2007, the airport experienced a drop-off in activity.

Table 15. DFW Air Cargo, 1996–2007 (Tons).

Year	Inbound	Outbound	Total
1996	188,226.06	196,132.49	384,358.55
1997	194,799.84	199,306.71	394,106.55
1998	186,645.35	191,051.17	377,696.52
1999	197,573.25	190,982.03	388,555.29
2000	216,402.83	199,691.29	416,094.11
2001	316,652.79	290,129.53	606,782.32
2002	325,006.28	286,628.37	611,634.65
2003	433,580.24	377,384.42	810,964.66
2004	485,381.67	406,400.25	891,781.93
2005	473,055.84	399,615.20	872,671.05
2006	481,322.45	408,279.78	889,602.23
2007	468,527.60	382,221.93	850,749.53

Table 16 shows the air-cargo activity by service class. Scheduled all-cargo flights accounted for about three-fourths of all air-cargo movements at DFW in 2007.

Table 16. DFW Air Cargo by Service Class, 2007 (Tons).

Service Class	Inbound	Outbound	Total	Percent Share
Scheduled passenger/cargo service	64,057	60,267	124,324	15.5
Scheduled all-cargo service	337,611	270,672	608,283	75.9
Non-scheduled civilian passenger/ cargo service	27	24	51	0.0
Non-scheduled civilian all-cargo service	42,351	26,724	69,076	8.6
Total all service classes	**444,046**	**357,687**	**801,734**	**100.0**

Table 17 indicates that 71 percent of the internationally based air cargo that moved through DFW in 2007 came from the Asian nations of Taiwan, South Korea, and China.

Table 17. DFW International Air Cargo, Top Five Countries, 2007 (Tons).

Rank	Country	Total	Percent Share
1	Taiwan	90,360	26
2	South Korea	53,399	15
3	Germany	35,413	10
4	China	35,069	10
5	Hong Kong-China	34,922	10
-	All other countries	99,096	29
Total international		**348,259**	**100**

George Bush Intercontinental Airport—Houston

Houston's George Bush Intercontinental Airport (IAH) moved 479,807.29 tons of air cargo in 2007, representing more than 23 percent of all 2007 air-cargo activity in Texas. Between 2002 and 2003, air-cargo activity at IAH increased dramatically from 262,799 tons to 417,737 tons, an increase of almost 59 percent. This increase was driven in part by the expansion of IAH-based activity for two major cargo carriers, FedEx Express and UPS Airlines. The airport's activity increased in 2007 by 6 percent over the previous year. These data are shown in Table 18.

Table 18. IAH Air Cargo, 1996–2007 (Tons).

Year	Inbound	Outbound	Total
1996	104,392.44	121,558.02	225,950.46
1997	114,165.58	120,196.95	234,362.53
1998	125,657.16	123,406.24	249,063.39
1999	130,413.49	127,109.80	257,523.29
2000	135,528.43	129,012.08	264,540.51
2001	125,799.08	124,091.89	249,890.97
2002	132,994.21	129,805.53	262,799.74
2003	213,970.93	203,766.26	417,737.19
2004	224,344.62	206,574.22	430,918.84
2005	219,957.59	212,681.29	432,638.88
2006	230,865.04	219,864.29	450,729.33
2007	231,731.54	248,075.75	479,807.29

IAH is a major hub for the passenger and freight operations of Continental Airlines, which has its corporate headquarters in Houston. As a result, flights classified as scheduled passenger and cargo service and scheduled all-cargo service dominated the air-cargo activity at IAH in 2007. This is shown in Table 19.

Table 19. IAH Air Cargo by Service Class, 2007 (Tons).

Service Class	Inbound	Outbound	Total	Percent Share
Scheduled passenger/cargo service	90,158	78,278	168,435	37.6
Scheduled all-cargo service	101,851	118,262	220,114	49.1
Non-scheduled civilian passenger/cargo service	86	610	696	0.2
Non-scheduled civilian all-cargo service	23,319	35,549	58,867	13.1
Total all service classes	**15,414**	**232,699**	**448,113**	**100.0**

A majority of the international air-cargo activity at IAH centered on Europe. The top international markets served from the airport are shown in Table 20.

Table 20. IAH International Air Cargo, Top Five Countries, 2007 (Tons).

Rank	Country	Total	Percent Share
1	United Kingdom	45,101	23
2	Netherlands	34,063	17
3	France	27,776	14
4	Luxembourg	13,474	7
5	South Korea	12,098	6
-	All other countries	63,144	32
Total international		**195,656**	**100**

Fort Worth Alliance Airport—Fort Worth

Fort Worth Alliance Airport (AFW) is located north of Fort Worth, adjacent to the Alliance Global Logistics Hub. In 1997, FedEx opened its Southwest Regional Sort Hub at Alliance Airport. Expansion of air-cargo activity at AFW expanded in 2002 and has grown over 90 percent annually since that time, as shown in Table 21. For the first time in several years, activity dropped in 2007 from the previous year.

Table 21. AFW Air Cargo, 1996–2007 (Tons).

Year	Inbound	Outbound	Total
1996	0.00	24.35	24.35
1997	17.49	0.00	17.49
1998	0.00	0.00	0.00
1999	27.67	44.91	72.58
2000	70.10	44.28	114.37
2001	0.00	1.78	1.78
2002	20,542.87	22,424.68	42,967.55
2003	67,176.27	75,182.12	142,358.39
2004	73,997.09	82,643.15	156,640.24
2005	100,797.26	108,396.82	209,194.08
2006	115,795.68	122,134.28	237,929.96
2007	107,993.32	115,504.63	223,497.95

As of 2007, no scheduled commercial air passenger service existed at AFW. As a result, all of the air-cargo movements at AFW operated as all-cargo service, as shown in Table 22.

Table 22. AFW Air Cargo by Service Class, 2007 (Tons).

Service Class	Inbound	Outbound	Total	Percent Share
Scheduled passenger/cargo service			-	0.0
Scheduled all-cargo service	107,540	115,387	222,927	99.7
Non-scheduled civilian passenger/cargo service			-	0.0
Non-scheduled civilian all-cargo service	453	118	571	0.3
Total all service classes	**107,993**	**115,505**	**223,498**	**100.0**

One impact of the role of AFW as the Southwest Regional Sort Hub for FedEx is the variety of domestic markets that were served by air-cargo flights to or from AFW. In 2007, there was a very small amount of international air cargo at AFW, as shown in Table 23. Table 23 also reveals that most of the activity was to Canada and European countries.

Table 23. AFW International Air Cargo, Top Five Countries, 2007 (Tons).

Rank	Country	Total	Percent Share
1	Sweden	91	56
2	Canada	22	13
3	Malaysia	21	13
4	Norway	18	11
5	United Kingdom	7	5
All other countries		2	1
Total international		**162**	**100**

San Antonio International Airport—San Antonio

In 2007, San Antonio International Airport (SAT) moved a total of 147,379.15 tons of air cargo, as shown in Table 24. Between 1996 and 2000, the total tons of air cargo moved at SAT was around 35,000 tons annually. Starting in 2001, air-cargo activity at SAT has grown steadily to its 2007 levels. In 2007, 90.3 percent of all air-cargo movements were made on scheduled all-cargo services, as shown in Table 25.

Table 24. SAT Air Cargo, 1996–2007 (Tons).

Year	Inbound	Outbound	Total
1996	21,992.84	15,542.41	37,535.25
1997	20,380.94	16,468.97	36,849.91
1998	20,384.41	15,825.49	36,209.90
1999	19,152.76	14,414.77	33,567.54
2000	20,035.81	16,312.80	36,348.61
2001	41,021.09	32,644.12	73,665.21
2002	49,258.78	38,008.95	87,267.72
2003	77,058.18	52,222.85	129,281.03
2004	76,852.46	52,981.75	129,834.21
2005	79,203.53	51,893.19	131,096.72
2006	87,210.09	58,185.90	145,395.99
2007	87,773.71	59,605.44	147,379.15

Table 25. SAT Air Cargo by Service Class, 2007 (Tons).

Service Class	Inbound	Outbound	Total	Percent Share
Scheduled passenger/cargo service	2,797	1,936	4,733	3.3
Scheduled all-cargo service	76,839	51,955	128,794	90.3
Non-scheduled civilian passenger/cargo service			-	0.0
Non-scheduled civilian all-cargo service	4,618	4,501	9,119	6.4
Total all service classes	**84,255**	**58,391**	**142,646**	**100.0**

In 2007, international air-cargo activity at SAT served two countries, with Mexico accounting for 99 percent of these international air-cargo tons, as shown in Table 26.

Table 26. SAT International Air Cargo, Top Five Countries, 2007 (Tons).

Rank	Country	Total	Percent Share
1	Mexico	7,750	99
2	Canada	98	1
Total international		**7,848**	**100**

Austin-Bergstrom International Airport—Austin

Austin-Bergstrom International Airport (AUS) is the primary commercial airport serving the state capital, moving a total of 113,026.56 tons of air cargo through the facility in 2007. While AUS mimicked the substantial growth in air-cargo activity throughout the state between

2000 and 2003, the total tons of air cargo in 2007 represented the fourth year of decline since the peak in 2003. The data are shown in Table 27.

Table 27. AUS Air Cargo, 1996–2007 (Tons).

Year	Inbound	Outbound	Total
1996	10,639.82	8,433.32	19,073.14
1997	12,364.05	9,344.79	21,708.84
1998	12,826.87	10,151.10	22,977.97
1999	15,371.04	11,780.34	27,151.38
2000	20,083.75	16,995.48	37,079.22
2001	22,182.00	18,704.86	40,886.86
2002	33,203.43	28,528.04	61,731.46
2003	69,068.61	65,266.81	134,335.42
2004	69,072.27	64,714.11	133,786.39
2005	63,365.22	59,601.71	122,966.93
2006	60,648.87	58,436.80	119,085.68
2007	57,199.80	55,826.76	113,026.56

Scheduled all-cargo service accounted for 89 percent of air-cargo movements at AUS in 2007, with most of the remaining air cargo moving on scheduled passenger and cargo-combined service. This is shown in Table 28.

Table 28. AUS Air Cargo by Service Class, 2007 (Tons).

Service Class	Inbound	Outbound	Total	Percent Share
Scheduled passenger/cargo service	4,042	6,818	10,860	9.8
Scheduled all-cargo service	51,696	47,055	98,751	89.1
Non-scheduled civilian passenger/cargo service	8	6	14	0.0
Non-scheduled civilian all-cargo service	40	1,139	1,179	1.1
Total all service classes	**55,785**	**55,018**	**110,803**	**100.0**

Only one international market, Mexico, was served by AUS in 2007, with a total of 10,317 tons of air cargo between AUS and locations in Mexico.

El Paso International Airport—El Paso

El Paso International Airport (ELP) has experienced an 11-year growth in air-cargo activity, reaching 85,770.32 tons in 2007. The historical trend is shown in Table 29.

Table 29. ELP Air Cargo, 1996–2007 (Tons).

Year	Inbound	Outbound	Total
1996	10,350.43	6,870.17	17,220.60
1997	10,530.11	7,168.21	17,698.32
1998	9,750.90	6,763.56	16,514.46
1999	11,271.74	7,379.38	18,651.13
2000	11,429.45	7,558.26	18,987.71
2001	13,707.20	8,201.25	21,908.45
2002	21,632.76	16,517.27	38,150.03
2003	45,767.18	41,609.84	87,377.02
2004	44,589.24	41,878.94	86,468.17
2005	40,688.19	39,421.73	80,109.93
2006	37,053.41	37,651.05	74,704.45
2007	41,538.93	44,231.39	85,770.32

In 2007, more than 95 percent of the air-cargo tonnage at ELP was carried on all-cargo operations, as shown in Table 30.

Table 30. ELP Air Cargo by Service Class, 2007 (Tons).

Service Class	Inbound	Outbound	Total	Percent Share
Scheduled passenger/cargo service	2,006	1,665	3,671	4.3
Scheduled all-cargo service	28,922	33,375	62,297	73.3
Non-scheduled civilian passenger/cargo service	85	91	175	0.2
Non-scheduled civilian all-cargo service	9,785	9,049	18,833	22.2
Total all service classes	**40,798**	**44,180**	**84,977**	**100.0**

Ninety-six percent of the international air-cargo activity at ELP is to and from Mexico. Canada and Australia are the other two international cities interchanging air cargo at ELP. These are shown in Table 31.

Table 31. ELP International Air Cargo, Top Five Countries, 2007 (Tons).

Rank	Country	Total	Percent Share
1	Mexico	2,466	96
2	Canada	96	4
3	Australia	1	0
Total international		**2,564**	**100**

Rio Grande Valley International Airport—Harlingen

Rio Grande Valley International Airport (HRL) in Harlingen moved 36,082.39 tons in 2007, as seen in Table 32. Growth in air-cargo tons at HRL has been steady, with major growth experienced beginning in 2001. Between 2005 and 2006 the air-cargo levels declined slightly but rebounded in 2007.

Table 32. HRL Air Cargo, 1996–2007 (Tons).

Year	Inbound	Outbound	Total
1996	945.57	819.86	1,765.43
1997	761.32	614.72	1,376.04
1998	832.00	756.08	1,588.08
1999	775.99	832.00	1,607.99
2000	877.99	829.38	1,707.37
2001	3,632.00	3,261.17	6,893.17
2002	6,023.77	4,843.94	10,867.70
2003	11,433.93	8,195.02	19,628.95
2004	18,136.11	14,415.49	32,551.59
2005	18,389.49	14,553.54	32,943.03
2006	16,778.63	15,356.89	32,135.52
2007	18,710.92	17,371.47	36,082.39

Scheduled all-cargo service made up 80.8 percent of the air-cargo service, followed by non-scheduled civilian all-cargo service with 15.6 percent and scheduled passenger/cargo service with 4.8 percent. This is shown in Table 33.

Table 33. HRL Air Cargo by Service Class, 2007 (Tons).

Service Class	Inbound	Outbound	Total	Percent Share
Scheduled passenger/cargo service	673	579	1,252	3.5
Scheduled all-cargo service	15,202	13,938	29,139	80.8
Non-scheduled civilian passenger/cargo service	25	30	54	0.1
Non-scheduled civilian all-cargo service	2,812	2,825	5,637	15.6
Total all service classes	**18,711**	**17,371**	**36,082**	**100.0**

Canada represents the only international country transporting air cargo to HRL. That activity accounted for less than 1 ton (1,810 lb) in 2007.

Dallas Love Field—Dallas

Dallas Love Field (DAL) is the regional airport in Dallas, located a few miles northeast of the Dallas central business district. Between 1996 and 2002, air-cargo activity levels at DAL averaged below 15,000 tons annually. After more than doubling in 2003, the air-cargo activity at DAL has remained constant at about 35,000 tons per year before realizing a decline in 2007. The historical data are shown in Table 34.

Table 34. DAL Air Cargo, 1996–2007 (Tons).

Year	Inbound	Outbound	Total
1996	4,622.13	8,321.15	12,943.27
1997	4,872.46	8,360.40	13,232.87
1998	5,424.90	8,148.49	13,573.39
1999	5,215.19	7,058.06	12,273.26
2000	4,909.54	6,739.91	11,649.45
2001	4,168.63	5,342.16	9,510.80
2002	7,326.89	8,341.22	15,668.11
2003	19,306.17	20,072.14	39,378.31
2004	19,206.12	18,561.20	37,767.32
2005	17,328.73	17,099.76	34,428.49
2006	17,330.28	17,258.03	34,588.31
2007	15,940.32	14,900.82	30,841.15

The cargo activity at DAL is made up of both scheduled passenger/cargo service and all-cargo service, which accounts for the majority, as shown in Table 35.

Table 35. DAL Air Cargo by Service Class, 2007 (Tons).

Service Class	Inbound	Outbound	Total	Percent Share
Scheduled passenger/cargo service	6,951	5,460	12,411	40.2
Scheduled all-cargo service	8,402	8,765	17,166	55.7
Non-scheduled civilian passenger/cargo service			-	0.0
Non-scheduled civilian all-cargo service	587	676	1,263	4.1
Total all service classes	**15,939**	**14,901**	**30,840**	**100.0**

Mexico was the only international market served by air cargo at DAL in 2007. That activity accounted for less than 1 ton (1,446 lb).

Lubbock International Airport—Lubbock

Lubbock International Airport (LBB) moved 28,105.21 tons of air cargo in 2007 (see Table 36). LBB experienced very little air-cargo activity between 1996 and 2001. Between 2001 and 2002, the air-cargo tons grew from 1,414.66 tons to 7,677.87 tons, or just over 440 percent. Between 2002 and 2003, LBB experienced a 236 percent growth from 7,677.87 tons to 25,863.75 tons. Overall between 1996 and 2007, air-cargo levels at LBB grew significantly from 936 tons to more than 28,000 tons. The historical data are shown in Table 36.

Table 36. LBB Air Cargo, 1996–2007 (Tons).

Year	Inbound	Outbound	Total
1996	708.22	228.18	936.39
1997	836.09	310.82	1,146.91
1998	932.55	331.55	1,264.10
1999	882.30	321.91	1,204.21
2000	1,069.34	257.45	1,326.79
2001	974.61	440.05	1,414.66
2002	4,477.41	3,200.45	7,677.87
2003	15,560.44	10,303.31	25,863.75
2004	15,505.64	10,967.49	26,473.13
2005	15,525.01	10,109.77	25,634.77
2006	16,095.14	8,995.40	25,090.54
2007	19,499.44	8,605.77	28,105.21

Scheduled all-cargo service made up almost all of the air-cargo service in 2007. As seen in Table 37, there was no international air-cargo activity at the airport in 2007.

Table 37. LBB Air Cargo by Service Class, 2007 (Tons).

Service Class	Inbound	Outbound	Total	Percent Share
Scheduled passenger/cargo service	380	109	489	1.7
Scheduled all-cargo service	19,120	8,497	27,616	98.3
Non-scheduled civilian passenger/cargo service	0	0	0	0.0
Non-scheduled civilian all-cargo service	0	0	0	0.0
Total all service classes	**19,499**	**8,606**	**28,105**	**100.0**

Laredo International Airport—Laredo

Laredo International Airport (LRD) moved 27,070.31 tons of air cargo in 2007, compared to only 2,816.46 tons in 1996. As seen in Table 38, the annual tons between 1996 and 2007 has not produced a steady growth annually but has experienced erratic annual levels before reaching levels greater than 20,000 tons per year, starting in 1993.

Table 38. LRD Air Cargo, 1996–2007 (Tons).

Year	Inbound	Outbound	Total
1996	1,186.11	1,630.35	2,816.46
1997	1,940.98	3,025.93	4,966.91
1998	3,901.70	5,316.08	9,217.79
1999	3,606.97	2,345.08	5,952.05
2000	6,883.51	2,930.08	9,813.58
2001	1,051.04	344.96	1,395.99
2002	4,186.20	3,064.50	7,250.70
2003	12,671.69	10,855.15	23,526.84
2004	14,578.79	11,292.26	25,871.05
2005	11,681.25	8,404.99	20,086.25
2006	14,880.24	8,790.22	23,670.46
2007	17,804.87	9,265.44	27,070.31

The majority of the air-cargo service in 2007 resulted from scheduled all-cargo service (56.7 percent), with non-scheduled civilian all-cargo service accounting for the remainder (43.2 percent), as seen in Table 39.

Table 39. LRD Air Cargo by Service Class, 2007 (Tons).

Service Class	Inbound	Outbound	Total	Percent Share
Scheduled passenger/cargo service	6	1	6	0.0
Scheduled all-cargo service	12,324	4,456	16,780	62.0
Non-scheduled civilian passenger/cargo service	2		2	0.0
Non-scheduled civilian all-cargo service	5,474	4,808	10,282	38.0
Total all service classes	**17,805**	**9,265**	**27,070**	**100.0**

There were only four international locations served by LRD in 2007, with Mexico accounting for 84 percent of the total international tons, followed by Canada at 14 percent. This is shown in Table 40.

Table 40. LRD International Air Cargo, Top Five Countries, 2007 (Tons).

Rank	Country	Total	Percent Share
1	Mexico	998	84
2	Canada	171	14
3	Honduras	12	1
4	Nicaragua	2	0
Total international		**1,183**	**100**

William P. Hobby Airport—Houston

William P. Hobby Airport (HOU) in Houston moved 16,283.30 tons of air cargo in 2007, ranking it as the 11th most active air-cargo airport in Texas for 2007. As indicated previously, the 2007 total only represents 0.79 percent of the total air-cargo tons moved through Texas airports. After achieving a high of over 25,000 tons in 1998, the annual air-cargo ton levels declined to 15,000 tons in 2001. Between 2001 and 2006, the air-cargo levels grew annually before decreasing in 2007. The historical data are shown in Table 41.

Table 41. HOU Air Cargo, 1996–2007 (Tons).

Year	Inbound	Outbound	Total
1996	8,051.89	6,906.12	14,958.00
1997	10,235.49	9,202.40	19,437.88
1998	12,219.49	12,867.58	25,087.08
1999	9,934.70	11,139.75	21,074.45
2000	9,579.07	10,443.48	20,022.55
2001	7,260.91	7,911.15	15,172.06
2002	8,045.14	8,405.66	16,450.80
2003	8,152.23	8,704.45	16,856.68
2004	8,692.08	9,632.42	18,324.50
2005	10,022.00	10,276.61	20,298.60
2006	8,969.10	11,482.59	20,451.68
2007	6,987.19	9,296.11	16,283.30

Scheduled passenger/cargo service accounted for almost all of the air-cargo tons in 2007, as shown in Table 42. No tons were moved by scheduled all-cargo service.

Table 42. HOU Air Cargo by Service Class, 2007 (Tons).

Service Class	Inbound	Outbound	Total	Percent Share
Scheduled passenger/cargo service	6,671	8,895	15,566	95.6
Scheduled all-cargo service	0	0	0	0.0
Non-scheduled civilian passenger/cargo service	21	7	28	0.2
Non-scheduled civilian all-cargo service	290	392	682	4.2
Total all service classes	**6,981**	**9,295**	**16,276**	**100.0**

Houston Hobby served one international air-cargo market in 2007, with 676.79 tons moved between Houston and South Korea.

FUTURE ACTIVITY LEVELS/AIR-CARGO FORECASTS AND TRENDS

As noted earlier, air-cargo activity is closely related to economic activity and is highly correlated to gross domestic product. Consequently, any forecast of air-cargo activity would resemble that of economic growth and output. With the current national and global economies working to recover from recessions, the economic conditions present many challenges for air transportation in general and air cargo specifically. Recent changes in and influences on the industry will impact future activity. The new air-cargo security screening requirement for 100 percent screening by 2010, growth in international trade, increases in fuel costs and surcharges, and the use of all-cargo carriers to carry mail are some examples already noted. Although the current operating environment has been challenging, air cargo is expected to grow. While 2009 is expected to show a contraction in activity, the FAA expects both domestic and international air cargo to grow at an average annual rate of 2.4 percent and 6.1 percent, respectively, through 2025. The FAA Aerospace Forecast 2009–2025 notes that the all-cargo share of activity has increased from 65.4 percent in 1997 to 85.0 percent in 2008. This is due to the growth in the express carriers (FedEx and UPS). This share is expected to continue growing to 88.4 percent in 2025.

The two largest passenger- and cargo-jet manufacturers, Boeing and Airbus, also publish market forecasts for air-cargo demand. The current Airbus Global Market Forecast is somewhat dated and runs from 2007 to 2026. The forecast predates the current global economic recession, but its analysis is still of value. Airbus expects global demand for air cargo to average 5.8 percent per year between 2007 and 2026. Much of this growth is expected to be driven by growth in China as the country sees a real emergence of its express-package service. Therefore, growth rates in and out of Asia will probably exceed those averages. More mature markets, like those involving Europe and North America, perhaps will see growth rates less than the average. Nevertheless, air cargo is expected to grow worldwide in the coming decades. The Boeing World Air Cargo Forecast cites both the surge in fuel prices and the financial crisis for slowing air-cargo demand. It notes the price of jet fuel has increased 600 percent between 1994 and the first quarter of 2008 (*24*). According to the FAA's most recent Aerospace Forecast, fuel prices increased 12 percent annually from 2000 to 2009 and 6.3 percent during the 2009–2010 fiscal year. They are expected to increase 3.8 percent annually from 2010 to 2020 (*25*).

It does, however, predict that air-cargo demand across the globe will triple from existing levels in the next 20 years. Boeing forecasts are driven by world economic growth as measured by gross domestic product. The company does not expect a sustained recovery of the economy before 2010. This follows annual growth rates in 2005, 2006, and 2007 of 1.7, 3.2, and 5.1 percent, respectively, in world air-cargo traffic.

The rise in fuel prices has led air-cargo operators to upgrade their fleets to more fuel-efficient aircraft. This has been especially true for wide-body aircraft. This is reflected in both the FAA and Boeing forecasts where wide-body aircraft are expected to exceed 1000 in 2025, increasing from 250 in 1994 and 575 in 2007. This trend plays a role in the increase of forecasted growth rates when compared to historical averages. Table 43 illustrates this comparison by market. Boeing's forecast for world demand is also expected to average 5.8 percent per year through 2027, which is a rate identical to the Airbus forecast mentioned earlier. All of the markets involving North America are expected to see demand outpace that of the previous 10 years.

Table 43. Historical and Forecast Air Cargo Growth Rates (Average per Year).

Market	Historic 10 Years (1997–2007) (Percent)	Forecast 20 Years (2008–2027) (Percent)
World	4.1	5.8
Intra-North America	0.5	2.7
Latin America-North America	1.5	5.6
Latin America-Europe	3.5	5.7
Europe-North America	3.1	5.1
Intra-Europe	2.1	3.6
Middle East-Europe	6.5	4.8
Africa-Europe	4.0	6.2
Asia-North America	4.8	6.7
Europe-Asia	9.7	6.5
Intra-Asia	7.0	8.1
Southwest Asia-Europe	5.4	6.0
Domestic China	15.6	9.9

Source: Boeing World Air Cargo Forecast 2008–2027.

The forecast developed by Boeing agrees with those of Airbus and the FAA in that the air-cargo fleet will trend toward larger aircraft. Boeing also believes the fleet itself will double from 1948 airplanes to 3892 airplanes in 2027. Table 44 shows the percent of current and expected freighter fleet by aircraft size. Not only will overall system capacity increase, but per-plane capacity will increase as the number of larger aircraft increases. The fleet capacity is also shown for 2007 and 2027.

Table 44. World Aircraft Fleet by Aircraft Size and Capacity.

Aircraft Size	**2007**		**2027**	
	Aircraft (Percent)	**Capacity (Percent)**	**Aircraft (Percent)**	**Capacity (Percent)**
Standard body (<45 tons)	39	7	35	6
Medium wide-body (40–80 tons)	35	18	30	20
Large (>80 tons)	26	75	35	74

Source: Boeing World Air Cargo Forecast 2008–2027.

A trend of particular interest to this study is what Boeing states is an increase in truck use due to air-cargo activity. This is due to both a shift to standard-body aircraft on domestic routes and the reduction of freight carried by scheduled airlines. The use of standard-body aircraft is a result of demand for wide-body aircraft for use in international markets. As a result, some combination carriers are relying more on trucks to offset this loss in capacity. These "truck flights"[1] allow carriers to offer improved service while finding cost savings associated with ground transportation compared to air transportation. Boeing reports that the number of truck-flight routes increased by 9 percent from 2005 to 2007, while their frequency increased 34 percent over the same time.

While Texas-specific data are not included in any of the three primary air-cargo forecast documents, it is reasonable to expect air-cargo activity in Texas to continue to grow at a similar rate given its facilities, diverse economy, and geographic position.

[1] According to the Boeing World Air Cargo Forecast, a truck flight, also known as road feeder service, transports cargo by surface, usually using a dedicated truck, on an airway bill. Carriage between the origin and destination can be exclusively by surface or may feed into airport-to-airport or surface transportation.

CHAPTER 4. EVALUATION OF LANDSIDE ACCESS AT AIRPORTS WITH AIR-CARGO ACTIVITY

This chapter evaluates the existing access to airports currently handling air cargo. This chapter also defines the operational area (area of influence) where access solutions may be employed. This analysis examined access to the facilities previously identified as handling air-cargo as well as the operational characteristics that define them. It also documented any challenges, concerns, or problems identified in the review process. A preliminary characterization of landside access at each airport with cargo activity was made. Additionally, an airport-access classification system was outlined to group the existing airports according to some definable criteria, e.g., design characteristics, in order to facilitate further exploration of representative airports within each group using in-depth case studies.

The research team identified the access points and operational characteristics of each of the specified airports (i.e., define the area of influence) using available mapping resources in conjunction with interviews of airport personnel who are familiar with the facility. The FHWA National Highway System Intermodal Connector Study (*26*) described the connectors for freight movements into Texas airports, thus providing an initial direct land connection to air-cargo operations.

Activities performed by the research team included the following:

- Define the area of influence for each of the airports selected.
- Utilize existing mapping resources to identify landside access to air-cargo operations at these airports.
- Document problems, challenges, or concerns identified in the review process.
- Group airports by defined criteria to facilitate in-depth study of access issues.
- Meet with the TxDOT Project Monitoring Committee to review the access characteristics at each Texas airport with air-cargo activities and jointly determine the ones to use for in-depth case studies.

The primary outputs of this task include:

- Maps and accompanying narrative describing the landside access to the air-cargo operations area and the defined influence area for all of the selected airports.
- Documentation of any problems, challenges, or concerns noted in the preliminary review.

- A list of airports grouped by operational characteristics and/or other criteria in order to better understand their operation.
- A list of airports selected for in-depth case studies and the rationale behind the selection of each one.

The airports reviewed in this task are listed below. Airports 1 through 11 represent nearly all of the air-cargo activity in the state. Kelly Field/Port San Antonio (number 12) is included due to its intermodal resources and facilities and its quest to become a major air-cargo facility in the state. The airports are discussed in the following order:

- Dallas/Fort Worth International Airport.
- Houston George Bush Intercontinental Airport.
- Fort Worth Alliance Airport.
- San Antonio International Airport.
- Austin-Bergstrom International Airport.
- El Paso International Airport.
- Valley International Airport (Harlingen).
- Dallas Love Field.
- Lubbock International Airport.
- Laredo International Airport.
- Houston Hobby Airport.
- Kelly Field/Port San Antonio.

Dallas/Fort Worth International Airport

Location

Dallas/Fort Worth International Airport is located about 25 miles northwest of Dallas and about 27 miles northeast of Fort Worth. It is in the center of a loop comprised of SH 114, SH 161, SH 360, and SH 121, with SP 97/International Parkway running north-south through the center of the airport. These state highways mainly feed off the IH 635 loop, which runs east-west to the north of downtown Dallas. This is a nested and complex roadway network with service targeted toward the airport.

Cargo Landside Access

The two primary cargo areas are located on the northeast and northwest sides of the airport. The northeast cargo area is the smaller of the two and is accessed from SH 114 (a freeway facility) at the Freeport Parkway interchange and then following Airfield Drive. Airfield Drive is a two-lane road that provides direct access to the facilities.

The northwest cargo area is significantly larger than the northeast cargo area. It can be accessed from SH 114 and SH 121 at the SP 97 interchange. SP 97 becomes International Parkway as it runs north-south through DFW Airport. Freight traffic then proceeds west on Airfield Drive. There are two other interchanges along SH 114, west of SP 97, which provide access to Airfield Drive as well.

Facilities

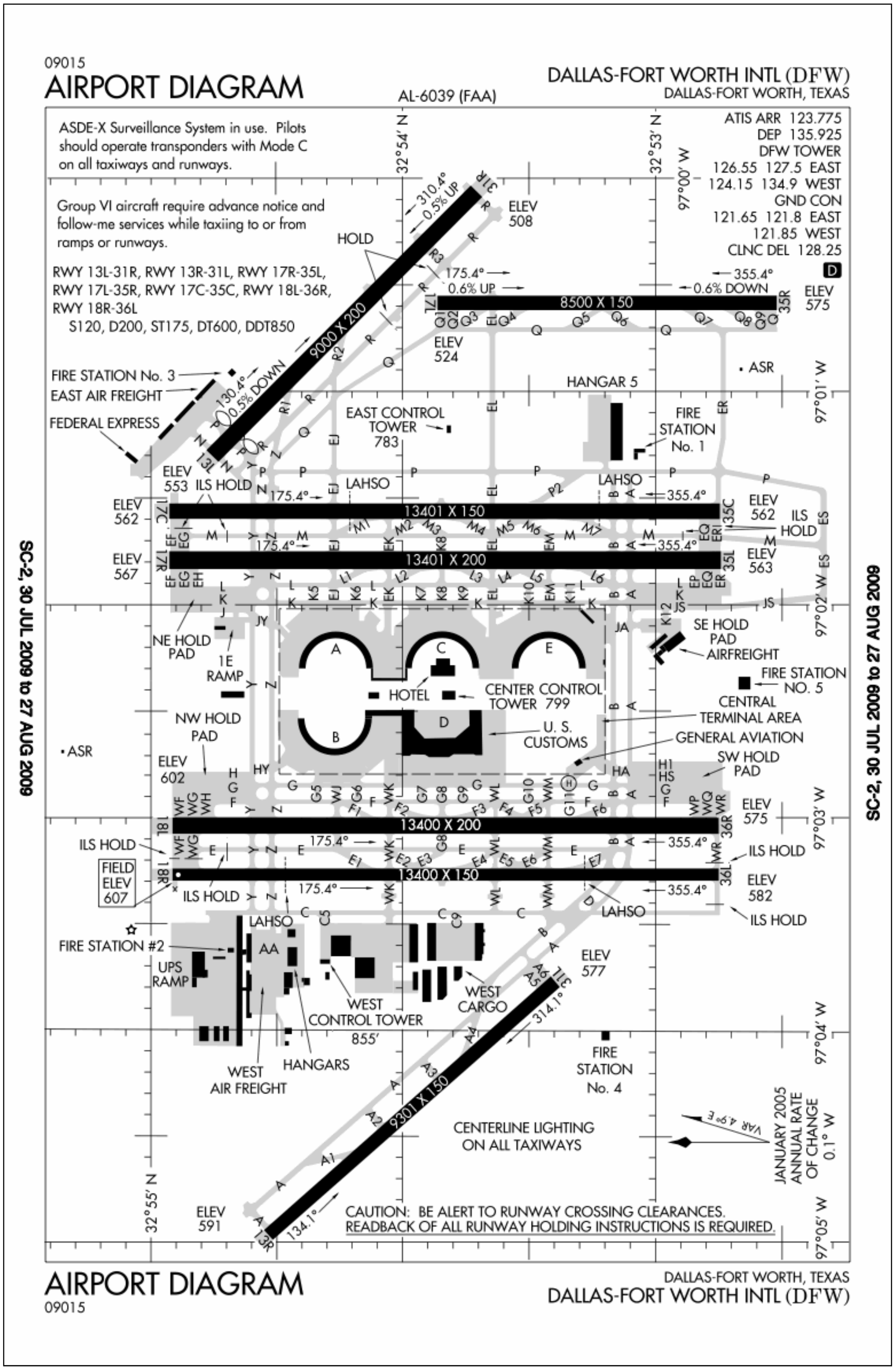
DFW has at least 15 warehouse facilities, including refrigerated space. There are 35 cargo carriers serving the airport. Customs and U.S. Department of Agriculture (USDA) facilities are located on the airport grounds. The airport is located within a free-trade zone.

Tenants

There are numerous cargo-only tenants at DFW, and specific information regarding the number of tenants on airport property will be obtained during Task 4.

Figures

The following figures show Dallas/Fort Worth International Airport, the two primary cargo areas, and portions of the complex road network serving them. Figure 12 is a diagram of the airport, and Figure 13 and Figure 14 are satellite images.



Source: FAA Airport/Facility Directory.

Figure 12. Dallas/Fort Worth International Airport Diagram.

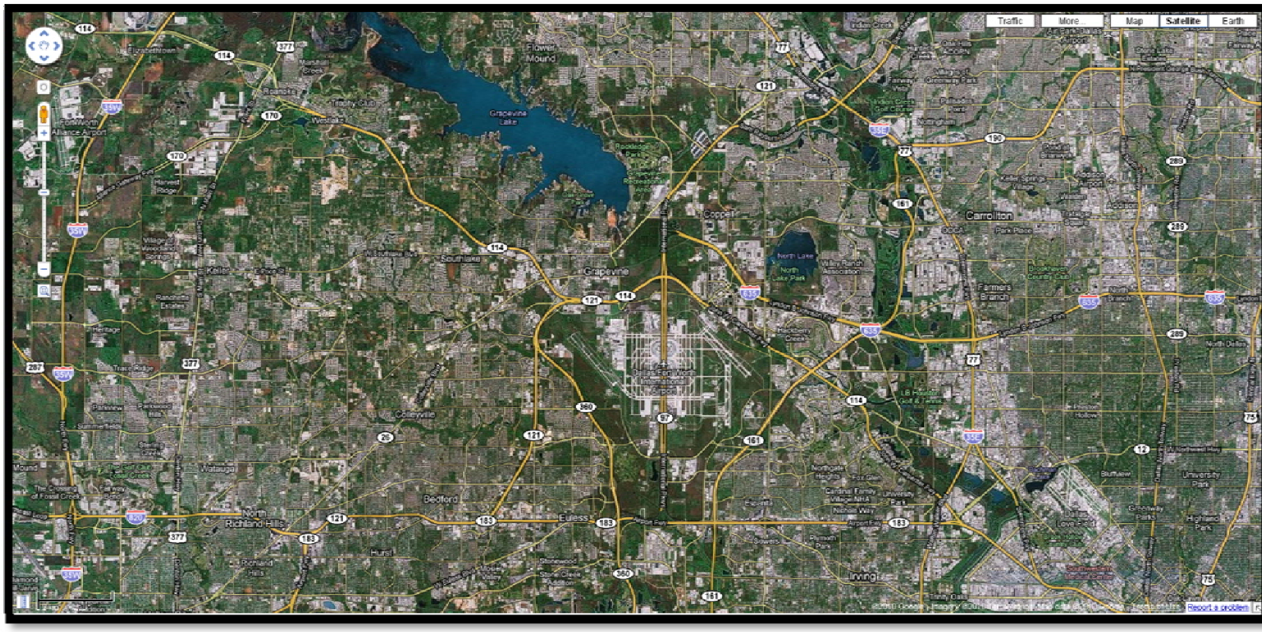


Figure 13. Dallas/Fort Worth International Airport Satellite Image.

Figure 14. Dallas/Fort Worth International Airport Satellite Image Close-Up.

Houston George Bush Intercontinental Airport

Location

Houston Intercontinental Airport is located 15 miles north of Houston's central business district. Access to the airport is provided by two National Highway System (NHS) routes, John F. Kennedy Boulevard from the south and Will Clayton Parkway from the east. John F. Kennedy Boulevard connects directly to Beltway 8 and indirectly to IH 45 and Hardy Toll Road. Will Clayton Parkway connects with US 59.

Cargo Landside Access

Cargo landside ingress/egress is shared with passenger ingress/egress in that the facilities are located off the two access roads that are used by passengers. Both of these access roads, John F. Kennedy Boulevard and Will Clayton Parkway, are divided arterials with signalized intersections. John F. Kennedy Boulevard is a six-lane roadway, and Will Clayton Parkway is a four- to six-lane roadway. Direct access to the cargo facilities is provided by Lee Road, a north-south undivided connector. Lee Road is located on airport grounds and connects John F. Kennedy Boulevard and Will Clayton Parkway with signalized intersections. Lee Road is a narrow two-lane roadway with drop-off shoulders.

Facilities

The airport has 2.5 million sq ft of cargo apron and 800,000 sq ft of warehouse space in total. There are three cargo areas at the airport, with most of the activity occurring in two. The first is in the northeast part of the airport located off Cargo Facility Roadway and Lee Road. The second area is an airfield support/cargo area and is located just west of the first location off Will Clayton Boulevard. It has smaller volumes of cargo operations than the Lee Road facility but includes a Continental Airlines mail-sort facility. The third area is the air-cargo distribution center located off John F. Kennedy Boulevard in the center of the airport complex and has access to the frontage roads. Both Cargo Facility Road and Lee Road are accessible from Will Clayton Parkway. USDA inspection and Customs operation are located on site. The nearest foreign trade zone is 5 miles away.

Tenants

According to airport officials, there are 41 air-cargo-related tenants located on site. This includes 31 all-cargo or combination carriers, three third-party developers, and seven ground-handling companies. The Air Cargo World *2009 Airports Directory* (*27*) indicates there are 400 freight forwarders that operate in the airport and hundreds more in the Houston region.

Figures

The following four satellite images show the airport and surrounding road network (Figure 15), the cargo apron located at the northeast part of the airport off Will Clayton Parkway and Lee Road (Figure 16), the cargo and airfield support area located off Will Clayton Parkway (Figure 17), and the air-cargo distribution center located in the center of the airport complex off John F. Kennedy Boulevard (Figure 18).

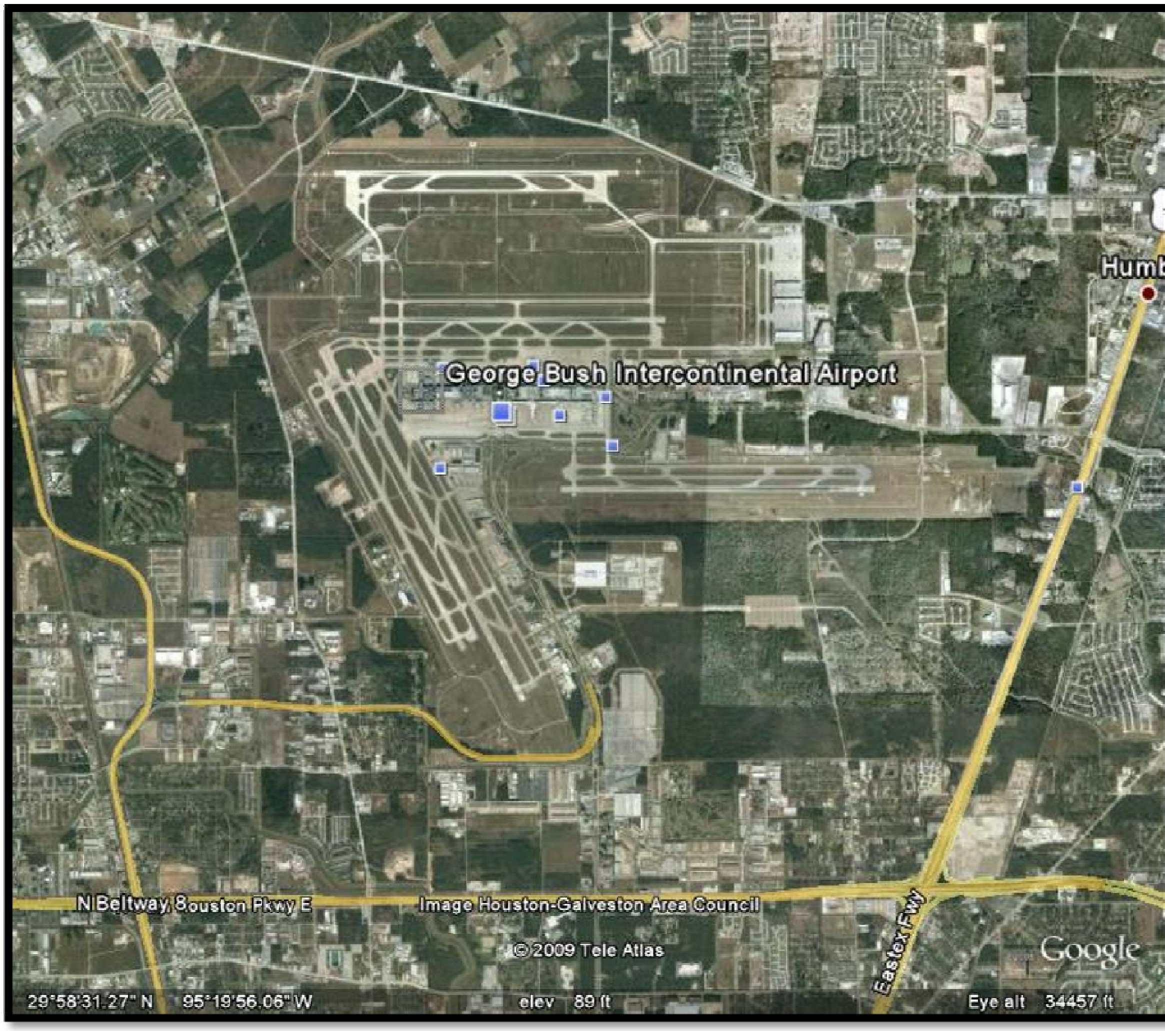


Figure 15. Houston Intercontinental Airport.

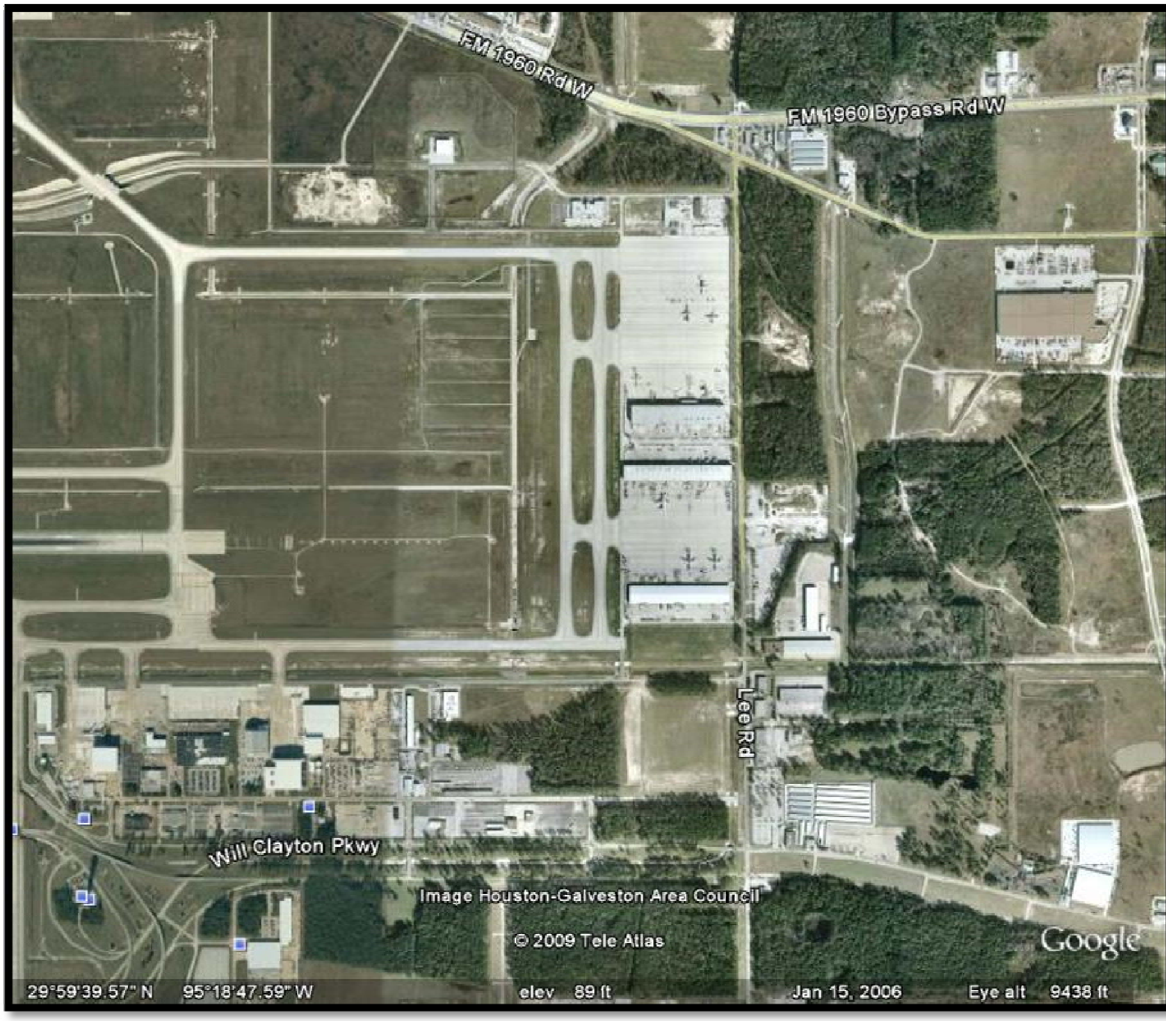


Figure 16. Houston Intercontinental Airport Northeast Air-Cargo Area.

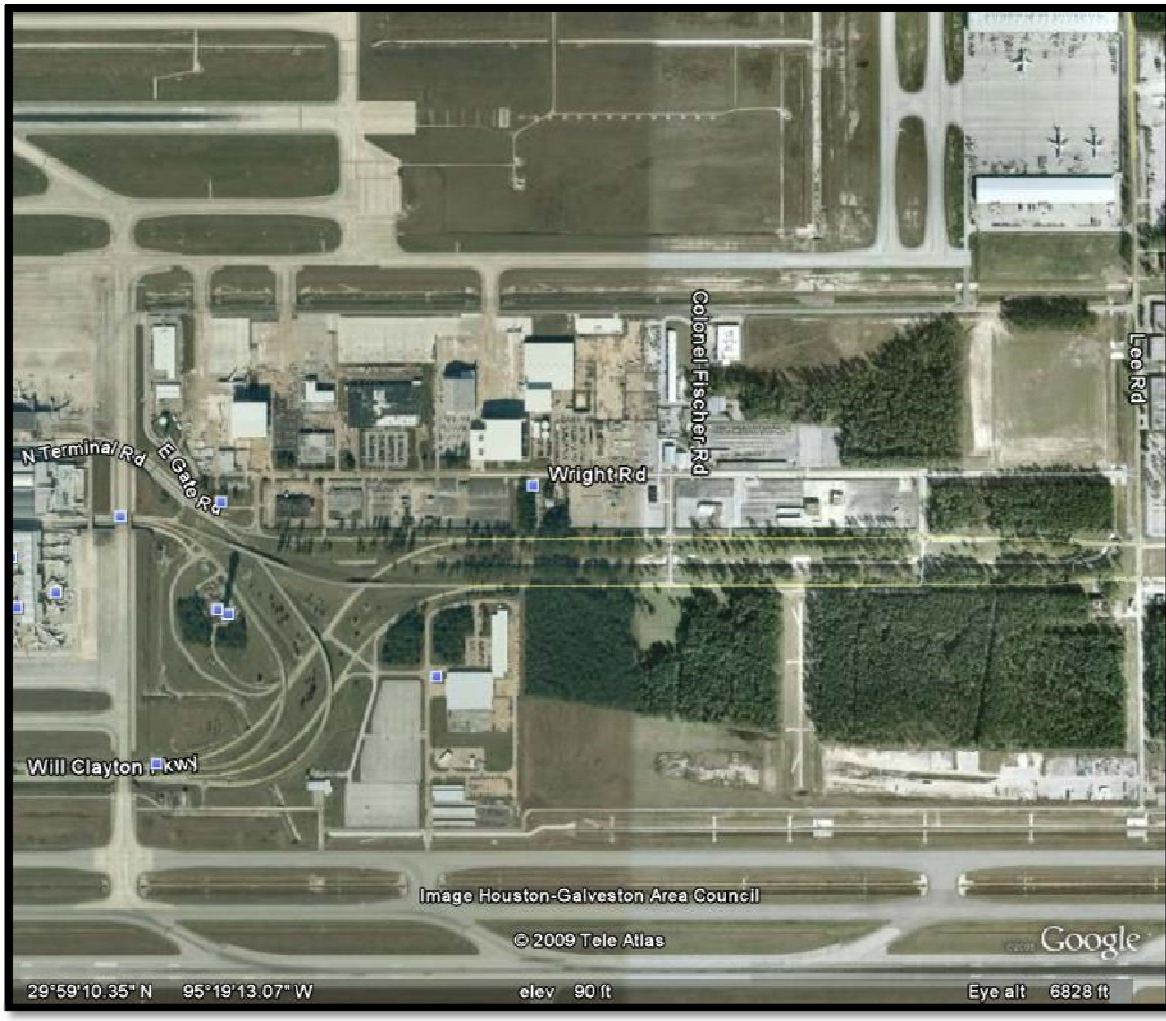


Figure 17. Houston Intercontinental Airport Cargo/Airfield Support Area.

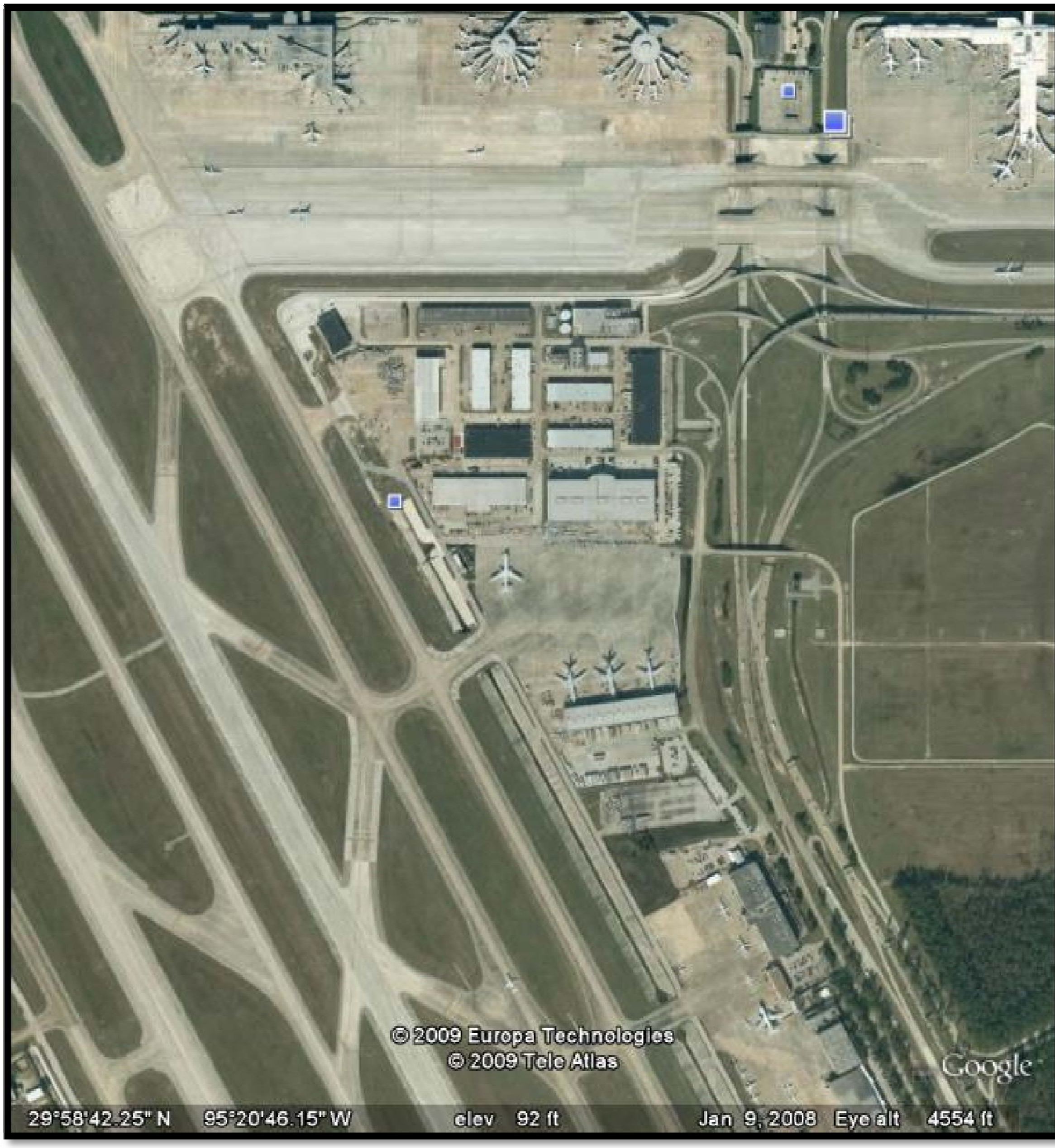


Figure 18. Houston Intercontinental Airport Central Air-Cargo Distribution Center.

Fort Worth Alliance Airport

Location

Alliance Airport is located about 20 miles north of downtown Fort Worth on IH 35W, adjacent to the Interstate on its west side. It is connected to IH 35W by three interchanges. Alliance offers excellent intermodal air-land cargo transportation.

Cargo Landside Access

Alliance Airport is part of a very large private development that includes large-scale warehouse facilities and a rail intermodal facility. Freight traffic accesses the warehouse facilities from the Eagle Parkway interchange on the north side of the airport and the FM 4042/Westport Parkway interchange on the south side.

Facilities

The airport has 3.5 million sq ft of cargo-handling ramp/tarmac surface space. During Task 4, the research team will identify the amount of warehouse space with direct airside access, in addition to the amount of warehouse space in the immediate area. There are Customs facilities on the airport grounds, and the airport lies within a free-trade zone.

Tenants

Detailed information about the airside and other tenants was not readily available due to the private nature of the development.

Figures

Following are three images of the Fort Worth Alliance Airport. Figure 19 is a diagram, Figure 20 is a satellite image, and Figure 21 is a photograph.

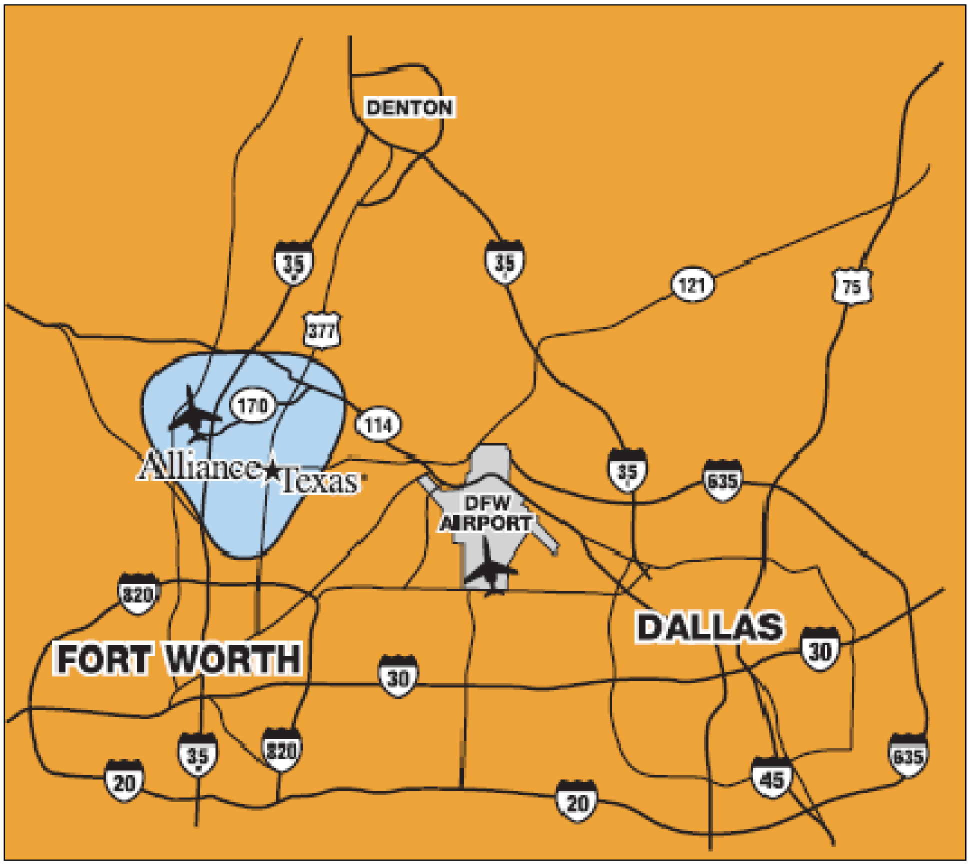


Figure 19. Fort Worth Alliance Airport Location.

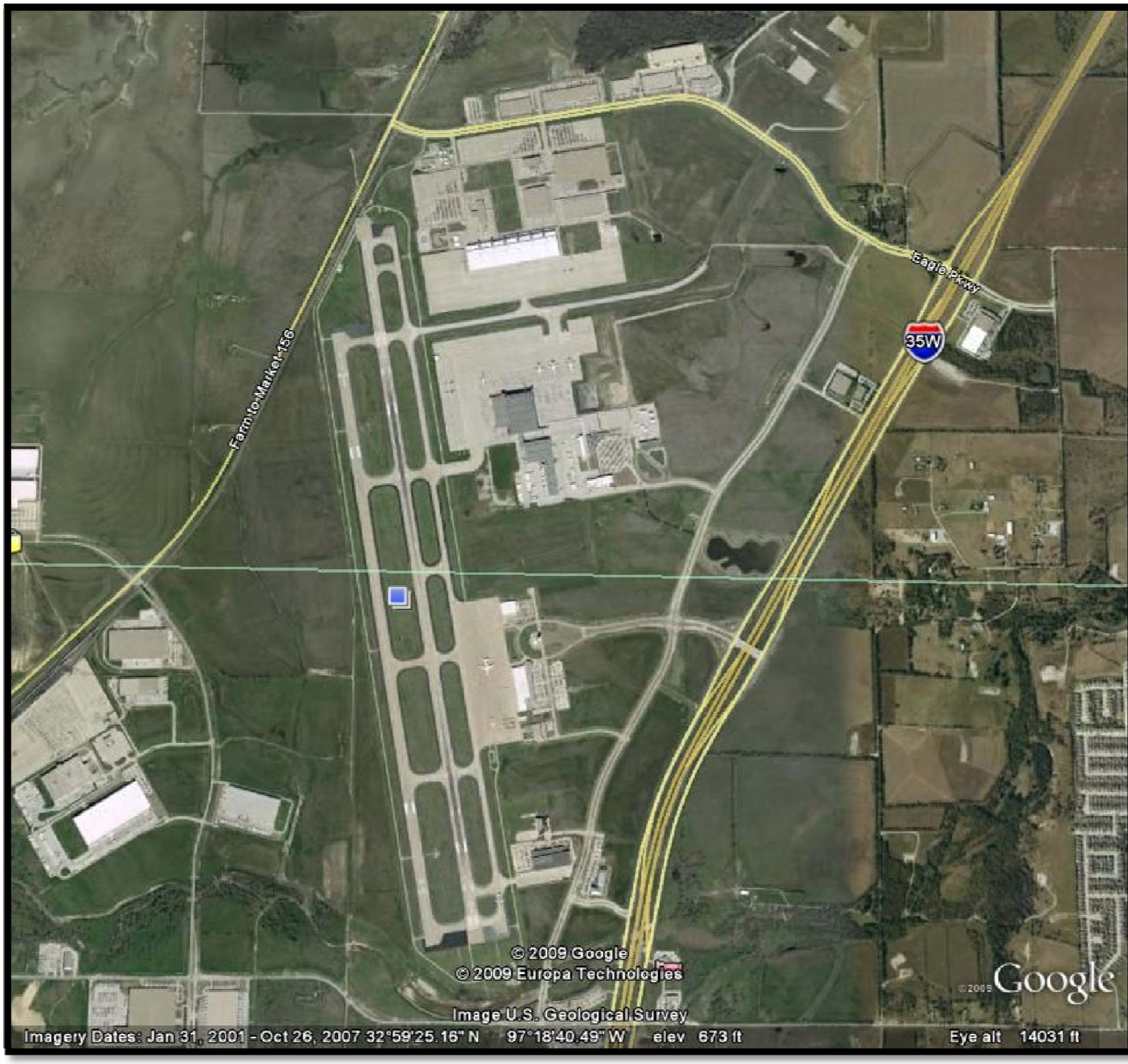


Figure 20. Fort Worth Alliance Airport Satellite Image.

Figure 21. Fort Worth Alliance Airport.

San Antonio International Airport

Location

San Antonio International Airport is located north of downtown San Antonio. Specifically, it is located at the north corner of the junction between the NE IH 410 loop and US 81. The airport is directly off either roadway, which provides ease of access, especially to trucks.

Cargo Landside Access

There are two main air cargo areas:

- West air cargo area, accessed from US 281 via Sandau Road.
- East air cargo area, accessed from the NE IH 410 loop via Wetmore Road.

Ingress/egress to both cargo areas is separate from the respective passenger one, and both have their own dedicated taxiways leading directly to the runway.

Access to Air Cargo East is direct from Wetmore Road, and truck movement within it appears to be uninhibited. It is more remotely located than Air Cargo West, and there appears to be land available for future expansion. Truck access to the west air cargo area is not direct from Sandau Road, and the area is densely populated with airport buildings and parking lots. Truck access as well as movement may be problematic due to space limitations, i.e., geometrics, for turn radii or backups, for example. These characteristics may be obstacles to future expansion.

Facilities

There are two foreign-trade-zone facilities. Air Cargo West houses over 65,000 sq ft of warehouse space. Air Cargo East houses 104,000 sq ft of warehouse space with over 1.1 million sq ft of leasable apron. The airport features 24-hour operation. Plans for runway and taxiway upgrades are under development.

Tenants

The west area houses general air cargo. The east area houses FedEx, UPS, Airborne Express, Eagle Global Logistics, and others.

Figures

Figure 22 is a map of the San Antonio International Airport and surrounding network of roads, and Figure 23 is a diagram of the airport cargo operations.

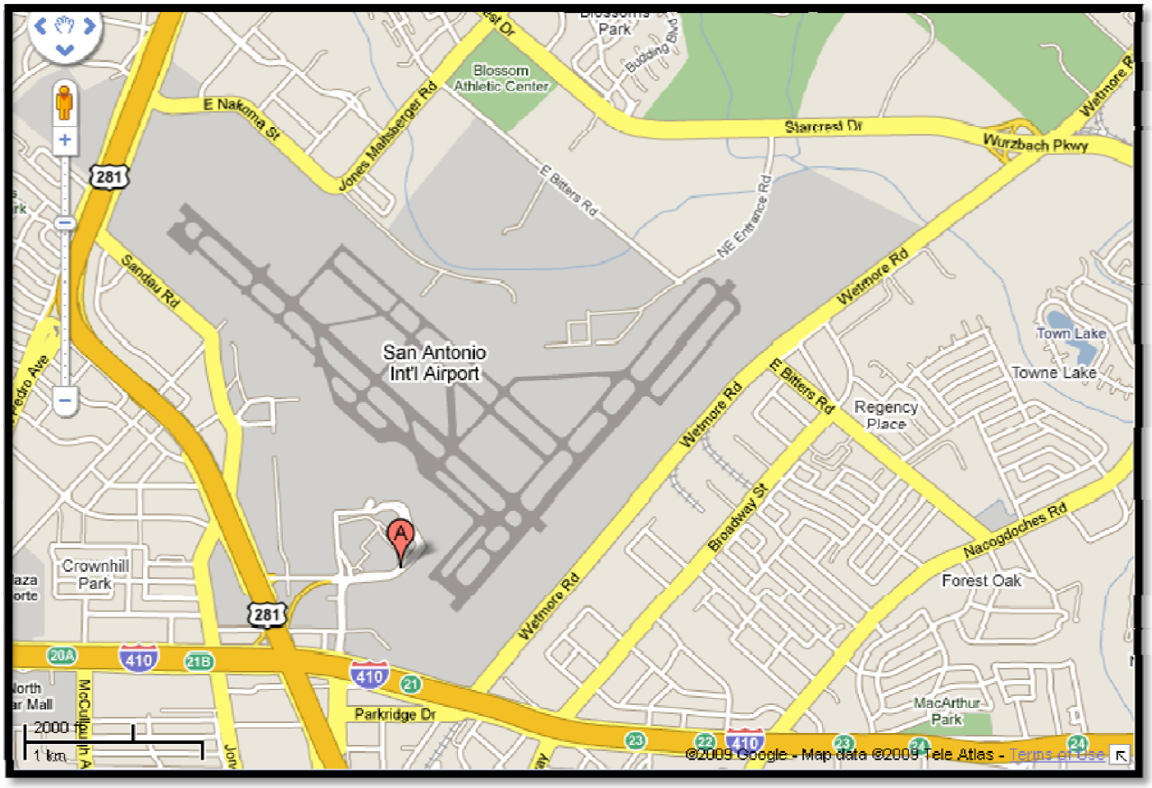


Figure 22. Location of San Antonio International Airport.

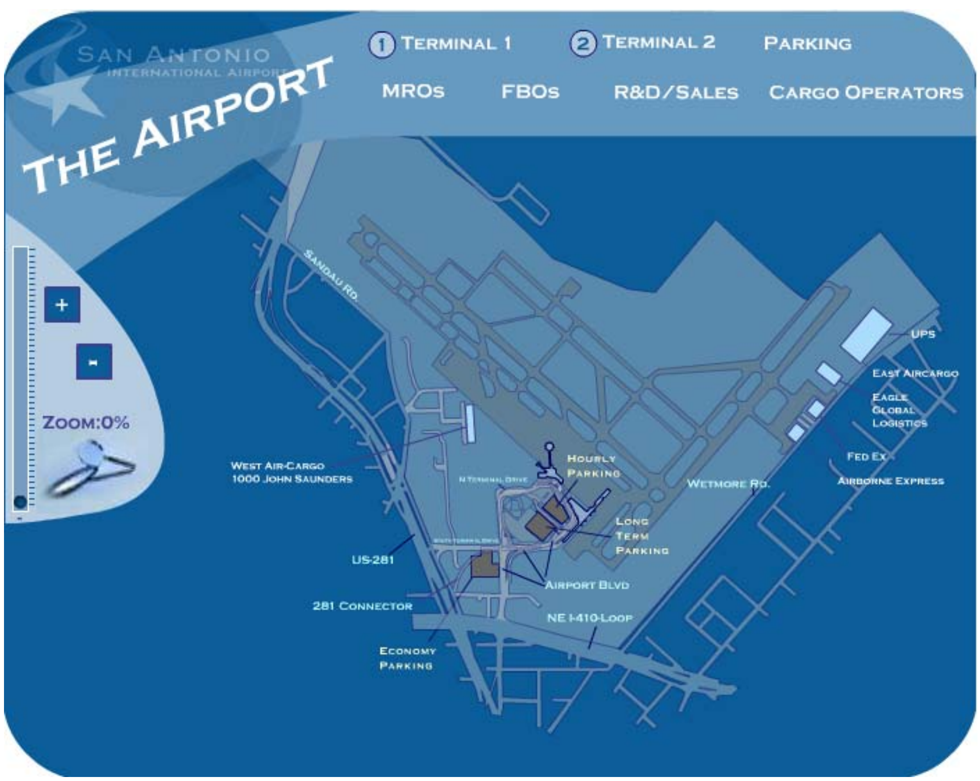


Figure 23. Location of San Antonio International Airport Cargo Operations.

Austin-Bergstrom International Airport

Location

Austin-Bergstrom International Airport is located at the southeast corner of the junction between SH 71 (NHS connector) and SH 183 and is directly off SH 71, which provides ease of access, especially to trucks.

Cargo Landside Access

Cargo landside ingress/egress is dedicated and discrete from the respective passenger ingress/egress. Also there are distinct and dedicated taxiways for cargo planes that lead directly to the main runway. No current problems with truck access or movement at this level of examination are apparent.

Facilities

The cargo apron is adjacent to the end of the right-of-way of SH 71, at the extreme corner of the SH 71 and SH 183 junction. There appears to be limited potential land for future expansion adjacent to the existing cargo area for additional facilities or infrastructure. At the time of this research, the City of Austin was seeking proposals to develop, build, and operate a commercial aeronautical service facility on 23 acres of land between the two runways. The new development could be partly occupied by air-cargo activities.

Tenants

Air-cargo carriers include ABX Air, Baron Aviation Service, FedEx, Telesis Express, and UPS. Ground handlers include Integrated Airline Service and Menzies Aviation USA.

Figures

Figure 24 is a map of Austin-Bergstrom International Airport, and Figure 25 is a map of the airport air-cargo facility.

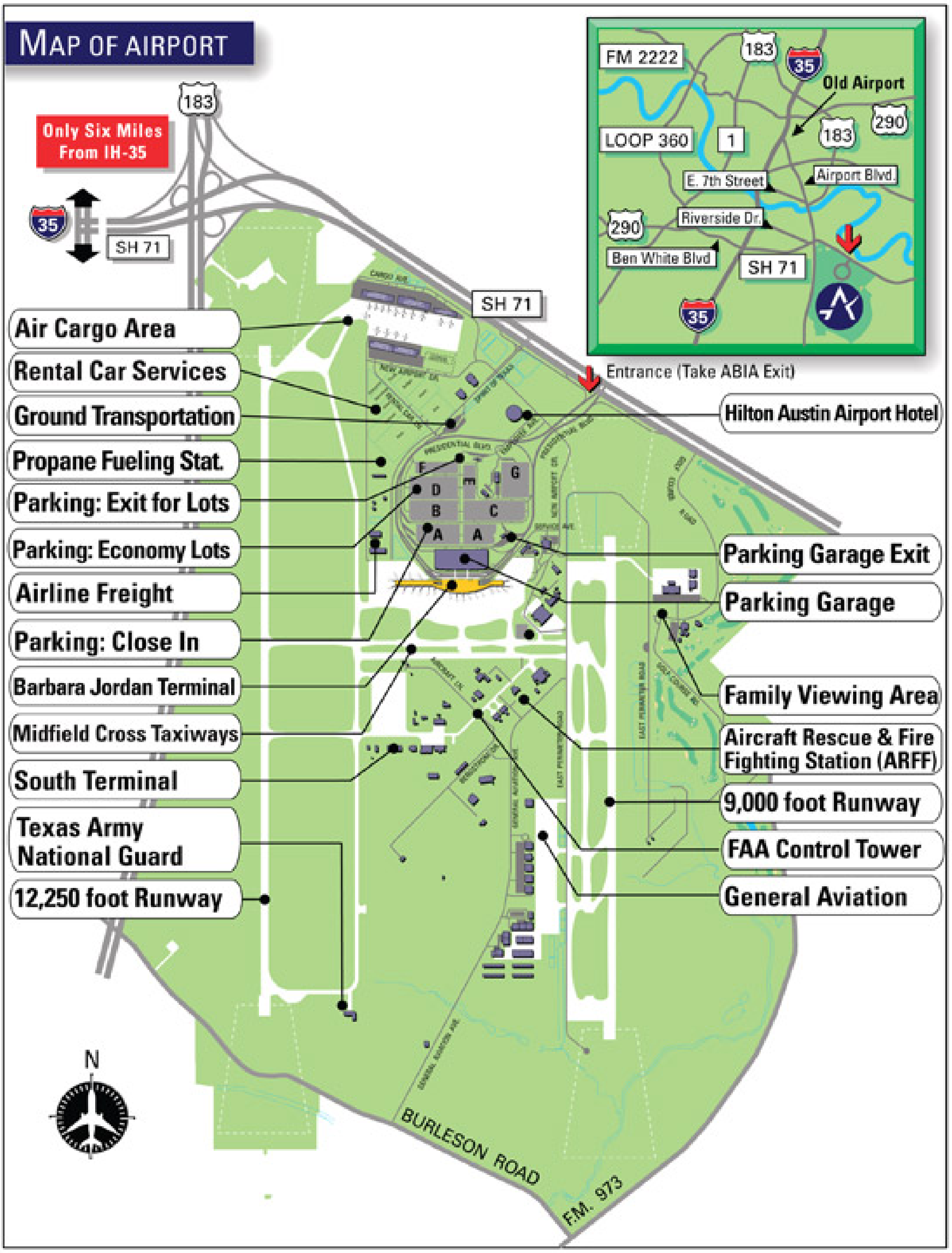


Figure 24. Map of Austin-Bergstrom International Airport.

Figure 25. Air-Cargo Map for Austin-Bergstrom International Airport.

El Paso International Airport

Location

El Paso International Airport is located directly on US 62, which runs east-west (about 2 miles) to the north of IH 10, and is about 4 miles from US 54 (runs north-south to the west). US 62 is a six-lane divided major arterial. Access from IH 10 is direct and unimpeded via secondary arterials through mixed development (residential/commercial/industrial). Biggs Army Airfield (Fort Bliss) is located to the north of the airport.

Cargo Landside Access

Landside access to the cargo area is separate from passenger access. The cargo area also has its own dedicated and direct taxiways to the runway. At this level of observation, truck access to and movement within the cargo area both appear to be adequate for trucks, i.e., geometrics, for turn radii and backups, for example.

Facilities

ELP developed air-cargo facilities during the last three years at a cost of approximately $60 million. This improvement was made to accommodate the needs of the rapidly growing just-in-time U.S.-Mexico air cargo in mind. The facilities consist of air-cargo buildings, aircraft parking, roadways, and an adjacent industrial park. All evidence shows ample capability for immediate expansion. In addition, a rail line also runs through airport grounds.

Tenants

Cargo carriers include DHL, UPS, FedEx, BAX Global/Schenker Logistics, and Integrated Airline Services.

Figures

Figure 26 shows a map of El Paso International Airport and the surrounding area, and Figure 27 is a photograph of the air-cargo facility.

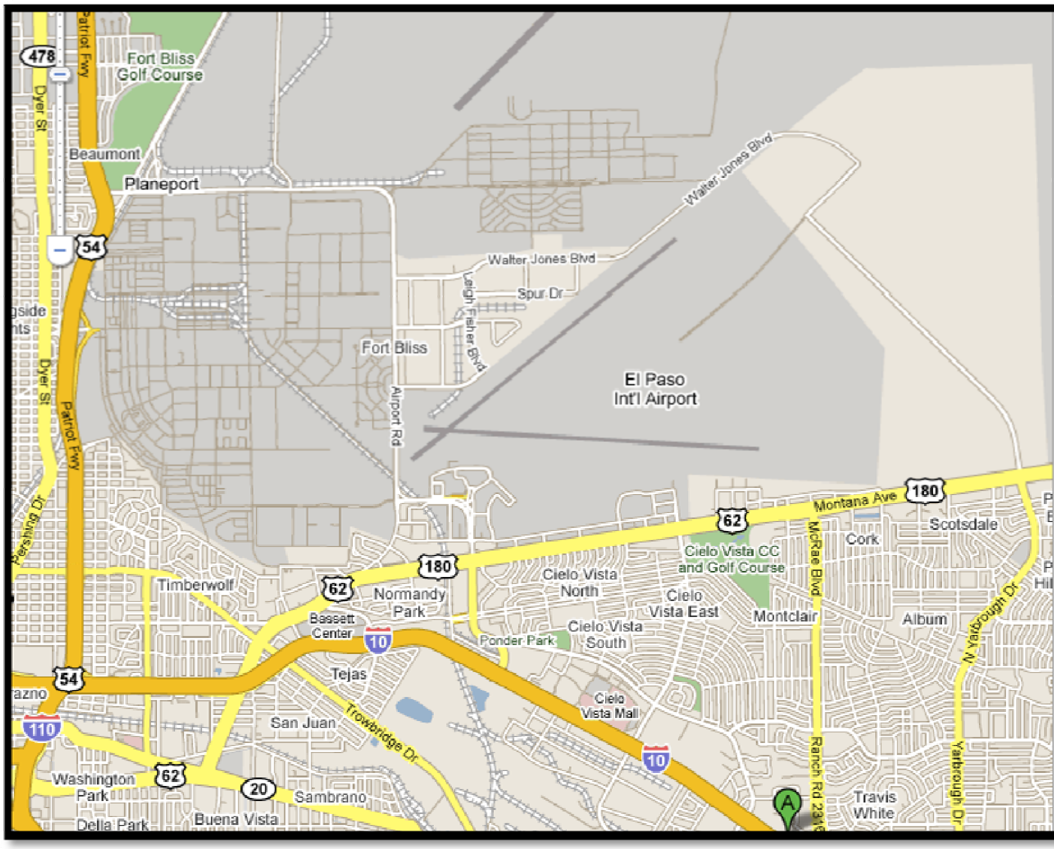


Figure 26. El Paso International Airport.

Figure 27. El Paso International Airport Cargo Loading Area.

Valley International Airport (Harlingen)

Location

Valley International Airport is located on the northeast side of Harlingen, approximately 3 miles east of US 77, a freeway facility. Primary access from US 77 is via SL 499, which is a four-lane divided road. From SL 499, there are various streets with access to the airport. Each of these specific routings can involve at least one intersection that is not laid out at a right angle.

Cargo Landside Access

There are three cargo areas at the airport, two on the west side and one on the east side. The east cargo area is the newest and is accessed from SL 499 by traversing Grimes Road, Bob Youker Street, and Bodenhamer Road. These roads are all two-lane facilities, and the intersections beyond SL 499 have limited turning radii.

Of the two west-side cargo areas, one is located on the northwest side, and the other is located on the southwest side. Each facility in the southwest cargo area is accessed directly from Airport Drive. The northwest cargo area is accessed from SL 499 by turning north on FM 507 at a non-right-angle intersection and then following Iwo Jima Boulevard and Cactus Street to Hackberry Street, which provides direct access to each facility. The left turn from SL 499 to FM 507 involves a very-acute-angle intersection.

Facilities

Valley International Airport has 400,000 sq ft of cargo apron and 80,000 sq ft of warehouse space. Customs facilities are located on the airport grounds. The airport is located within a free-trade zone.

Tenants

There are at least three cargo-only operators with warehouse facilities on the airport grounds. In addition, at least one passenger airline has a cargo facility separate from the passenger terminal. Two other companies provide cargo service at the airport but take trucks directly to airplanes and do not have warehouse facilities.

Figures

The following four figures show the Valley International Airport (Figure 28), the three cargo areas (Figure 29, Figure 30, and Figure 31), and portions of the road network serving them.

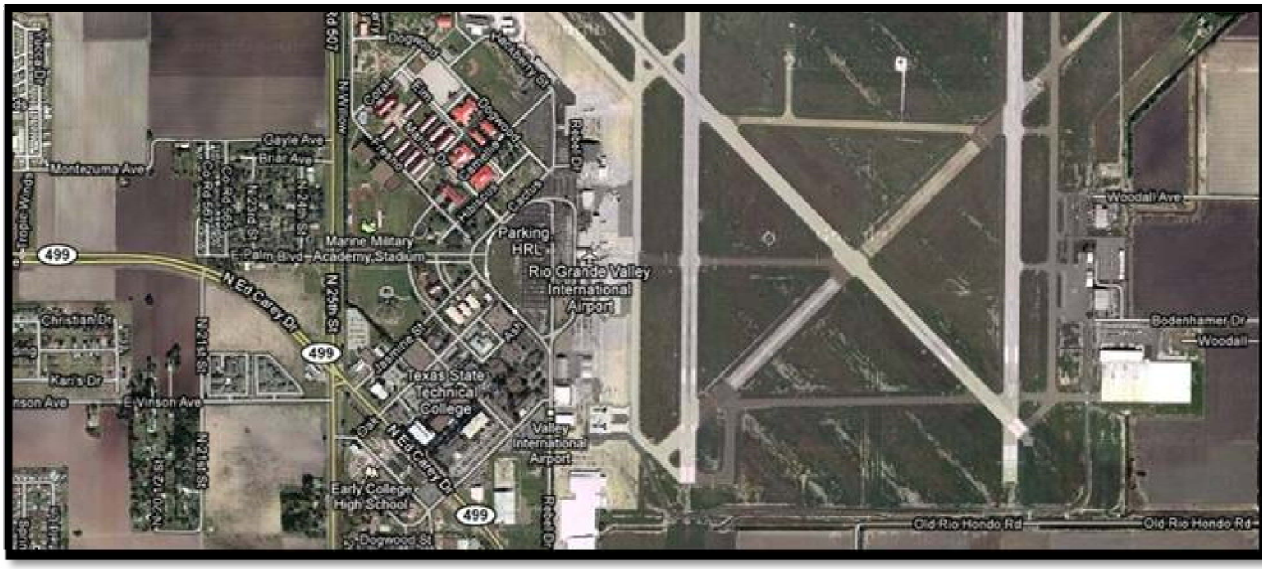


Figure 28. Valley International Airport.

Figure 29. Valley International Airport Northwest Cargo Area and Street Network.

Figure 30. Valley International Airport East Cargo Area.

Figure 31. Valley International Airport Southwest Cargo Area.

Dallas Love Field

Location

Love Field is located approximately 5 miles north of downtown Dallas, between IH 35E and the Dallas North Tollway. Primary freight access to Love Field is from IH 35E, along Mockingbird Lane.

Cargo Landside Access

Cargo and passenger traffic enter Love Field via Cedar Springs Road, which basically serves as the primary access road to the airport. Cargo traffic leaves Cedar Springs Road immediately south of the passenger terminal heading to the northeast.

Facilities

Southwest Airlines, the only significant cargo transporter at Love Field, recently opened a new cargo facility on the airport grounds. There are no other cargo facilities currently being used at Love Field.

Tenants

There are no cargo-only operators at Love Field. FedEx was the last such tenant and moved out more than five years previous to the time of this research.

Figures

Figure 32 and Figure 33 are satellite images showing Dallas Love Field, the surrounding area, and the internal road system.

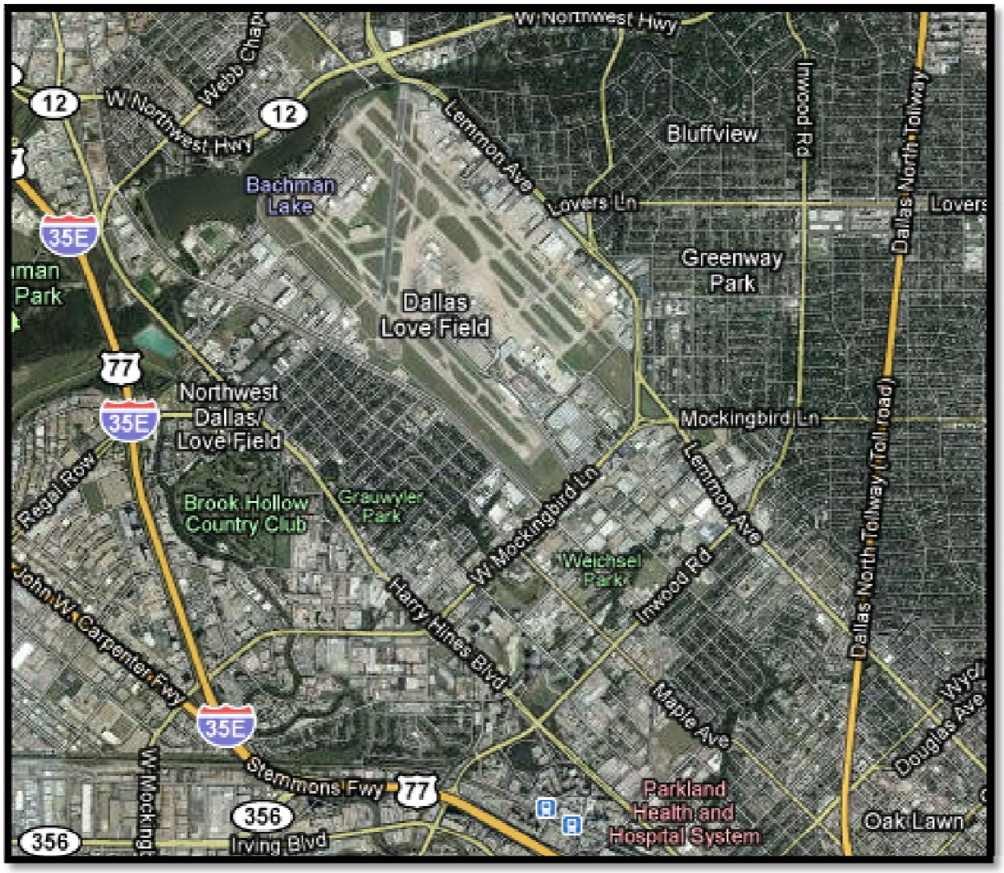


Figure 32. Dallas Love Field.

Figure 33. Dallas Love Field Terminal and Internal Road System.

Lubbock International Airport

Location

Lubbock International Airport is located approximately 8 miles north of downtown Lubbock, near IH 27. There are three access points from IH 27 for the airport—FM 2641/Regis Street, Independence Drive, and County Road 6000.

Cargo Landside Access

The primary cargo area is located on the northwest side of the airport and is accessed from IH 27 by County Road 6000. From County Road 6000, traffic can approach cargo facilities via Cedar Avenue. Frienes Street also connects Cedar Avenue and the IH 27 frontage road (a one-way facility) between the County Road 6000 interchange off-ramp and the County Road 6000 intersection, allowing traffic to access the primary cargo area without having to go as far north as County Road 6000.

Facilities

The airport has minimal facilities, including a FedEx freight distribution center.

Tenants

According to an airport official, there are three cargo-related operators at the airport, with FedEx being the primary tenant.

Figures

Figure 34 and Figure 35 illustrate Lubbock International Airport and the primary cargo area, respectively.

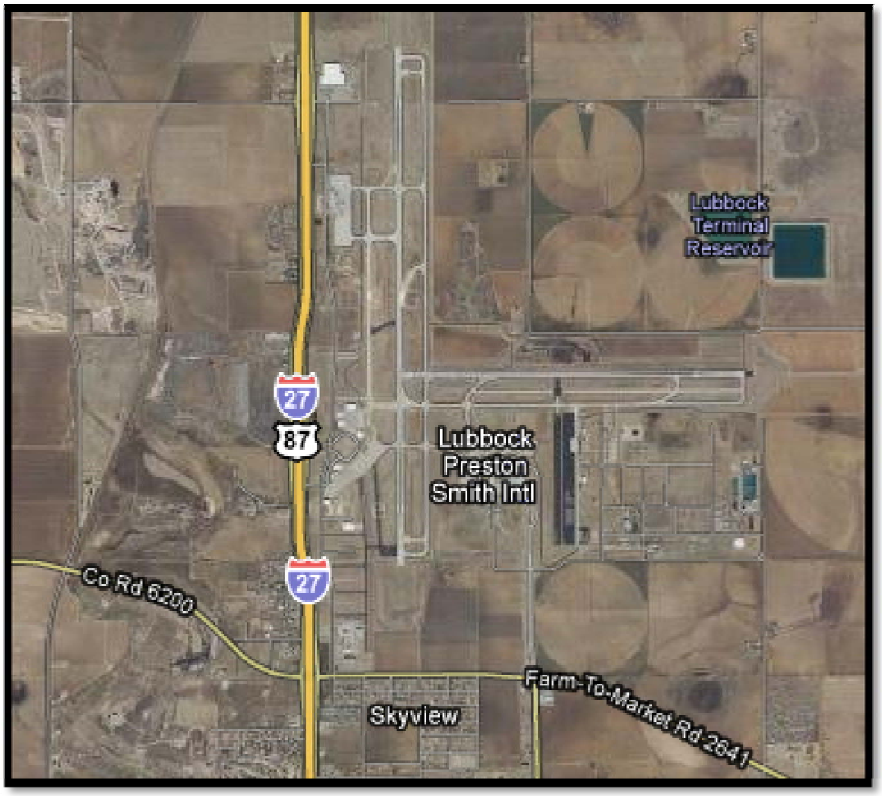


Figure 34. Lubbock International Airport.

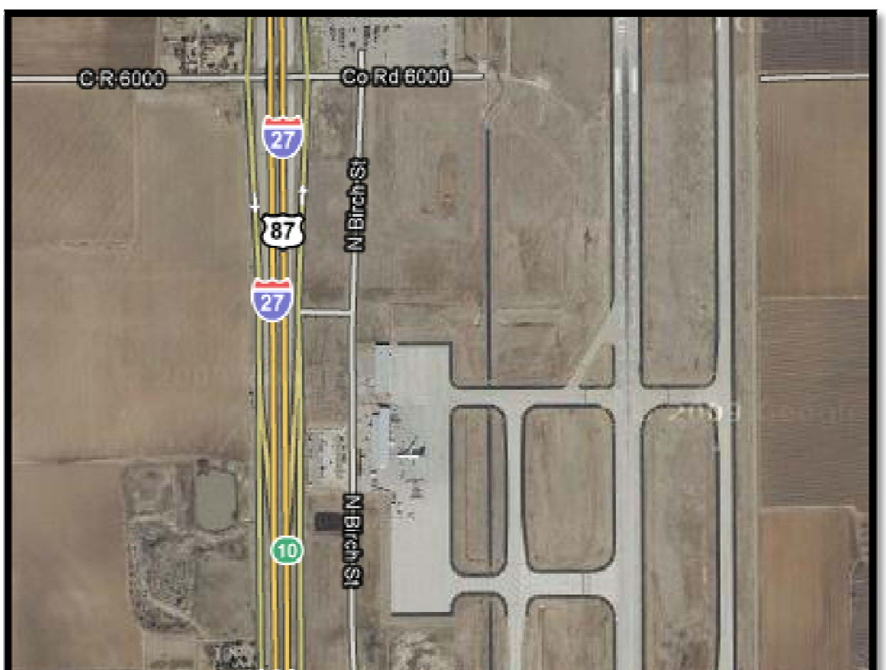


Figure 35. Lubbock International Airport Primary Cargo Area.

Laredo International Airport

Location

Laredo International Airport is located on the Texas-Mexico border 3 miles northeast of the central business district and 6 miles from the Mexican border. The airport is located west of Bob Bullock Loop (Loop 20) and north of US 59/East Saunders Street. Passenger-terminal access to the airport is from Loop 20, and cargo access is primarily from US 59.

According to the Laredo Chamber of Commerce, the City of Laredo is developing into a major cargo-distribution center serving an area up to 400 miles across the Mexican border. The airport is planning for significant future growth in air-cargo operations.

Cargo Landside Access

The airport currently has two separate areas for cargo operations. The main air-cargo area is located on the very southwest part of the airport. This cargo-operations area is accessible from US 59/East Saunders Street via Airpark Drive or alternatively via Maher Avenue between East Bustamente Street and Pappas Street, depending on the buildings to be accessed. A separate cargo facility that houses the FedEx operations is located directly north of the main passenger terminal and directly off Bob Bullock Loop 20.

The NHS connector for the airport cargo area is Bartlett Street between East Saunders Street (US 59) and Maher Avenue (0.1 mile), and Maher Avenue between Bartlett Street and Pappas Street (0.4 miles).

Facilities

According to the 2005 airport master plan, there are 11 air-cargo facilities located in the main cargo area in the southwest quadrant of the airport. This area has more than 250,000 sq ft of cargo storage space. The second cargo area, utilized by FedEx and located north of the passenger terminal on the eastern side of the airport, has 30,000 sq ft of storage space. The Air Cargo World *Airport Directory* (*27*) states the airport has nearly 45 million sq ft of ramp space with a 15-inch concrete tarmac.

The airport has 24-hour Customs and immigration services and 24-hour freight-forwarding services available. It is a large port-of-entry on the U.S.-Mexico border with rail and truck connections less than 3 miles away. Laredo International Airport has a designated foreign-trade zone on site and an additional three at nearby industrial parks.

Tenants

The airport master plan indicates the airport is served by four scheduled cargo carriers: Emery Worldwide, BAX Global, FedEx, and UPS. According to airport officials, these carriers account for the vast majority of the activity at the airport. The airport is also served by non-scheduled cargo operators that include Ameristar, Express One, and USA Jet.

Figures

The four satellite images that follow show the airport and the surrounding roadway network in Figure 36, the southwest cargo area with access along Airpark Drive for some buildings and along Maher and East Bustamente for others in Figure 37, a close-up view of the southwest cargo area showing roadway access to all areas of the cargo area in Figure 38, and the FedEx cargo area north of the main passenger terminal (north of the concrete/old runway, off Bob Bullock Loop 20) in Figure 39.

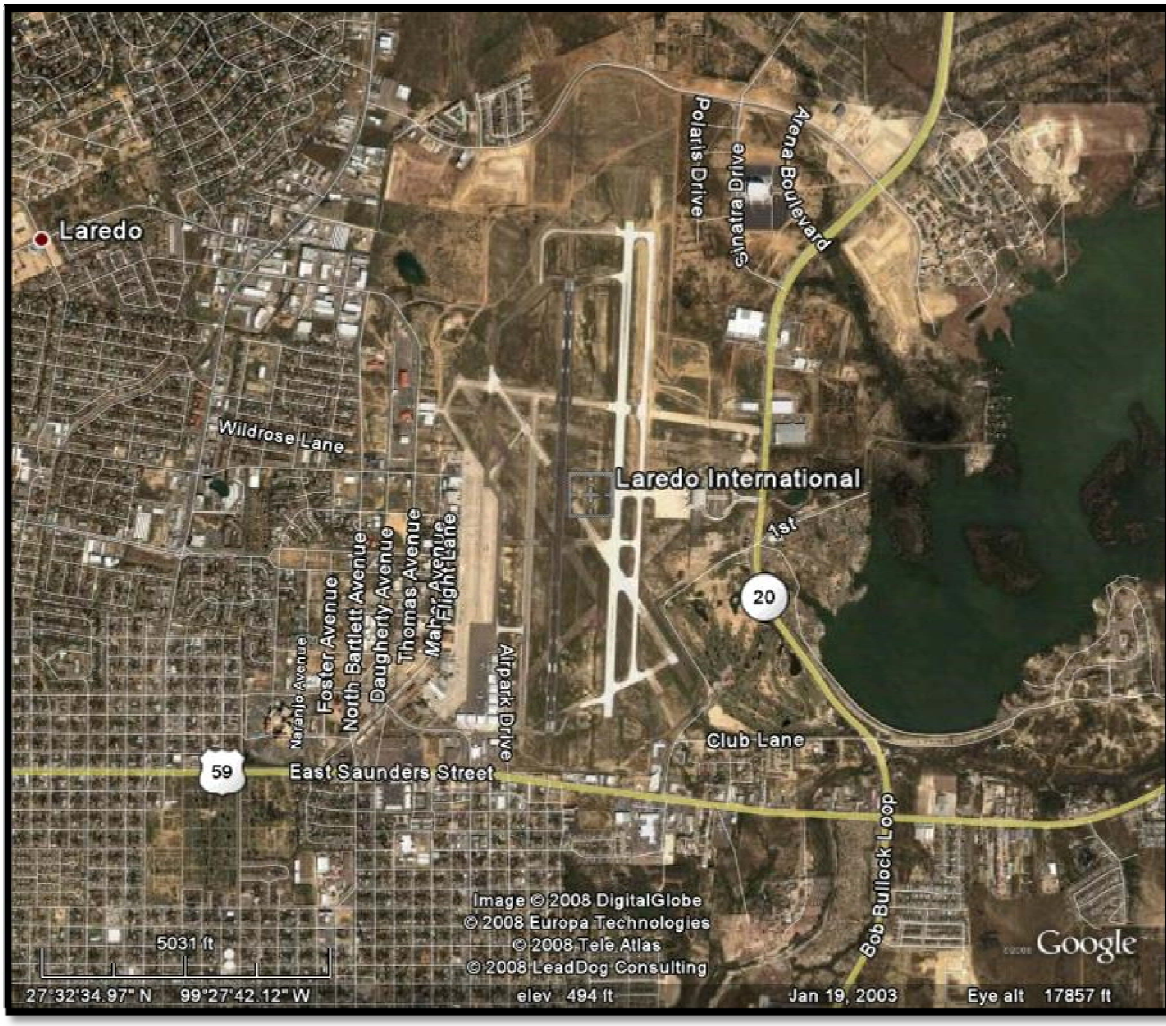


Figure 36. Laredo International Airport.

Figure 37. Laredo International Airport Southwest Cargo Area.

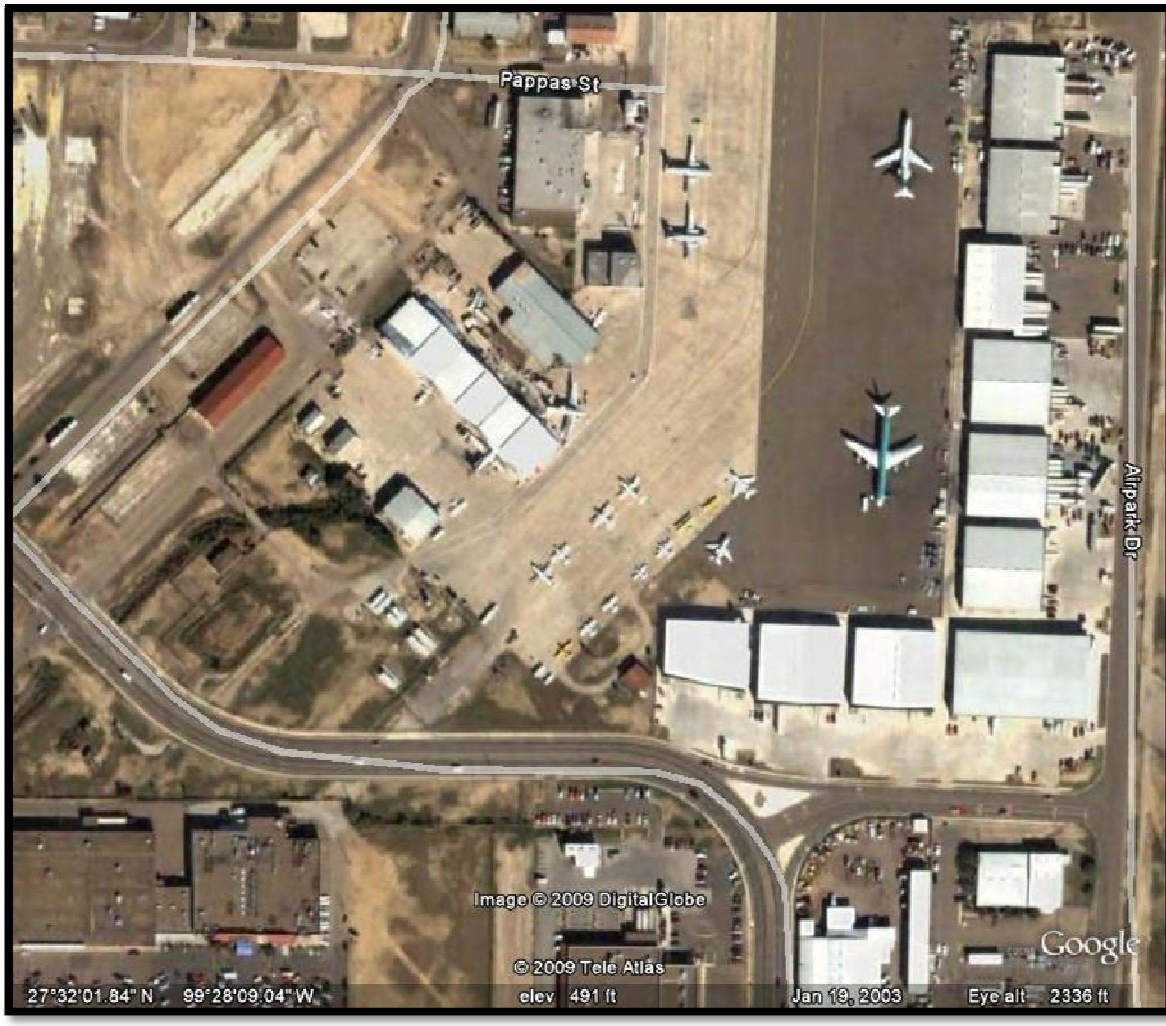


Figure 38. Laredo International Airport Southwest Cargo Area Close-Up.

Figure 39. Laredo International Airport FedEx Cargo Area.

Houston Hobby Airport

Location

Houston Hobby Airport is located 8 miles south of Houston's central business district west of IH 45. The airport is served by an NHS route, Airport Boulevard, and Broadway Street. Airport Boulevard connects to IH 45, and the entrance to the main terminal is approximately 1.5 miles west of the interstate. Broadway Street ends at the main entrance to the passenger terminal where it intersects with Airport Boulevard.

Cargo Landside Access

The cargo ramp at Houston Hobby Airport is located on the north end of the airport and east of the passenger terminal. Access to the facility from Airport Boulevard is provided by West Air Cargo Road and East Air Cargo Road. This roadway runs parallel to Airport Boulevard in a frontage road fashion and intersects it at its ends (See Figures 41 and 42).

Facilities

Most of the cargo at the airport is carried by passenger airlines. There are no current plans to expand the air-cargo facilities since the Houston Airport System has made a significant investment in cargo facilities at Houston Intercontinental Airport. Hobby Airport is not served by any all-cargo carriers. The airport has a multi-tenant air-cargo facility that totals more than 46,000 sq ft, of which more than 6,300 sq ft is dedicated to truck-loading operations.

Tenants

Hobby Airport has no all-cargo operators, but it is home to cargo operations for Southwest and Delta/Northwest Airlines.

Figures

In the following three satellite images, Figure 40 shows the airport and the surrounding roadway network; Figure 41 shows the general vicinity of the cargo area at the airport; and Figure 42 shows a close-up view of the cargo area, showing the roadway connections between the cargo facility and Airport Boulevard.

Figure 40. Hobby Airport.

Figure 41. Hobby Airport Cargo Area.

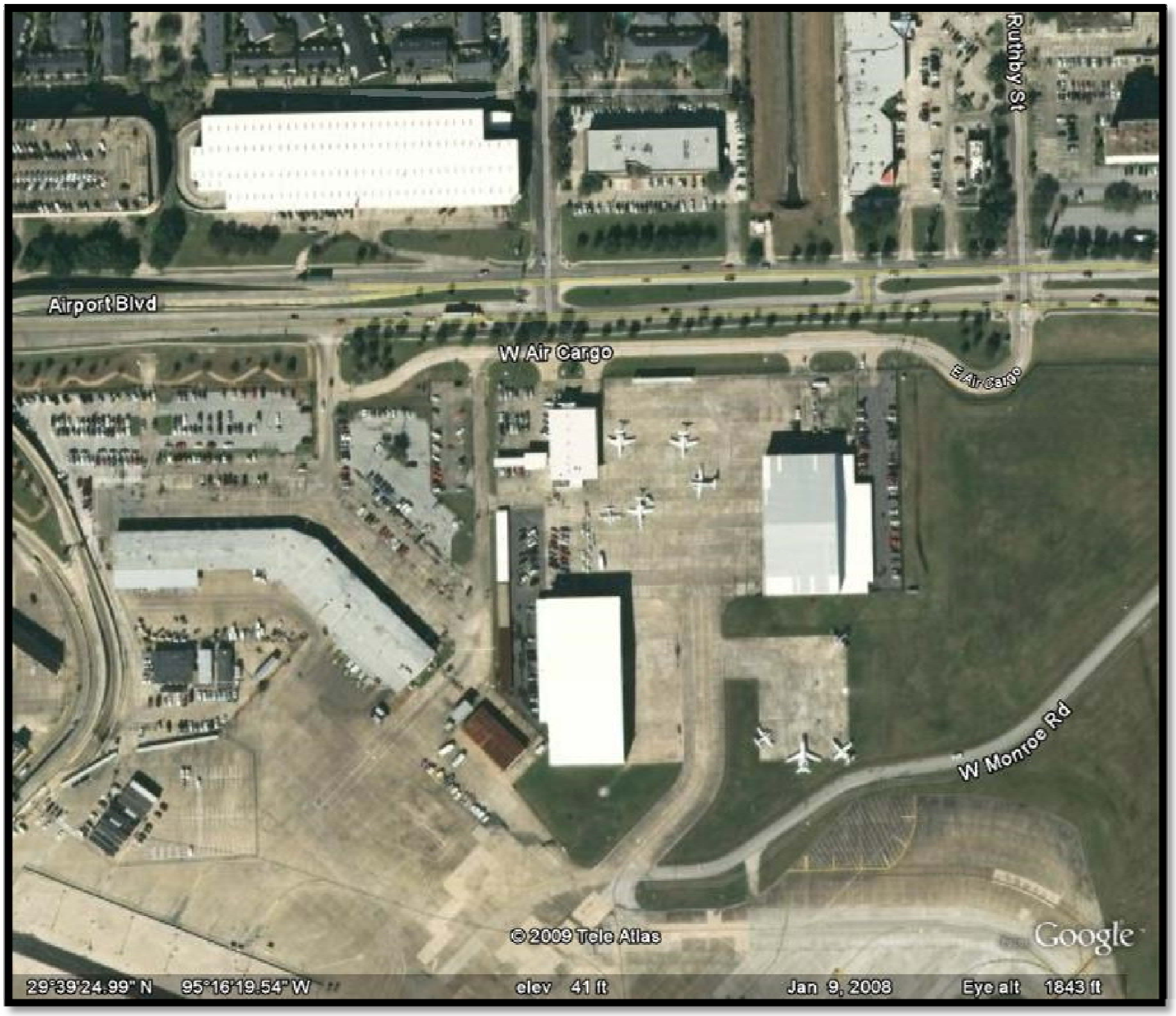


Figure 42. Hobby Airport Cargo Area Close-Up.

Kelly Field (Port San Antonio with Lackland AFB)

Location

Kelly Field is an exclusively cargo airport. It is located south of downtown San Antonio. Kelly Field and Lackland Air Force Base comprise Port San Antonio.

Cargo Landside Access

Kelly Field is located south of US 90, north of State Loop. It is directly accessed from US 90 via several four-lane divided secondary arterials that have adjacent residential areas. Proximity from the south (i.e., State Loop via US 81S) is a longer route since the main entrance to the airport is on its north side. In addition, the area adjacent to US 81S is more residential than the area adjacent to the route leading to the airport from US 90. Truck access to airport grounds and movement on airport grounds both appear adequate, i.e., geometrics, for turn radii or backups, for example.

Facilities

Kelly Field features a foreign-trade zone, direct rail access (Union Pacific), rail-served warehouses, and transload facilities. The runway can accommodate an Airbus A-380 and other heavy aircraft. Port San Antonio is currently building an 89,500-square-ft cargo facility capable of handling up to four Boeing 747s and built to state-of-the-art truck specifications.

Tenants

Heavy aerospace industrial activity is based at Kelly Field, including Boeing, Lockheed Martin, Standard Aero, Pratt and Whitney, Gore Design Completions, and Chromalloy Gas Turbine.

Figures

The following four images of Kelly Field include a map of the airport's location (Figure 43), as well as two diagrams (Figure 44 and Figure 45) and a photograph (Figure 46) of the air-cargo facility.

Figure 43. Location of Kelly Field/Port San Antonio.

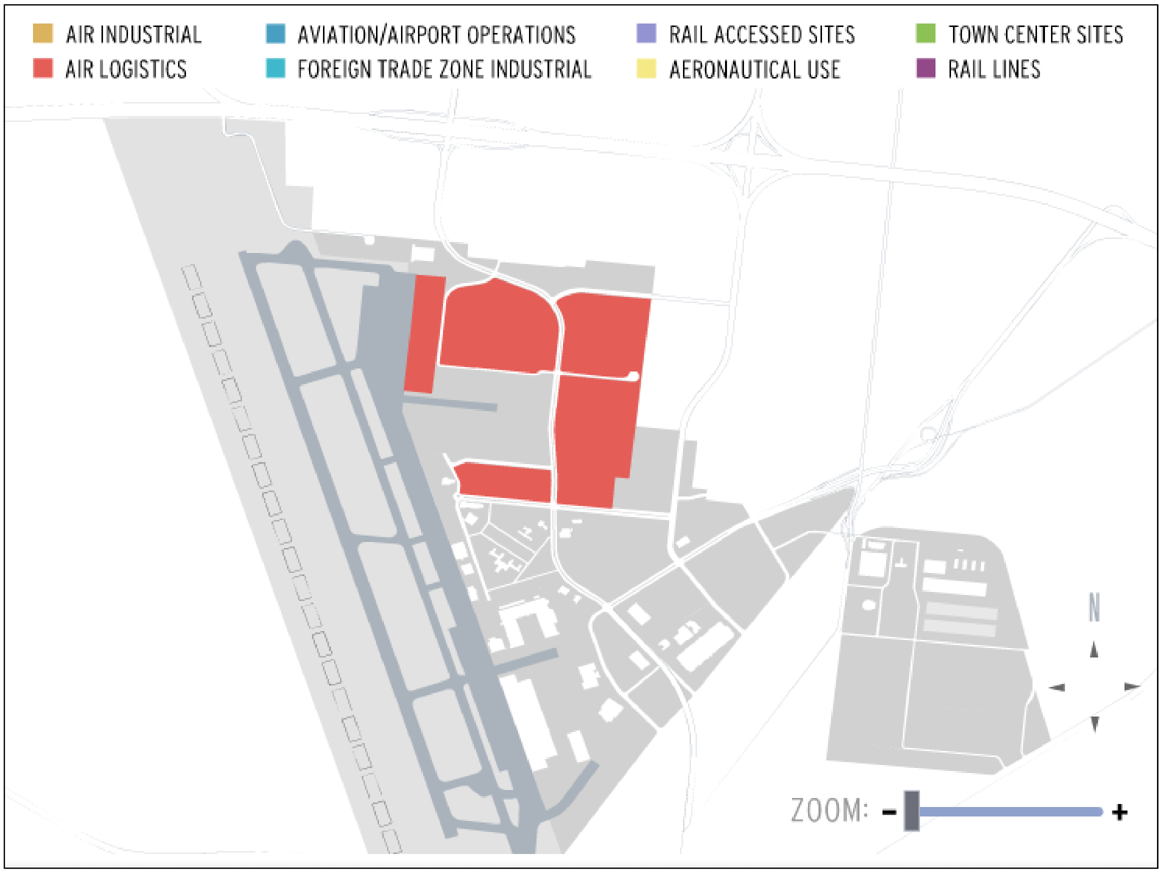


Figure 44. Kelly Field/Port San Antonio Air Logistics Land Uses.

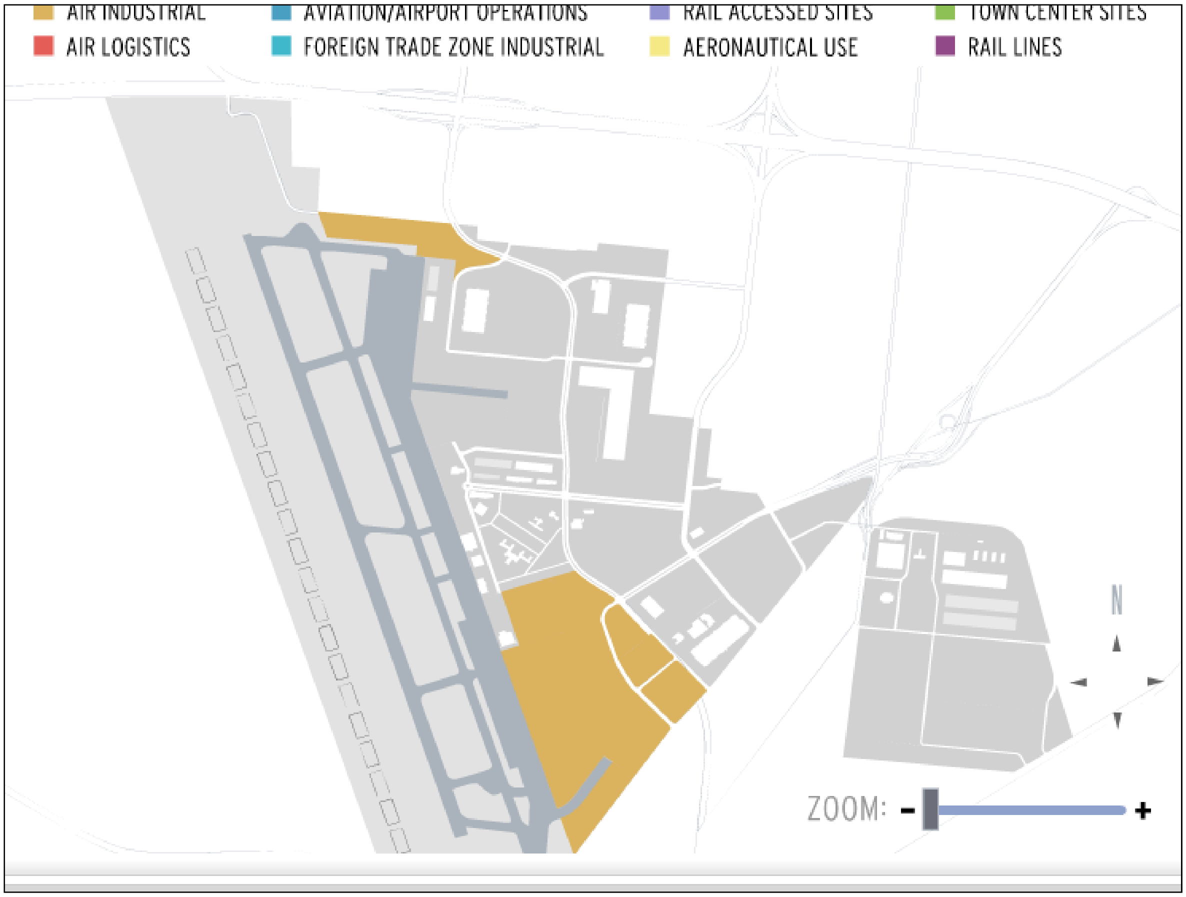


Figure 45. Kelly Field/Port San Antonio Air Industrial Land Uses.

Figure 46. Kelly Field/Port San Antonio Cargo Loading Areas.

DEVELOPMENT OF AN AIRPORT-ACCESS CLASSIFICATION SYSTEM

This evaluation of airport landside freight access at the top 11 cargo airports in the state has provided a foundation on which to develop an airport-access classification system. The classification scheme groups the airports by common characteristics based on these criteria:

- The airport's location in the city it serves.
- The airport's proximity to various roadway classifications.
- The distance trucks must travel from the roadway system in order to access the cargo locations on airport grounds.

The research team developed the following classification scheme to group the airports:

- Large metro—inner city/surface-street access.
- Large metro—urban fringe/direct freeway access.
- Dedicated freight.
- Small metro.
- General aviation.

Airports of interest to the research team have been classified according to this structure. Currently active cargo airports as well as some aspiring general-aviation airports were included. Each class and those airports that fit its definition are listed below.

Large Metro—Inner City/Surface-Street Access

This category includes airports that are located within large metropolitan areas and are typically accessed by 1 mile or more of arterial streets between the airport and the nearest freeway facility. Examples include:

- Dallas Love Field.
- Houston Hobby Airport.
- El Paso International Airport.

Large Metro—Urban Fringe/Direct Freeway Access

These airports were originally built, and still may be located, on the fringe of large metropolitan areas. They typically have at least one access point with direct access to at least one freeway facility. Examples include:

- Dallas/Fort Worth International Airport.
- Houston Intercontinental Airport.
- Austin-Bergstrom International Airport.
- San Antonio International Airport.

Dedicated Freight

These airports have no scheduled passenger service and are primarily used for cargo operations. There may be general-aviation fixed-base operators at these airports. Examples include:

- Fort Worth Alliance.
- Port San Antonio (Kelly USA).
- Lancaster Municipal Airport (future).

Small Metro

These airports are located in or near small metropolitan areas. They typically have relatively low levels of cargo operations and primarily serve passenger and general-aviation traffic. Examples include:

- Laredo International Airport.
- Valley International Airport in Harlingen.
- Lubbock International Airport.
- Midland International Airport.

General Aviation

These are airports that currently serve primarily general-aviation traffic. They may have small amounts of cargo traffic and do not have any scheduled passenger service. Some of these airports have plans for future increased cargo and passenger service. Examples include:

- Hondo Municipal Airport.
- North Texas Regional Airport (Grayson County).
- Edinburgh International Airport.

AIRPORT CASE STUDIES

Subsequent to the airport landside cargo-access evaluations and development of the classification system, the research team recommends performing more detailed case studies of the following airports:

- Large metro—inner city/surface-street access:
    - Dallas Love Field.
    - El Paso International Airport.
- Large metro—urban fringe/direct freeway access:
    - Houston Intercontinental Airport.
    - Austin-Bergstrom International Airport.
    - Oklahoma City Will Rogers World Airport.
- Dedicated freight:
    - Fort Worth Alliance.
    - Port San Antonio (Kelly USA).
- Small metro:
    - Laredo International Airport.
    - Valley International Airport in Harlingen.
    - Midland International Airport.
- General aviation:
    - Hondo Municipal Airport.

CHAPTER 5. CASE-STUDY FRAMEWORK—LANDSIDE FREIGHT ACCESS TO AIRPORTS

INTRODUCTION

An important element of this research was conducting case studies. Through the course of the project, the research team developed a category system for airports. This system is comprised of the following categories and case studies in each category:

- **Large metro**—inner city/surface-street access: typically older airports in areas with more than 500,000 population, surrounded by various types of land development, a few miles from the nearest controlled-access highway:
    - Dallas Love Field.
    - El Paso International Airport.
    - San Antonio International Airport.
- **Large metro**—urban fringe/direct freeway access: typically airports that were developed away from the inner cities, with very short connections to controlled-access highways:
    - George Bush Intercontinental Airport (Houston).
    - Austin-Bergstrom International Airport.
    - Will Rogers World Airport (Oklahoma City).
- **Dedicated freight**: typically have significant freight activity, possibly some general-aviation activity, and no scheduled passenger service:
    - Alliance Airport (Fort Worth).
    - Port San Antonio Airport (Kelly Air Force Base).
- **Small metro:** typically smaller airports that have some level of freight activity, are located in areas with populations less than 500,000, and may be considering expanded freight activity:
    - Laredo International Airport.
    - Valley International Airport (Harlingen).
    - Midland International Airport/Odessa Intermodal Development (Private).
- **General aviation:**
    - Hondo Municipal Airport.

The research team developed a set of potential case-study airports in consultation with the Project Monitoring Committee. Researchers interviewed officials from airports and other agencies with transportation-planning responsibilities, conducted site visits, photographed examples of features related to landside freight access, and prepared case-study summaries. This chapter presents the case-study summaries, which contain numerous photographic examples of features identified.

One unique case study was in the Midland-Odessa area. Midland International Airport currently does not have significant air-cargo activity. Discussions with local officials identified areas of town where freight centers may be developing. The research team developed a brainstorming process involving representatives from the airport and other agencies with transportation-planning responsibilities. The brainstorming process was intended to bring together as many stakeholders as possible and identify the various issues related to landside freight access that arose. This process was determined to be a success by the research team and the local participants. Details of the process and the findings are included with the Midland International Airport case study. The best practices identified in the case studies are listed in Chapter 7, "Best Practices and Next Steps."

LARGE METRO—INNER CITY/SURFACE-STREET ACCESS

Dallas Love Field

Airport Name

This section describes Dallas Love Field.

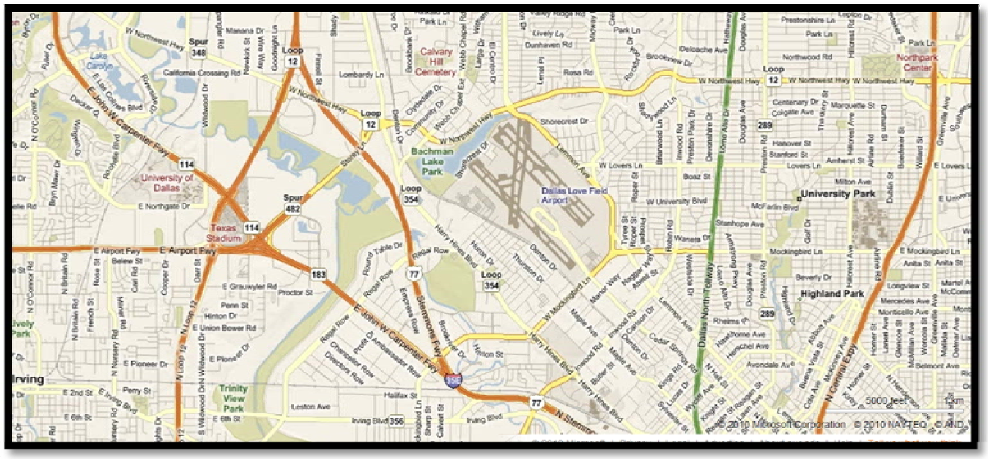
Category and Geographical Location

Dallas Love Field is classified as large metro—inner city/surface-street access. Dallas Love Field is located approximately 5 miles north of downtown Dallas.

Nearest Freeway(s) and Distance(s)

It is probable that truck traffic not originating in the immediate area is coming from SH 183 or IH 35E, exiting at Mockingbird Lane. As shown in Figure 47, both of these freeways are located approximately 3 miles west of Love Field (they diverge immediately south of

Mockingbird Lane, in the northward direction). Other possible access routes include Old Denton Road or Harry Hines Boulevard, with a subsequent turn onto Mockingbird Lane.



Source: BingMaps.com

Figure 47. Map of Dallas Love Field and Surrounding Road Network.

Access/Entry/Gateway Points

The primary entrance to Love Field is Cedar Springs Road, a north-south street that becomes the main circulation road through the passenger-terminal area. Passenger traffic and freight traffic initially share this entrance and then diverge. Freight traffic leaves Cedar Springs when it becomes the passenger-terminal circulation road, immediately south of the passenger terminal building.

Freeway Connection/Route Characteristics

Per visual field observations, the pavement on Mockingbird Lane appears to be in very good condition overall. It is a concrete, six-lane road with raised medians and left-turn lanes. Intersections at the freeway frontage roads and at Cedar Springs (the airport entrance) appear to have adequate geometrics for trucks carrying freight into or out of Love Field. There are no at-grade railroad crossings between SH 183 or IH 35E and the airport. A previous rail spur near the western edge of the airport (immediately parallel to Old Denton Road) has been removed. In its place, Dallas Area Rapid Transit (DART) is constructing an elevated light-rail line. This creates a grade-separated rail crossing at the Old Denton Road intersection on Mockingbird Lane. The adjacent land uses along Mockingbird Lane are primarily commercial in nature. As shown in

Figure 48 there are high-rise hotels and office buildings in close proximity to the freeways. Older retail development is the dominant land use between Old Denton Road and the high-rise buildings near IH 35E.

Source: BingMaps.com

Figure 48. High-Rise Buildings along Mockingbird Lane.

Wayfinding (Off Site and On Site)

Signage along IH 35E and SH 183 directs motorists to the Mockingbird Lane exit and the airport in general. Freight and passengers share the only entry to Love Field and there are no signs specific to freight traffic on the freeways or Mockingbird Lane.

There are two signs on Cedar Springs Road, inside the airport boundary, directing freight traffic toward the freight area, which is on the east side of the terminal. The initial sign, shown in Figure 49, informs motorists that the cargo-area traffic needs to be in the right lane. The second sign, shown in Figure 50, tells motorists to turn right at the following intersection.

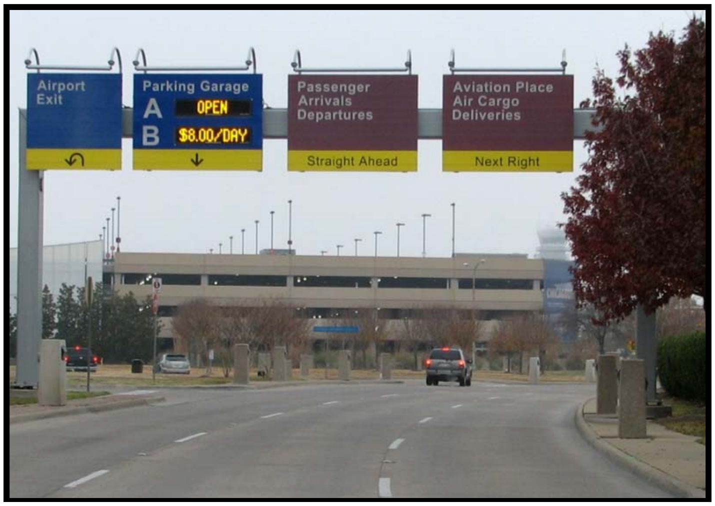


Figure 49. Initial Cargo Routing Sign at Dallas Love Field.

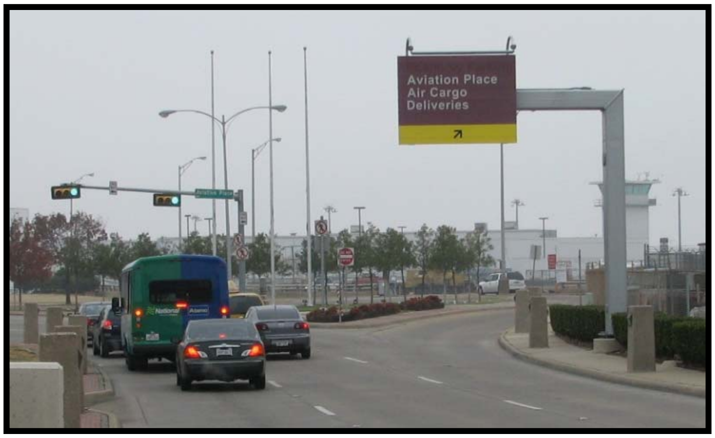


Figure 50. Second Cargo Routing Sign at Dallas Love Field.

Relative Scale of Cargo Activities

Love Field ranks eighth in cargo tonnage handled among Texas airports. There are currently no dedicated freight carriers at Love Field. The last one was FedEx, which moved out about five years ago. The only freight activities at the airport are those undertaken by scheduled airlines in aircraft bellies. While they have no facilities at the airport, companies such as UPS and FedEx do transfer small freight items with the airlines. Figure 51 shows a UPS truck making a transfer at the Southwest Airlines cargo facility.

Figure 51. Small Delivery Truck at Love Field Cargo Area.

Therefore, there is no significant volume of large trucks carrying freight into or out of Love Field. The other two major airports in the Dallas-Fort Worth area, DFW and Alliance, handle significant amounts of freight.

Shared or Separate Access to Cargo Areas

Southwest Airlines recently opened a new cargo facility separate from the passenger terminal and previous cargo building. This new facility is located in the same general area as the previous one and uses the previous access as described in this case study.

Future Planning Activities

There are no plans for increased freight activities at Love Field.

El Paso International Airport

Airport Name

This section describes El Paso International Airport. The City of El Paso is the owner, and the City Department of Aviation is the manager of the airport.

Category and Geographical Location

El Paso International Airport is classified as large metro—inner city/surface-street access. El Paso International Airport is located on approximately 7000 acres, approximately 5 miles east of downtown El Paso (*28*). It is bordered on the south by mixed development and on the west, north, and east by Fort Bliss.

Nearest Freeway(s) and Distance(s)

The airport is bordered on the south by Montana Avenue (US 62/180), on the east by Loop 375, on the north by Spur 601, and on the west by Airport Road. Spur 601 is a new freeway facility that connects Loop 375 and US 54. US 54 runs north-south and is approximately 1 mile to the west of the airport. IH 10 is approximately 1 mile to the south of the airport terminal. Figure 52 shows the roadway network surrounding El Paso International Airport.

Source: BingMaps.com

Figure 52. El Paso International Airport and Surrounding Roadway Network.

Access/Entry/Gateway Points

El Paso International Airport has two air-cargo areas and a significantly sized industrial park located on airport property. Access to each location is unique and discussed below.

Air Cargo I and II. These are long-standing air-cargo facilities and are located in close proximity to the passenger terminal. Cargo activity in these two areas is primarily associated with passenger airlines: Southwest, US Airways, Continental, Frontier, United, and Delta. Figure 53 shows the two air-cargo facilities that are adjacent to the passenger terminal. According to airport representatives, this air-cargo area is collectively referred to as Air Cargo I and II.

Access to these air-cargo facilities is provided by Airway Boulevard, which travels north from IH 10 across Montana Avenue before curving to the west toward Airport Road. From Airway Boulevard, the facilities are accessed from Convair Road. Multiple driveways provide entry to individual air-cargo buildings.

Source: GoogleMaps.com

Figure 53. El Paso Air Cargo I and II.

Air Cargo III and IV (Air Cargo Center). Air Cargo II and IV are located in a newly developed area, primarily used by all-cargo carriers such as FedEx, UPS, and DHL. Airport representatives collectively referred to these two air-cargo areas as the Air Cargo Center. This area is circled in Figure 54.

Access to the Air Cargo Center is provided by Global Reach Drive, which can be accessed either by Montana Avenue on the south or the newly constructed Spur 601 that runs along the northern airport border. The facilities are located on George Perry Boulevard, which intersects Global Reach Drive at a signalized intersection. Several driveways provide access to the individual air-cargo bays located within the two major buildings.

Source: GoogleMaps.com

Figure 54. El Paso Air Cargo II and IV (Air Cargo Center).

Butterfield Trail Industrial Park. Butterfield Trail Industrial Park is located on the northwest corner of the airport property. Primary access is provided by Airport Road, Founders Boulevard, Butterfield Trail Boulevard, or Leigh Fisher Boulevard. Founders Boulevard travels east and turns into Walter Jones Boulevard, which runs along the northern border of the airport property to meet Global Reach Boulevard at a signalized intersection. Spur 601 is located a couple 100 ft north of this intersection.

Freeway Connection/Route Characteristics

The connections to the two cargo areas and the industrial park are currently in good condition and lead from/to highways conducive to large-truck operations. Common roadways include Montana Avenue, Airport Road, Global Reach Boulevard, and Spur 601. Montana Avenue is a six-lane major arterial that runs east-west, with the airport to its north and mixed development to its south. Airport Road is also a six-lane facility that runs north-south, with the airport property to its east and Fort Bliss to its west.

Global Reach Boulevard is a new six-lane, median-separated roadway that easily accommodates truck operations. The intersections with George Perry Boulevard to the Air Cargo Center, and Walter Jones Boulevard to the Butterfield Trail Industrial Park, are both signalized.

Spur 601 is a newly constructed, limited-access freeway that travels east-west between Loop 375 and US 54 to the north of the airport. Airport representatives feel this new roadway provides excellent access for trucks traveling in and out of the Air Cargo Center and the Butterfield Trail Industrial Park.

Air Cargo I and II are directly accessed via Convair Road. Convair Road is a two-lane roadway with wide lanes that appear to have no issues accommodating truck operations. Airway Boulevard is a six-lane arterial that provides good access between Convair Road and Airport Road to the west, and Montana Avenue and IH 10 to the south.

The Air Cargo Center is located on George Perry Boulevard, which has two wide lanes to accommodate truck operations. Walter Jones Boulevard/Founders Boulevard is designed to serve truck traffic in the Butterfield Trail Industrial Park.

Wayfinding (Off Site and On Site)

Signage exists to direct passengers and cargo to the El Paso International Airport at several locations on IH 10. Airway Boulevard has several signs that specifically direct air-cargo shipments, as shown in Figure 55 through Figure 57.

Figure 55. El Paso International Airport Air-Cargo Guide Sign—Airway Boulevard Northbound Approaching Terminal.

Figure 56. El Paso International Airport Air-Cargo Guide Sign—Airway Boulevard Westbound at Convair Road.

Figure 57. El Paso International Airport Air-Cargo Guide Sign—Airway Boulevard Eastbound.

Once off Airway Boulevard and onto Convair Road, there is additional guidance to the air-cargo facilities operated by the passenger airlines (Air Cargo I and II), as shown in Figure 58.

Figure 58. El Paso International Airport Air-Cargo Guide Sign—Convair Road.

No specific signs exist to direct truck traffic to the Air Cargo Center. On Spur 601 there is an airport symbol sign on top of the Global Reach Drive exit sign, as indicated in Figure 59.

Figure 59. El Paso International Airport—Airport System Sign atop Exit Sign.

Relative Scale of Cargo Activities

Cargo activity at the two air-cargo areas and the industrial park represents a significant overall number of truck movements into and out of the airport property. The recent development of the Air Cargo Center, along with future plans to construct additional air-cargo facilities on adjacent tracts, indicates a firm belief by the airport, city, and regional planners that air cargo will continue to grow in the El Paso region.

Shared or Separate Access to Cargo Areas

Air Cargo I and II are located adjacent to the passenger terminal, so cargo and passenger vehicular traffic mixes along Airway Boulevard near the airport.

Future Planning Activities

The *El Paso International Airport Land Use Plan* indicates the planned development of a new industrial park on 150 acres east of Global Reach Drive and south of George Perry Boulevard. The plan mentions the expansion of Fort Bliss as a major factor in the need to expand industrial capacity (*28*).

San Antonio International Airport (SAT)

Airport Name

This section describes San Antonio International Airport (SAT)

Category and Geographical Location

San Antonio International Airport is classified as large metro– inner city/surface street access. San Antonio International Airport is located approximately 8 miles north of downtown San Antonio. SAT is owned and operated by the City of San Antonio.

Nearest Freeway(s) and Distance(s)

SAT is located in northern San Antonio northeast of the intersection between the IH 410 inner loop and US 281. It is probable that truck traffic not originating in the immediate area is coming from IH 35, which runs north-south approximately 4 miles east of the airport or IH 37, which comes into downtown San Antonio from the southeast, becomes US 281, and continues north to the airport and beyond. Additional freight traffic comes in from IH 10, which travels east-west through the city and provides another major access route for freight in San Antonio. The city's outer loop, Loop 1604, runs east-west just 2 miles north of the airport. Figure 60 shows an overhead photo of the airport, and Figure 61 shows its layout as shown in the 1998 master plan. The East Cargo area is highlighted by the circle on the right side of the Figure 60. The West Cargo area is just north of the passenger terminal area and in the circle on the left side of the figure.

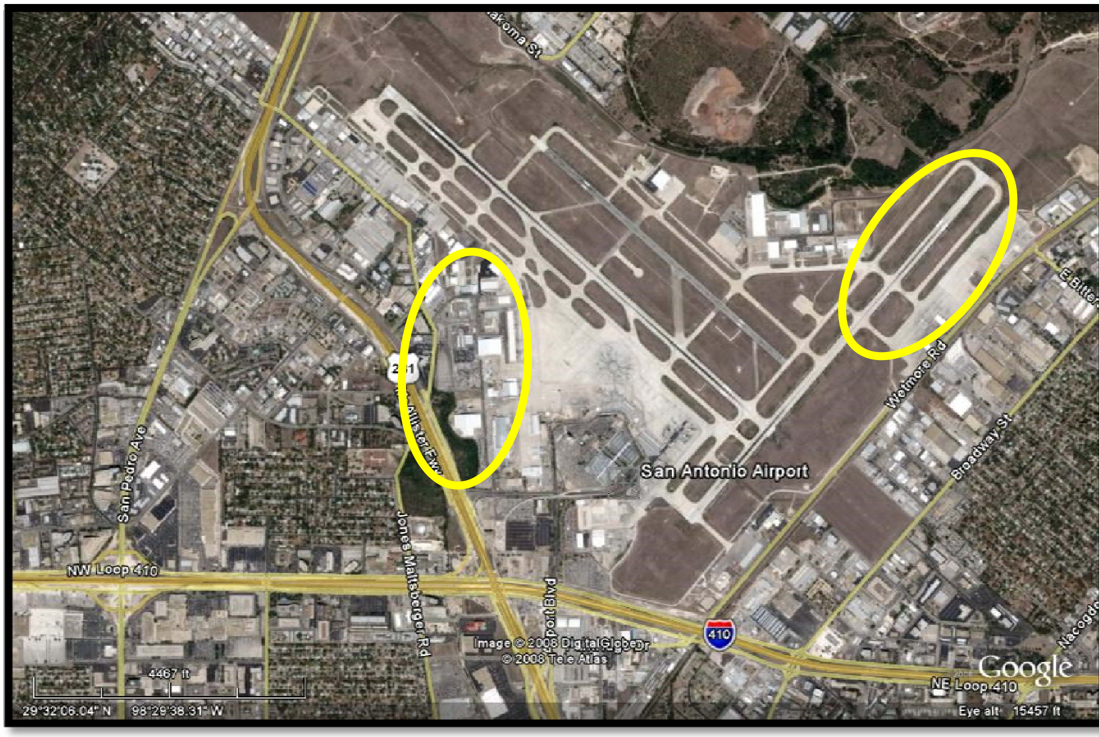


Figure 60. San Antonio International Airport.

The dense roadway network around the airport, as well as the location of the Union Pacific Railroad southeast of the airport, limits opportunities for expansion of airport infrastructure. Expansion would allow for longer runways that could service heavier and dedicated aircraft, such as those engaged in international air freight operations. As a result, much of the freight activity at SAT is related to small packages and cargo transported in commercial passenger aircraft bellies.

Access/Entry/Gateway Points

The primary entrance to SAT's dedicated freight facilities is via Wetmore Road, a southwest to northeast local four lane roadway forming the southeastern boundary of the airport and offering direct highway access to the East Cargo area. A second cargo center is the West Cargo area on West Cargo Road and John Saunders Road that service UPS, FedEx Freight, and other small package companies who primarily utilize aircraft belly cargo services. The two passenger terminals are located at the southwest corner and one is still under construction. Primary passenger access to the airport is provided by US 281.

Freeway Connection/Route Characteristics

There is no signalized intersection where Wetmore Road meets the East Cargo area entry. Freight traffic entering the SAT area from the west via Wetmore Road faces difficulty in turning left across opposing traffic in order to enter the East Cargo area of the airport. As a result, trucks must often continue eastbound on Wetmore, then U-turn onto the westbound direction, and make a right turn entry into the East Cargo area. Other possible access routes to the East Cargo area include the partially completed Wurzbach Parkway. Figure 61 shows the planned route of Wurzbach Parkway on the northern side of the airport connecting US 281 and Wetmore Road. When completed, Wurzbach Parkway is expected to lead to an increase in the number of trucks entering the airport from the northeast via Wetmore Road.

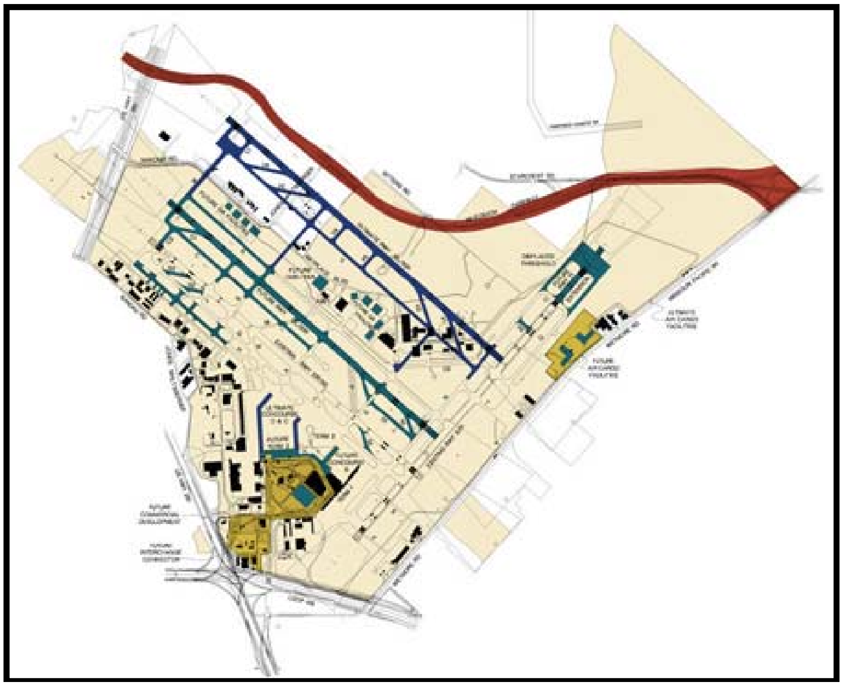


Figure 61. San Antonio International Airport—Wurzbach Road Plans.

The concrete pavement on Wetmore Road appears to be in good condition overall. Wetmore Road carries 23,823 vehicles per day and runs parallel to the Union Pacific Railroad route (*29*). Figure 62 shows Wetmore Road from the northeast looking southwest toward the East Cargo area. As noted above, the entrance to the East Cargo area is located along Wetmore Road but there is no signalized intersection—and obviously no features such as protected left/right turn signal phase or wide left/right turn lanes that would ease the movement of truck traffic entering or departing the freight area.

Figure 62. San Antonio International Airport—Wetmore Road and Wurzbach Parkway.

As Figure 62 shows, Wetmore Road and Wurzbach Parkway is a signalized intersection. Adding another signalized intersection at the entrance to the East Cargo area may prove difficult due to several factors including:

- Need for appropriate spacing between signals.
- Traffic back-up along the roadway caused by truck turning movements.
- Adjacent railroad right-of-way.
- Nearby location of a school bus route and parking facility just northeast of the cargo entrance and south of Wetmore Road.

Figure 63 shows the entrance to the East Cargo area from Wetmore Road and the high level of automobile traffic through which truck drivers must navigate in order to access the cargo facilities. Left turns from the opposite direction (eastbound) must yield to this traffic or plan on entering the area from the westbound direction. The fire hydrant at the corner poses another obstacle to trucks entering and leaving the facility. Internal parking and maneuvering room for trucks at the facilities inside the cargo area is also constrained by the existence of personal vehicle parking areas. The number of bays at current facilities allows for several trucks to be serviced at the same time. The airport's long term plan includes plans for expansion of the cargo area and construction of new facilities farther to the northeast along Wetmore Road.

Figure 63. San Antonio International Airport— Exit from East Cargo Area to WB Wetmore Road.

Wayfinding (Off Site and On Site)

At the West Cargo area, confusing one-way roads and signage along with tight turn radii result in reduced compatibility with larger trucks. Airport planners stated that access is almost limited to smaller box trucks, which are the typical service vehicle in the area. Figure 64 shows the signage at the entrance to the West Cargo area. In addition to its freight facilities, the West Cargo area is home to an airport branch of the U.S. Post Office and its associated postal distribution center, aircraft part vendors, aircraft maintenance facilities, and a new hangar. Truck and auto traffic generated by these facilities results in high levels of traffic conflict.

Figure 64. San Antonio International Airport—Signage/Turn Radii at Entrance to West Cargo Area.

Relative Scale of Cargo Activities

SAT ranks 4th in cargo tonnage handled among Texas airports. Figure 65 shows the percentage of market share by type of cargo operation in 2008, and Figure 66 shows the historical trends in air cargo volume in the preceding 10-year period (1999–2008), as obtained from the airport's 2008 Annual Report. During the site visit, planners stated that it is possible that traffic would decrease in 2009, then make a slow recovery, and reach historical forecasts again by 2013 or 2014.

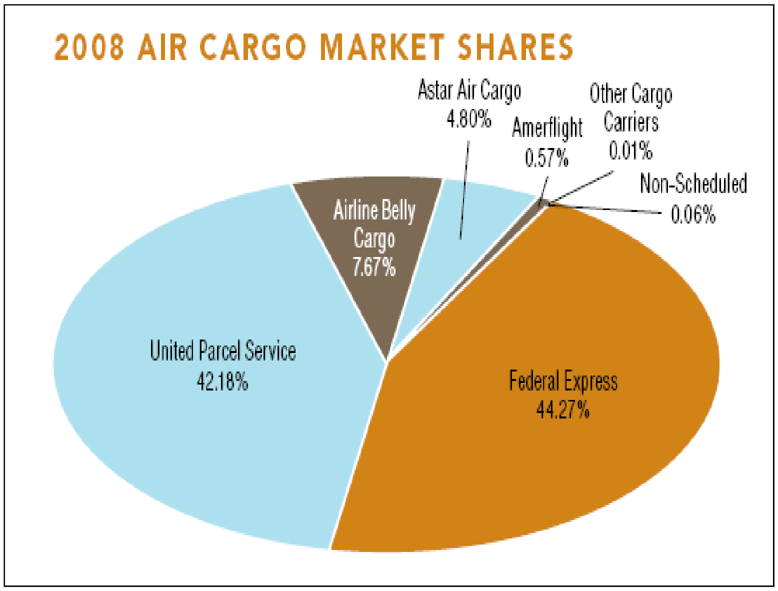


Figure 65. San Antonio International Airport—Air Cargo Market Shares.

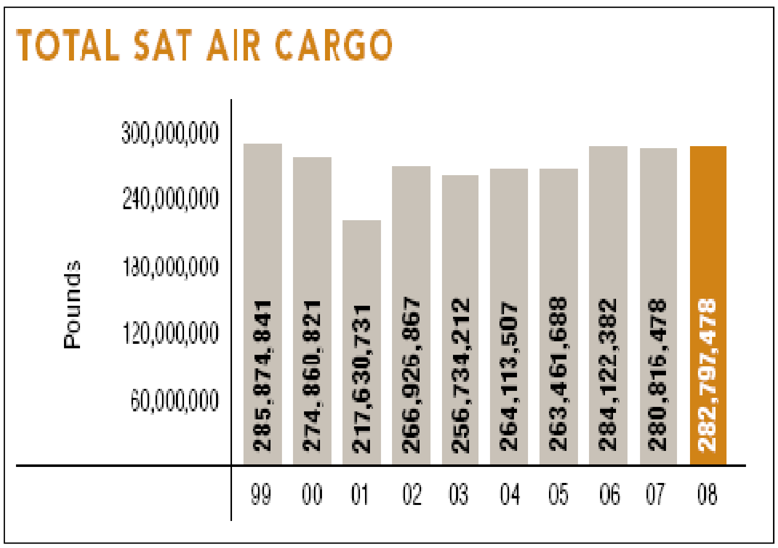


Figure 66. San Antonio International Airport—Air Cargo Volume Historical Trends.

Future Planning Activities

Current planning efforts at SAT are seeking to enter into a cooperative mode with the Port San Antonio airport and Stinson Airport to provide an overall plan for the San Antonio area. AECOM consulting is currently under contract with SAT to complete a new master plan for the airport. SAT is extending Runway 3/21 by 1000 ft to allow for an increase in freight operations, anticipated increased use of larger planes such as the Boeing 777 by UPS/FedEX, and increased belly cargo operations. Heavier freight may be handled at the Port San Antonio airport, which has a longer runway shared with continued operations of the U.S. Air Force. Recent TxDOT projects have improved access to the airport from IH 410 and other major highways. Many of the needed landside freight access improvements that remain are related to local roadways. Seeking a way to cooperatively work toward implementation of these improvements should be the focus of TxDOT efforts. Figure 67 shows cargo, packages, and luggage being loaded on to the belly of a Southwest Airlines Boeing 737 aircraft, taken during the research team's site visit to SAT.

Figure 67. San Antonio International Airport—Belly Cargo Loading.

LARGE METRO—URBAN FRINGE/DIRECT FREEWAY ACCESS

George Bush Intercontinental Airport (Houston)

Airport Name

This section describes George Bush Intercontinental Airport.

Category and Geographical Location

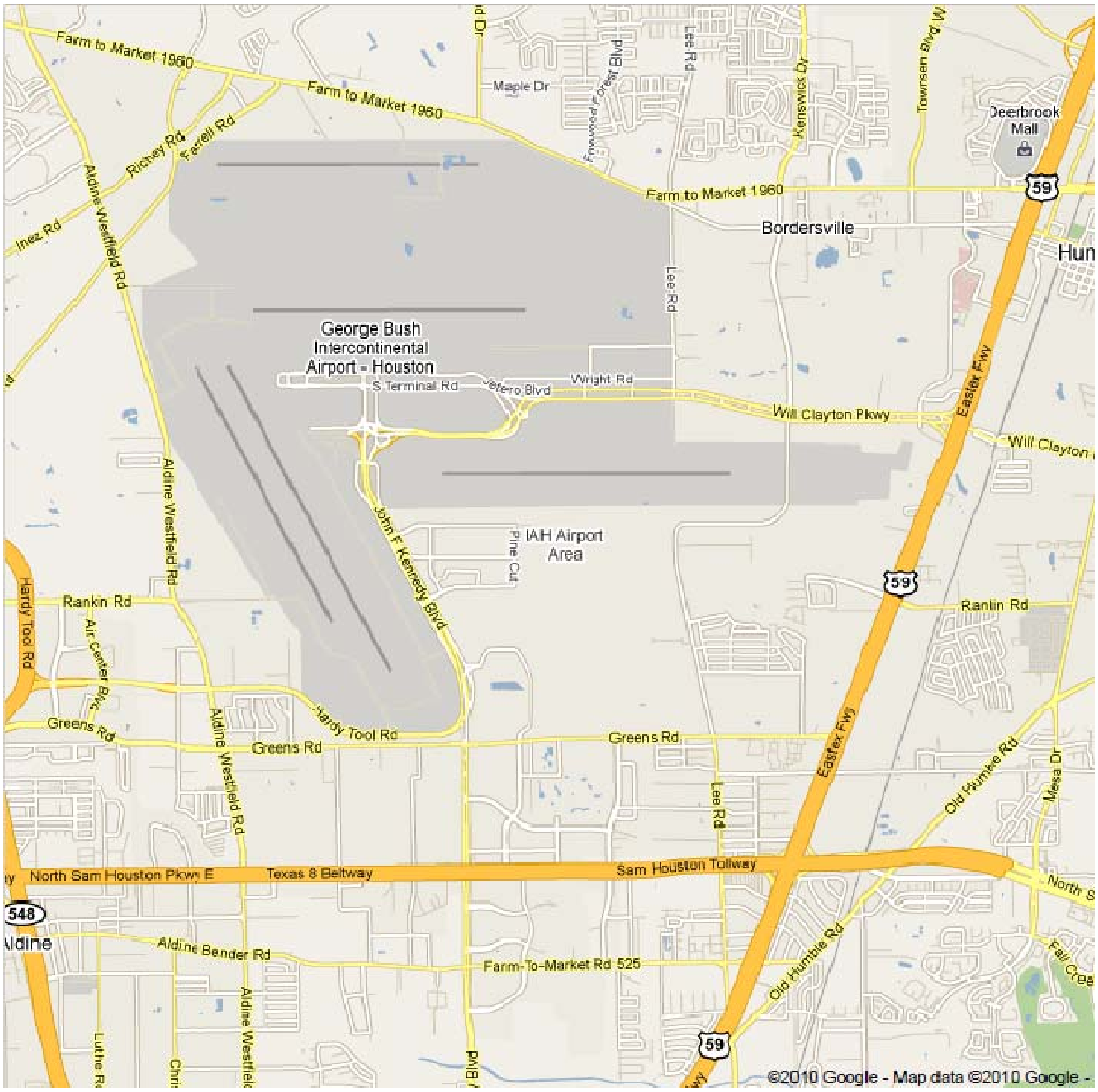
George Bush Intercontinental Airport is classified as large metro—urban fringe/direct freeway access. George Bush Intercontinental Airport is located 15 miles north of downtown Houston.

Nearest Freeway(s) and Distance(s)

George Bush Intercontinental Airport is located 15 miles north of Houston's central business district. The airport is bound by FM 1960 to the north, US 59 to the east, Beltway 8 to the south, Hardy Toll Road (Texas 548) to the west, and IH 45 farther west. A Hardy Toll Road spin-off leads to the south side of the airport (airport connector).

Access/Entry/Gateway Points

Access to the airport is provided by three routes. Two of these utilize John F. Kennedy Boulevard to the south, and the third utilizes Will Clayton Parkway to the east. John F. Kennedy Boulevard connects directly both to Beltway 8 (Sam Houston Tollway) and to Hardy Toll Road, and indirectly to IH 45 via Beltway 8 (Sam Houston Tollway). Will Clayton Parkway connects directly to US 59. Figure 68 shows an area map of the airport and the roadway network.



Source: Google Maps

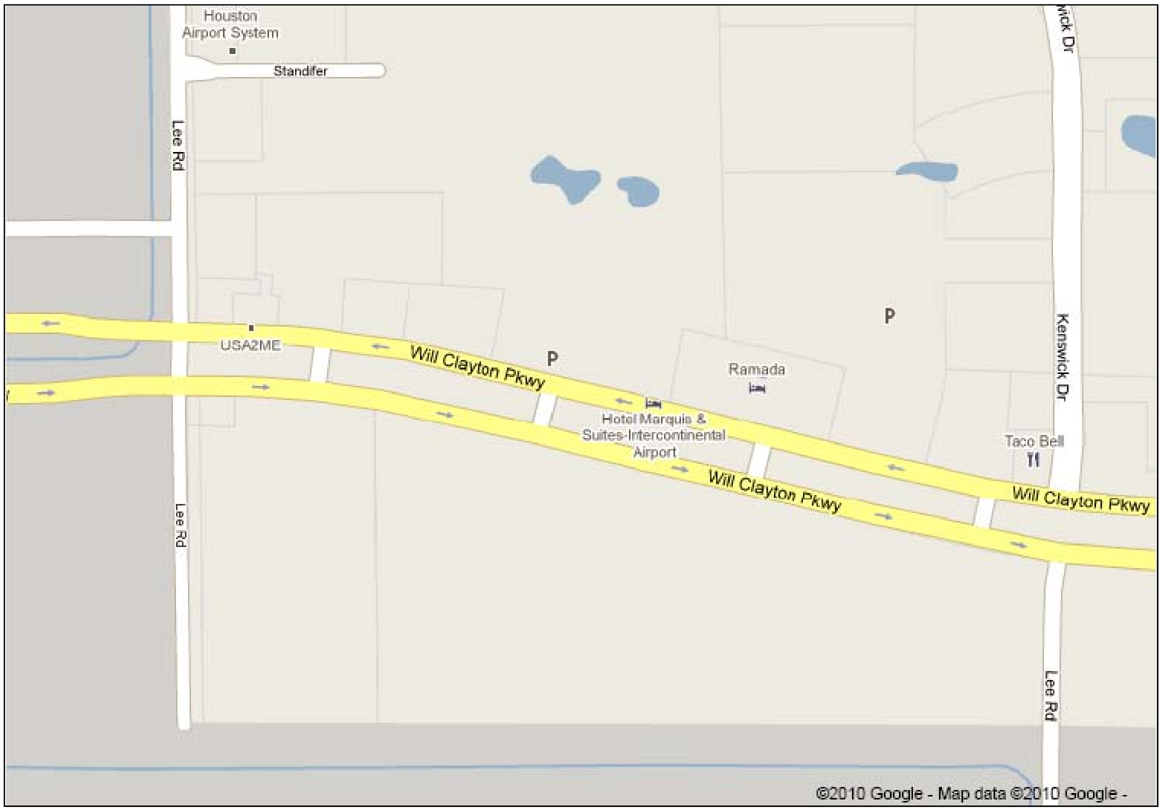
Figure 68. George Bush Intercontinental Airport Area Map.

Freeway Connection/Route Characteristics

For the most part, access to the cargo center (CargoCenter) and the passenger terminals is provided by the same airport roads. Both access roads, John F. Kennedy Boulevard and Will Clayton Parkway, are multi-lane, divided arterials with signalized intersections. John F. Kennedy Boulevard is a six-lane roadway, and Will Clayton Parkway is a four- to six-lane roadway. Access routes to the CargoCenter that would minimize conflict between truck traffic and passenger traffic are US 59 through Will Clayton Parkway or FM 1960 from the east, and IH 45 through FM 1960 from the west. The first option, US 59 through Will Clayton Parkway, however, presents unique challenges described below.

The Cargo Center is located at the northeast corner of the airport, and direct access to it is provided by north Lee Road, a north-south two-lane, undivided connector that is heavily used by non-airport-related local traffic. North Lee Road is located on airport grounds and connects FM 1960 south to Will Clayton Parkway, with signalized intersections at each end. It is a narrow roadway with shoulders that drop off, conditions that are not conducive to truck movement. Lee Road south of the Will Clayton Parkway intersection is a dead end. However, a second leg of south Lee Road starts a little farther east on Will Clayton Parkway at its confluence with Kenswick Drive and leads all the way south to Beltway 8. Therefore, traveling southbound on north Lee Road requires a left turn at the signalized intersection with Will Clayton Parkway and a right turn at south Lee Road in order to travel southward to Beltway 8.

However, there is no traffic intersection at the geographic confluence between Will Clayton Parkway, south Lee Road, and Kenswick Drive. A median separates the two traffic directions of Will Clayton Road. Hence, westbound trucks on Will Clayton Parkway, which would include southbound Kenswick Drive trucks, need to U-turn onto the eastbound direction after passing the confluence in order to eventually turn right at south Lee Road and continue toward Beltway 8. Similarly, northbound trucks on south Lee Road need to turn right on eastbound Will Clayton Parkway and later U-turn onto the westbound direction in order to travel toward Kenswick Drive or north Lee Road. Large complexes, including the warehouses and offices of several high-profile freight forwarders, located on Kenswick Drive generate significant levels of heavy truck traffic. This complex and inefficient road network configuration are shown in Figure 69.



Source: Google Maps

Figure 69. George Bush Intercontinental Airport—Will Clayton Parkway and Lee Road.

The lack of direct access between Will Clayton Parkway, south Lee Road, and Kenswick Drive, as well as the substandard roadway geometrics on north Lee Road, lead to truck-traffic circulation and access problems as well as pavement damage caused by inadequate turning radii to accommodate large trucks. These issues are evident in the following figures. North Lee Road near the CargoCenter is shown in Figure 70. Figure 71 shows a turnaround that is necessary to use when traveling between Will Clayton Parkway and south Lee Road and that is in comparatively good condition. Figure 72 through Figure 75 show the pavement and curb damage incurred due to the inadequacy of turning radii to accommodate truck maneuvering in this complex network. Figure 76 shows the intersection between westbound Will Clayton Parkway and north Lee Road where pavement and curb repair has clearly taken place.

Figure 70. George Bush Intercontinental Airport—North Lee Road.

Figure 71. George Bush Intercontinental Airport—Turnaround on Eastbound Will Clayton Parkway.

Figure 72. George Bush Intercontinental Airport—Turnaround on Eastbound Will Clayton Parkway.

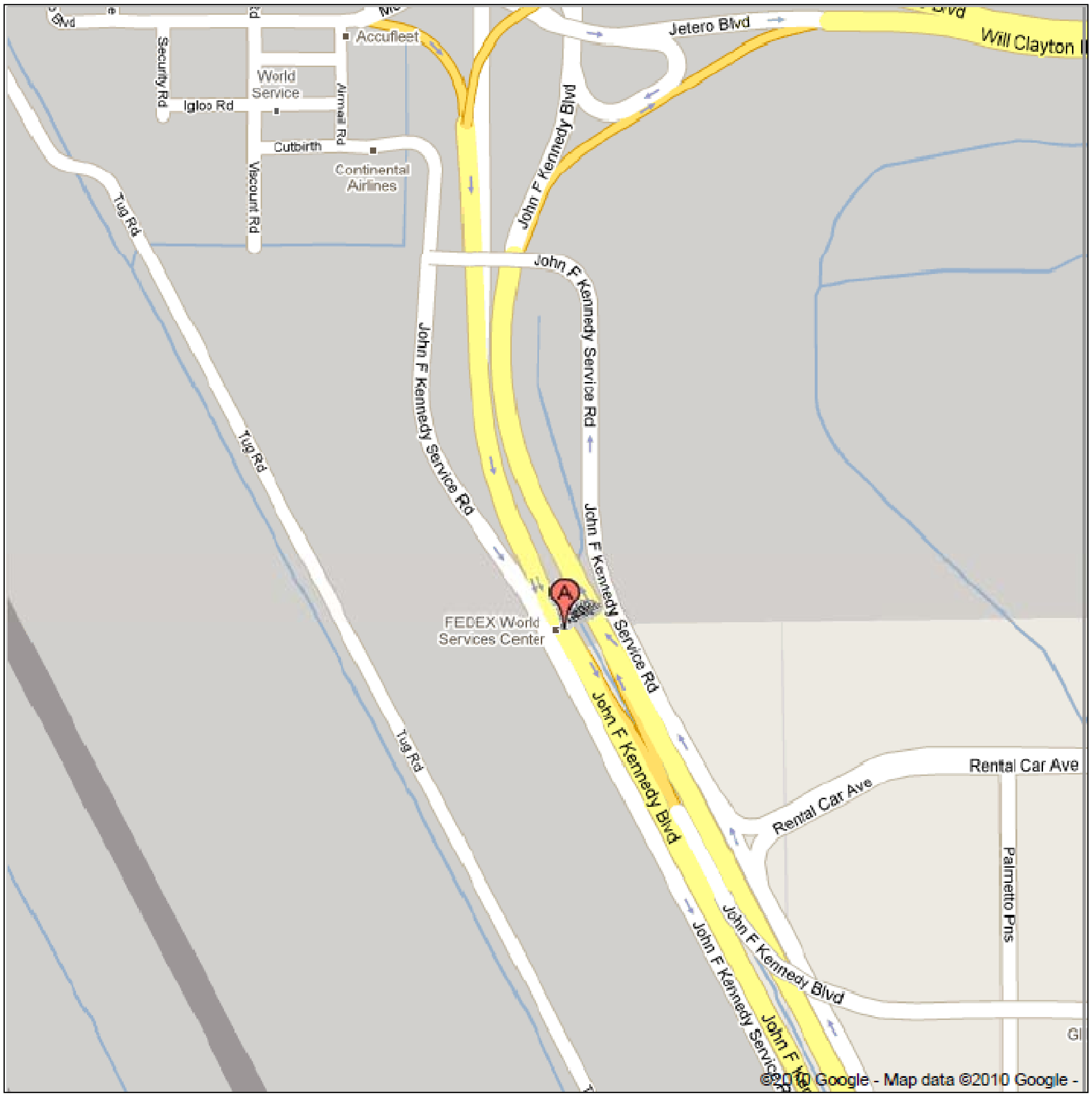
Figure 73. George Bush Intercontinental Airport—Turnaround on Eastbound Will Clayton Parkway.

Figure 74. George Bush Intercontinental Airport—Turnaround on Eastbound Will Clayton Parkway.

Figure 75. George Bush Intercontinental Airport—Turnaround on Westbound Will Clayton Parkway.

Figure 76. George Bush Intercontinental Airport—Intersection of Westbound Will Clayton Parkway and North Lee Road.

Additional cargo operations take place at the FedEx World Services Center located just west of John F. Kennedy Boulevard. Access to this facility is provided by the John F. Kennedy Service Road, which feeds off John F. Kennedy Boulevard from both the northbound direction via the turnaround and the southbound direction via an exit. The exit onto the Service Road is just before the FedEx facility noted by the “A” in Figure 77.



Source: Google Maps

Figure 77. George Bush Intercontinental Airport—FedEx Cargo Area Map.

Wayfinding (Off Site and On Site)

Signage providing directions to the airport along all three major routes in the vicinity is clear, concise, and easily visible, as one would expect at a major international airport. Signage on both John F. Kennedy Boulevard and Will Clayton Parkway directs drivers to the entrances to the passenger terminals and to the cargo center. Signs directing drivers to the FedEx facility are also present off John F. Kennedy Boulevard. Figure 78 and Figure 79 show directional signage to the CargoCenter on eastbound Will Clayton Parkway. Figure 80 shows directional signage to the CargoCenter on westbound Will Clayton Parkway.

Figure 78. George Bush Intercontinental Airport—CargoCenter Signage on Eastbound Will Clayton Parkway.

Figure 79. George Bush Intercontinental Airport—CargoCenter Signage on Eastbound Will Clayton Parkway.

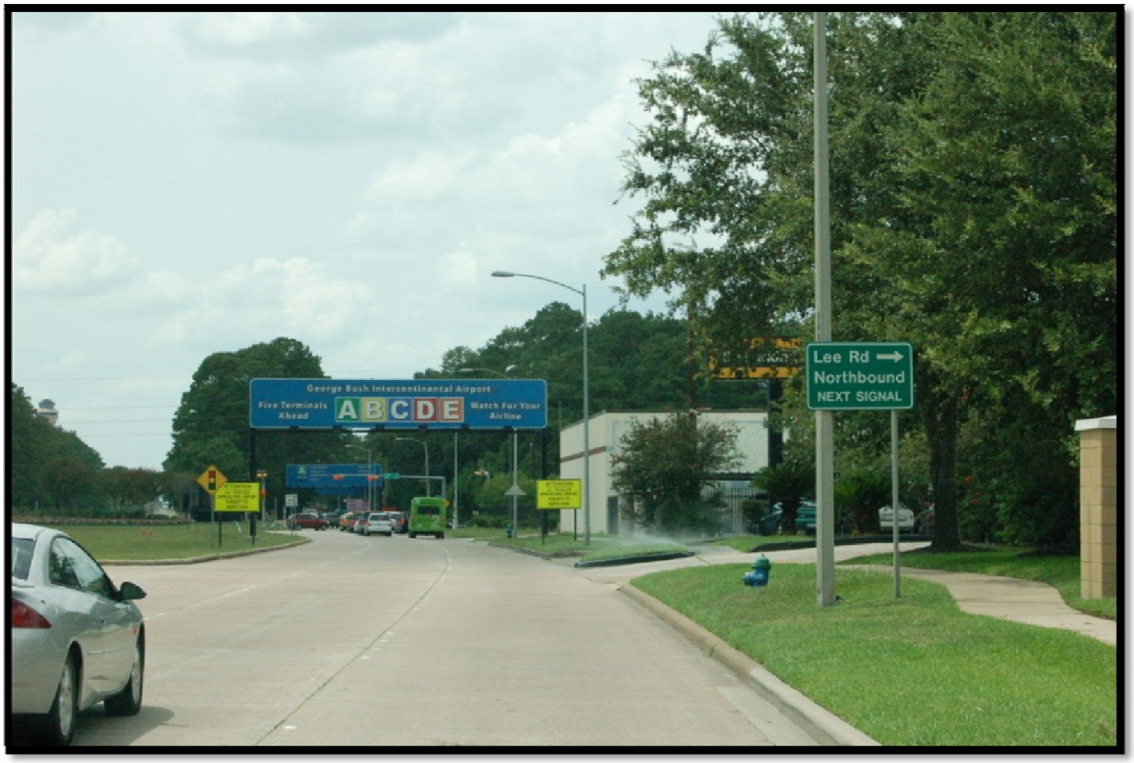


Figure 80. George Bush Intercontinental Airport—CargoCenter Signage on Westbound Will Clayton Parkway.

Relative Scale of Cargo Activities

George Bush Intercontinental Airport is the 11th largest in the United States by volume of international cargo and the 16th largest by volume of total cargo. Statewide, it ranks second behind Dallas/Fort Worth International Airport.

The airport provides services to air freighters of all sizes including the Antonov AN-225, the world's largest/heaviest freighter. The airport has 2.5 million sq ft of cargo apron and 800,000 sq ft of warehouse space in total. There are three cargo areas at the airport with most of the activity occurring in two. The first (CargoCenter) is in the northeast part of the airport located off Cargo Facility Roadway and Lee Road, both of which are accessible from Will Clayton Parkway. The second area is an airfield support/cargo area and is located just west of the first location off Will Clayton Boulevard. It has minimal cargo operations but includes a Continental Airlines mail-sort facility. The third area is the air-cargo distribution center located off John F. Kennedy Boulevard in the center of the airport complex. It includes the FedEx World

Services Center and has direct access to frontage roads. USDA inspection and Customs operations are located on site, and the nearest foreign-trade zone is 5 miles away.

According to airport officials, there are 41 air-cargo-related tenants, including 31 all-cargo or combination carriers, 3 third-party developers, and 7 ground-handling companies. The Air Cargo World *2009 Airport Directory* (*27*) states that there are 400 freight forwarders operating in the airport and hundreds more in the Houston region. Figures 14 through 17, respectively, show satellite images of the airport and surrounding road network, the cargo apron located at the northeast part of the airport off Will Clayton Parkway and Lee Road, the cargo and airfield support area located off Will Clayton Parkway, and the air-cargo distribution center located in the center of the airport complex off John F. Kennedy Boulevard.

Shared or Separate Access to Cargo Areas

Access to the passenger terminals and to the cargo areas is largely the same. The CargoCenter is located in the east side of the airport off Lee Road and accessed from both FM 1960 and Will Clayton Parkway. Traffic to and from the FedEx facility utilizes John F. Kennedy Boulevard, as does passenger-terminal traffic.

Future Planning Activities

George Bush Intercontinental Airport recently completed a fumigation center located on the north side of the cargo area. A cold-storage facility to house flowers and other perishable cargo was also recently completed and is now partially occupied. This is expected to contribute to cargo growth at the airport. The airport is also currently considering an expansion of the CargoCenter as well as initiation of an environmental impact study of future runway expansion.

Additional Airport/Air-Cargo Characteristics. The airport handles both domestic and international air freight. In 2008, it handled more than 200,000 metric tons of international air freight consisting of:

- Industrial equipment and computers.
- Articles of iron or steel.
- Electrical machinery, equipment, and parts.
- Optic, photographic, and medical equipment and parts.
- Plastics and plastic articles.

The airport estimates that it accommodates an estimated 1500 truckloads a month or 50 trucks per day based on an average or typical truckload of 44,000 lb. The radius of ground-freight movement from the airport is up to 1000 miles.

The largest aircraft accommodated by the airport include the Antonov AN-225, the Airbus A-380, and the Boeing 747-800 series. The most distant freight destinations include Doha, Qatar; Moscow, Russia; and Hong Kong, China.

The airport works with the Houston Galveston Area Council (HGAC), the Metropolitan Transit Authority of Harris County (Houston METRO), and other transportation-planning entities to plan ways of integrating their facilities into an intermodal transportation system. This includes incorporating high-speed rail, rapid transit, and seamless interchange between airport and rail into the airport master plan.

The expected growth at the airport is also a function of its strategic advantages. On the air side, these include location and proximity to Mexico and Latin America, impressive ramp capacity able to accommodate 20 wide-body freighters, and additional room to expand. On the land side these include intermodal advantages consisting of proximity to major interstate highways and the Port of Houston.

Will Rogers World Airport (Oklahoma City)

Airport Name

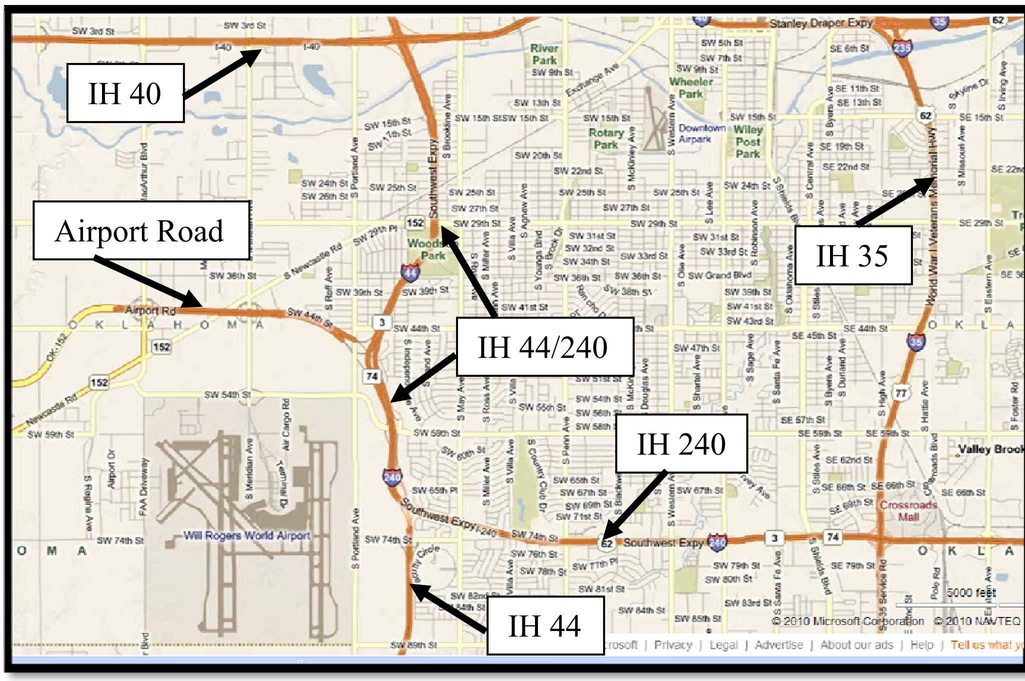
This section describes Will Rogers World Airport (OKC). The City of Oklahoma City is the owner, and the City Department of Airports manages the airport.

Category and Geographical Location

Will Rogers World Airport is classified as large metro—urban fringe/direct freeway access. Will Rogers World Airport is located on approximately 8000 acres, approximately 6 miles southwest of downtown Oklahoma City. For the most part, the airport is buffered from the nearest land uses by undeveloped land and roads. There are some office, industrial, and training facilities adjacent to the northwest side of the airport.

Nearest Freeway(s) and Distance(s)

IH 44 runs north-south, approximately 1 mile east of the airport, and IH 40 runs east-west, approximately 3 miles north of the airport. IH 240 runs east-west from IH 44 to IH 35 and runs north-south, concurrent with IH 44 near the airport. The closest freeway is Airport Road, which runs primarily east-west from IH 44 to points west of the airport. Airport Road becomes SH 152 just west of its intersection with South Meridian Avenue. Figure 81 shows a map of the airport and surrounding roads.



Source: BingMaps.com

Figure 81. Will Rogers World Airport and Surrounding Roadway Network.

Access/Entry/Gateway Points

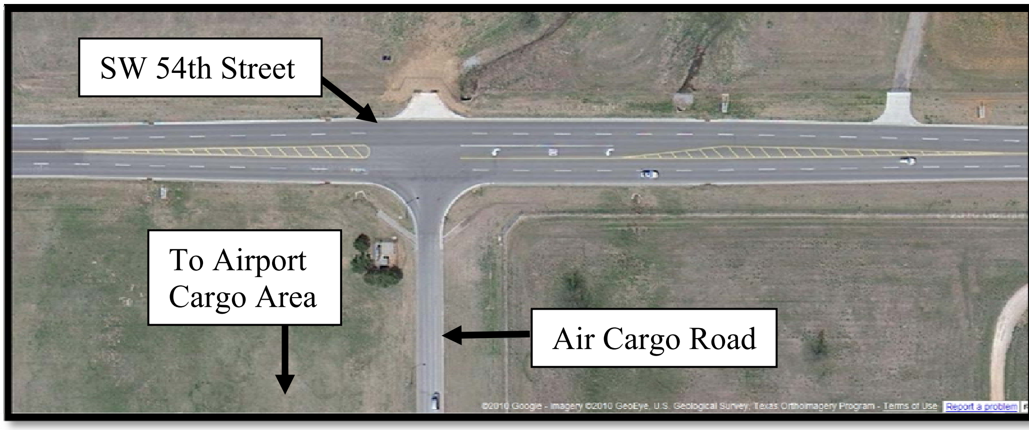
Will Rogers World Airport can be accessed from IH 44/240 via SW 50th Street (which becomes SW 54th Street as it approaches the airport) and from Airport Road via Meridian Boulevard, which runs north-south. The primary airport gateway is on Meridian Boulevard where it intersects Terminal Drive, which becomes the airport-terminal circulation road (see Figure 82).

Figure 82. Southbound Airport Road Veers off from Meridian Boulevard.

Freeway Connection/Route Characteristics

Meridian Boulevard connects Airport Road, as well as IH 44, to the airport. The surrounding land is mainly undeveloped. The segment Meridian Boulevard between Airport Road and the airport was recently improved to four lanes, and the intersection at SW 54th Street features a grade separation. The Meridian Boulevard traffic passes over SW 54th Street, eliminating the need for traffic on Meridian Boulevard to stop. SW 54th Street carries traffic from IH 44/240 to the airport.

Freight traffic is separated from passenger traffic at two points. The primary freight access point is Air Cargo Road where it runs south from SW 54th Street. Air Cargo Road runs north-south from SW 54th Street to the cargo facility, which is located on the east side of the airport. One point of separation is on SW 54th Street at Air Cargo Road, where freight traffic destined for the airport turns south on Air Cargo Road. SW 54th Street is mainly a four-lane, undivided road in this area, with a left-turn land and associated transitions at the Air Cargo Road intersection. This intersection has sufficient turning radii for long-wheelbase trucks, as seen in Figure 83. Air Cargo Road is a two-lane road as seen in Figure 84. Freight buildings are typically located a sufficient distance from Air Cargo Road to allow trucks to maneuver completely on site. The driveways also have sufficient turning radii for long-wheelbase trucks, shown in Figure 85.



Source: GoogleMaps.com

Figure 83. SW 54th Street-Air Cargo Road Intersection at OKC.

Figure 84. Air Cargo Road at OKC.

Figure 85. Driveway and Building Setback from Air Cargo Road.

Wayfinding (Off Site and On Site)

Field observations found no signs on eastbound IH 40 to direct traffic to the airport. A sign on westbound IH 40 directs traffic to take a left exit to Will Rogers World Airport (following IH 44), 1 mile in advance of the interchange. Signs in both directions on IH 44 indicate the exit for Airport Road but make no mention of Will Rogers World Airport, nor do the signs have a typical airport placard. The first sign on IH 44 for Airport Road appears 2 miles in advance of the interchange. A sign on westbound Airport Road advises traffic that the next exit is for southbound Meridian Avenue and the airport. This sign is approximately 0.25 miles prior to the exit and does not afford much opportunity for traffic to weave from the left-hand lane. A similar sign is approximately 0.75 miles in advance of the exit on the eastbound side of Airport Road. There are relatively small signs on SW 54th Street informing motorists that they are approaching the Air Cargo Road intersection.

One of the best examples of signage observed by the research team is the standard address sign for facilities along Air Cargo Road. Figure 86 shows examples of these signs, which feature large numerals that help motorists identify locations easily. Directional signage on Meridian Avenue, approaching the airport from the north, is not of a consistent nature. One sign, as seen in Figure 87, features multiple colors for lettering, backgrounds, and directional arrows.

Figure 88 presents a sign providing directions to parking areas, as well as an overhead sign in the background that provides directions to various facilities.

Figure 86. Address Signage on Air Cargo Road.

Figure 87. Directional Signage on Meridian Avenue.

Figure 88. Signs on Meridian Avenue at OKC.

Relative Scale of Cargo Activities

Cargo activity at the two air-cargo areas and the industrial park represents a significant overall number of truck movements into and out of the airport property. The recent development of the Air Cargo Center, along with future plans to construct additional air-cargo facilities on adjacent tracts, indicates a firm belief by the airport, city, and regional planners that air cargo will continue to grow in the El Paso region.

Shared or Separate Access to Cargo Areas

The cargo area is separate from the passenger terminal. Some freight and passenger traffic may be comingled on Meridian Avenue between Airport Road and Amelia Earhart Lane, where freight traffic is directed to turn left toward Air Cargo Road. Other freight traffic approaches the cargo area from SW 54th Street, turning south on Air Cargo Road. This freight traffic does not have an opportunity to be comingled with passenger traffic on Meridian Avenue/Terminal Drive.

Future Planning Activities

There are no plans to expand the air-cargo facilities at the time of this report.

DEDICATED FREIGHT

Alliance Airport (Fort Worth)

Airport Name

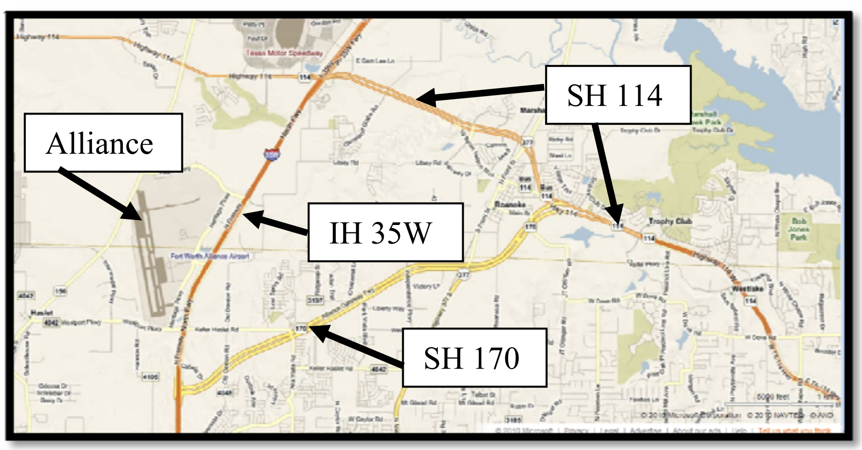
This section describes Alliance Airport.

Category and Geographical Location

Alliance Airport is classified as dedicated freight. Alliance Airport is located approximately 20 miles north of downtown Fort Worth.

Nearest Freeway(s) and Distance(s)

IH 35W is approximately 1 mile east of Alliance Airport. While IH 35W is the only freeway providing direct access to the airport, two other major highways, SH 114 and SH 170, intersect IH 35W north and south of the airport, respectively. These two highways are planned to become controlled-access facilities in the future. Figure 89 is a map of the area, and Figure 90 shows the view of Alliance Airport from northbound IH 35W.



Source: BingMaps.com

Figure 89. Map of Alliance Airport Area.

Figure 90. View of Alliance Airport from Northbound IH 35W.

Access/Entry/Gateway Points

There are three major access points to Alliance Airport from IH 35W. Eagle Parkway provides access at the north end of the airport, Alliance Boulevard provides direct access to the main building at the center of the airport, and FM 4042/Westport Parkway provides access at the south end.

Freeway Connection/Route Characteristics

Alliance Airport is one element of the Alliance Texas development, which includes numerous distribution centers/warehouses, industrial activity, and a large Burlington Northern Santa Fe (BNSF) rail intermodal facility. The three interchanges and associated roads listed above provide access to Alliance Airport and the other use components of the Alliance Texas development. These connector roads between IH 35W and the airport are excellent examples of streets designed to provide landside freight access to an airport.

The southern access point, Westport Parkway, is potentially used more by trucks accessing the BNSF intermodal facility and nearby warehouses than by trucks accessing the airport. Westport Parkway is a four-lane, divided street from IH 35W, west to immediately beyond Heritage Parkway, which leads to the Alliance Airport main building. Beyond that point, Westport Parkway is a two-lane street. The intersections at IH 35W and Heritage Parkway both have geometrics that provide turning radii necessary for long-wheelbase trucks accessing Alliance Airport and the surrounding development. Figure 91 provides a view of Westport Parkway, facing west from IH 35W, including the turning radius to accommodate trucks.

Figure 91. Westport Parkway, Facing Westbound from IH 35W.

Alliance Boulevard is the central access point from IH 35W and provides access to the main buildings, general-aviation facilities, and control tower. It also provides access to the FedEx facility that has airside services. Because Alliance Boulevard was built to serve Alliance Airport, its intersections at the IH 35W interchange and Heritage Parkway have excellent turning radii for long-wheelbase trucks, as presented in Figure 92. Alliance Boulevard is a four-lane, divided street from the IH 35W interchange to the main buildings at the airport.

Figure 92. Turning Radius to Accommodate Large Trucks—Intersection of Alliance Boulevard at Heritage Parkway.

Eagle Parkway, the northern access point for the airport, provides access to the FedEx facility (via Heritage Parkway), an American Airlines maintenance base, and several warehouse and industrial facilities. It is a four-lane, divided street with intersections designed to accommodate long-wheelbase trucks. Figure 93 presents the turning radius provided to accommodate trucks westbound on Eagle Parkway from northbound IH 35W.

Figure 93. Truck Turning from Northbound IH 35W Frontage Road to Westbound Eagle Parkway.

Wayfinding (Off Site and On Site)

Approximately 1 mile south of Westport Parkway, signage advises traffic from IH 35W of the three interchanges that provide access to Alliance Airport, as seen in Figure 94. IH 35W has two lanes in each direction through the Alliance Airport area, so trucks in the left-hand lane only have to maneuver through one lane of traffic to access the exits.

Figure 94. Sign Directing Northbound IH 35W Traffic to Alliance Airport.

Signs for the Alliance Boulevard exit on northbound IH 35W include the important feature of advising motorists that the lane is "exit only," as shown in Figure 95. This third northbound lane is continuous between Westport Parkway and Alliance Boulevard.

Figure 95. Exit-Only Sign for Alliance Boulevard on Northbound IH 35W.

Wayfinding on the airport grounds and the surrounding development uses signs of a consistent scheme. The signs are rectangular with white lettering and a blue background. Their appearance is significantly different from typical street signs, potentially standing out to motorists, and they usually appear in groups of three signs on one post. With relatively low speeds and traffic volumes (as observed by researchers on site visits), the signs appear to be sufficient to provide advance notice of intersections and facilities. Figure 96 provides an example of signage on the roadway network around Alliance Airport.

Figure 96. Example of Signage around Alliance Airport.

Relative Scale of Cargo Activities

Alliance Airport ranks third in cargo tonnage handled among Texas airports, behind Dallas-Fort Worth and Houston Intercontinental. Alliance handled over 223,000 tons of cargo, or 11 percent of the total air freight in Texas, in 2007. FedEx is the largest-volume shipper at the airport, while other companies (not identified to the public) handle a variety of medical, automotive, cell-phone, and skidded freight goods. Approximately 110 trucks per day serve the FedEx facility alone. Figure 97 shows the FedEx facility at Alliance Airport.

Figure 97. FedEx Facility at Alliance Airport.

Shared or Separate Access to Cargo Areas

There are no scheduled airlines serving Alliance Airport. General aviation and freight traffic shares Alliance Boulevard for approximately 1 mile between IH 35W and Heritage Parkway. At the time of this study, FedEx was the primary freight shipper with airside access at

Alliance Airport and had the largest freight facility on the airport grounds. The other two access points from IH 35W carry a combination of freight traffic and passenger vehicles of employees and visitors of surrounding facilities. FedEx has its own entrance to its airside facility (see Figure 98); other companies must use the main airport entrance to access airside facilities.

Figure 98. FedEx Entrance at Alliance Airport.

Future Planning Activities

There are plans to extend the main runway from 9600 ft to 11,000 ft. This extension will also require relocating approximately 7 miles of FM 156 and 11 miles of the BNSF railroad. The purpose of the runway extension is to provide freight companies the opportunity to fly non-stop to Europe and Asia (through Alaska) fully loaded. The project is sponsored by the City of Fort Worth, owner of Alliance Airport. Funding has come from the Federal Aviation Administration, Tarrant County, the City of Fort Worth, and the North Central Texas Council of Governments. All of these agencies have been involved in planning the project, and there has been additional coordination with Denton County and the City of Haslet.

Port San Antonio Airport (Kelly Air Force Base)

Airport Name

This section describes Port San Antonio Airport (SKF) (formerly Kelly Air Force Base).

Category and Geography—Location Relative to Major Cities

Port San Antonio Airport actually fits into two classifications: large metro-inner city/surface-street access and dedicated freight. Port San Antonio is located approximately

6 miles southwest of downtown San Antonio at the site of the former Kelly Air Force Base. The airfield is a joint-use civilian/military airport.

Nearest Freeway(s) and Distance(s)

Port San Antonio is a private, although publicly supported, economic redevelopment/re-use project at the former Kelly AFB, which was closed by the Base Realignment and Closure Commission in the 1990s. The overall redevelopment is a broad-based project that includes air and rail freight components along with commuter rail, transit-oriented housing development, and business development through the hosting of several major businesses at the port. The roadway network around the airport, shown in Figure 99, is quite robust. In addition several new roadway upgrades have been recently completed, which will aid in the handling of truck-freight access.

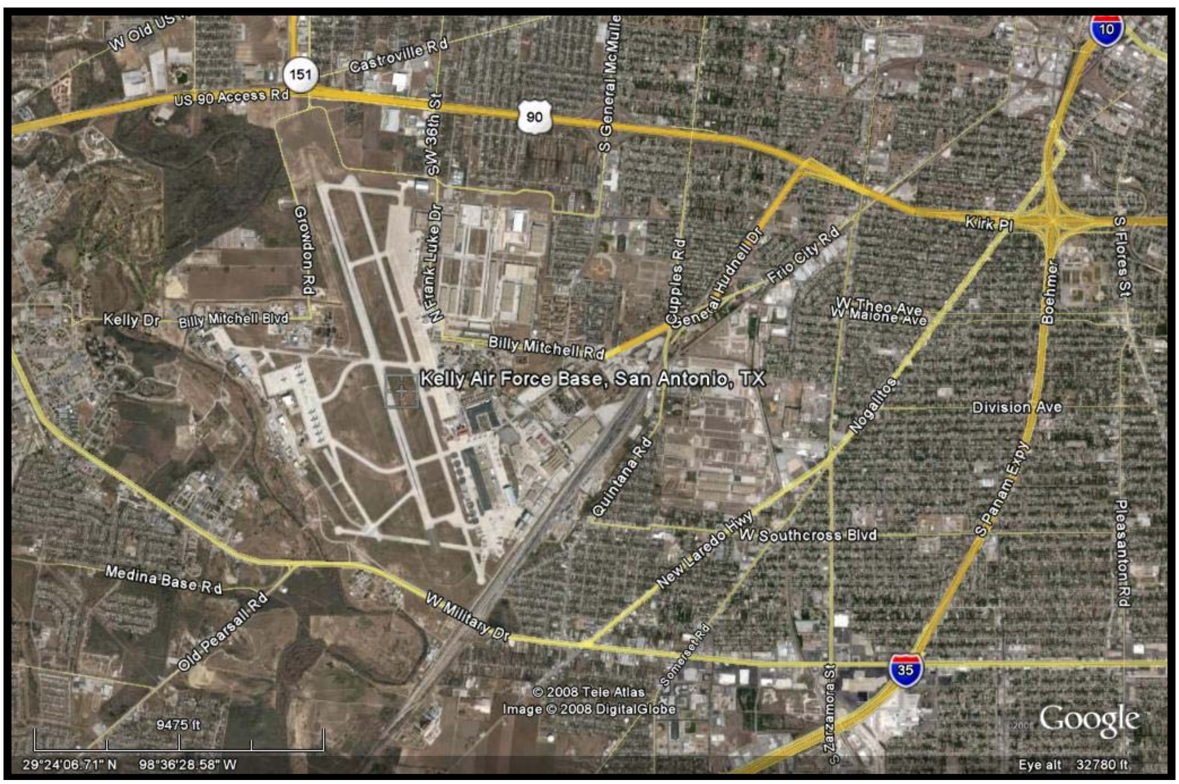


Figure 99. Port San Antonio and Surrounding Roadways.

IH 35 is approximately 2 miles to the east of the airport, providing north-south freight access, and IH 10 is also approximately 3 miles to the northeast, connecting to a major east-west roadway. US 90 runs east-west just north of the airport with major connectors along General Hudnell Drive and Billy Mitchell Road, Frio City Road, and the newly completed 36th Street extension. Military Drive also runs east-west to the south of the airport. Other nearby roads include IH 37 from San Antonio, which also provides access to the southeast and the Port of Corpus Christi and IH 410, which loops the San Antonio urban area near the facility. The eastern side of the Port San Antonio development has a rail yard with connections to the Union Pacific Railroad and BNSF railway.

Access/Entry/Gateway Points

The primary entrance to Port San Antonio's truck-freight facilities will shift to the northern gateway from US 90 via 36th Street and Frank Luke Drive now that it has been completed and opened. Figure 100 shows this new connection in red. This route provides direct access to the newly constructed Air Cargo Facility at the northern end of the airfield. Additional access via General Hudnell Road will remain possible as an alternative but will be discouraged as transit-oriented development, business activity, and residential traffic increase in the business/residential core of the Port San Antonio facility.

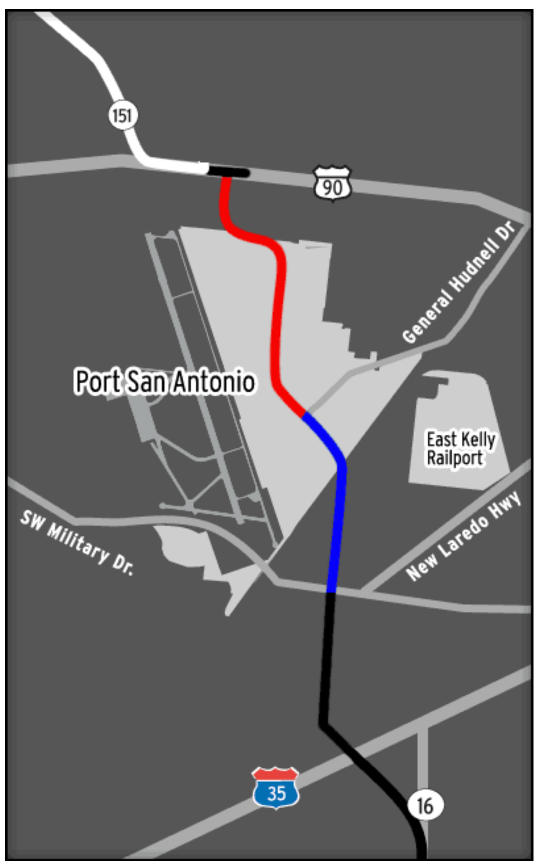


Figure 100. Port San Antonio Airport Roadway Diagram Showing 36th Street Extension.

Freeway Connection/Routes Characteristics

Freight traffic entering the Port San Antonio area will have its best access to the new Air Cargo Facility at the north end of the airfield via the newly opened 36th Street extension and connection with US 90. Roadway conditions are good overall, as shown in Figure 101, which shows Frank Luke Drive/36th Street near the entrance to the air-cargo truck access. Figure 102 and Figure 103 show landside and airside views of the Air Cargo Facility, respectively.

Figure 101. North Frank Luke Drive/36th Street near the Air Cargo Facility.

Figure 102. Landside View of the Port San Antonio Air Cargo Facility.

Figure 103. Airside View of the Port San Antonio Air Cargo Facility.

Figure 101, Figure 102, and Figure 103 show that the new facilities and roadway network are quite adequate for potential future growth of air-cargo operations at Port San Antonio. At the present time, planners at the port are still working to develop air-cargo traffic customers.

Wayfinding (Off Site and On Site)

As traffic into and out of the Air Cargo Facility grows over time, the need for additional traffic signaling along the access road and/or improved turn radii into the parking area on the truck-access area may be needed. While the parking and truck-access areas on the land side of the building are well designed and quite ample, the driveway openings may need to be widened to allow more turning room for trucks. Figure 104 shows the driveway opening, which would allow only one truck/other large vehicle at a time to enter or leave the parking area. This condition is partially addressed by the existence of two driveways, which could allow for traffic-flow planning through the parking area, i.e., one for inbound traffic and one for outbound traffic.

Figure 104. View of Driveway Entrance from 36th Street to the Air Cargo Facility.

Relative Scale of Cargo Activities

At the time of the research team's site visit in December 2009, air-cargo traffic at Port San Antonio was occasional and had been adversely affected by the general decrease in air-cargo traffic due to the wider economic downturn. Several air-cargo charters by Toyota Corporation, which has a nearby production plant, had been the primary user of the new facility up to that time. Ongoing negotiations with the Air Force over runway-traffic-based maintenance fees were also being completed to allow more marketing to take place.

Shared or Separate Access to Cargo Areas

Figure 105 shows Gen. McMullen Drive on Port San Antonio, which was opened in March 2010, allowing another route of traffic between the airfield and other development at Port San Antonio. Former military housing on both sides of the roadway was transferred to the port for redevelopment between the time of the site visit and the March opening.

Figure 105. Gen. McMullen Drive in December 2009.

Figure 106 shows a view of the Lackland Air Force Base operations that continue on the shared runway at Port San Antonio. While the length of the runway and capabilities for air-cargo handling at Port San Antonio are improved, in relation to the existing ones at SAT, ongoing negotiations with the Air Force over around-the-clock joint use of the airfield will be a part of the ongoing development needs of air-freight access to this airport. If additional, around-the-clock operations of civilian air freight are developed, Air Force operations and priority access during emergencies will have to be taken into account by planners. Likewise, around-the-clock operations will also affect the number and times of truck deliveries over TxDOT-maintained and local roads to the airport area.

Figure 106. View of Military Side of Port San Antonio Airfield from the Civilian Side.

Future Planning Activities

Current planning efforts are seeking to bring the Port San Antonio Airport planning efforts into a cooperative mode with San Antonio International Airport and Stinson Airport to provide an overall air-traffic plan for the San Antonio area. Port San Antonio is planned to handle air-cargo growth that cannot be handled by SAT in the future. The Port San Antonio Airport has a longer runway, which it shares with continued operations by the U.S. Air Force. Recent TxDOT projects to improve access to the airport from US 90 and other major highways leaves many of the needed improvements for freight at SAT related to local roadways, which is being addressed by Port San Antonio development planners. Seeking a way to cooperatively work to assist with these improvements should be the focus of TxDOT efforts.

SMALL METRO

Laredo International Airport

Airport Name

This section describes Laredo International Airport.

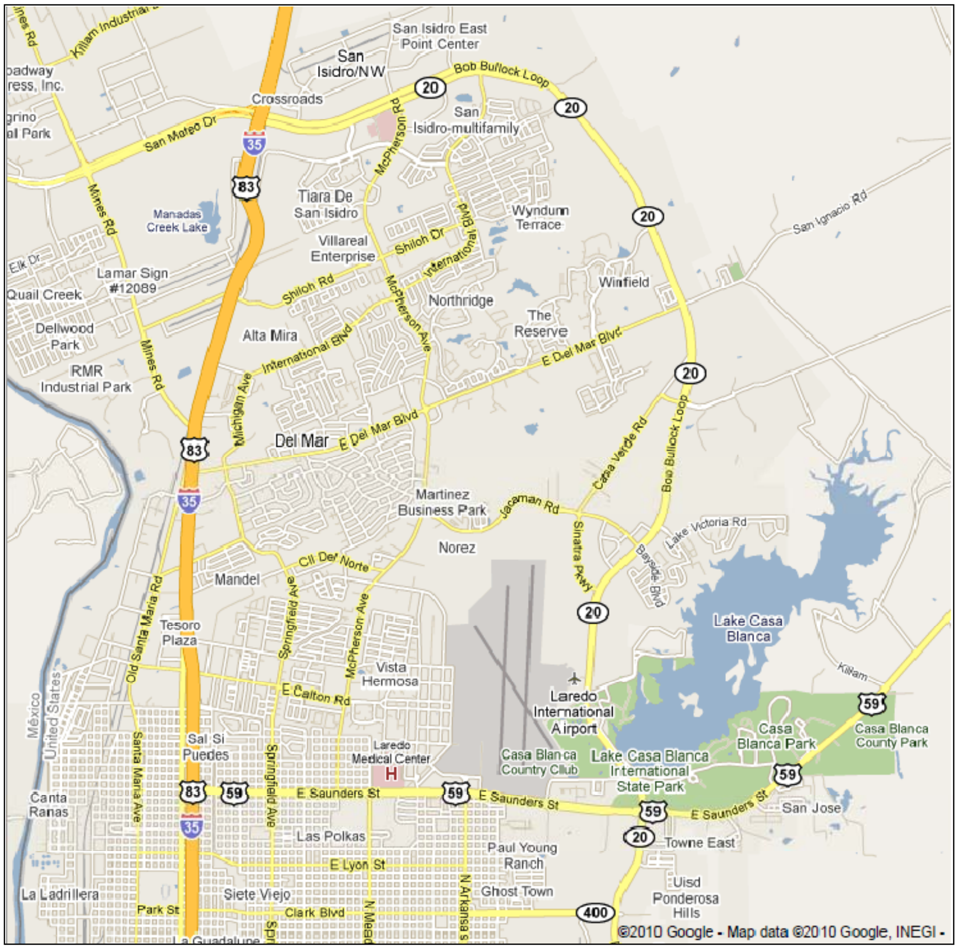
Category and Geographical Location

Laredo International Airport is classified as small metro. Laredo International Airport is located 3 miles northeast of downtown Laredo.

Nearest Freeway(s) and Distance(s)

Laredo International Airport is located off Bob Bullock Loop (Loop 20) approximately 3 miles west of IH 35. It is probable that truck traffic not originating in the immediate area is coming from IH 35. Access from IH 35 to the airport from the north is via Loop 20, with an approximate roadway distance of just over 7 miles. Additional access from IH 35 from the south is via US 59/Loop 20. This road distance is less than 5 miles.

Access to the airport from the west is provided by IH 35 and Loop 20. Access from the east is also provided by Loop 20 from either US 59 or SH 359 in addition to local roads. The airport location, the surrounding roadway network, and its proximity to freeways are shown in Figure 107.



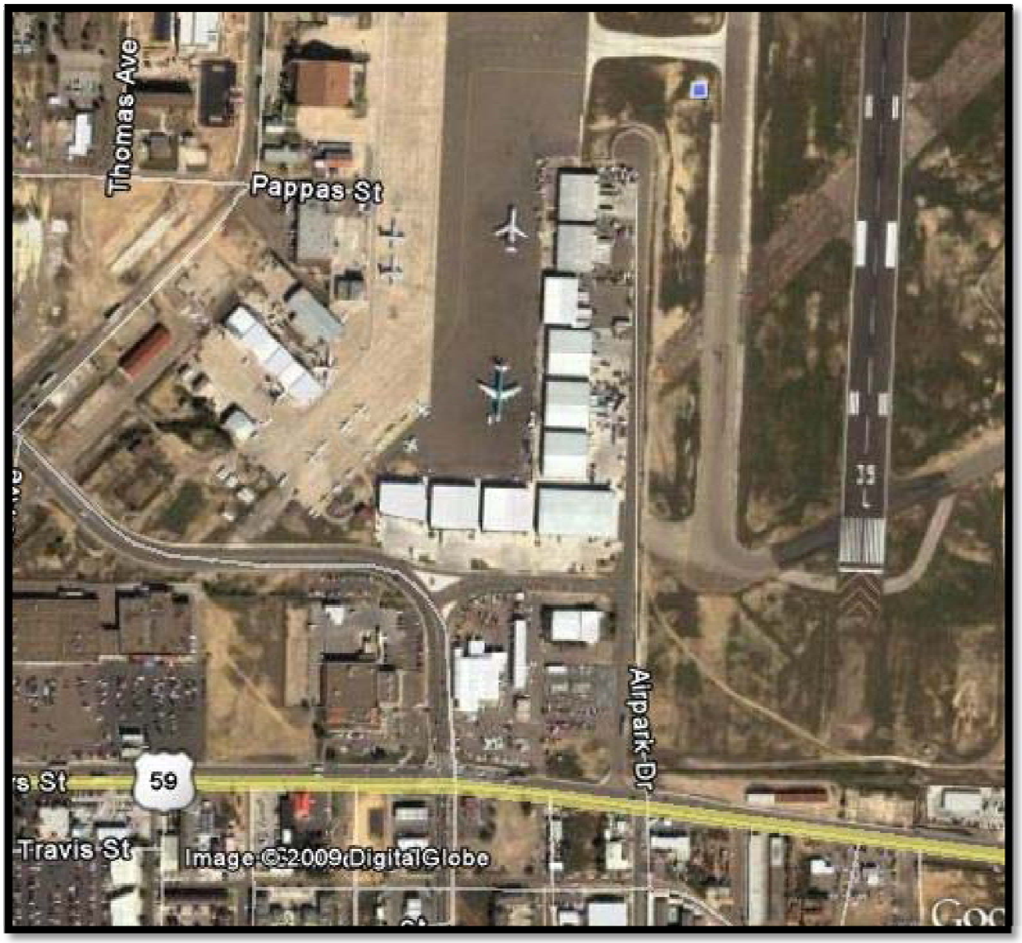
Source: Google Maps

Figure 107. Laredo International Airport Location Map.

Access/Entry/Gateway Points

The primary entrance to Laredo International Airport is on East Corridor Road, which is directly off Loop 20. This is the primary access to the passenger terminal. The airport currently has two separate areas for cargo operations. The main air-cargo area is located on the very southwest of the airport property. This cargo operations area is accessible from US 59/East Saunders Street via Airpark Drive, or alternatively via Maher Avenue between East Bustamante Street and Pappas Street, depending on the buildings to be accessed. Airpark Drive is perpendicular to East Saunders Street and parallel to the runway. It is a narrow access road that is utilized by numerous trucks, as shown in Figure 108 and Figure 109.

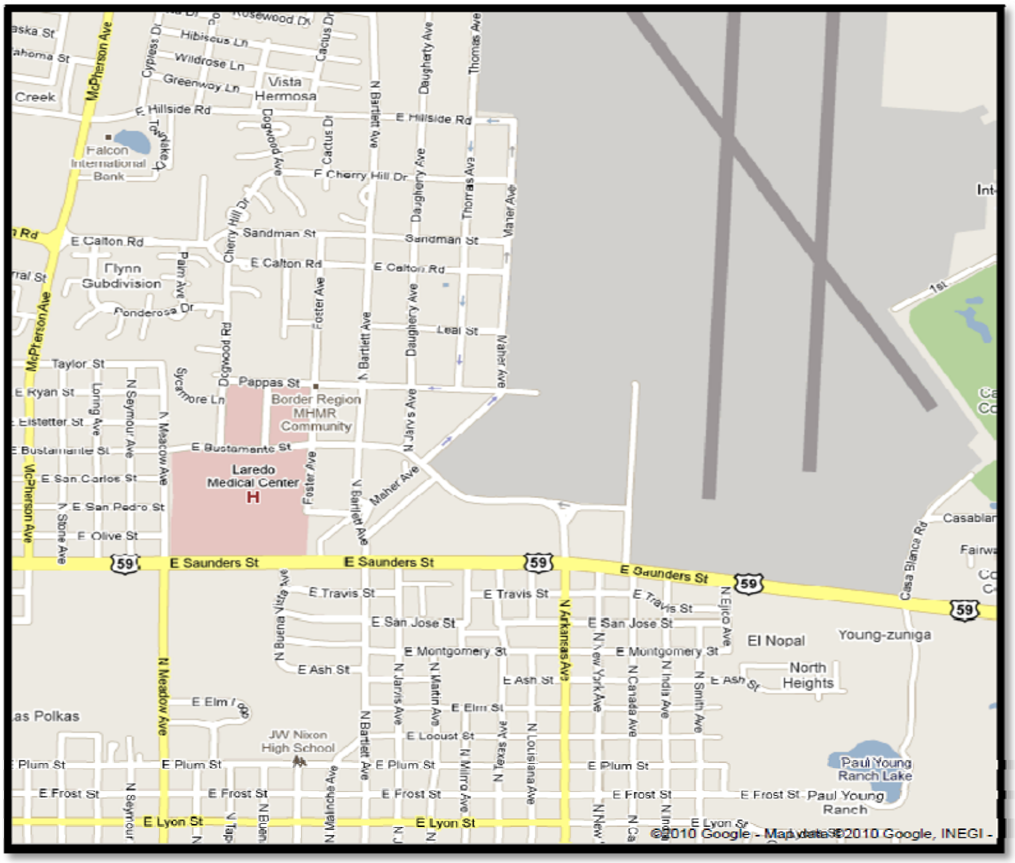
Figure 108. Laredo International Airport—Airpark Drive.



Source: GoogleMaps.com

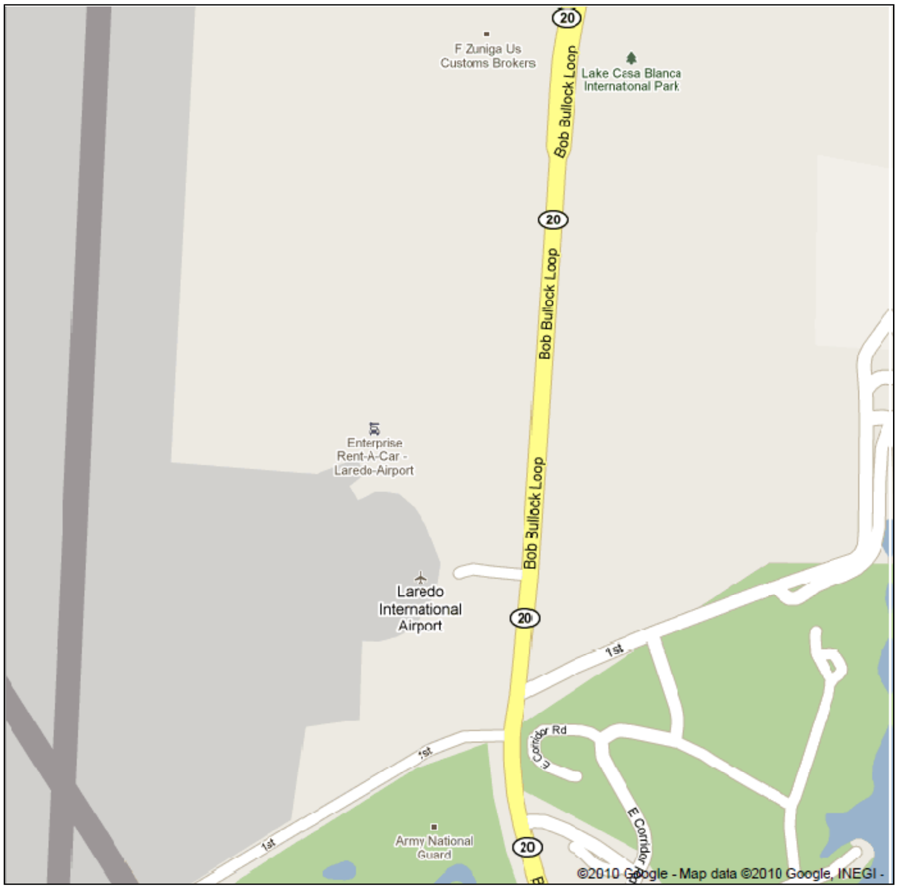
Figure 109. Laredo International Airport—Airpark Drive and US 59.

A separate cargo facility that houses the FedEx operations is located directly north of the main passenger terminal and directly off Bob Bullock Loop 20. Maps showing access to the two cargo operating areas are shown in Figure 110 and Figure 111.



Source: Google Maps

Figure 110. Laredo International Airport Southwest Cargo Area.



Source: Google Maps

Figure 111. Laredo International Airport FedEx Cargo Area.

Freeway Connection/Routes Characteristics

The airport's southwest cargo area is served by the City of Laredo's designated truck route network that includes both Maher and Thomas Avenues. Maher Avenue is the western border of the airport and is shown in Figure 112. As can be seen from the photo, the pavement on Maher Avenue shows signs of deterioration caused by extensive truck use.

Figure 113 shows Thomas Avenue, also part of the city's truck-route network, which serves the southwest cargo area. The pavement is also shown to be seriously damaged as well as not wide enough to accommodate heavy trucks.

Figure 112. Laredo International Airport—Maher Avenue.

Figure 113. Laredo International Airport—Thomas Avenue.

Alternative access to the southwest cargo area is provided by US 59/East Saunders Street or Bustamante Street. Arkansas Avenue then intersects with East Bustamante Street at the tip of the southwest cargo area. US 59/East Saunders Street is a six-lane facility with a center turn lane. There is, however, no direct access to the southwest cargo area for eastbound truck traffic turning left onto Airpark Drive. Trucks need to turn at the Arkansas Avenue intersection and access Airpark Drive and the cargo area via East Bustamante Street. Figure 114 shows the intersection of US 59/East Saunders Street and Arkansas Avenue. Figure 115 shows the Arkansas Avenue and East Bustamante Street intersection looking at the cargo area, while Figure 116 shows the intersection looking from the cargo area.

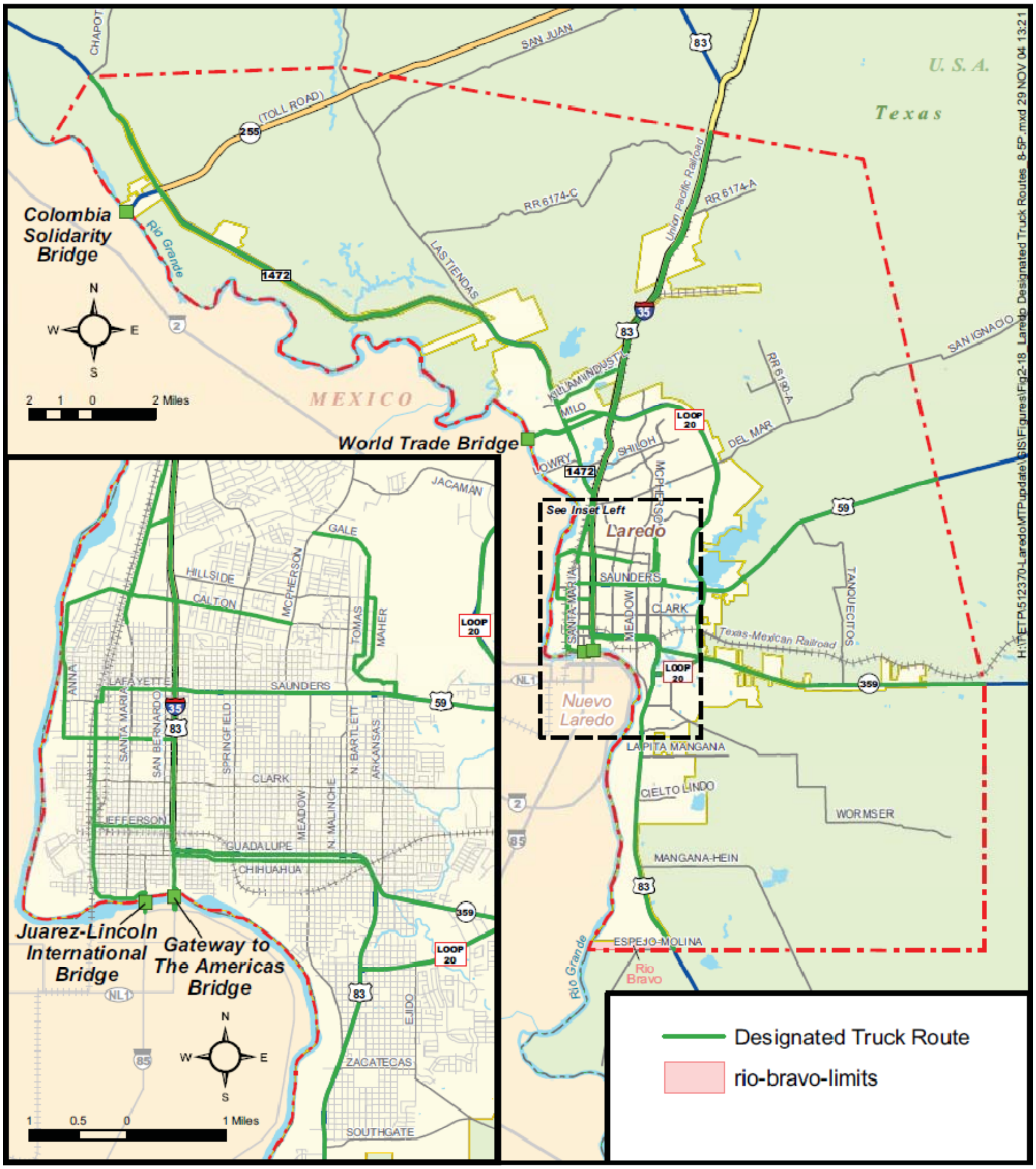
Figure 114. Laredo International Airport—Intersection of East Saunders (US 59) and Arkansas Avenue.

Figure 115. Laredo International Airport—Intersection of Bustamante Street and Arkansas Avenue to Cargo Area.

Figure 116. Laredo International Airport—Bustamante Street and Arkansas Avenue from Cargo Area.

Improvements to Bartlett Avenue, including its expansion to four lanes and its extension to Del Mar Boulevard north of the airport, will most certainly increase traffic on East Bustamante Street. It will allow access from the north via IH 35 and Del Mar Boulevard to the southwest cargo area. Even a rough estimate of the increase in truck traffic is uncertain at this point since it is also a function of air-cargo activity at the airport. However, East Bustamante Street is the primary access road to the southwest cargo area from the west. It is probable that truck-traffic levels will continue increasing on at least certain sections of the roadway.

It is probable that the city's designated truck routes in the vicinity of the airport will continue to be East Saunders Street, Thomas Avenue, and Maher Avenue. Use of any of these routes to access the southwest cargo area implies use of East Bustamante at some point. Figure 117 shows the city's truck-route network in the area.



Source: *City of Laredo Comprehensive Plan*, 2004

Figure 117. City of Laredo Designated Truck Routes.

The east-side cargo area utilized by FedEx is more accessible than the southwest cargo area since it is served directly by Loop 20. Figure 118 shows the location, while Figure 119 shows the curb and driveway access to the facility. The roadway's pavement condition is very good, and geometrics are suitable for truck operations into and out of the facility.

Figure 118. Laredo International Airport FedEx Cargo Facility.

Figure 119. Laredo International Airport FedEx Cargo Facility Driveway.

Wayfinding (Off Site and On Site)

Signage along Loop 20 and US 59 directs motorists to the airport's passenger terminal. Signage to direct them to the cargo areas seems to be absent. However, the city's designated truck routes serving the airport's cargo areas are clearly marked. These are shown in Figure 120 and Figure 121.

Figure 120. Laredo International Airport—Airport Guide Signs on US 59/Saunders Street and Loop 20 South of the Airport.

Figure 121. Laredo International Airport—Designated Truck Route Sign on Maher Street West of the Airport.

Relative Scale of Cargo Activities

The airport ranked 11th in Texas in 2007, in terms of total air cargo moved, at approximately 27,000 tons. This was just under the 28,000 tons moved at Lubbock International Airport and significantly over the 16,000 moved at Houston Hobby Airport.

According to the airport's 2005 master plan, there are 11 air-cargo facilities located in the main cargo area in the southwest quadrant of the airport. This area has more than 250,000 sq ft of cargo storage space. The second cargo area, utilized by FedEx and located north of the passenger terminal on the eastern side of the airport, has 30,000 sq ft of warehouse space. The Air Cargo World *Airport Directory* states the airport has nearly 45 million sq ft of ramp space with 15-inch concrete tarmac.

The airport master plan indicates the airport is served by four scheduled cargo carriers: Emery Worldwide, BAX Global, FedEx, and UPS. These carriers account for most of the activity at the airport. The airport is also served by non-scheduled cargo operators that include

Ameristar, Express One, and USA Jet. Figure 122 and Figure 123 show the airport's two largest scheduled air-cargo carriers on their respective ramps.

Figure 122. Laredo International Airport—FedEx Cargo Aircraft at East-Side Cargo Area Ramp.

Figure 123. Laredo International Airport—UPS Cargo Aircraft at Southwest Cargo Area Ramp.

Shared or Separate Access to Cargo Areas

The two cargo facilities are separate and distinct from the passenger terminal. Access to the FedEx cargo area requires utilizing Loop 20, as does the passenger terminal. The two entrances, however, are sufficiently far apart so as to not interfere with the operations of each other. The southwest cargo area does not interfere in any way with passenger-terminal operations or any other airport activities due to its remote location on airport grounds.

Future Planning Activities

According to the Laredo Chamber of Commerce, the City of Laredo is developing into a major cargo distribution center serving an area extending up to 400 miles into Mexico. The airport is planning for significant future growth in air-cargo operations and in recent years has made significant investments in its cargo facilities and capabilities.

The airport has 24-hour Customs and Immigration services and 24-hour freight-forwarding services available. It is a large port-of-entry on the U.S.-Mexico border with rail and truck connections less than 3 miles away. Laredo International Airport has a designated foreign-trade zone on site and an additional three at nearby industrial parks. The airport is also home to a Federal Inspection Service office and a Mexican Customs office, to clear aircraft destined for Mexico before they leave Laredo. Other future plans include a refrigerated building for cold-storage use of any inbound or outbound cargo.

The airport does have available land for expansion, including areas adjacent to the east-side cargo area that could be used for additional cargo operations, especially considering the ease of access to this location from Loop 20. Expansion of cargo operations at the southwest cargo location is significantly more limited. Figure 124 shows the availability of land for growth adjacent to the FedEx facility on the east side of the airport, which offers direct access to Loop 20.

Figure 124. Laredo International Airport—Land Available (East Side) for Future Air-Cargo Expansion.

Valley International Airport (Harlingen)

Airport Name

This section describes Valley International Airport. The City of Harlingen is the owner.

Category and Geographical Location

Valley International Airport is classified as small metro. Valley International Airport is located approximately 5 miles northeast of downtown Harlingen. It is surrounded primarily by agricultural land, with some offices and a military school immediately to the west.

Nearest Freeway(s) and Distance(s)

US 77, a north-south highway that connects Harlingen with Corpus Christi, is approximately 3 miles west of the airport. US 83, which runs east-west through the Rio Grande Valley area, intersects US 77 approximately 6 miles southwest of the airport. Both of these highways are controlled-access freeways through the area. Figure 125 provides a map of the airport and surrounding roadway network.

Source: BingMaps.com

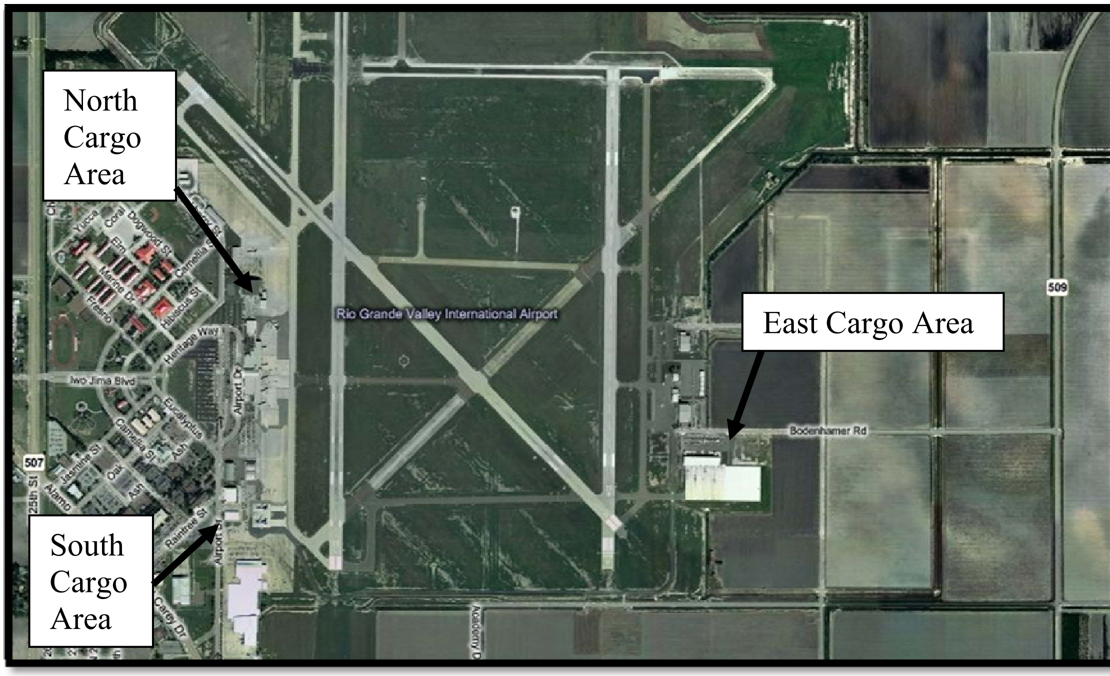
Figure 125. Valley International Airport and Surrounding Roadway Network.

Access/Entry/Gateway Points

Multiple access points to Valley International Airport exist. The gateway entrance, shown in Figure 126, is on northbound SL 499, where it begins to turn to the northwest, and Airport Drive continues northward.

Figure 126. Gateway Entrance to Valley International Airport.

Air-Cargo Facilities. Valley International Airport has three air-cargo areas on the airport property. The two older cargo areas are located north and south of the terminal building. The third cargo area is much newer and located on the east side of the airport, across the runways from the terminal building. This newer cargo area has completely separate access from the rest of the airport, as described below. Figure 127 shows the locations of the three air-cargo facilities at Valley International Airport.



Source: BingMaps.com

Figure 127. Air-Cargo Facilities at Valley International Airport.

Air-Cargo Area Descriptions. The north air cargo facility has been used historically by overnight parcel-delivery companies, such as DHL. It has direct access to Hackberry Street, which becomes Cactus Street immediately south of the facility and runs parallel to the passenger-terminal circulation road, which is comprised of Airport Road and Heritage Way. At least some large trucks need to use Hackberry Street to begin backing movements into docking areas of some facilities in the cargo area. Figure 128 shows one of the buildings in the north air cargo facility.

Figure 128. North Cargo Area at Valley International Airport.

The south air cargo facility is used by overnight parcel-delivery companies, such as FedEx, and airlines such as Southwest. Buildings in this facility have direct access to Airport Road, immediately south of where it becomes the passenger-terminal circulation road. Because the buildings are very close to Airport Road, there are instances when trucks need to use the street to begin backing into the cargo parking/loading areas. Freight and passenger traffic comingle on this segment of Airport Road, depending on the routing that drivers take to the cargo facility or passenger terminal. Figure 129 provides a view of the south air cargo facility looking north on Airport Road.

Figure 129. South Cargo Area at Valley International Airport.

The east air cargo facility is used by overnight parcel-delivery companies, such as BAX Global and UPS Supply Chain. Buildings within the east air cargo facility have parking/loading areas that allow large trucks to perform backing maneuvers on site, without the need to begin on the adjacent street. Figure 130 presents a view of one of the buildings in the east air cargo area. The driveway design, providing a large turning radius, can be observed in the photograph.

Figure 130. Freight Facility in the East Air Cargo Area at Valley International Airport.

This facility is relatively new and has separate access via Grimes Road (east from SL 499, north on Bob Youker Street, and then west on Bodenhammer Road). Though more circuitous, this access routing keeps truck traffic destined for the East Air Cargo facility completely separate from the passenger-terminal traffic. These two-lane roads currently have very low traffic volumes. Large trucks performing turning movements at these street intersections must use the entire cross section, as seen in Figure 131. When traffic volumes increase on these streets, these maneuvers could become problematic if the streets are not widened. Widening the streets only at the intersections may be sufficient, thus not requiring the expense of widening the entire street segments. Channelized right-turn lanes with appropriate radii would also help in this case.

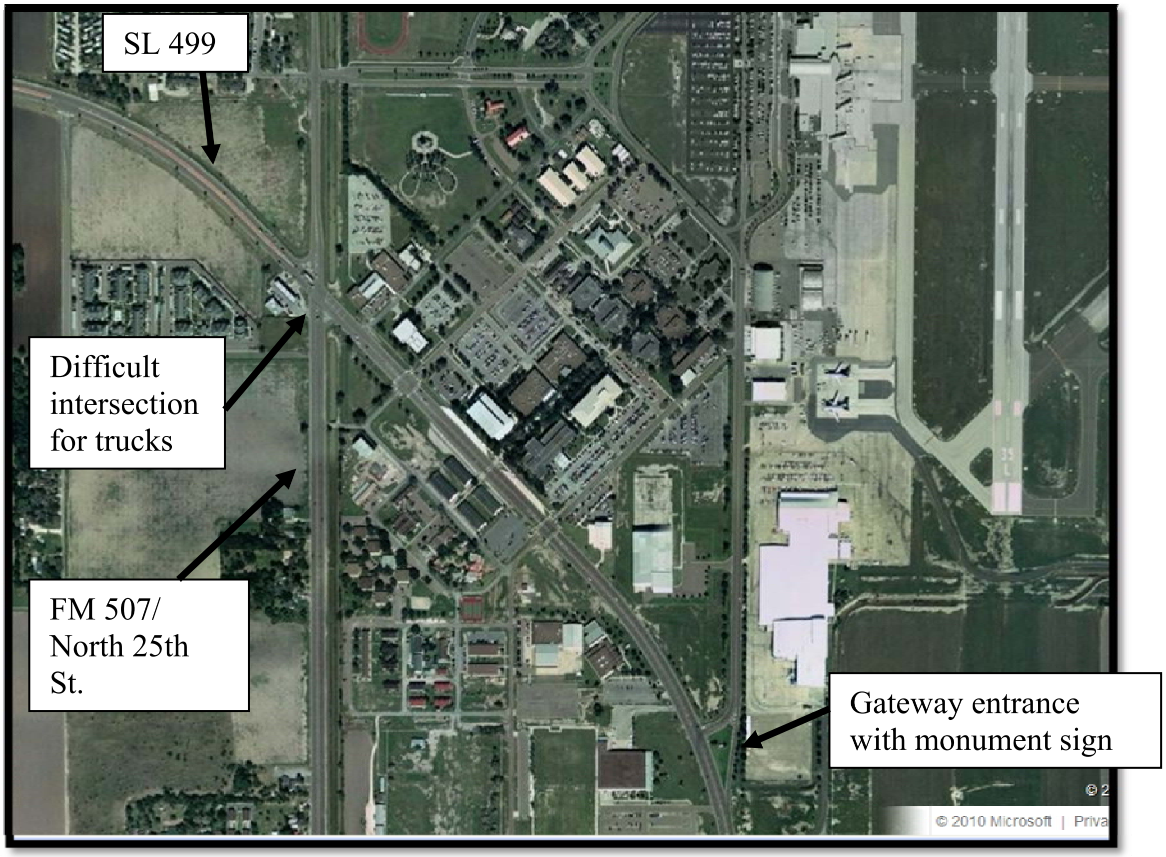
Figure 131. Truck Turning at Intersection near East Air Cargo Area.

In addition to companies that have cargo facilities at the airport, at least two other companies use the airport by bringing trucks airside and loading the planes directly.

Freeway Connection/Route Characteristics

The main connection between the area freeways and the airport is SL 499 from US 77. SL 499 recently has been improved to be a four-lane, divided road between US 77 and North 25th Street/FM 507, approximately 0.5 miles west of the airport. Beyond that intersection SL 499 is comprised of four lanes and a two-way left-turn lane. The land on either side of SL 499 between US 77 and North 25th Street/FM 507 is transitioning from agricultural to residential with some commercial areas.

The airport was originally an Air Force base and features a street system immediately west of the airport, where military buildings were located, that is laid out at angles to the north-south roads in the area. As a result intersection geometrics are somewhat complex, as seen in Figure 132. Most notable is the intersection of SL 499 and FM 507/North 25th Street, though it was not part of the original Air Force base street system. East/southeast-bound large trucks destined for the north air cargo area can experience difficulty turning northbound on FM 507/North 25th Street because of the intersection geometrics.



Source: BingMaps.com

Figure 132. Street System on Valley International Airport Grounds.

Figure 133 presents a ground-level perspective, facing northwest, of the skewed SL 499-FM 507/North 25th Street intersection.

Figure 133. Skewed Intersection—SL 499 at FM 507/North 25th Street.

Traffic destined for the north cargo area typically enters the airport on Iwo Jima Boulevard, which was originally the main access road to the previous Air Force base. It is logical that traffic destined for the south air cargo area will approach via Airport Drive from SL 499.

Wayfinding (Off Site and On Site)

Signs on eastbound US 83 direct traffic to proceed north on US 77 to access the airport. Signs on US 77 (both directions of travel) direct traffic to exit SL 499 to access the airport. All of these signs appear at least 1 mile in advance of exits and include the typical airport placards. Primary signage on the airport grounds can be found at the east end of Iwo Jima Boulevard, as seen in Figure 134.

Figure 134. Directional Sign at East End of Iwo Jima Boulevard.

Relative Scale of Cargo Activities

Valley International Airport ranks seventh among Texas airports in terms of cargo activity, carrying less than 2 percent of the statewide total. According to airport officials, the majority of freight handled is mail and overnight parcels. Types of freight commonly handled at Valley International Airport include auto parts, computers, fish, and flowers.

Shared or Separate Access to Cargo Areas

The east cargo area has completely separate access from other passenger and cargo facilities at the airport. The north and south cargo areas share multiple access points with passenger traffic, as discussed previously in this case study. Figure 129, presented previously in this case study, provides a view of Airport Road, which carries both freight and passenger traffic.

Future Planning Activities

At the time of this study, Valley International Airport was in the process of developing a master plan. That plan is to include recommendations for a runway extension to accommodate larger freight planes. Overall economic growth in the Rio Grande Valley, including growth of maquiladoras, is the greatest factor driving these plans. The airport staff coordinates with the Cameron County Regional Mobility Authority (CCRMA), though there is not currently a formalized relationship. Coordination with the CCRMA includes projects such as a new causeway to South Padre Island and plans to extend FM 509 to make it loop around the airport northward and westward to connect to US 77.

Midland International Airport/Odessa Intermodal Development (Private)

Author's note: This expanded case study includes the findings of a "brainstorming session" conducted with representatives of multiple agencies in the area to identify issues related to a hypothetical freight center being developed in Odessa and generating freight traffic to Midland International Airport.

Airport Name

This section describes Midland International Airport (MAF).

Category and Geographical Location Relative to Major Cities

Midland International Airport is classified as small metro. Midland International Airport is located approximately 10 miles west of downtown Midland and 10 miles east of downtown Odessa.

Nearest Freeway(s) and Distance(s)

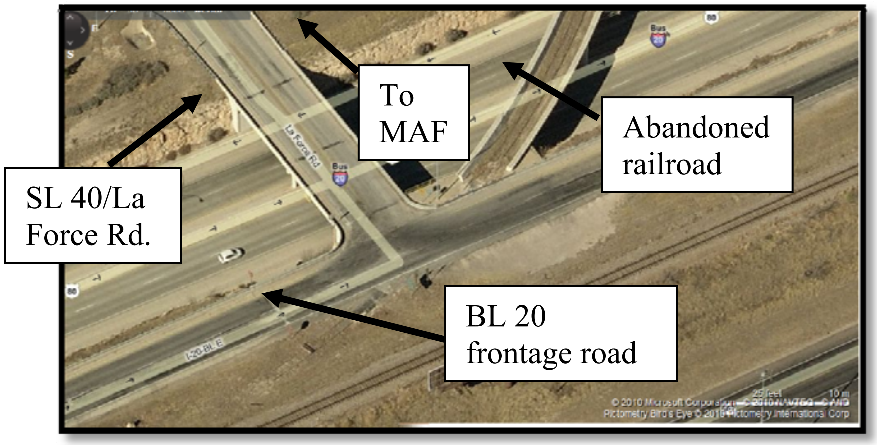
MAF is located between IH 20 and SH 191, both of which are east-west freeways connecting Midland and Odessa, as shown in Figure 135.

Source: BingMaps.com

Figure 135. Map of Midland International Airport and Surrounding Road Network.

Access/Entry/Gateway Points

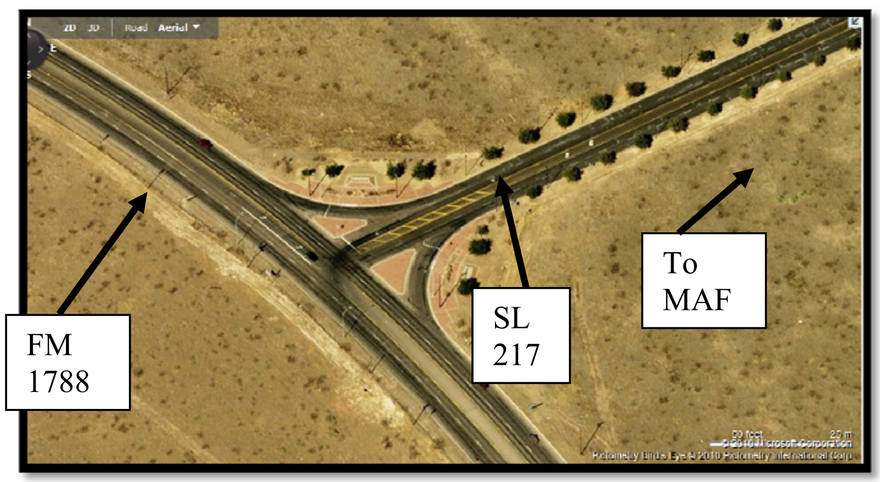
There are two entrances to MAF. The east entrance is SL 217/Sloan Field Road from FM 1788 (runs north-south), and the south entrance is SL 40/La Force Road from BR 20 (runs east-west). The SL 40/La Force Road intersection at the eastbound BR 20 frontage road has a very tight turning radius, which may be a deterrent to trucks with longer wheelbases. Modifications to this intersection would be potentially expensive because the SL 40/La Force Road leg is a bridge. Figure 136 provides a view of that intersection.



Source: BingMaps.com

Figure 136. SL 40/La Force at BR 20 Frontage Road Intersection.

The SL 217/Sloan Field Road entrance from FM 1788 is comprised of an intersection that has turning radii that appear to be able to accommodate all trucks that would access airport freight areas. Figure 137 presents the intersection.



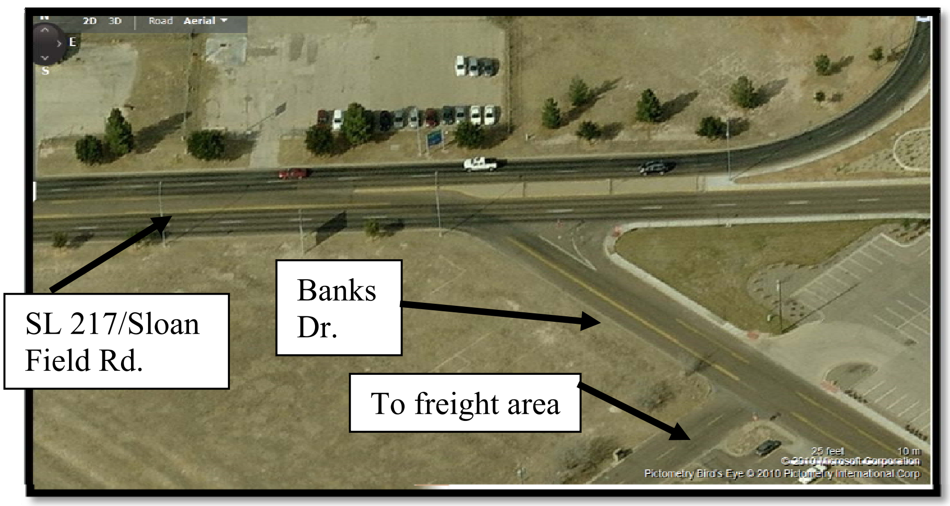
Source: BingMaps.com

Figure 137. SL 217 at FM 1788 Intersection.

Freeway Connection/Route Characteristics

FM 1788, which runs north-south, connects the two freeways in the area, SH 191 and IH 20, as well as BR 20, all of which run primarily east-west. BR 20 has two grade-separated interchanges in the immediate vicinity of the airport but has primarily at-grade intersections between Midland and Odessa. FM 1788 is comprised of four lanes and a flush median, wider than a typical two-way left-turn lane. The land between SH 191 (north of the airport) and the airport is primarily undeveloped. The University of Texas of the Permian Basin, whose main campus is in Odessa, has two buildings at the southeast corner of FM 1788 and SH 191. The land along FM 1788 between IH 20 and BR 20 (approximately 1 mile in length) is largely developed with truck stops and industrial uses.

The west entrance, SL 217/Sloan Field Road, is comprised of four lanes and a two-way left-turn lane. Freight traffic leaves SL 217/Sloan Field Road at an intersection with Banks Drive. This intersection is at an obtuse angle, providing a very good turning radius for trucks turning from SL 217/Sloan Field Road to Banks Drive. Figure 138 provides a photograph of this intersection.



Source: BingMaps.com

Figure 138. Intersection of SL 217/Sloan Field Road at Banks Drive.

The south entrance, La Force Road, as it diverges from SL 40, traverses through primarily office and light industrial land uses between BR 20 and Banks Drive, which leads to the freight area. La Force Road is four lanes wide through this area, undivided in the southern half and with a two-way left-turn lane in the northern half.

Wayfinding (Off Site and On Site)

Directional signage begins to appear approximately 1 mile prior to the exits for FM 1788 on SH 191 and IH 20 and approximately 1 mile prior to the exits for the airport on BR 20. With relatively light traffic on these facilities, this advance notice appears to be adequate for trucks to maneuver to the exits safely. If the volume of longer-wheelbase trucks increases at the airport, there may be a need to route them to the airport via FM 1788 from BR 20, due to the geometrics of the intersection with SL 40/La Force Road. This issue was discussed and illustrated previously in the “Access/Entry/Gateway Points” portion of this case study. Figure 139 shows the airport exit sign on eastbound BR 20.

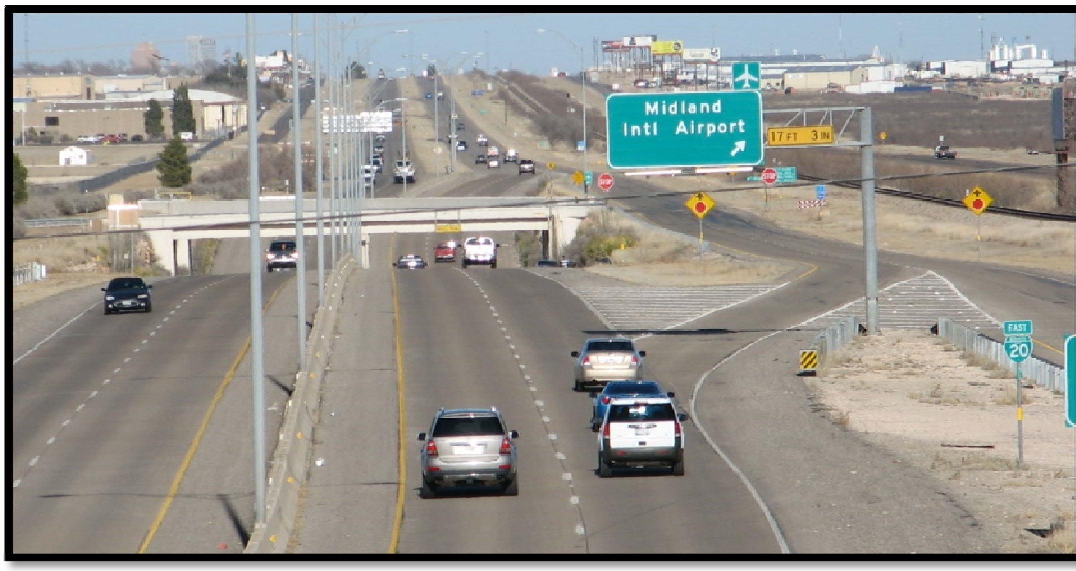


Figure 139. Exit for MAF from Eastbound BR 20.

Signage on the airport grounds has a consistent format of sufficiently large white print on a blue background. There is plenty of space around each set of word(s)/arrow(s) to allow the driver to determine which direction to proceed for various areas of the airport. Figure 140 presents examples of signage at Midland International Airport, including a sign directing traffic toward the Air Cargo area.

Figure 140. Directional Signage at MAF.

Relative Scale of Cargo Activities

Midland International Airport ranks 12th in cargo tonnage handled among Texas airports. The most recent available data indicate that the airport handled approximately 3500 tons of cargo in one year, representing only 0.17 percent of the statewide total. According to airport officials, the majority of the cargo traffic is overnight parcel service provided by FedEx and UPS. Airlines also carry some cargo, including medical supplies, oilfield equipment (relatively small items), and cut flowers. These cargo services are typically supported by single-unit vans.

Southwest Airlines leases a portion of a cargo building from MAF, which also houses additional ground-freight operations. There are three freight companies that do not have significant air-cargo service, with truck-terminal facilities located at the airport that have tractor-trailer trucks entering and leaving at various times of the day. Figure 141 shows the main freight building at MAF, which is shared by an airline and other freight companies that have very little air-cargo activity.

Figure 141. Freight Building at MAF.

Shared or Separate Access to Cargo Areas

The road network, including the main access points, at MAF is shared by freight and passenger traffic up to the intersection of La Force Road and Banks Drive. Beyond that intersection, La Force Road becomes the passenger-terminal access road.

Future Planning Activities

There have been multiple discussions regarding a potential development of a new freight center at the south end of the airport that would replace the current facilities. According to airport officials, an apron is already in place, and runways do not need any changes to accommodate a new freight center. City representatives reported that various stakeholders in the community have suggested that a new freight center would be beneficial to the airport and the adjacent cities. Airport officials cited the following characteristics as providing strategic benefits to developing a freight center at MAF:

- Central location to 43 counties from the Mexico border to points east, west, and north.
- La Entrada al Pacifico international trade corridor (system of highways from Chihuahua City, Chihuahua, Mexico, to Odessa-Midland and points beyond).
- Weather conditions (particularly in winter), which get worse with increasing frequency moving north (toward Lubbock and beyond).

Results of Multi-Agency Brainstorming Session

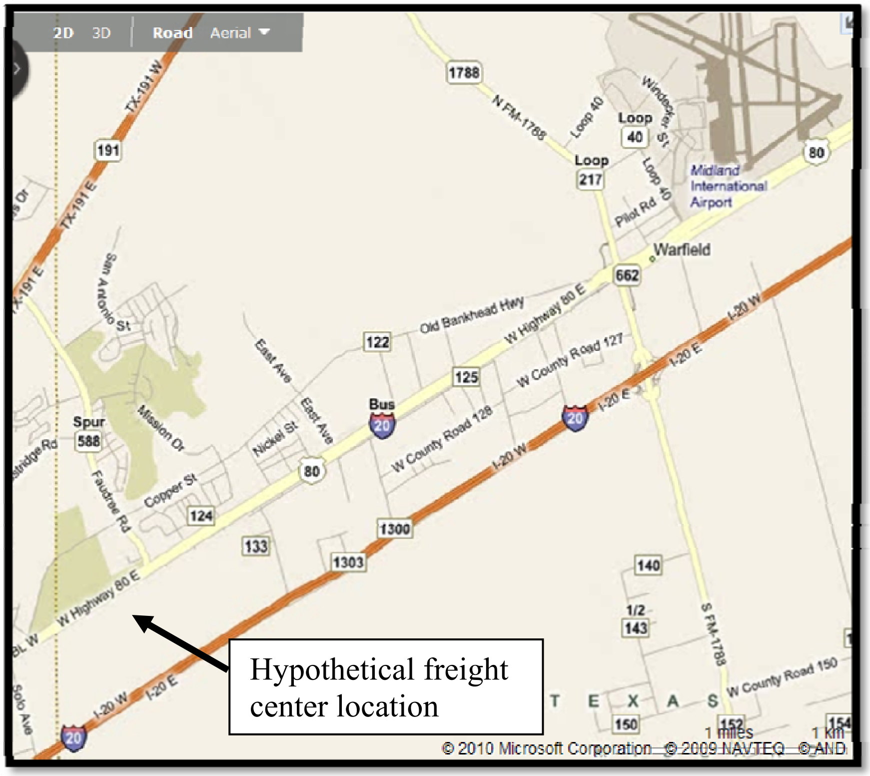
The research team used MAF as an enhanced case study by conducting what was deemed a brainstorming session involving representatives from the following agencies:

- Midland International Airport (operated by the City of Midland Aviation Department).
- City of Midland (geographic-information-system, planning, and public-works departments).
- City of Odessa (transportation and public-works departments).
- Midland-Odessa Metropolitan Planning Organization (MPO).
- TxDOT Odessa District.

This session provided the opportunity for participants to give their perspectives on what impacts there might be on roadway infrastructure and what roadway improvements may be necessary to accommodate an increase in freight traffic between potential new freight centers in Odessa and the airport.

Hypothetical Situation

The session began with the following question: "What impacts would there be, and what improvements might be necessary if a source of freight traffic destined for the airport were developed on the east side of Odessa, north of IH 20, south of BR 20, and east of SL 338?" Representatives of the various agencies present provided their input as discussed in the following subsections. Figure 142 shows the location of the hypothetical freight center relative to the airport.



Source: BingMaps.com

Figure 142. Hypothetical Freight Center.

Access at the Hypothetical Freight Center Location

One of the first basic observations made was that the freight traffic from the hypothetical freight center would either have to access the airport via IH 20 or cross the railroad that runs parallel and immediately adjacent to the south side of BR 20. Participants recognized the fact that new at-grade railroad crossings are typically looked upon very unfavorably and that a new grade-separated crossing would be very expensive.

The frontage roads on IH 20 are currently two way but will be converted at some point to one way. Frontage-road conversions would possibly include the need to rebuild the interchange at SL 338, including the installation of turnarounds. The nearest interchanges along IH 20 are located at SL 338 in Odessa, approximately 1.5 miles to the west, and FM 1788, approximately 3.5 miles to the east. Truck traffic would have to use the frontage road between either of these interchanges until an intermediate interchange is built. Some participants discussed the idea that an interchange located at what would be an extension of SP 588/Faudree Road would be useful at some point in the future for this hypothetical freight traffic, as well as for traffic to/from points north.

Connection Route Issues

There was consensus that the majority of the road segments that would be used between the hypothetical freight center and the airport have plenty of capacity. One segment was identified as potentially problematic from an access-management perspective, though. This is the approximately 1-mile segment of FM 1788 between IH 20 and BR 20. Both sides of this segment are substantially developed with truck stops and industrial uses. Figure 143 provides an illustration of the land uses and traffic, including turning movements of large trucks. One potential obstacle to addressing access issues is that there is a multi-year non-annexation agreement between the City of Midland and some businesses that could make land use and access controls more difficult in the near term.

Figure 143. FM 1788 between BR 20 and IH 20 with Heavy-Truck Volumes and Turning Movements.

The group discussed solutions such as installing a raised median in at least part of this segment to reduce turning movements and reduce congestion. Another potential suggested solution was installation of backage roads parallel to FM 1788. It was also observed that reconfiguring the IH 20-FM 1788 interchange so that IH 20 passes over FM 1788 would provide some improvements. FM 1788 currently passes over IH 20 at the interchange.

Participants suggested that it would be worthwhile to analyze underutilized interchanges and intersections and that there may be benefits to locating the airport's freight center at the north end of the airport, instead of the south end.

Potential Freight Attractors

The La Entrada al Pacifico international-trade corridor runs from Chihuahua City, Chihuahua, Mexico, to the Odessa-Midland area and northward. MAF is the first major airport along the corridor and could provide the first Customs point for freight along the corridor that is allowed to cross the border without inspection.

Airport Traffic Issues

Airport representatives suggested that while there is overall good internal circulation and access at the airport, there may be the need to rework some geometrics and pavements. One question that was asked, but no definitive answer provided for was, "Will an increase in freight traffic be detrimental to passenger traffic?"

Funding Issues

While it was agreed that this brainstorming session would not be completely limited by current funding issues, TxDOT staff did a very good job of explaining the potential costs of some of the potential improvements, limited funds currently available, and the probable need to adjust current transportation priorities in the area. Participants stated that the economic-development agencies in both cities could provide some funding if improvements were consistent with either or both of their goals. Airport representatives pointed out that passenger-facility taxes cannot currently be used to build cargo facilities, but they raised the question of whether a change should be considered.

Planning Process

The group recognized that the MPO would take the lead in the overall transportation-planning process, but that planning for specific roads would depend on who owns them and who is providing the funding. TxDOT would work with all potential funding sources.

GENERAL AVIATION

Hondo Municipal Airport

Airport Name

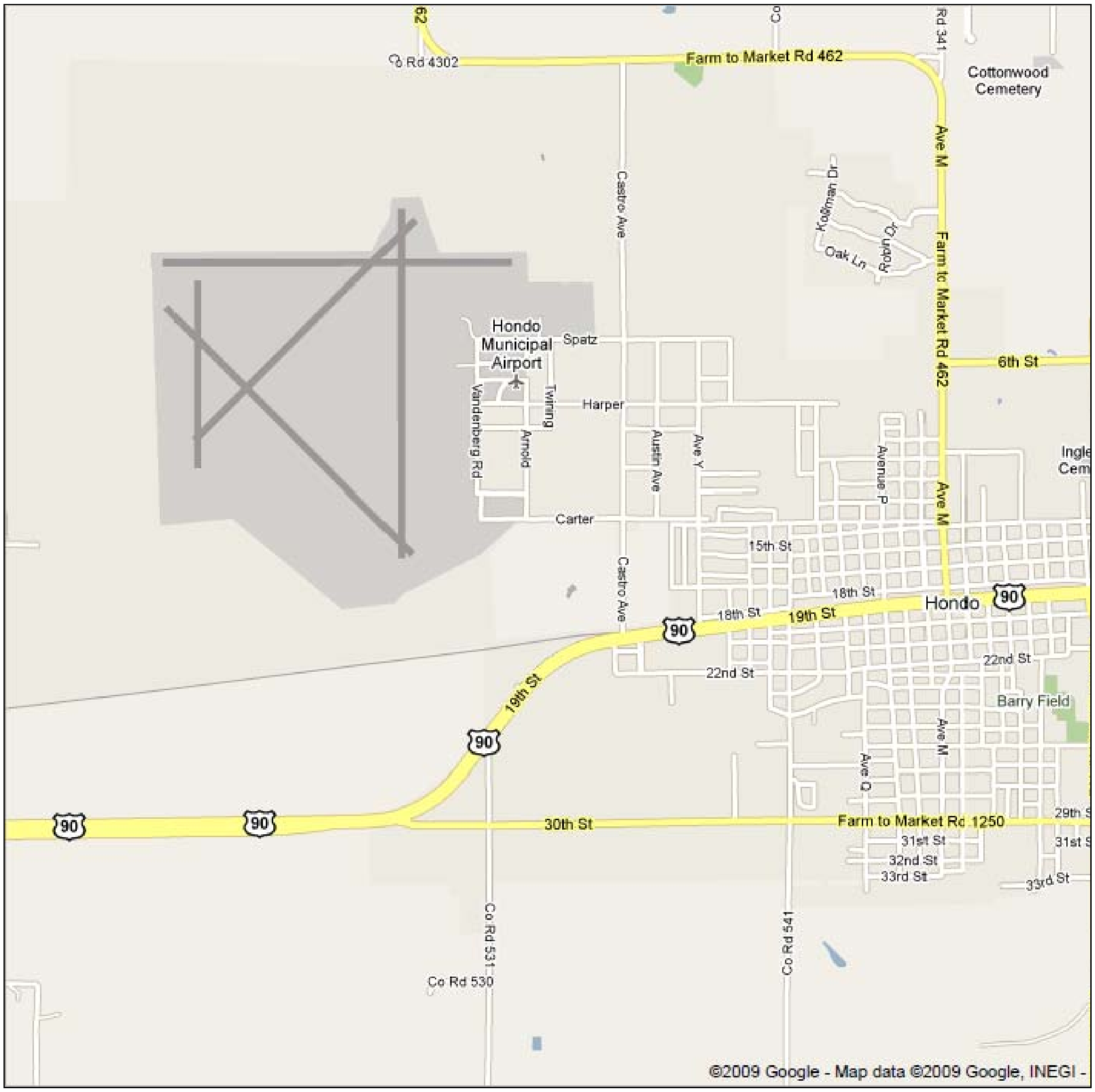
This section describes Hondo Municipal Airport. The airport is owned and operated by the City of Hondo, Texas.

Category and Geographical Location

Hondo Municipal Airport is classified as general aviation. Hondo Municipal Airport is located 2 miles northwest of the Hondo central business district.

Nearest Freeway(s) and Distance(s)

Freeway access to the airport is provided by the US 90 exit at Castro Avenue. This is the only access to the general airport terminal area from a major highway. Any other access would utilize city streets. The airport is a former military base and has the typical layout of such a facility, as shown in Figure 144. A map of the airport vicinity including surrounding city streets is shown in Figure 145.



Source: Google Maps

Figure 144. Hondo Municipal Airport Location/Access Map.

Source: Google Maps

Figure 145. Hondo Municipal Airport Vicinity Map.

Access/Entry/Gateway Points

Hondo Municipal Airport is classified as a general-aviation airport and is a former military facility. The airport can be accessed from US 90 and FM 462. US 173 is less than 5 miles east of the airport. Primary access is provided by US 90. After leaving US 90, access to the airport environment is typically provided by Castro Avenue, which runs north-south less than 0.5 miles east of the airport's ramp area.

Freeway Connection/Route Characteristics

The primary freeway connection for inbound and outbound truck activity is US 90.

Wayfinding (Off Site and On Site)

Signage for the Hondo Municipal Airport is in the form of the typical roadway signage for general-aviation airports, which depicts an aircraft and an arrow pointing toward the direction of the airport. Additional signage would be necessary should air-cargo operations commence at the airport. This signage would need to show the designated truck route and direct commercial drivers to the cargo facility on the airport's grounds. The airport's sheer size can allow such a facility to be developed on currently undeveloped land.

Relative Scale of Cargo Activities

There are currently no air-cargo operations at the airport.

Shared or Separate Access to Cargo Areas

There are currently no air-cargo operations at the airport.

Future Planning Activities

No plans exist for air-cargo operations at the airport. Being an old military base, the airport has several runways ranging from 3224 to 6059 ft in length. Two of the airport's runways are just over 6000 ft, with additional runways at 5400 ft and 5624 ft. All runways over 5000 ft have widths of 150 ft. None of these runways appear to have the pavement strength necessary to accommodate the heaviest of air-cargo aircraft but could accommodate smaller cargo aircraft with some improvements.

The airport has numerous large-scale development potential. Among its advantages with respect to air-cargo operations are a large apron area and hangar space, extensive land holdings, unobstructed airspace, and well-developed infrastructure including highway, rail lines, utilities, and available space for a foreign-trade zone and industrial development.

The Hondo Industrial Air and Rail Park is located on the airport property. According to the city, the air park offers more than 1400 acres of commercial/industrial properties strategically located in South Texas, just 30 miles west of San Antonio. Directly accessible by rail, air, and highway, this emerging development represents a unique blend of transportation modes combined with a great location, providing ample room for growth. Figure 146 shows the land uses, including land available for development and land with direct rail access.

Source: City of Hondo

Figure 146. Hondo Industrial Air and Rail Park Development/Land Use Map.

CHAPTER 6. LANDSIDE FREIGHT ACCESS ISSUES, GUIDANCE, AND SOLUTIONS

The research project identified nine major issues related to landside freight access to airports. Six of these relate to physical requirements for logistics and three relate to decision-making criteria.

- Physical requirements:
  - System/roadway design.
  - Comingling of freight and passenger traffic.
  - Wayfinding.
  - Adjacent land uses along connecting roads.
  - Traffic control.
  - Truck-queue storage and backing,
- Decision-making criteria:
  - Business decisions.
  - Cargo-facility site location.
  - Performance management and needs identification.

Each of these issues is discussed in the following subsections. These discussions are typically organized as follows:

- Issue.
- Obstacles.
- Solutions.
- Resources.

Some of the discussions refer to areas of influence in the vicinity of an airport. The areas of influence were developed to differentiate the locations and types of roads used to access airports. There are four areas of influence referenced in this report:

- 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; there are typically access points for freight centers 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. There is almost no freight traffic here; hence, this area is not explicitly discussed further below. The term is used for reference purposes.

SYSTEM/ROADWAY DESIGN

Issue

Both roads and pavements will function better and last longer if properly designed for large trucks. The most common geometric design issue at airports visited relates to turn radii. When designing roadways, intersections, and driveways, corner radii and turning paths should accommodate trucks with 48-ft trailers (WB 62 trucks—typical interstate semi-trailer or 18-wheeler) (*30*). 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 has been credited as a way to avoid scouring and rutting as well as broken edges.

Obstacles

There can be a lack of communication and cooperation among airport authorities, TxDOT, and local transportation agencies. Airport, state, and local transportation master plans and improvement plans are often developed or updated independently and/or on different time schedules. As a result truck-specific issues that need to be addressed preferably at the planning stage or at least at the operational stage are often overlooked. A higher concentration of truck traffic can be observed in the vicinity of an airport by comparison to truck-traffic levels across an urban area, particularly when the economy is doing well and particular attention to this issue is warranted.

Solutions

TxDOT's *Roadway Design Manual* and *Access Management Manual* offer the following treatments as potential solutions to truck-traffic issues on roads:

- 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 highway—30 ft minimum.
    - Right-turn deceleration lane— required on highways with 30 or more trucks making inbound right turns during 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) recommended if 30 or more trucks per peak hour are making left turns.
    - 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 (*31*).
- 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; there should be no likelihood of queues extending back 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 and 30-ft radius minimum.
    - Pavement: concrete within 200 ft of 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 locations that have a high number of crashes and that may be affected by increases in large trucks.
    - Check necessary traffic control.
    - Check to 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 to see that emergency access will be available without creating undue congestion on a state highway (*32, 31*).

Resources

The following resources provide additional information on these issues:

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

COMINGLING OF FREIGHT AND PASSENGER TRAFFIC

The contents and recommendations in this chapter 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 are serving many types of traffic in addition to airport traffic. However, once a truck driver enters Area of Influence 3, he/she benefits when there is as little comingling of automobile traffic as possible. Problems occur when there are numerous intersections, entrances, and exits along airport access roads and traffic is weaving among lanes while entering and/or exiting the access roads. Many of the automobile and truck drivers may also be unfamiliar with the routes, needing to pay attention to the directional signage, 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 most clear 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 147).

Figure 147. 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 to retrofitting access-road exits, entrances, and intersections to provide improved weaving distances. With these potential limitations in mind, there is an increased importance to install directional signage providing maximum advance notice of directions to freight areas.

When new airports are developed, there are greater opportunities to provide adequate weaving distances and advance signage directing traffic toward freight areas and passenger terminals. Figure 148 provides an example from George Bush Intercontinental Airport in Houston 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, on at least one of the previous signs that provide information about which airlines are in each passenger terminal, that the freight area will have a left-lane exit.

Figure 148. Freight-Area Directional Signage at George Bush Intercontinental Airport in Houston.

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, as well as applications for each area of influence. Truck and automobile drivers may be unfamiliar with the routes to an airport. Therefore, good signage is needed to provide accurate directions with enough advance notice to make necessary lane changes in advance of exits and intersections. This is particularly true for large, semi-trailer 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 is applied on highways and surface streets throughout the metropolitan area. One could say, therefore, that regarding wayfinding, Area of Influence 1 extends beyond the immediate controlled-access highways or that wayfinding is an issue with applications beyond Area of Influence 1. As a result, all of these applications are included within the Area of Influence 1 discussion.

Solutions

The solutions for these issues are discussed according to area of influence.

Area of Influence 1

Wayfinding is very 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, there are instances when signage may be necessary outside of the metropolitan area. 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, 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.

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 149 shows a placard sign on northbound Congress Avenue at the intersection with Riverside Drive. This sign has importance because Riverside Drive dead ends at 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 149. Airport Placard Sign near Downtown Austin.

Larger metropolitan areas that have multiple airports will sometimes have signs for different airports throughout the area. For example, there are many locations in the Houston area where signs include directional information for both Hobby Airport and George Bush Intercontinental Airport. Figure 150 presents an example of this signage along southbound US 59 at the IH 610 interchange, southwest of downtown Houston. An interesting note about this particular signage is that it is located on a road segment headed away from both airports. There is still recognition for the need to provide directional signage on the roadway to distinguish between the two Houston airports, which are a significant distance from one another.

Figure 150. 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 signs 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 Figure 151 and Figure 152. 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 151. Cargo Exit Sign for Austin-Bergstrom International Airport (SH 71).

Figure 152. 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 Figure 153 and Figure 154, appear to work well for directional information at intersections, but larger signage in advance of the intersection should be considered when possible.

Figure 153. Placard Sign for Dallas Love Field on Southbound IH 35E Frontage Road.

Figure 154. Close-Up View of Placard Sign at Intersection.

Figure 155 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 can be seen in the background. One can easily note the difference between the placard seen in Figure 153 and Figure 154 and the larger directional sign in Figure 155.

Figure 155. 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. Figure 156 and Figure 157 provide an example of effective sequential signage at Dallas Love Field. The sign in Figure 156 provides advance notice of which lane exits toward the cargo area. Figure 157 provides the subsequent exit information.

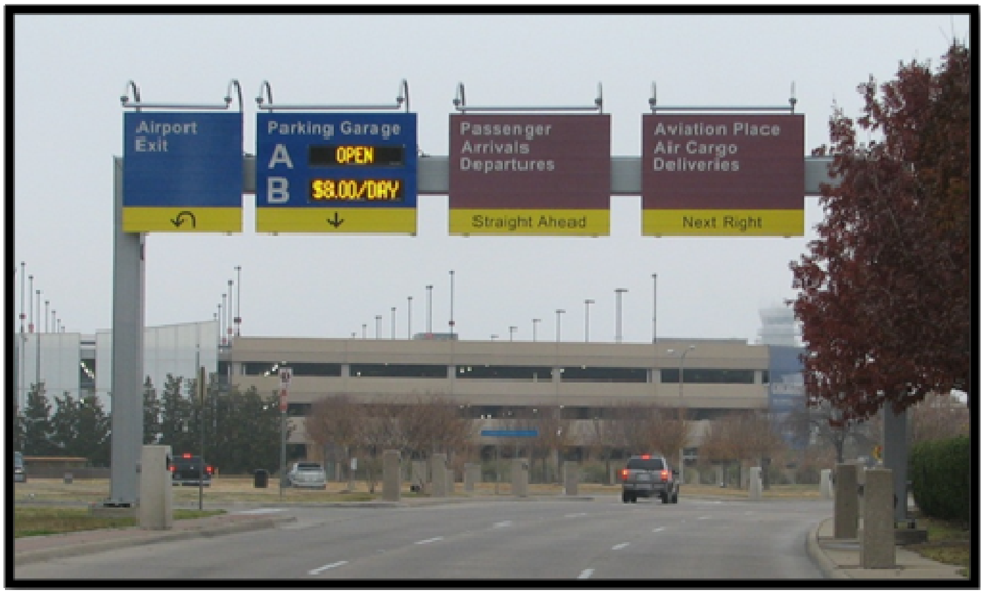


Figure 156. General Signage in Area of Influence 3 at Dallas Love Field.

Figure 157. 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 road. Another effective example of signage in Area of Influence 3 is found at the Midland International Airport, as seen in Figure 158. 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 158. Consistent Signage with Minimal Information.

In contrast to the Midland International Airport example of large signs with minimal information, consider the example shown in Figure 159 from another airport. This sign contains information for multiple uses, relatively small lettering, and multiple backgrounds on one sign. It may be difficult for the unfamiliar driver to quickly identify the information needed to get to the proper location.

Figure 159. 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. They are addressed below as two issues. 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. By the same token, significant truck volumes can pose problems on roads with frequent intersections, especially those used by pedestrians. Older, inner-city 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 there may not have been many conflicts 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 inner cities, freight traffic at the inner-city 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's George Bush Intercontinental Airport. The primary lesson learned in these cases, and applicable to new or expanding airports, is to limit land uses and the number of access points on roads connecting airports to controlled-access highways to those that are most compatible with truck traffic.

Truck-Traffic Compatibility 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.

Truck-Traffic Compatibility 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.

Figure 160 and Figure 161 provide examples of such signs. Figure 162 provides an example of a designated truck-route sign near the Laredo International Airport.

Figure 160. Commercial Traffic Sign near El Paso International Airport.

Figure 161. Sign Prohibiting Truck Traffic near El Paso International Airport.

Figure 162. 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. It may be necessary for the airport and the agency responsible for an adjacent arterial street to work together to identify and address problems.

Left Turns on Arterial Streets 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.

Left Turns on Arterial Streets Solutions

Solutions include signalized intersections, where warranted, and median treatments at other locations to prohibit left turns. Figure 163 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: BingMaps.com

Figure 163. 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. A signal may address one concern while having no effect on other concerns—or even helping create new issues. At the same time, there can be a lack of communication and cooperation between the various stakeholders, including airport authorities, TxDOT, and local transportation agencies. Airport, state, and local transportation master plans and improvement plans are often developed or updated independently, and as a result truck-specific issues that need to be addressed at either the planning stage or at the operational stage are often overlooked. A higher concentration of truck traffic can be observed in the vicinity of an airport by comparison to truck-traffic levels across an urban area, particularly when the economy is doing well, which warrants particular attention to this issue.

Solutions

The *Texas Manual on Uniform Traffic Control Devices* (*33*), which was derived from the U.S. *Manual on Uniform Traffic Control Devices* (*34*), does apply and should be adhered to 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 the 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 will have one or more of the following advantages:

- Provide for the orderly movement of traffic.
- Increase the traffic-handling capacity of the intersection if:
    - Proper physical layouts and control measures are used.
    - 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.

- Reduce the frequency and severity of certain types of crashes, especially right-angle collisions.
- Coordinated to provide for continuous or nearly continuous movement of traffic at a definite speed along a given route under favorable conditions.
- Used to interrupt heavy traffic at intervals to permit other traffic, vehicular or pedestrian, to cross.

Traffic control signals are often considered a solution 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* (*33*), 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.
- 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, consideration should be given to providing alternatives to traffic control signals even if one or more of the signal warrants has been satisfied. The delays inherent in the alternating assignment of right-of-way at intersections controlled by traffic control signals can frequently be reduced by widening the major roadway, the minor roadway, or both roadways. 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. It should be based on an engineering study of roadway, traffic, and other conditions. An engineering study of traffic conditions, pedestrian characteristics, and physical characteristics of the location shall be performed to determine whether installation of a traffic control signal is justified at a particular location. The investigation of the need for a traffic control signal shall include an analysis of factors related to the existing operation and safety at the study location, 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.
- Warrant 9: Intersection near a Grade Crossing.

A traffic control signal should not be installed unless one or more of the factors listed are met. However, the satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

Resources

The following resources provide additional information on these issues:

- *Texas Manual on Uniform Traffic Control Devices*. Austin, Texas: Texas Department of Transportation, 2006. http://www.dot.state.tx.us/txdot_library/publications/tmutcd.htm.
- *Manual on Uniform Traffic Control Devices*, 2009 Edition. Washington, D.C.: Department of Transportation, Federal Highway Administration, December 2009. http://mutcd.fhwa.dot.gov/pdfs/2009/pdf_index.htm.
- *Traffic Signals Manual.* Austin, Texas: Texas Department of Transportation, 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 a very important consideration for all airport planners and managers. As briefly discussed previously in this report, there may be competing interests regarding the location of freight facilities at an airport. Looking at just the airport property and not considering off-airport access issues, certain locations on the airport may appear to be most well suited for a freight center. However, when looking at the bigger picture and considering 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 to be considered 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 off-site locations are encouraged, adjacent land use/development patterns must also be taken into account.

BUSINESS DECISIONS

Issue

It is very important to understand and keep in mind that while an airport may have a strategic plan to develop freight facilities, it is ultimately the marketplace that determines what types of activities will 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 Airport, 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 will ultimately determine 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 often provide a forum from which public/private partnerships can develop.

TRUCK-QUEUE STORAGE AND BACKING

Issue

As freight activity and truck volumes increase, truck queues and storage can pose challenges. If there are no regulatory controls or physical alternatives, trailers may be stored on public roads. In addition, trucks may use the public roads to perform backing maneuvers that cannot physically be performed on the company’s site. Figure 164 presents an example of trailers being stored on a street in a freight area.

Figure 164. Trailers Stored on Street.

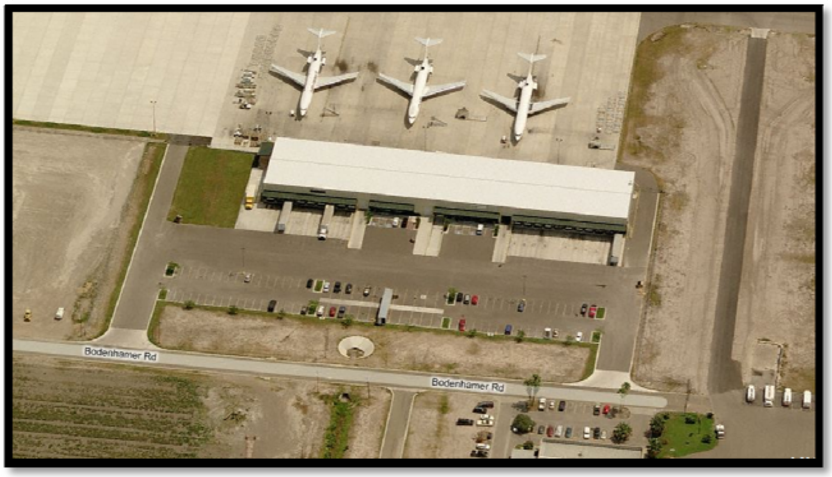
One freight shipper at a smaller airport is reportedly planning to expand its facility but will need to reconfigure its driveway, parking area, and docking area to allow for trucks to completely enter the facility before needing to turn around and back up to the loading docks. At the time of the interview, 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 165 provides an example from the east freight area at Harlingen International Airport where such on-site space is provided.



Source: BingMaps.com

Figure 165. Freight Facility with Space for Truck Backing Maneuvers.

In some cases freight shippers will use a relatively smaller facility on the airport grounds and have a larger transfer facility at a nearby location. In these cases only smaller single-unit trucks typically access the airport facility, while the larger tractor-trailer trucks access the off-airport facility. When this process is used, the volumes of larger trucks accessing the airport are decreased.

PERFORMANCE MANAGEMENT AND NEEDS IDENTIFICATION

Issue

Performance measurement of an airport's freight ground-transportation system should be conducted at least periodically and preferably continuously or regularly by either dedicated airport staff or outside sources. There is little evidence that performance measurement of the freight ground-transportation system is currently conducted in such a manner at Texas airports.

Obstacles

Airport, state, and local transportation master plans and improvement plans are often developed or updated independently, and as a result truck-specific issues that need to be addressed at preferably the planning stage or at least at the operational stage are often overlooked. 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 a need 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 the airport's freight ground-transportation system, which will 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, with evidence of freight indicators being implemented at MPOs, state departments of transportation, and the U.S. Department of Transportation, who employ dedicated transportation engineers. 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. These are often prepared by third parties such as state and local planning authorities or MPOs on a need basis, sometimes through external contracts with private consulting firms as objective analyses of traffic impacts and needs in order to assess access requirements for a specific proposed development. It is recommended that TIAs 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 will benefit all parties by determining at least:

- What access is needed.
- Where the access would best be located.
- What improvements to adjacent and other off-site roadways are needed and how they should be configured.
- What traffic controls should be employed.

- Other conclusions or recommendations responding to issues or requests raised by the tenants or participating agencies.

TxDOT should be involved in the TIA scoping and review if it is expected that an improvement or access to a state highway will be requested. If any off-site roadway improvements are possibly needed or desired, airport authorities should request a TIA. The TIA can be used for several purposes but should only include items 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 a high number of accidents.
- Developing and addressing the effectiveness and feasibility of alternative improvements.
- Exploring funding strategies for requested highway improvements.
- Addressing other issues, needs, or options of interest to the airport, cargo tenants, or transportation agencies.

To initiate the TIA, the TIA preparer, airport authority, cargo tenants, local transportation agencies, TxDOT, and other stakeholders should meet to 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 measure performance of an airport's freight ground-transportation system is important for assessing the condition of the system, identifying its problems, and prioritizing actions to resolve those problems. Freight-system performance measures are important to support decisions about investments, operations, and policies by a range of stakeholders such as the airport authority, TxDOT, local transportation agency, and private sector, e.g., shippers, carriers, receivers, and freight forwarders. Performance measures for an airport's freight ground-transportation system will also help educate planners, decision makers, and the public about the importance of freight ground transportation at airports to our economy and quality of life.

Areas of emphasis of performance measurement should include, but not be limited to, efficiency, effectiveness, capacity, safety, security, infrastructure condition, congestion, energy, and environment. The set of performance measures to be chosen at each airport depends on several factors such as airport characteristics, types of operations, objectives of performance measurement, and data availability. General freight performance measures are presented on FHWA's dedicated Performance Measurement website and can provide guidance for development of airport-specific performance measures (*35*). 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: peak travel time to off-peak travel time.
- Travel time.
- Ratio: variance to average for peak trip times.
- Annual miles per truck.
- Conditions on intermodal connectors.
- Customer satisfaction.

TxDOT is also 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 department's ongoing performance in areas of safety, construction, pavement and bridge condition, finance, design, right-of-way, and more.

Performance measures specific to airport freight ground-transportation operations can be developed and adapted on the basis of the above examples. Additional ones can be developed to address specific areas of emphasis at airports such as adequacy of facilities through metrics such as cargo-area truck queues, intra- and inter-cargo-area travel times, bay maneuvering space, etc.

Airports should have dedicated transportation professionals who are capable of developing, executing, and monitoring comprehensive freight ground-transportation performance measurements. 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 would also benefit from private-sector involvement that has a longer history and better understanding through measuring performance of its operations. Institutionalizing performance measurement would facilitate consistent, thorough, and early involvement of all stakeholders; promote 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.* Washington, D.C.: Transportation Research Board of the National Academies, 2003. http://www.accessmanagement.info/manual.html.
- *Access Management Manual.* Austin, Texas: Texas Department of Transportation, December 2009. http://onlinemanuals.txdot.gov/txdotmanuals/acm/acm.pdf.
- Performance Measurement. Washington, D.C.: 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. Austin, Texas: Texas Department of Transportation. http://apps.dot.state.tx.us/txdot_tracker/.

CHAPTER 7. BEST PRACTICES AND NEXT STEPS

BEST PRACTICES

This research identified best practices and lessons learned from interviews with airport, transportation agency, and shipper representatives, as well as the case studies and associated field observations. These best practices represent success stories that are already in place or planning processes to address future freight activity. Best practices are not listed in any particular order of importance and include examples observed in case studies (Chapter 5 of this report) or interviews. These practices, or modifications of them, have enhanced landside freight access to airports or are planning practices that should enhance access when the time comes for implementation. These best practices are presented to offer airports and related agencies ideas on how to improve their freight access. It is understandable that it may not be possible to implement all of the best practices at any single airport.

The following are the best practices and examples identified in this research. Airports should include all stakeholders early in airport freight-center development or expansion. This recommendation also applies to development and expansion of off-site freight facilities that may be freight-traffic generators that affect freight traffic to and around the airport. Examples include:

- Midland-Odessa area—The brainstorming session conducted in this area related to a hypothetical off-site freight center that would generate traffic to the airport.
- Alliance Airport (Fort Worth)—The airport coordinates with multiple agencies in long-range planning for on- and off-site improvements.
- San Antonio area—Coordination occurs among area airports, including San Antonio International, Port San Antonio, and Stinson Municipal.

General-aviation airports planning to accommodate future freight activity should address future plans and needs in master plan updates, taking into consideration landside access when placing airside facilities. One key is to give early consideration in the master planning process to air cargo so that all issues can be discussed at appropriate times. Preparing a business plan, including performing air-cargo market analyses, is very important to understanding potential activities. Examples include:

- Hondo Municipal Airport—The airport set a good example of addressing future plans and needs with master plan updates (the airport currently has no freight activity, but it is being considered for the future).

Wayfinding was identified as one of the most important issues from shipper/trucking perspectives through interviews conducted. Wayfinding should include consistent signage and begin in Area of Influence 1 (controlled-access roads furthest from the airport). Examples include:

- Houston metropolitan area—The area has excellent examples of providing directional signage for both major airports throughout the area.
- Alliance (Fort Worth)—The area has good, consistent signage that is easily identifiable and stands out from other street signs.
- Midland International—Excellent examples of signage appear in Area of Influence 3 and on airport grounds for a smaller airport. Signs are large with minimal information and are easy to read.
- George Bush Intercontinental (Houston)—The area has very good, consistent overhead signage on roads leading to cargo and passenger facilities. Signs are large and well organized and provide advance information.

Freight-center development should include sufficient space for truck maneuvers to be performed on site and should include parking for trucks and trailers. Examples include:

- Valley International Airport (Harlingen)—The newest cargo facilities on the east side of the airport provide ample space for trucks to perform turning and backing movements without impeding traffic flow on adjacent streets.
- Will Rogers World Airport (Oklahoma City)—Cargo facilities provide ample space for trucks to perform turning and backing movements without impeding traffic flow on adjacent streets.

Airports should provide separate freight access that minimizes comingling with passenger traffic and resulting conflicts. Examples include:

- Valley International Airport (Harlingen)—The newer facility on the east side of the airport has routing that is completely separate from passenger traffic.
- Will Rogers World Airport (Oklahoma City)—Freight traffic can approach the cargo area on a street (Air Cargo Road) that passenger traffic typically does not use.

- El Paso International Airport—Spur 601 is a newly constructed, limited-access freeway that travels east-west between Loop 375 and US 54 to the north of the airport. Airport representatives feel this new roadway provides excellent access for trucks traveling in and out of the Air Cargo Center and the Butterfield Trail Industrial Park.
- Austin-Bergstrom International Airport (a full case study was not performed in the research project)—There is a separate exit from SH 71 for freight traffic from the exit for passenger-terminal traffic.

Intersection geometrics should be sufficient to accommodate long-wheelbase trucks. Examples include:

- Alliance (Fort Worth)—The airport provides excellent examples of providing intersection geometrics from the original concept of the airport and surrounding related developments.
- Midland International—The intersection of FM 1788 at SL 217 provides access from the west side of the airport. There is no significant freight and truck activity at the airport currently, but this intersection will accommodate future truck traffic that may occur.
- Port San Antonio—This airport is an excellent example of retrofitting access to an airport recently converted from an Air Force base. The roadway network around the airport is quite robust, and several new roadway upgrades have been recently completed, which will aid in the handling of truck-freight access.

Airports should minimize distances between nearest controlled-access highways and the freight center, and select connection routing with minimal incompatible land uses. Examples include:

- Alliance (Fort Worth)—Because this airport was designed for freight activity and built from scratch on previously undeveloped land, it had the best opportunity for success. Freight traffic can approach from three highway exits, and there are no unrelated land uses currently in the vicinity of two of the highway exits.
- El Paso International Airport—The new Spur 601 facility provides a route that minimizes the distance from the freeway system and does not currently have

incompatible land uses. Because the airport and Fort Bliss own the land surrounding this road, there should be no land-use conflicts in the future.

- Port San Antonio—The primary entrance to Port San Antonio's truck-freight facilities will shift to the northern gateway from US 90 via 36th Street and Frank Luke Drive now that it has been completed and opened. This route provides direct access to the newly constructed Air Cargo Facility at the northern end of the airfield. Additional access via General Hudnell Road will remain possible as an alternative but will be discouraged as transit-oriented development, business activity, and residential traffic increase in the business/residential core of the Port San Antonio facility.
- Laredo International—Designated truck routes exist. Agencies should ensure that pavement and cross sections are sufficient to handle truck traffic.

The airport should address intersection and access-management issues when adapting to the existing roadway network. Examples include:

- Laredo International—The area installed median treatments at intersections where freight traffic accesses the arterial street system.
- Midland-Odessa area—Access-management issues were identified and discussed related to frontage roads and a major segment of potential freight routing in the area.

The airport should identify all potential funding sources when improving freight access, including public-private partnerships. Examples include:

- Alliance (Fort Worth)—The airport coordinated and identified multiple funding sources for a runway expansion and related roadway and railroad modifications around the airport.
- Midland-Odessa area—The brainstorming session conducted among area agencies resulted in ideas for potential funding sources, including economic-development agencies, as well as communication related to current funding limitations.
- El Paso International Airport—With the expansion of activities at Fort Bliss, adjacent to the airport, the development of Spur 601 was a federal, state, and local venture.

In summary, the best practices identified in this research project include:

1. Airports should include all stakeholders early in the airport freight-center development or expansion.

2. Wayfinding should include consistent signage and begin in Area of Influence 1—on the controlled-access roads farthest from the airport.
3. Intersection geometrics should be sufficient to accommodate long-wheelbase trucks.
4. Airports should minimize distances between nearest controlled-access highways and the freight center, and select connection routing with minimal incompatible land uses.
5. Airports should address intersection and access-management issues when adapting to the existing roadway network.
6. Airports should identify all potential funding sources when improving freight access, including public-private partnerships.

FUTURE ADDITIONAL WORK

The research team made some field observations related to pavement conditions on roads at or near airports. Visual observations can be misleading, however, and specific studies need to be performed related to pavement design needs. Based on the Midland-Odessa brainstorming process, as well as interviews with various agency representatives, a next step would be to study and develop planning processes and associated land-use regulations related to freight-center development at airports, rail centers, and other freight-traffic generators.

ANNOTATED BIBLIOGRAPHY

As part of the review of existing literature, the research team conducted an initial search of literature related to freight access to airports. The two primary literature databases used were the Transportation Research Information Services (TRIS) database and the TRANSPORT database. The TRANSPORT database includes the following sub-databases: *Transport 2003-2008/06*, *Transport 1988-2002*, and *Transport Pre-1988*. All three databases were used in this search.

According to their website, the TRIS database is the world's largest and most comprehensive bibliographic resource on transportation research information. It is produced and maintained by the Transportation Research Board (TRB) at the National Academy of Sciences with sponsorship by state departments of transportation, the various administrations at the U.S. Department of Transportation, and other sponsors of TRB's core technical activities. It contains about 700,000 records of published research.

A variety of search terms and combinations of search terms were used to identify sources of information. This included airport access, intermodal access, connector, freight, air cargo, landside access, ground access, transport, roadway access, freight terminal, goods, shipment, and various combinations of the aforementioned words and phrases. More than 250 documents were found. A cursory review of the documents and their abstracts was conducted to identify those that may be of specific value to this project. The most relevant documents were then categorized according to four subject areas: Texas airports, general air cargo, landside access, and planning and solutions. Additional news/magazine sources are included in the literature results at the end of this chapter. The following review of the existing literature is in annotated bibliography form.

TEXAS AIRPORTS

- Federal Highway Administration. *Official NHS Intermodal Connector Listing - Texas*. http://www.fhwa.dot.gov/planning/nhs/intermodalconnectors/texas.html.

  Summary:

  This spreadsheet summarizes the characteristics of connectors for airports in Texas, including number, description, length, and facility identification of their connectors.

- Mahmassani, Hani S., Michael McNerney, Keisha Slaughter, and Hussein Chebli. *Synthesis of Literature and Application to Texas Airports.* Interim Literature Review Report, September 1999–February 2000, Austin: Center for Transportation Research, Bureau of Engineering Research, The University of Texas at Austin, 2000.

Abstract:

Air transportation plays a vital role in the Texas economy. Air passenger/cargo traffic is projected to continue to increase considerably at many of the state's large airports. Ground access to airports is an important function that must be provided for at the regional level as well as in the immediate vicinity of the facility itself. Congestion problems affecting airport access are in some instances reaching unacceptable proportions; there are also concerns regarding the negative impacts such as congestion and its effect on air quality and other environmental considerations. Accordingly, these issues require concerted action to meet project needs.

To address the above challenges and current gaps, this project will take a comprehensive look at the landside access issues associated with the major airports in the state. It will seek to improve on existing planning procedures and processes to meet the unique needs of airport traffic demand, for both people and goods. To be effective, planning for airport ground access must be multimodal and intermodal; consider operational, regulatory, and capital-intensive infrastructure provision issues; consider multiple levels of scale/resolution; and recognize the unique dynamic aspects of air traffic demand, i.e., its temporal patterns.

This report presents an overview and synthesis of the literature reviewed under the first task. The research team concludes that the motivation and the need for the ground-access study are high, and that existing approaches and documents are insufficient to meet the needs for strategic ground-access planning of major airports in Texas.

- Thompson, Kelsey A., Michael S. Bomba, C. Michael Walton, and Jordan E. Botticello. *The Trans-Texas Corridor and the Texas Airport System: Opportunities and Challenges.* Technical Report, Austin: Center for Transportation Research, The University of Texas at Austin, 2006.

Abstract:

The proposed Trans-Texas Corridor (TTC) will allow for faster and safer movement of people and goods throughout Texas, relieve congestion on existing roadways, divert hazardous materials away from urban areas, and stimulate economic growth and development along its path. However, to become fully integrated with the Texas transportation network, the TTC must also consider connections with the state's extensive airport system. While the TTC could produce significant opportunities for commercial services and general-aviation airports, many of its planners and engineers are not familiar with the special land-use and connectivity needs of airports. While the TTC offers prospects for producing significant opportunities to commercial-service and general-aviation airports, it also has the potential to limit their safety, operation, and expansion if planned poorly. Possible airport benefits include direct ones, e.g., increased usage because of improved airport user access, and indirect ones, e.g., economic development along its path. Potential challenges include infringement on approaches and approach procedures, restriction of airport growth, limited accessibility or connectivity to the TTC, and competition with land-based modes for passenger and freight movement. Integrating Texas airports into the overall multimodal TTC design will leverage intermodal transportation for inter-city travel and freight movement throughout Texas.

GENERAL AIR CARGO

- Adidjaja, Christina, and Mary Hrabowska. *Freight Facilities and System Inventory.* Final Report, New York: New York Metropolitan Transportation Council, 1995.

Summary:

This report is based on various existing freight studies in the New York region and freight-related and logistics articles in journals recent to 1995. It describes the general physical and operational characteristics and bottlenecks to the efficient operation of intermodal terminals and systems in the New York metropolitan area and its vicinity. The findings are summarized by mode (aviation, marine, rail, and truck terminals).

- Chen, Chih-Hsien. “Developing a Performance Index for Air Cargo Terminal.” *International Conference on Networking, Sensing and Control.* Taipei, Taiwan: National Taiwan University of Science and Technology, 2004, pp. 231–236.

Abstract:

The purpose of this article is to identify the variables influencing the performance of air-cargo terminals. It defines performance as the degree of qualitative variables offered to the clients and quantitative variables from the cargo-terminal point of view. According to the test of difference between two proportions and multivariate analysis, a set of significant variables is established for the performance of the air-cargo industry. The customer satisfaction also appears to have had significant improvement with the last year. Finally, four qualitative factors—personnel attitude, charge activities, knowledge and ability, and commitment factors—as well as four quantitative variables—cargo safety, import/export/express processing efficiency, cargo mishandling (i.e., cargo missing and cargo damaged), and parking variables—are found for evaluation of performance.

- CTC and Associates LLC, Wisconsin Department of Transportation Research and Library Unit. *Economic Impact of Air Cargo Operations.* Transportation Synthesis Report, Wisconsin Department of Transportation, Madison, Wisconsin, 2008.

Summary:

This project seeks to develop a guidebook to assist practitioners in measuring the value and impact of air-cargo activities. The search produced a State System Plan that analyzes the market for air-cargo activity, as well as reports and studies that focus on state or regional programs and strategies specific to air-cargo operations.

- Hauser, Ed, and Nicholas Swartz. *Economic Impact Assessment of Charlotte Douglas International Airport.* Charlotte, N.C.: The Center for Transportation Policy Studies, The University of North Carolina at Charlotte, 2005.

Summary:

This report summarizes the approach to the issues and the results of a study about various factors that are essential to estimate the impact of the Charlotte Douglas International Airport

on the economy of the region. The target impact area for this study included 13 counties in the greater Charlotte Metropolitan Region. Surveys were conducted of all airport tenants at Charlotte Douglas, airline passengers, airport contractors, corporate and general-aviation operators, hotels, and travel agencies. In addition, as a way to develop a measure of the airport's impact on the business community, mail-out surveys were sent to employers with more than 100 employees from the 13-county region. The report consists of a brief description of the methodology, analysis, and findings of the surveys; makes projections of the study data to the region; and draws conclusions of the total economic impact of the airport on the region. Findings and conclusions are supported by an extensive database, which is on file at the Center for Transportation Policy Studies.

- Hrabowska, Mary. *Freight Facilities and System Inventory in the New York Metropolitan Region.* Task Report, New York: New York Metropolitan Transportation Council, 2000.

Summary:

As part of the implementation phase of the intermodal management system, the New York Metropolitan Transportation Council (NYMTC) central staff created this inventory report for major freight facilities and systems active in the New York region. The current work updates the first inventory report issued by NYMTC in 1995. The purpose of this inventory report is to describe the current condition of major freight transportation facilities and systems. The major elements of this report include: rail carload and intermodal (rail/highway) transportation, trucking, air I-2 (domestic/international), and water transportation (domestic/international). It specifically describes and summarizes the air-cargo industry in the United States and major freight-handling airports in the metropolitan region in New York.

- Hrabowska, Mary. *Truck Terminals and Warehouses Survey Results in the New York Metropolitan Region.* New York: New York Metropolitan Council, 2001.

Summary:

The purpose of this survey was to provide an inventory of the existing trucking and storage facilities in the NYMTC area, and to identify the highway and other access bottlenecks to truck movements, adequate storage place, and commodity flows. This survey was a continuation of the truck terminals and warehouses survey conducted by NYMTC staff and its member agencies' staff in 1995, which resulted in the publication of the NYMTC report, *Truck Terminal and Warehouse Survey Results*, issued in 1996. The comparison of changes within the last five years and findings are discussed. The survey was conducted in 1999 by NYMTC staff and agency staff from New York City and Nassau, Putnam, Suffolk, Rockland, and Westchester Counties. The results of this survey helped identify the key issues affecting the future of freight transportation in the region and provided a base for planning future facilities.

- Karlsson, Joakim, Amedeo Odoni, and Megan Brett Gaudet. "Cost of Aviation Infrastructure in the United States." *Transportation Research Record*, Journal of the Transportation Research Board of the National Academies, 2008, pp. 28–36.

Summary:

This paper addresses the following critical question: "How many cents out of every dollar spent on commercial air transportation services by service users eventually go toward paying for the capital costs, operational costs, and security costs of infrastructure?" "Commercial air transportation services" here refers to passenger airlines and cargo carriers. Computational analysis is limited to the U.S. airline industry and uses data from 2004.

- Sperry, Benjamin R., Jeffery E. Warner, and Jeffrey D. Borowiec. *Evaluation of the Role and Needs of Air Cargo in Texas.* Southwest Region University Transportation Center, College Station, Texas, 2008.

Abstract:

According to the U.S. Department of Transportation, the cargo industry continues to grow, with air cargo identified as the fastest growing segment within the cargo industry. The value of freight moved by air has doubled since 1993 and currently exceeds $2.7 billion per day. During that same period, the typical freight shipment distance increased 40 percent, partly due to the distances of the air-cargo movements. Because most air-cargo shipments begin and end using trucks, growth in this segment will undoubtedly create additional growth in truck movements in and around the airport environment. It has been more than 30 years since the state has made a comprehensive review of the air-cargo business within its borders. In that time, much has changed in Texas, in the United States, and across the globe. The industry has changed through consolidation and mergers with ground-transportation companies, in the services they provide, and in the current level of technology employed. The world is a different place, our economies have been transformed, and the nature of doing business has altogether changed. So far, the impact of growth in air cargo on the Texas transportation system has gained little attention when compared to issues related to seaport traffic. The research objective for this project is to better understand the operations of the air-cargo industry in Texas in order to better accommodate the industry's needs, provide for a more efficient transportation network, better utilize general-aviation facilities, and provide for economic development across the state. This research identifies the existing demand for air-cargo movement in Texas, the ground facilities available to process this demand, and a network that would be efficient and responsive to the needs of industry stakeholders. It also identifies the state's network of existing air-cargo facilities, both those handling existing air-cargo activity and those capable of handling air cargo in the future.

- Strauss-Wieder, Inc. *The Role of the National Highway System Connectors: Industry Context and Issues.* Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1999.

Summary:

This report provides an understanding of the evolving role of freight transportation in maintaining a competitive business environment and effective national security; articulates the importance of intermodal connectors in providing an efficient, flexible transportation system that meets the expectations of businesses and national priorities; and identifies both the opportunities and barriers to improving intermodal connections.

- Transportation Security Administration. "Air Cargo Programs: Recent Air Cargo Security Changes." http://www.tsa.gov/what_we_do/layers/aircargo/07102006_changes.shtm. 2009.

Summary:

The TSA ensures the security of the air-cargo supply chain by mandating air carriers and freight forwarders implement Sensitive Security Information (SSI), which is prohibited from public distribution. The effective date for implementation of the requirements in the security programs was March 12, 2007. The new security programs involve cargo security changes that affect all modes within the air-cargo supply chain.

- Transportation Security Administration. *Air Cargo Security Requirements; Compliance Dates; Amendment.* Interim final rule, request for comments, Department of Homeland Security, 2004.

Summary:

This interim final rule (IFR) amends the Air Cargo Security Requirements final rule (Air Cargo Final Rule) by extending the compliance dates by which aircraft operators, foreign air carriers, and indirect air carriers (IACs) must ensure that their employees and agents with unescorted access to cargo, and IAC proprietors, general partners, officers, directors, and certain owners of the entity successfully complete a Security Threat Assessment (STA). This extension is based on technology problems that TSA is experiencing with the processing of STA applications.

- Transportation Security Administration. "Air Cargo Watch: You Are the Key to Air Cargo Security." http://www.tsa.gov/aircargo. October 2006.

Summary:

This presentation offers basic information on the air-cargo watch program. It describes the campaign purpose, program distribution and display, posters, and laminated guide.

- Transportation Security Administration. "TSA Air Cargo Programs: You Are the Key to Air Cargo Security—What Should I Look for in Identifying Potential Security Risks?" www.tsa.gov/aircargo.

Summary:

This is a quick reference guide to assist in the identification of potential security risks within the air-cargo supply chain. Items listed in the guide fall into four categories: cargo acceptance, packaging, documents, and general. Information regarding "what can I do to increase security" and "who do I call to report a potential security risk" is also provided.

LANDSIDE ACCESS

- Aultman-Hall, Lisa, Ken Agent, Brian Aldridge, Dave Cain, and Joel Weber. *Truck Route Access Evaluation.* KTC Report No. 99-32, Kentucky Transportation Center and the Department of Civil Engineering, University of Kentucky, Lexington, Kentucky, 1999.

Introduction Excerpt:

This is a study undertaken on behalf of the Kentucky Transportation Cabinet (KYTC). There are two main objectives in the Freight Movement and Intermodal Access in Kentucky Study (SPR 98-189): 1) evaluation of the access for trucks between intermodal or other truck-generating sites and the National Highway System, and 2) furthering the understanding of freight commodity flows throughout the state. This report summarizes the access evaluation for the areas around the Standiford Field Louisville Airport. This includes two large generators, Ford Motor Company and the United Parcel Service, and smaller industries to the west of the airport field along Crittendon Avenue. Work on other specific sites throughout Kentucky as well as the freight commodity flow task is ongoing and documented elsewhere. The site was visited for video recording on November 21, 1998; data collection began on September 29, 1998; and intersection traffic counts started on December 15, 1998. A phone survey was conducted with a UPS facility manager early in the study process. The survey found that approximately 150 trucks per day normally access the site, with as many as 400 in the peak of the year. The most common truck is a 28-ft drop van, but trucks as large as 53-ft semi-trailers also accessed the site. No traffic congestion problems were raised.

- Bradley, Malcolm. "A Comparison of Australian Airport Rail Links with Elsewhere in the World." *Papers of the Australiasian Transport Forum,* Vol. 28, 2005, pp. 18–36.

Abstract:

Australia's experience with airport-rail links in Sydney and Brisbane has reportedly proved to be somewhat unsuccessful in terms of patronage, or lack of it. Furthermore, as a possible consequence, the Victorian Government had earlier decided to put on hold the concept of the Melbourne airport rail link. The Australian experience prompted this investigation into the drivers behind airport-rail link patronage along with other issues that should be considered when providing an assessment of the ridership forecast. This paper compares airport-rail links in the United States and Europe, in addition to the two Australian cases. The key comparative measure in each case is the rail mode share, and factors considered important in having an impact on this mode share are discussed. Other factors, evident in the case of Australia, are also covered in a qualitative manner rather than quantitative and are considered to have a bearing on the mode share and also on the reasoning as to why ridership had not achieved the forecasted levels.

- Cambridge Systematics, Inc. "Intermodal Freight Connectors: Strategies for Improvement—Final Report." National Cooperative Highway research Program Project, Transportation Research Board, Washington, D.C., 2003.

Abstract:

The intermodal connectors of the National Highway System are the first and last miles of roadway used by truckers to travel between the major highways of the NHS and the nation's ports, rail terminals, and air-cargo hubs. They are usually local roads and often weave their way through older industrial and residential neighborhoods. Nationally, there are 1222 miles of NHS intermodal connectors, less than 1 percent of total NHS mileage. The connectors serve 616 terminals: 253 ocean and river ports, 203 truck-rail terminals, 99 air-cargo (and passenger) terminals, and 61 pipeline-truck terminals. They are critical but increasingly weak links in the freight transportation network. Potholes, narrow roadways, and tight turns increase wear and tear on trucks while slowing traffic and aggravating congestion. Although the federal transportation reauthorization process is likely to call attention to the needs of freight and may result in more flexibility for intermodal connector funding, many institutional and other obstacles are likely to remain. The purpose of this NCHRP project was to scan the literature, survey existing project experience to identify potential actions and

strategies, assess their viability during several intake sessions, and provide practical guidance to the American Association of State Highway and Transportation Officials (AASHTO) and others for advancing the state of practice in implementing freight intermodal connector improvements.

- Federal Aviation Administration. *Bulletin 1-Best Practices—Surface Access to Airports.* Washington, D.C.: 2006.

  Summary:
  This bulletin provides information to facilitate future coordination with surface transportation agencies. It also identifies current and future research in the planning and design of airport surface-access facilities related to terminal curbside, access roads, and pedestrian walkways. The following topics are addressed: use of passenger facility charges, airport improvement program, and airport revenue for airport ground-access projects; coordination of airport access needs with surface transportation agencies; summary of useful resource documents; and research projects for airport surface-access planning and design.

- Gosling, Geoffrey D. "Airport Ground Access Mode Choice Models." *Airport Cooperative Research Program Synthesis of Airport Practice No. 5*. Transportation Research Board, 2008.

  Abstract:
  This synthesis extends previous efforts to document the state of practice for airport ground-access mode-choice models. It examines the characteristics of existing models and discusses the issues involved in the development and use of such models to improve the understanding and acceptance of their role in airport planning and management. Information presented in this report may be of interest to a range of airport managers, airport and regional transportation planners, consultants and transportation modeling specialists, and researchers interested in issues involving airport ground-access mode choice. For this synthesis, a comprehensive review of the relevant literature was undertaken. To document the extent of the recent use of airport ground-access mode-choice models and to identify sources of technical documentation on existing models, this literature review was supplemented by a

survey of airport authorities, metropolitan planning organizations, consulting firms and research organizations, and other government agencies and industry organizations. Follow-up communications by telephone and e-mail were made where necessary.

- Hall, Randolph W. "Alternative Access and Locations for Air Cargo." Los Angeles, Calif.: University of Southern California, 2002.

  Abstract:
  This paper documents and analyzes issues confronting air-cargo movements in Southern California (the Los Angeles and San Diego areas), develops strategies for accommodating growth in air cargo, and assesses the impacts of these strategies on carrier operations. The emphasis is on the operation of the cargo carriers themselves, rather than on the governmental entities that serve these carriers. Particular emphasis is given to operation of integrated carriers.

- Lu, Xiao Yun, Geoffrey D. Gosling, and Jing Xiong. *Opportunities for Improved Intermodal Connectivity at California Airports.* California PATH Working Paper, California PATH Program, Institute of Transportation Studies, University of California, Berkeley, 2005.

  Abstract:
  This working paper was prepared as part of research to develop a combined quantitative and qualitative approach to planning for improved intermodal connectivity at California airports. The quantitative approach involved the development of an Intermodal Airport Ground Access Planning Tool that combines an air-passenger model-choice model, a model of transportation-provider behavior, and a traffic-network analysis model. The qualitative approach would later be used to enhance the quantitative analysis to account for those factors, which were difficult to quantify, and to provide recommended policy and planning guidelines.

- Mahmassani, Hani S., Keisha Slaughter, Hussein Chebli, and Michael McNemey. *Domestic and International Best Practice Case Studies.* Research Report, Austin: Texas Department of Transportation, 2001.

Abstract:

Air transportation plays a vital role in the Texas economy. Air passenger/cargo traffic is projected to continue to increase considerably at many of the state's large airports. Ground access to airports is an important function that must be provided for at the regional levels as well as in the immediate vicinity of the facility itself. Congestion problems affecting airport access are in some instances reaching unacceptable proportions; there are also concerns regarding the negative impacts such congestion is having on air quality and other environmental considerations. Accordingly, these issues require concerted action to meet project needs.

To address the above challenges and current gaps, this project will take a comprehensive look at the landside access issues associated with major airports in the state. It will seek to improve on existing planning procedures and processes to meet the unique needs of airport traffic demand, for both people and goods. To be effective, planning for airport access must be multimodal and intermodal; consider operational, regulatory, and capital-intensive infrastructure provision issues; consider multiple levels of scale/resolution; and recognize the unique dynamic aspects of air traffic demand, i.e., its temporal patterns.

This report documents domestic and international best-practice case studies. The overall impact of the entire airport transportation network must be considered in order to address ground-access issues. This study confirmed the objectives and tasks laid out in the research proposal.

- Office of Freight Management and Operations, Federal Highway Administration. *NHS Intermodal Freight Connectors: A Report to Congress.* Washington, D.C.: U.S. Department of Transportation, 2000.

Abstract:

Section 1106(d) of the Transportation Equity Act for the 21st Century (TEA-21) directed the secretary to conduct a review of the National Highway System freight connectors that serve seaports, airports, and major intermodal terminals and report to Congress by June 9, 2000. The Federal Highway Administration conducted this study with the following objectives: 1) evaluate the condition of NHS connectors to major freight intermodal terminals, 2) review improvements and investments made or programmed for these connectors, and 3) identify

impediments and options to making improvements to the intermodal freight connectors. NHS freight connectors are the public roads leading to major intermodal terminals. This report discusses the study and its findings.

- Sacramento Airport System. "SMF Gets New Neighbors." *California Department of Transportation Journal,* Vol. 3, No. 1, July–August 2002, pp. 6–11.

  Summary:
  This journal article describes the trends of developments around Sacramento's International Airport, which represent an opportunity that few airports have—the possibility of crafting "speed century development" on new space instead of having to displace earlier development, much of it residential or industrial. The empty fields around Sacremento International Airport (SMF) today lie fallow, in wait for some uniquely 21st century development. Caltrans, the County of Sacramento, the airport, and Metro AirPark's developers are working together to develop the access needed as nearby developments come online. The Sacramento Council of Governments and Sacramento Regional Transit District are studying a number of light-rail routes to Sacramento International Airport. That development will have a major impact on the airport, the land around it, and Sacramento's ground-transportation system.

- Shafran, Isaac, and Anne Strauss-Weider. *Financing and Improving Land Access to U.S. Intermodal Cargo Hubs.* NCHRP Report 497, Washington: Transportation Research Board, 2003.

  Abstract:
  This report presents guidance on the most effective strategies for financing improvements to cargo-hub and intermodal freight facilities. These strategies focus on existing and emerging funding sources and on developing partnerships between government agencies, cargo-hub operators and users, and local communities. After preparing an inventory of cargo-hub improvements projects across the United States, the research team selected 12 projects as case studies for in-depth analysis.

Appendices to the report include detailed information on each case study, the full inventory of major cargo-hub access improvement projects, and a listing of relevant federal and selected state funding sources and mechanisms. The report should be particularly valuable to planners and senior decision makers in government and the private sector who are faced with the growing challenge of maintaining or improving access to cargo-hub facilities that are growing rapidly in size, quantity, and importance.

- Shapiro, Phillip S. "Intermodal Ground Access to Airports: A Planning Guide—A Good Start." Presented at the Sixth Transportation Research Board Conference on the Application of Transportation Planning Methods, Dearborn, Michigan, May 19–23, 1997.

Summary:

This article provides an introduction to the *Intermodal Ground Access to Airports: A Planning Guide*. It summarizes the guide's primary focus, which is providing passenger access to commercial airports from primary origins or destinations. It deals with:

- Off-airport roads and high-occupancy vehicle (HOV) facilities up to the airport boundary.
- On-airport roads, parking circulation elements, and curb facilities up to the terminal entrance.

Several issues were discussed afterwards, including:

- Importance of airport access.
- Relationship between ground-transportation characteristics and originating passengers.
- Access facilities.
- Curbside configurations.
- Parking requirements.
- Mode of access to U.S. airports.

The article comments that while this guide is a good start, it still needs some additional work related to this subject. Some suggestions for additional work are given.

- Sharp, Andrew. “Air Rail Intermodality—An Overview.” *International Airport Review,* Vol. 11, 2007, pp. 16–19.

Abstract:

Around the world, 300 airports are considering, planning, or building rail connections, while about 120 already have one or more. In addition to airport freight (cargo) rail, airport passenger rail is discussed, including light rail, metro and suburban services, regional rail, Asia-Pacific airport express services, and high-speed rail. A major function of airport rail service, accommodating airport employee traffic, is presented. Examples of rail links around the world are given, including those offering check-in and baggage checks at sites outside airports. Integrated check-in for intermodal trips is also discussed.

- Shriner, Heather Wishart, and Lester A. Hoel. “Evaluating Improvements in Landside Access for Airports.” *Transportation Research Record,* Journal of the Transportation Research Board of the National Academies, No. 1662, 1999, pp. 32–40.

Abstract:

U.S. airport authorities conducted a national survey to determine the characteristics of airport access services provided. The results of the survey indicated that landside access to airports is a major concern at airports of all sizes, but there is no significant difference in reported access problems at large, medium, and small airports. An access evaluation methodology was developed to assess landside access service between approaches to the airport and the terminal entrance. It is based on performance measures relating to cost, time, reliability, convenience, and quality. This evaluation methodology was demonstrated by investigating landside access facilities at the Richmond International Airport. The flexibility of the methodology may provide the airports with a wide range of assessment needs and resources. No special training is required for the evaluation process. It is recommended that the evaluation methodology be incorporated into access-fund-appropriation processes as a consistent means of evaluating performance, identifying access needs, and evaluating potential access improvements.

- Siggerud, Katherine. “Challenges to and Potential Strategies for Developing Improved Intermodal Capabilities.” General Accounting Office, Washington, D.C., 2006.

  Summary:

  Significant challenges are the lack of specific national goals and funding programs to develop intermodal capabilities. Federal funding is often tied to a single transportation mode; as a result it may be difficult to finance projects, such as intermodal projects, that do not have a source of dedicated funding. A number of planning challenges that federal transportation projects, including intermodal projects, are facing include limits on the uses of federal funds, ensuring that widespread public participation is reflected in decisions, physical and geographic land constraints, and the difficulty in coordinating among multiple jurisdictions in transportation corridors. Finally, intermodal capabilities, while offering benefits to mobility, may need to develop a demand over time.

  Two general strategies could help public decision makers improve intermodal options. In the first strategy, Congress would shift federal transportation funding to a more system-wide approach across all modes and types of travel. The second strategy is to increase the role of the federal government in planning and funding intermodal projects and shift the federal transportation policy’s focus on state and local decision making of long time to either nationwide or along particularly congested corridors.

- Trunick, Perry A. “Intermodal Connections Take Off.” *Logistics Today*, 2007, pp. 26–27.

  Summary:

  “Intermodal Connections Take Off” inventoried airport intermodal expansion across the Midwest. These airport intermodal expansions pave the way for regional economic growth. The article also provides a list of 5-Star Midwestern Logistics Cities with their ranking scores.

PLANNING AND SOLUTIONS

- Airport Cooperative Research Program. “Current and Emerging Issues Facing the Airport Industry.” *Research Results Digest 5*, 2009.

Abstract:

A well-functioning airport system is essential to U.S. participation in the global economy. Airports provide (and often operate) facilities and infrastructure that accommodate various services needed to access the national and international air transportation system. The ACRP conducts and distributes applied research on problems important to the airport industry in order to assist airport operators in fulfilling their responsibilities. To ensure useful research is conducted, occasionally an inventory of the most critical issues faced by airport operators is needed. This digest reports on such an inventory undertaken by the ACRP.

- Airport Cooperative Research Program. "Synthesis of Information Related to Airport Practices." *Research Results Digest 4*, 2009.

  Summary:

  This synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be most successful in resolving specific problems. It identifies already available publications, works under way as of December 2008, and topics selected for 2009 program.

- Cambridge Systematics, Inc. *Unclogging America's Arteries: Effective Relief for Highway Bottlenecks—1999–2004.* Washington, D.C.: American Highway Users Alliance, 2004.

  Summary:

  This report concludes with two trends of traffic congestion across the whole nation: congestion has grown across the United States, and improvements are possible. This study is an update to their 1999 study, *Unclogging America's Arteries: Prescriptions for Healthier Highways*. Specifically, this study had three objectives:

  - Identify the worst traffic bottlenecks in the United States.
  - Estimate the benefits to travelers and the environment.
  - Estimate the benefits that would be derived from removing bottlenecks nationwide.

- Cambridge Systematics, Inc. *West Coast Corridor Coalition Trade and Transportation Study.* Final Report, West Coast Corridor Coalition, 2008.

Summary:

The West Coast freight transportation system—seaports, airports, border crossings, and the highways and rail corridors that connect them to the region's metropolitan areas—is a key element of the national and international freight shipments connecting major markets in the United States, Canada, and Mexico. However, this vital transportation network is being stressed by continued growth in freight volumes. Through the identification of key trade, infrastructure, operational, and policy concerns affecting the West Coast region at the system level, this study provides a foundation and a process to allow West Coast Corridor Coalition members to work with national transportation policy makers, the private-sector freight community, and local partners to begin addressing specific system-wide issues and chokepoints that cross jurisdictional, interest, and financial boundaries. More importantly, it encourages a system-level, regional approach to planning for and investing in the region's trade and transportation system that will help the West Coast stakeholders work collaboratively to ensure its continued efficiency, reliability, and sustainability.

- Eisele, William L., and Casey M. Toycen. *Identifying and Quantifying Operational and Safety Performance Measures for Access Management: Micro-simulation Results.* Technical Report, College Station, Texas: Texas Transportation Institute, 2005.

Abstract:

This research report summarizes the activities of a research project intended to identify and quantify appropriate operational and safety performance measures that can be used for investigating access-management treatments. Specifically, the research had three objectives: 1) assess the state-of-the-practice relative to performance measures that are applicable to access management and identify existing and/or new measures—particularly measures that can capture the safety benefits of access-management treatments, 2) perform micro-simulation using the identified measures on two selected case-study corridors and on three theoretical corridors to demonstrate the application of the measures, and 3) develop guidance for applying the performance measures for evaluating roadway improvements that include

access-management treatments (e.g., raised medians and driveway consolidation) and incorporating them into the transportation planning process. The research will be useful to practitioners because it identifies desirable input and output characteristics for individuals searching for a micro-simulation tool to use for assessing the impacts of access management. It also identifies surrogate safety measures related to time to collision (TTC), and incorporates them into a micro-simulation model (VISSIM) as a demonstration of how both safety and operational impacts might be investigated in the same software package. Generally, the results appear intuitive—particularly at lower volumes and for the theoretical corridors.

The research report also discusses how the safety measures can be incorporated into the traditional transportation planning process. It also cautions that corridor improvements are very case specific and illustrates how micro-simulation, when calibrated appropriately to field conditions, provides a tool to estimate the effects of combined corridor characteristics. Finally, the research report concludes with future research needs that can enhance the state-of-the-practice in this area.

- Eisele, William L., and William E. Frawley. *Access Management Guidebook for Texas.* Technical Report, College Station, Texas: Texas Transportation Institute, 2005.

Abstract:

This guidebook explains the principles of access management for a variety of audiences. It discusses the benefits of access management and the three themes TxDOT is using as a foundation for the statewide program. It provides details and photographic examples of access-management treatments for roadways. Text descriptions of access classifications for roads are also included. The guidebook is intended to be used by a wide variety of audiences, ranging from lay people to technicians to policy and decision makers.

- Eisele, William L., and William E. Frawley. *Recommended Access Management Guidelines for Texas.* Technical Report, College Station, Texas: Texas Transportation Institute, 2005.

Abstract:

This report documents the research performed during this two-year research project to provide recommendations for the use of access-management techniques on state roadways in Texas. In the first year of the project, the research team focused on developing a matrix of guidelines for the application of different access-management techniques for various roadway-access classifications. The access-management treatments for which recommended guidelines are presented include access spacing, corner clearance, median treatments, auxiliary lanes, alternate left-turn treatments, access separation at interchanges, frontage roads, and the use of traffic impact analyses for site development. The matrix allows the user to identify critical threshold criteria for the application of each access-management technique for each roadway-access classification. In the second year of the project, the matrix was revised. The revised matrix and supporting information is presented in this document. The guidelines presented in this report will be valuable for state transportation professionals for use on new and retrofit projects as a toolbox of techniques for managing access to all state roadways—thus preserving the intended use of these facilities.

- Eisele, William L., William E. Frawley, and Casey M. Toycen. *Estimating the Impacts of Access Management Techniques: Final Results.* Technical Report, College Station, Texas: Texas Transportation Institute, 2004.

Abstract:

This research report summarizes the research activities and findings of the 2.5-year research project to investigate the impacts of access-management treatments. The first objective of the project was to estimate the impacts of access-management techniques through field data collection at selected sites in Texas and to perform simulation of traffic performance. Findings related to travel time and delay from three case studies are provided in this report. Theoretical corridors were also created and analyzed to provide further insight into corridor performance with changes in median type, driveway density, and traffic volume. The researchers identify key considerations for using micro-simulation (VISSIM) for investigating access-management treatments. Generally, the research identified a range of differences in travel time (and relatively small changes in speed) when comparing a corridor with a two-way left-turn lane (TWLTL) with the installation of a raised median along the

three case-study corridors and three theoretical corridors. The reduction in the number of conflict points along the corridors with access management was large (up to 60 percent for the case studies and up to 75 percent for the theoretical corridors). The reduction in conflict points illustrates the potential safety impacts of access management. The second objective of the research was to estimate the safety benefits of access-management treatments by investigating crash data from select corridors where access-management treatments have been installed. A key part of this analysis is the assessment of the crash information used in the analysis. The research identified a relationship between increasing access-point density and increasing crash rates. It also identified a reduction in crashes when comparing corridors with a TWLTL with those with a raised median. Crash severity was also reduced with the raised median.

- Eisele, Willam L., William E. Frawley, Anna T. Griffin, and Jeffrey D. Miles. *Estimating the Impacts of Access Management Techniques: Methodology and Preliminary Findings.* Technical Report, College Station, Texas: Texas Transportation Institute, 2002.

Abstract:

This research report describes the first-year activities and preliminary findings of a two-year research study to investigate the impacts of access-management treatments. The first objective of the research was to estimate the impacts of access-management techniques through field data collection at selected sites in Texas and to perform simulation of traffic performance. Preliminary findings of one such case study are provided in this report. Further case studies were investigated in the second year of this research. Simulation was also performed in the second year of this research on theoretical scenarios. The theoretical scenarios are intended to assist TxDOT in alternatives analysis. Two additional case-study locations were also simulated in the second year of the study. The second objective of the research was to estimate the safety benefits of access-management treatments by investigating crash data from select corridors where access-management treatments had been installed. A key part of this analysis is the assessment of the crash information used in the analysis. This report includes preliminary crash analysis from one case-study corridor, and researchers anticipated investigation of at least four additional case-study locations in the second year of the research study.

- Frawley, William E., and William L. Eisele. *Summary of Access Management Impacts: Access Point Density and Raised Medians.* Project Summary Report 0-4221-S, College Station, Texas: Texas Transportation Institute, 2005.

Summary:

This report summarizes a project for TxDOT to find what type of benefits can be estimated by using micro-simulation of access-management techniques on arterial streets. Being able to estimate the impacts of an access-management technique can assist decision makers in developing and selecting projects, as well as in communicating benefits of projects to the general public.

- Frawley, William E., and William L. Eisele. *Summary of Access Management Programs and Practices in the United States.* Project Summary Report 0-1847-S, College Station, Texas: Texas Transportation Institute, 2001.

Summary:

The concept of developing and implementing a comprehensive access-management program for the Texas highway system was investigated for TxDOT in this project. The report utilized a case-study method for in-depth study—Colorado, New Jersey, Wisconsin, Michigan, and Montana. A comprehensive access-management program is recommended by the report for TxDOT.

- Howard, Linda, and William Keller. "Aviation System Planning: Addressing Airport Infrastructure Needs." *Transportation in the New Millennium*, 2000.

Summary:

This paper identifies the problems of coordination between air transportation and the rest of the transportation system. It describes the issues that system planning must address and the value of improving the way they are addressed. It also provides objective ways to measure both the effectiveness of system planning and the aviation system's performance in meeting user needs.

- Mestre, Vincent, and Laguna Niguel. *Effects of Aircraft Noise: Research Update on Selected Topics-A Synthesis of Airport Practice.* ACRP Synthesis 9, Washington D.C.: Transportation Research Board, 2008.

  Summary:

  In the years since *Aviation Noise Effects* (FAA Report: FAA-EE-85-2) was published in 1985, much has changed in the aviation world. Our knowledge of the effects of aviation noise has also changed. The greatest increases in knowledge are in the areas of health effects, annoyance, sleep disturbance, and potential effects on children's learning abilities in school. This document is intended to update and complement the original document, primarily by focusing on the latest research efforts and conclusions. Issues covered include health effects of aviation noise; annoyance and aviation noise; sleep disturbance and aviation noise; speech interference and aviation noise; effects of aviation noise on schools; effects of aviation noise on parks, open space, and wilderness areas; aviation low-frequency noise and vibration; aviation noise effects on wildlife and domestic animals; aviation noise effects on property values; effect of meteorology on aviation noise; and effect of topography and ground absorption on aviation noise.

- North Central Texas Council of Governments. *Rail North Texas Corridor Facts Sheets.* North Central Texas Council of Governments, Arlington, Texas, 2008.

- North Jersey Transportation Planning Authority, Inc., New Jersey Institute of Technology. *Brownfield Economic Redevelopment.* Final Report, Newark, N.J.: Federal Transportation and Community and System Preservation Pilot (TCSP) Program, 2003.

  Summary:

  This final report on the Brownfield Economic Redevelopment (BER) project focuses on how these sites, known as brownfields, can be used as strategic assets to meet the evolving needs of the freight industry. The report presents the findings of several case studies of brownfield sites, which yielded insights into the complex issues that confront the region in achieving the redevelopment of the thousands of acres of brownfields in the port area.

- Smith, Clay R. "Southwest San Antonio (Kelly AFB) Mobility Study." *Proceedings of the Seventh TRB Conference on the Application of Transportation Planning Methods.* Boston, Mass.: Transportation Research Board, 1999, pp. 389–394.

<u>Abstract:</u>

Many Air Force bases nationwide, including Kelly AFB in San Antonio, Texas, were selected for either phase-out or privatization. The 1995 Defense Base Closure and Realignment Commission (BRAC) determined the Air Force has excess capacity and infrastructure in their depot system, and realignment of the San Antonio Air Logistics Center (ALC) would permit improved utilization of the remaining depots and reduce Department of Defense operating costs. The BRAC recommended the consolidation of workloads to other Department of Defense depots or to private-sector commercial activities. The City of San Antonio created the Greater Kelly Development Corporation (GKDC) to lead the communities' efforts to reuse and re-energize the many resources and develop the master plan for Kelly. The GKDC's planning and implementation efforts are aimed at developing a multimodal distribution center. Surface transportation needs to preserve and enhance accessibility to, from, and within Kelly are imperative. The MPO, TxDOT, the City of San Antonio, Bexar County, the GKDC, and other stakeholder representatives comprised an oversight group, the Kelly Transportation Task Force (KTTF), to access the transportation infrastructure needs outside of the current Kelly Air Force Base boundaries. The challenge of the study focused on a base that originally had restricted base access for security reasons to a free unrestricted movement of goods to the inside of Kelly. The primary goal of the mobility study was to maximize opportunities for commuters and freight to redevelop the new Kelly facility without compromising the quality of life in the surrounding neighborhoods, schools, and small businesses. The identified improvements, both short and long range, included transportation management policies, pedestrian amenities, widening of existing arterials, and construction of new arterials and interchanges. These improvements were identified by area residents, school districts, church representatives, local officials, and TxDOT through a series of public meetings. Large intermodal shipping companies are seeking the warehouse space, staging areas, and strategic locations at Kelly to increase their global position in the market. Assets such as an all-weather runway capable of landing C-5s, the Union Pacific intermodal rail terminal, and a network of external highways around Kelly AFB make the future inland

port concept a viable option. With the GKDC's continued efforts to lure good companies through privatization of an intermodal site and with the KTTF study now complete, efforts are underway to implement the identified transportation needs and seek the appropriate funding for the short-term and long-range projects.

- U.S. Department of Transportation. *Traffic Bottlenecks: A Primer—Focus on Low-Cost Operational Improvements.* Washington, D.C.: Federal Highway Administration, 2007.

  Excerpt:
  This document describes traffic bottlenecks and explores the opportunity for near-term operational and low-cost construction opportunities to correct them.

- Western Transportation Trade Network. "Western Transportation Trade Network Phase II." Final Report, Western Association of State Highway and Transportation Officials, 1999.

  Summary:
  The Phase II work builds upon the results of Phase I and focuses on the specific highways, rail lines, ports, waterways, airports, container on flat car (COFC)/trailer on flat car (TOFC) facilities, and grain elevators within the 20 designated Western Trade Transportation Network (WTTN) trade corridors. Freight transportation performance is evaluated, and deficiencies are identified from a freight transportation perspective.

ADDITIONAL SOURCES (NEWSPAPERS, MAGAZINES, ETC.)

- "Air Cargo: The Bottom Line." *Air Cargo World,* Vol. 98, No. 12, 2008, p. 62.
- "2009 Air Freight Trucking Guide." *Air Cargo World,* Vol. 98, No. 12, 2008, pp. 35–43.
- Barnard, Bruce. "Global Air Cargo Off 23%." *The Journal of Commerce,* January 29, 2009. http://www.joc.com/articles/Printable.asp?sid=47704.
- De Jonge, Jan Maurits. "2009 Will Be a Grim Year for the Air Cargo Industry." *Air Cargo World,* Vol. 98, No. 12, 2008, pp. 20–28.

- Fried, Brandon. "Federal Screening Is Unworkable." *Air Cargo World,* Vol. 98, No. 12, 2008, p. 64.
- O'Reilly, Joseph. "Airfreight Forwarders Perspectives 2008." *Inbound Logistics*, June 2008, pp. 2–11.
- Page, Paul. "Airfreight via Truck." *Journal of Commerce,* August 11, 2008. http://www.joc.com/news/.
- Page, Paul. "Friendly Skies." *Journal of Commerce,* August 18, 2008. http://www.joc.com/news.
- Price, Jeff. "Air Cargo Screening on Track for 2010 Deadline." *Airport Magazine Online,* Vol. 20, No. 7, 2009, pp. 47–49. http://airportmagazine.net.

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3. Allaz, C. *The History of Air Cargo and Airmail: From the 18th Century*. Paris: Christopher Foyle Publishing, 2004, p. 65.

4. Federal Aviation Administration. Aerospace Forecasts 2009–2025. http://www.faa.gov/data_research/aviation/aerospace_forecasts/2009-2025/media/FAA%20Aerospace%20Forecasts%20FY%202009-2025.pdf.

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