Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA/TX-10/0-5930-2		

4. Title and Subtitle
POTENTIAL DEVELOPMENT OF AN INTERCITY PASSENGER TRANSIT SYSTEM IN TEXAS – FINAL PROJECT REPORT

5. Report Date
February 2010
Published: May 2010

6. Performing Organization Code

7. Author(s)
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8. Performing Organization Report No.
Report 0-5930-2

9. Performing Organization Name and Address
Texas Transportation Institute
The Texas A&M University System
College Station, Texas 77843-3135

10. Work Unit No. (TRAIS)

11. Contract or Grant No.
Project 0-5930

12. Sponsoring Agency Name and Address
Texas Department of Transportation
Research and Technology Implementation Office
P. O. Box 5080
Austin, Texas 78763-5080

13. Type of Report and Period Covered
Technical Report:
September 2007–October 2009

14. Sponsoring Agency Code

15. Supplementary Notes
Project performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration.
Project Title: Potential Development of an Intercity Passenger Transit System in Texas
URL: http://tti.tamu.edu/documents/0-5930-2.pdf

16. Abstract

This report describes the findings of a research study of the potential for development of an intercity rail and express bus system in the state of Texas. Rather than focus on regional commuter or light rail systems radiating from urban areas, this project examined long distance intercity and interregional corridors to determine which are most likely to need additional intercity travel capacity in the coming decades. Specific corridor characteristics for 18 intercity corridors were examined. Ranking of the corridors based upon these characteristics identify those that may need added intercity transit capacity in the future. The underlying analysis of corridors is based upon several factors related to:

- current and future population and demographic projections along 18 intercity corridors in the state;
- projected future demand based upon forecasts by the Texas State Demographer and other state agencies; and
- current transportation network capacity and routes for intercity highway, bus, air, and rail travel.

A preliminary concept plan was developed during the first year of the project, and the second year focused on determination of potential costs and benefits of implementing the concept plan or individual system components along each corridor.

17. Key Words
Intercity Travel, Intercity Transit, Intercity Passenger Rail, Intercity Bus, Corridor Planning, Rail Planning

19. Security Classif.(of this report)	20. Security Classif.(of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	208	

POTENTIAL DEVELOPMENT OF AN INTERCITY PASSENGER TRANSIT SYSTEM IN TEXAS – FINAL PROJECT REPORT

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Project 0-5930
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The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data, opinions, findings, and conclusions presented herein. The contents do not necessarily reflect the official view or policies of the Texas Department of Transportation (TxDOT), Federal Highway Administration (FHWA), The Texas A&M University System, or the Texas Transportation Institute (TTI). This report does not constitute a standard, specification, or regulation. In addition, the above listed agencies assume no liability for its contents or use thereof. The researcher in charge of the project was Mr. Curtis A. Morgan.

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

ACKNOWLEDGMENTS

This project was conducted in cooperation with TxDOT and FHWA. The research team thanks the TxDOT project director, Mr. Orlando Jamandre, for his assistance throughout the project and Ms. Jennifer Moczygemba, the TxDOT program coordinator. We would also like to thank Ms. Wilda Won, formerly of TxDOT, the original project director.

The guidance of the project monitoring committee (PMC) is gratefully acknowledged and appreciated. The PMC consisted of the following individuals:

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CHAPTER 1:
PROJECT DESCRIPTION AND BACKGROUND

BACKGROUND

The state of Texas has long been a leader in the provision of quality transportation infrastructure for its citizens. Along with its federal funding partners, the state has built the most expansive highway system of any state with over 79,000 miles of state-maintained highways. In addition, over time, local municipalities and airport authorities (with financial assistance from the federal government and other sources) have also developed an excellent commercial passenger air transportation system that has steadily grown in use. Urban airports in Dallas-Fort Worth and Houston have become national and international hubs for through flights as well as serving intra-state passenger travel needs. Commercial airports in smaller Texas urban areas have grown to act as feeders to the hub airports for travel both within the state and beyond.

The public highway system and commercial aviation have served the intercity travel needs of Texans up to this point, even as Texas has undergone dramatic growth to become the second most populous U.S. state. The implicit choice to invest in these two transportation modes for intercity travel, at the expense of others, was made several decades ago and based upon the transportation, economic, and demographic conditions that existed at that time within the state. At the time these modal and funding decisions were being made, the Interstate Highway System had only recently been completed and several major new airports were being constructed or contemplated within the state. Right-of-way acquisition for further highway expansion and the addition of flights between airports serving the largest Texas cities was not problematic for a number of years following this construction boom. The federal environmental and planning rules were much less restrictive than they are today.

Over time, however, urban and suburban work and travel patterns have shifted, becoming longer and more frequent as suburbs have grown in importance as centers of both housing and commercial activity. Intercity travel by bus and rail became marginalized as highways and air travel grew in market share. But by the early 1990s, dramatic changes in transportation funding and planning methods began to take place. Provisions of the Clean Air Act, passed in 1990, limited the impacts that new transportation projects could have in creating emissions. The 1991 passage of the federal Intermodal Surface Transportation Equity Act dramatically altered federal and state-level transportation priorities and funding formulas. Highway construction costs and automobile fuel prices also began a steady rise, punctuated by peaks where the costs of materials and crude oil have skyrocketed.

Rising fuel costs and security concerns following the September 11, 2001, terrorist attacks in New York and Washington resulted in a restructuring of the air carrier industry during the last 10 years, which has resulted in fewer airlines, with fewer major hubs, carrying more passengers on smaller aircraft. While the number of passengers traveling by air has now recovered beyond 2001 levels, the new air transport system faces a capacity crunch in the number of flights, total available seats due to an overall decrease in plane size, the available number of takeoff and landing slots at major airports to handle additional flights, and airport ground handling capacity.

Aviation fuel costs, spiking in 2008, further exacerbated the aviation capacity problem, although this time as a result of reductions/consolidations of flights made by the private airline companies in an attempt to reduce operational expenses.

In short, the context within which past public sector modal choices to invest almost exclusively in highway and air infrastructure were previously made has changed greatly—requiring that increased investment in alternative modes of travel, such as improved mass transit by rail and bus, once again be considered on a statewide basis. A coordinated intercity rail and express bus system could potentially augment the existing highway and air transportation systems allowing each mode to operate more effectively. The primary step in developing such a system is to identify the existing and expected future travel patterns.

INTRODUCTION

This report summarizes the results of Texas Department of Transportation (TxDOT) Project 0-5930, "Potential Development of an Intercity Passenger Transit System in Texas." A preliminary, mid-project report presenting findings of the first year of the project (Tasks 1-5) TxDOT Report 0-5930-1, "Potential Development of an Intercity Passenger Transit System in Texas- Report on Tasks 1-5" was published by TxDOT in November 2009. This final report includes a more full description of the entire project—adding additional information on the intercity travel corridors identified during the first year of the study and more fully documenting the characteristics and interconnections with existing transit systems for each study corridor as well as examining estimated costs, performance, and qualitative benefits to be achieved by implementing such a system. The report reviews the most pertinent information from the first year of the project, but more detailed information may be documented in the earlier report.

Data Years Analyzed

The project was begun and initial data for corridor analysis was collected and analyzed during FY 2008. As a result, the data and analysis described in the report largely represents roadway, rail, and air capacity conditions from the years 2006 and earlier, which was the most current at the time the project was being performed. These data therefore reflect travel patterns prior to the unprecedented, slight decrease in intercity travel experienced throughout the U.S. during the 2007 and 2008 period due to the economic slowdown and the dramatic increase in the price of fuel experienced at the same time. Despite this short-term decrease in intercity travel, future traffic demand is expected to return to and exceed 2006 “peak” levels in the next few years due to increased freight and passenger demand as the economy recovers and Texas’ population continues to grow. As the data presented in these chapters and the supporting appendices show, the existing highway- and air-based intercity transportation network in Texas will face great challenges in addressing this expected growth.

Scope of Analysis

This project included an element that ranked intercity passenger transportation corridors and provided a discussion of preliminary concepts for a potential statewide intercity bus and rail network in the state of Texas. The overall purpose of this project was to examine longer intercity corridors to determine where the state of Texas could most appropriately invest its resources to connect different regions of the state to create an interregional, statewide transit system rather than focusing on expansion of existing urban-centered bus transit systems or specific regional commuter or light rail systems. Linking the statewide system to existing, local urban rail/bus transit systems is vital to ensure that travelers can reach their final destination seamlessly. The analysis in this project is based upon a variety of factors related to:

- current and future population and demographic projections along 18 intercity corridors in the state;

- projected future demand based upon forecasts by the Texas State Demographer and other state agencies; and
- current network capacity and routes for intercity highway, bus, air, and rail travel.

More detailed analysis of the concept plan and individual corridors was completed and documented during year two of the research in order to provide some gross estimates of potential costs and benefits of implementing individual corridor elements as part of a phased implementation. Identification of existing transit operations/systems along each corridor with which a statewide system would have to interact and interconnect was also an important part of the research. The final corridor rankings of intercity passenger demand do not dictate that rail or express bus service must be implemented in a given corridor but, rather, provide transportation planners with background information on current and expected future intercity transportation needs. Ultimately, the value of this research is to inform TxDOT and regional planners regarding which corridors have the greatest potential for future intercity transit service by rail or express bus. Planners in other states and at the federal level can also benefit from the analysis contained in this report.

CHAPTER 2: EXISTING INTERCITY PASSENGER TRANSIT SERVICES IN TEXAS

Currently, travelers between major cities within Texas have two primary alternatives for intercity travel. Highway travel in private automobiles and commercial air travel have been the dominant modes for intercity travel for the past half-century; however, if the population of the state continues to grow as forecast in the coming decades, additional intercity public transportation options such as intercity rail and express bus transit must be considered if TxDOT is to continue to fulfill its mission of efficient and effective movement of both people and goods. An examination of the current state of intercity passenger transit—including intercity rail, intercity bus, and commercial aviation—was initially performed. The following sections document the findings of this initial examination.

EXISTING INTERCITY PASSENGER RAIL SERVICE

Amtrak currently operates three routes through Texas—the Heartland Flyer, the Sunset Limited, and the Texas Eagle, as described in Table 1 and shown graphically in Figure 1. Amtrak also provides through ticketing and coordinated schedules for rail passengers to additional destinations via connecting bus service, known as Thruway Motorcoach service, which is also described in Table 1.

Table 1. Current Amtrak Routes and Connecting Bus Service in Texas.

Route Name	Description
Heartland Flyer	Operates between Fort Worth and Oklahoma City once daily in each direction, southbound in the morning, returning northbound in the evening.
Sunset Limited	Operates three days per week in each direction between New Orleans and Los Angeles. Westbound stops: Beaumont and Houston on Mon., Wed., and Fri.; San Antonio, Del Rio, Sanderson, Alpine, and El Paso on Tues., Thurs., and Sat. Eastbound stops: El Paso, Alpine, Sanderson, Del Rio, and San Antonio on Mon., Thurs., and Sat.; Houston and Beaumont on Tues., Fri., and Sun. Thruway Motorcoach connections are provided to Galveston via Houston; Brownsville and Laredo via San Antonio; and Albuquerque via El Paso.
Texas Eagle	Operates between Chicago and San Antonio daily and between Chicago and Los Angeles three days per week in conjunction with the Sunset Limited. Stations west of San Antonio are served on the same schedule as the Sunset Limited. Thruway Motorcoach connections are provided to Shreveport and Houston via Longview; Fort Hood and Killeen via Temple; Brownsville and Laredo via San Antonio; and Albuquerque via El Paso.

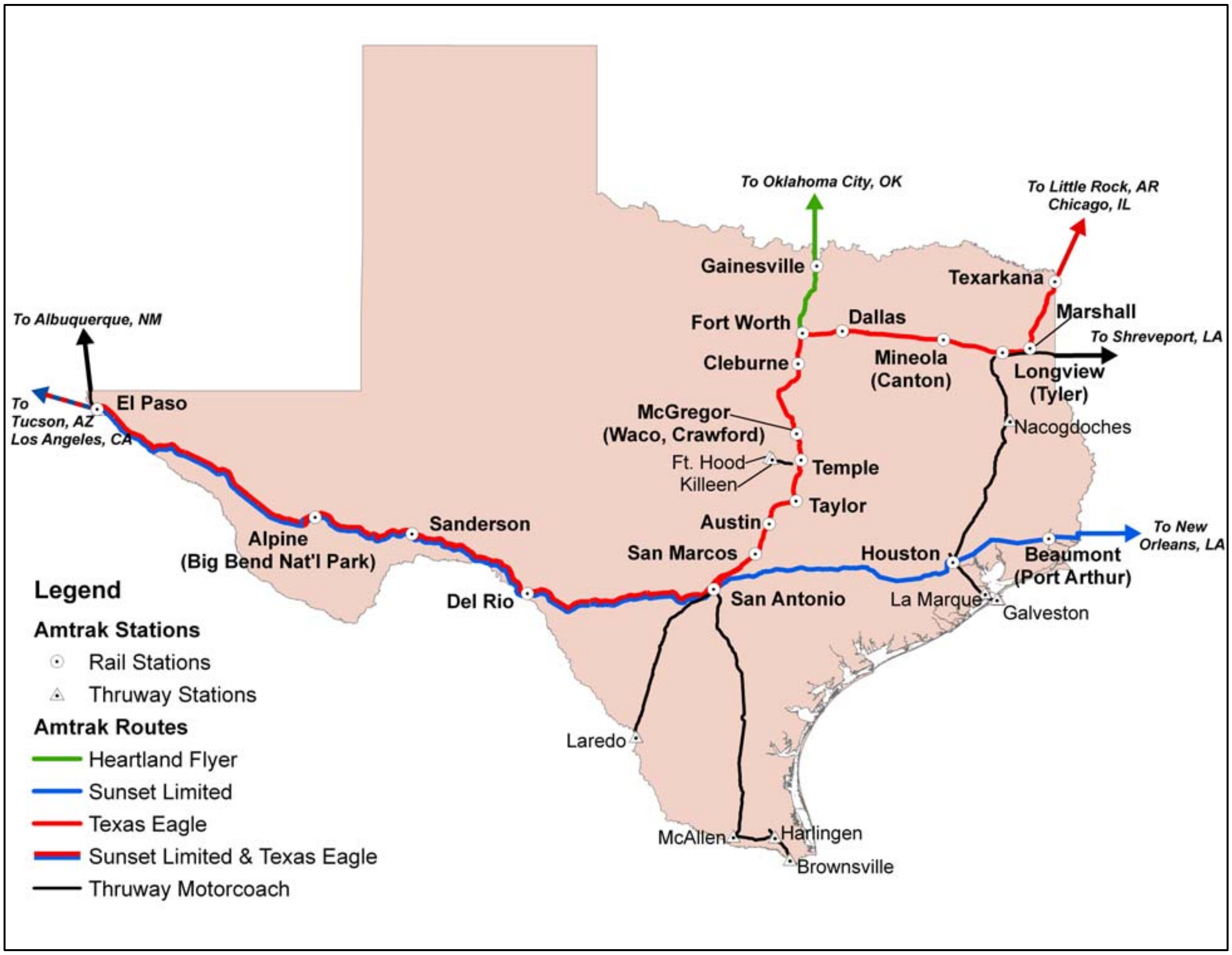
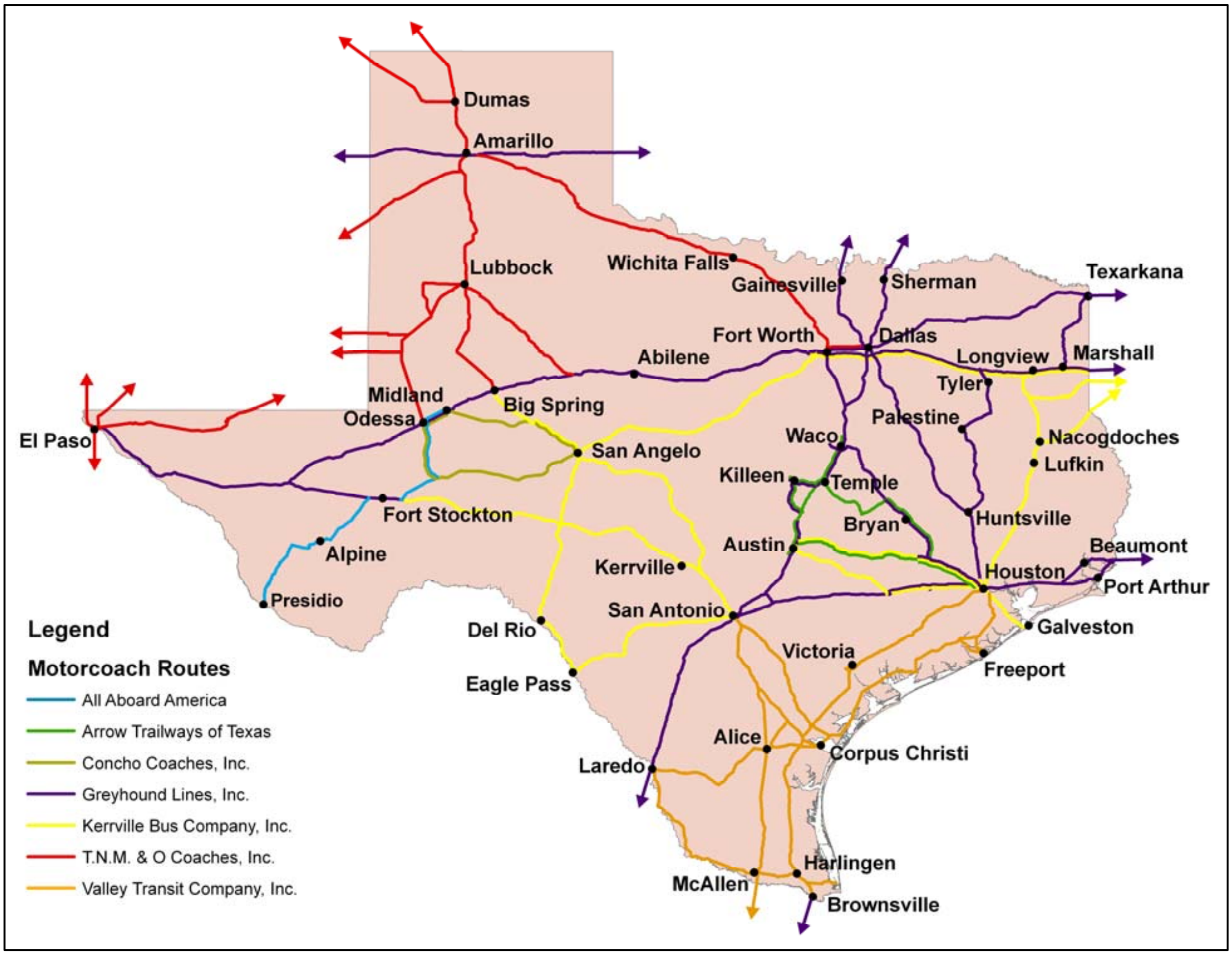


Figure 1. Texas Amtrak Passenger Rail and Thruway Motorcoach Service.

EXISTING INTERCITY BUS SERVICE

Intercity bus service routes in Texas continue to provide extensive coverage to all regions of the state despite cutbacks to the system in recent years. Figure 2 shows the current intercity bus services provided in Texas as of 2008. This map is based upon information provided by the Texas Bus Association, Inc., an industry organization representing several major intercity bus service providers. The existing intercity bus network covers almost 8000 miles of Texas roadways and services an estimated 190 stations. In addition to these intercity bus carriers, there are currently 8 metropolitan transit systems in major urban areas, 30 urban transit systems in smaller urban areas, and 39 rural transit providers operating in Texas. Many of these local systems operated limited services that could be classified as “intercity” (operating between two or more municipalities or urban areas). These local/short-distance intercity services are not shown in Figure 2 but are documented in Appendix A of this report, which discusses all intercity transit services operated throughout the state at the time the project was being completed.



Source: Texas Transportation Institute map created in geographic information system based on information provided by Texas Bus Association, Inc.

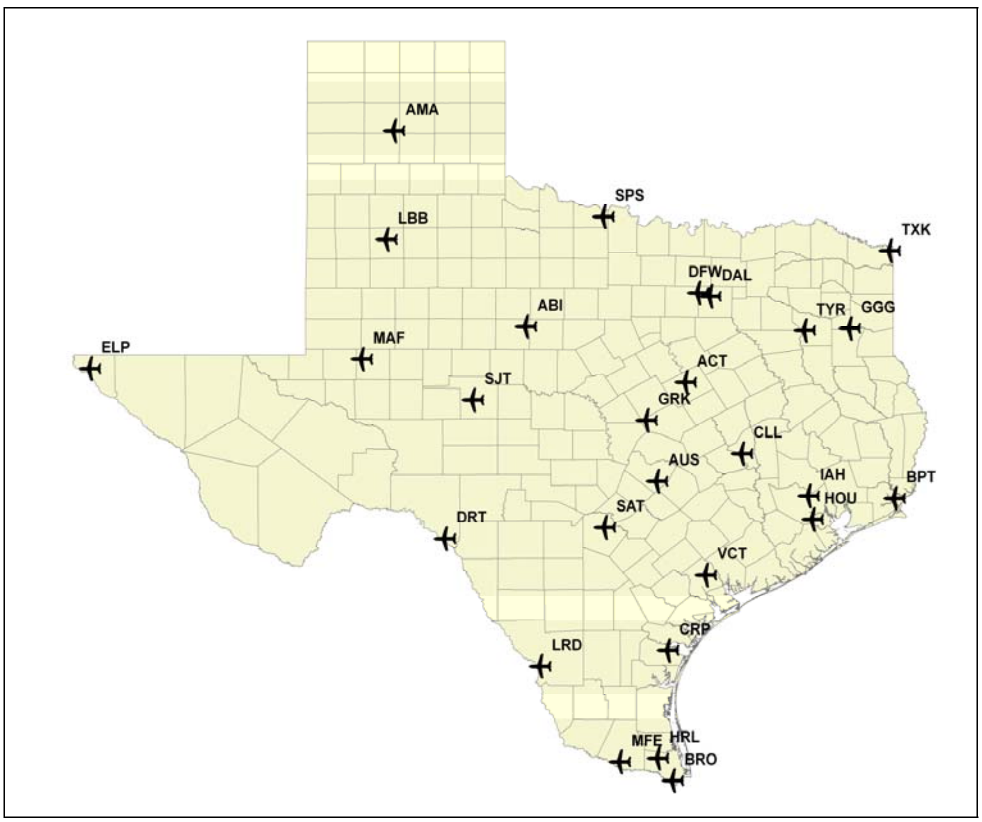
Figure 2. Intercity Scheduled Motorcoach Service.

Another emerging intercity bus system was also identified during the course of the research project. Several Mexican-based bus companies, some of which are subsidiaries of American bus companies, also provide intercity motorcoach service between and through many Texas cities along their routes between Mexican destinations and locations throughout the U.S. In some cases, these bus companies have developed station hubs within Texas to serve their customers. Appendix A also includes additional information on these Mexican-based bus companies.

EXISTING COMMERCIAL AVIATION PASSENGER SERVICE

Texas residents make frequent use of commercial aviation services for both intrastate and interstate travel. The state of Texas is home to 27 commercial airports that serve the state's 23.8 million citizens (*1*). (One of these airports, Texarkana Regional Airport, is physically located in Miller County, Ark.) Figure 3 shows the commercial passenger service airports serving Texas.

In 2006, nearly 700 million passengers traveled by air domestically within the United States (*2*). This staggering number is projected by the Federal Aviation Administration (FAA) to increase by an average annual rate of 3.4 percent through the year 2020, reaching 1.066 billion passengers per year through the national system. In Texas, nearly 66 million passengers were enplaned in 2005, and that number is expected to grow to more than 102 million per year by 2020 (*3*). Dallas/Fort Worth International, Dallas Love Field, Houston George Bush Intercontinental, and Houston's William P. Hobby together accounted for 81 percent of these enplanements in 2005.



Source: Texas Transportation Institute

Figure 3. Location of Texas Commercial Service Airports.

According to the Air Transport Association (ATA), the Houston-Dallas/Fort Worth market continues to be one of the most heavily traveled airline route segments in the nation, ranking 16th among domestic airline markets in 2006, while the Dallas-New York market ranked 18th (*4*). A total of 65 unique intercity routes are served in the state. As would be expected, the larger hubs serve the most routes since they are the focal point of airline hub-and-spoke operations, which allow service to smaller communities. TxDOT Report 0-5930-1 contains a chapter with more detail regarding Texas' commercial air passenger transportation system that was completed during the first year of the research. Appendix B to this report is an updated chapter, reflecting changes to the commercial aviation passenger system through the second year of the research project, reflecting 2008 and 2009 data.

CHAPTER 3:
IDENTIFICATION AND ANALYSIS OF TEXAS INTERCITY TRAVEL CORRIDORS

BACKGROUND

During the proposal development and literature review task for this project, the research team discovered that the Texas Transportation Institute (TTI) had conducted a similar study of intercity travel corridors in 1976. This study, performed at the direction of the Texas State Legislature, produced a report entitled *An Evaluation of Intercity Travel in Major Texas Corridors.* For Project 0-5930, the research team began with the corridors identified in the 1976 study and then suggested several additional corridors that have emerged as intercity travel corridors in the state since the time that the previous study was completed. In addition to the 1976 study corridors, the following changes were recommended:

- addition of an intercity travel corridor between Houston and Texarkana along U.S. Highway 59; and
- split of the Dallas/Fort Worth to Texarkana intercity travel corridor into two study segments; one along Interstate 30 and one along Interstate 20 toward northwestern Louisiana.

Based on the input of the project management committee at the first project update meeting in early 2008, the team also added the following additional corridors to the study:

- Houston to Waco via Bryan/College Station, along U.S. Highway 290 and Texas State Highway 6;
- Laredo to Brownsville, along U.S. Highway 83; and
- Dallas/Fort Worth to San Antonio, along U.S. Highway 281.

Finally, in light of its designation in the “Ports to Plains” trade corridor, the research team determined that an additional intercity corridor between Lubbock and Midland-Odessa, following U.S. Highway 87 and Texas State Highway 349 should be added to the analysis. The research team and project monitoring committee then selected a final system of 19 intercity travel corridors to evaluate in this project, which are shown in Figure 4.

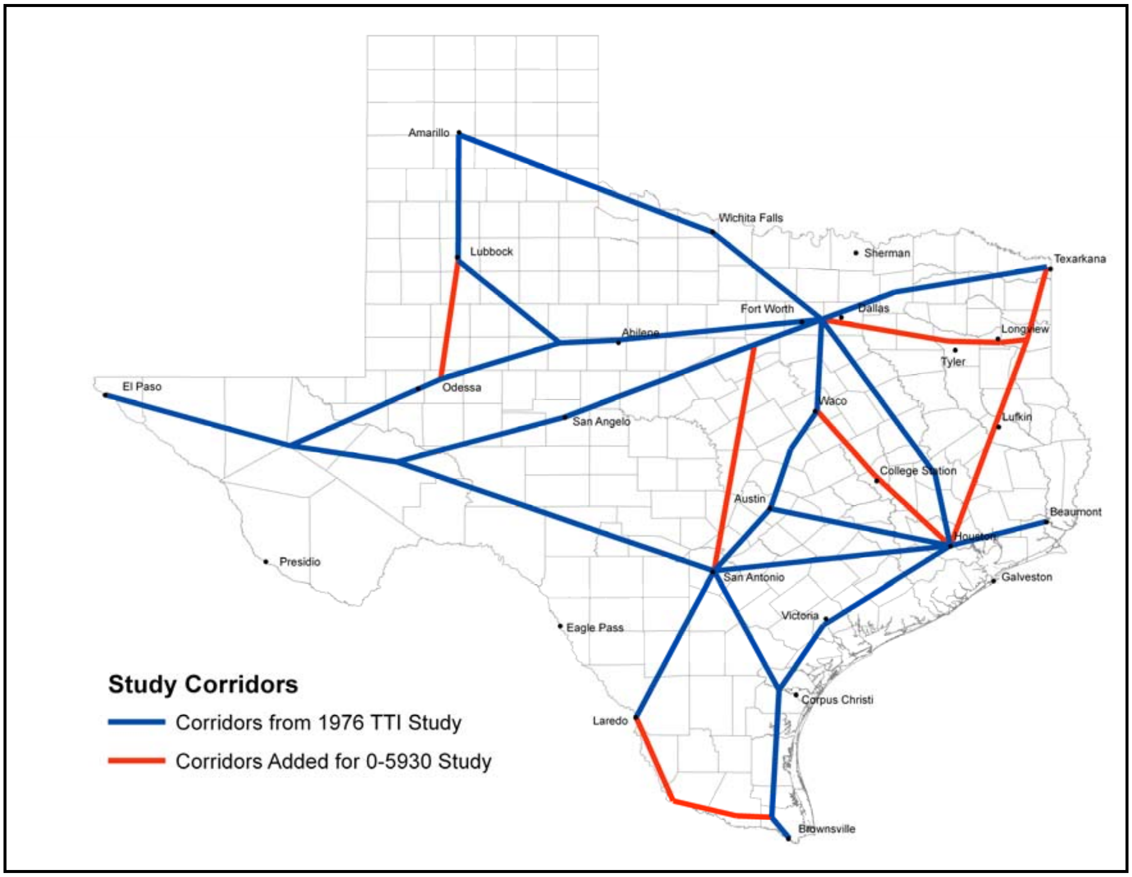


Figure 4. Map of Initial Intercity Travel Evaluation Corridors for Project 0-5930.

Since highway travel remains the predominant intercity transportation mode in the state, researchers determined to use a similar methodology to the previous TTI study and use highways as the basis for each intercity corridor. Table 2 describes each corridor and gives its project-designated abbreviation, full description, base roadways, and length. The project-designated abbreviations were developed for the ease of reporting data on each corridor without requiring the full description for each. The base roadways were selected based on the most direct route between the corridor endpoint cities along major Interstate, U.S., and state highways. The length of each corridor was measured in miles along the roadways between major roadway junctions or other interchanges in each of the corridor endpoint cities. For corridors with an endpoint in Dallas/Fort Worth (DFW), the length was computed as the average of the distance between Dallas and the opposite corridor endpoint and the distance between Fort Worth and the opposite corridor endpoint.

Table 2. Description of Project 0-5930 Intercity Travel Evaluation Corridors.

Corridor Reference Number	Name	Corridor Description	Roadway(s)	Length
1	AMALBB	Amarillo to Midland-Odessa via Lubbock	I-27, US 87, TX 349	245
2	DFWELP1*	Dallas/Fort Worth to El Paso via Abilene	I-20, I-10	621
3	DFWAMA	Dallas/Fort Worth to Amarillo via Wichita Falls	US 287	362
4	DFWHOU	Dallas/Fort Worth to Houston	I-45	252
5	DFWLBB	Dallas/Fort Worth to Lubbock via Abilene	I-20, US 84	331
6	DFWLOU	Dallas/Fort Worth to Louisiana Border	I-20	183
7	DFWSAT	Dallas/Fort Worth to San Antonio	I-35	267
8	DFWSATb	Dallas/Fort Worth to San Antonio via US 281	US 281, US 377	294
9	DFWELP2*	Dallas/Fort Worth to El Paso via San Angelo	US 377, US 67, I-10	648
10	DFWTXK	Dallas/Fort Worth to Texarkana	I-30	190
11	HOUAUS	Houston to Austin	US 290	163
12	HOUBMT	Houston to Beaumont	I-10	87
13	HOUBVN	Houston to Brownsville via Corpus Christi	US 59, US 77	364
14	HOUSAT	Houston to San Antonio	I-10	199
15	HOUTXK	Houston to Texarkana	US 59	307
16	HOUWAC	Houston to Waco via Bryan/College Station	US 290, TX 6	184
17	SATBVN	San Antonio to Brownsville via Corpus Christi	I-37, US 77	280
18	SATELP	San Antonio to El Paso	I-10	636
19	SATLRD	San Antonio to Brownsville via Laredo	I-35, US 83	349

* In previous reports on this project, the two corridors evaluated between DFW and El Paso were abbreviated DFWABI and DFWSNA to differentiate the route through Abilene and the route through San Angelo. These two corridors have been renamed DFWELP1 for DFW to El Paso via Abilene and DFWELP2 for DFW to El Paso via San Angelo to ensure that the end points are shown in the abbreviation as in the majority of the other corridors. SATLRD still represents San Antonio to Brownsville via Laredo while SATBVN represents San Antonio to Brownsville via Corpus Christi.

Each of the study highway corridors described in Table 2 is surrounded by additional transportation facilities that could be used in planning the development of an improved intercity transit network. Interconnecting any proposed transit system into its larger multimodal framework should be a part of any proposed plan. Figure 5 shows the original 19 study highway corridors along with the location of Texas' commercial airports, bus stations, Amtrak passenger rail and Thruway bus connector stations, and significant freight rail lines. For the purposes of this study, the term "significant rail lines" included all of the state's Class I and certain secondary railroads that are parallel to or adjacent to sections of the identified intercity travel corridors that were evaluated. A thorough analysis of the possible existing rail routes paralleling the study evaluation corridors is included in the previous report, TxDOT 0-5930-1 and in Appendix C of this report regarding freight rail capacity and existing rail corridor routes paralleling the study routes.

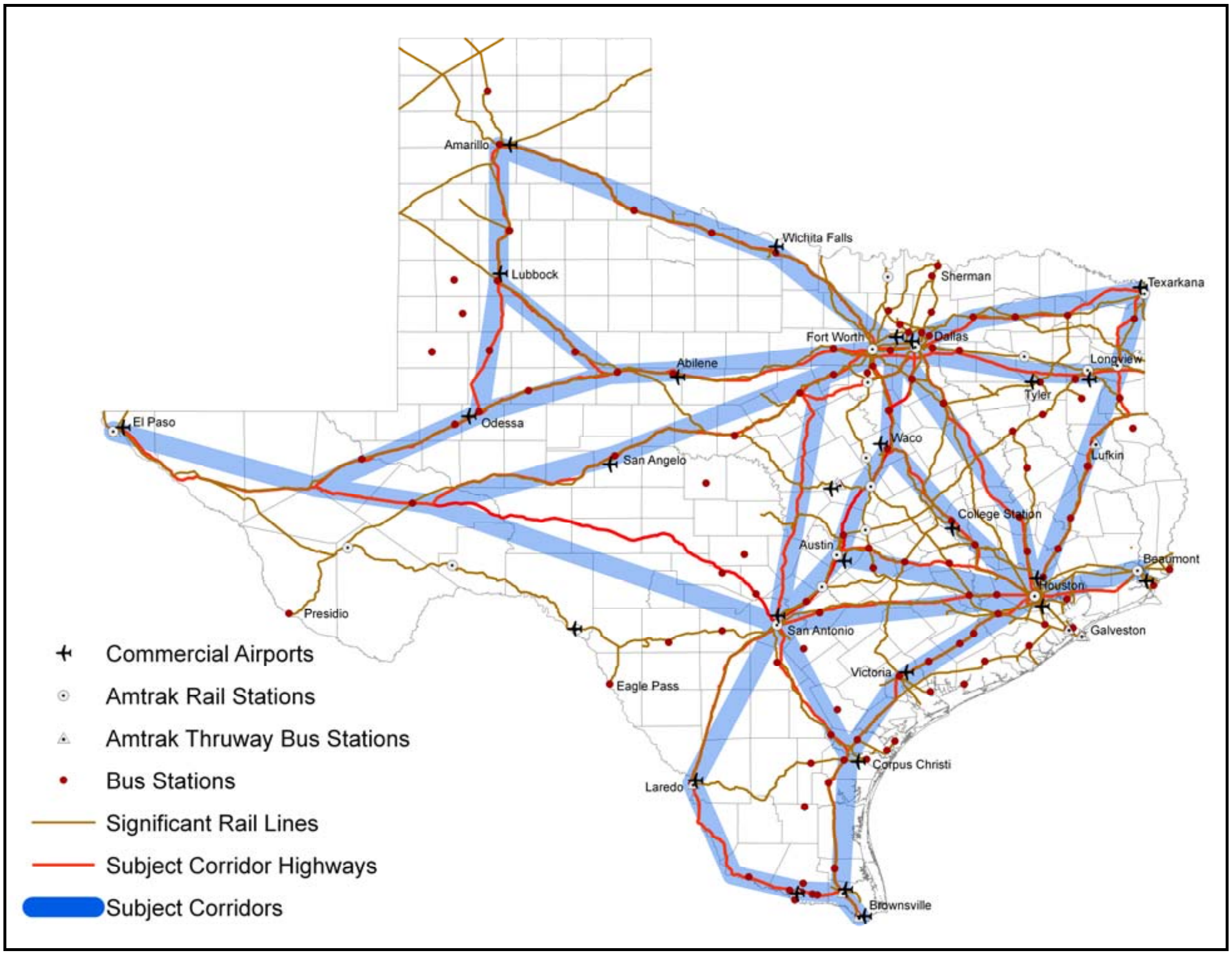


Figure 5. Study Corridors Map Showing Alternative Modal Facilities.

ANALYSIS OF RECENT AND FORECAST INTERCITY HIGHWAY CORRIDOR TRAFFIC

Tables 3 and 4 below show the results of TTI analysis of the selected study corridors using two primary data sources—the Federal Highway Administration (FHWA) Freight Analysis Framework (FAF) database and the 2006 TxDOT Roadway Highway Inventory Network (RHiNo) database. For each of the two Average Annualized Daily Traffic (AADT)-based criteria, a higher value indicates a greater demand for travel within an intercity corridor and thus indicates a greater need for investment in intercity rail or express bus service in that corridor. These AADT values include traffic internal to the study corridors (i.e., not only vehicles that are traveling between the corridor endpoint cities). Despite this drawback, the research team determined that these two AADT-based criteria were appropriate early planning-level surrogate measures of travel demand within an intercity corridor acceptable for transit analysis since shorter distance, intra-corridor trips would certainly be taken by either by intercity rail or express bus passengers. Later in the planning and development process, detailed ridership studies should be performed to more accurately measure and isolate intercity travel demand between specific endpoint city pairs and at intermediate stops.

In both types of AADT analyses, the historical 10-year trends (TxDOT RHiNo data) and the future forecast (FHWA FAF data), the control sections comprising each intercity corridor were selected graphically and independently, each from its own individual GIS system. The reason is that in the control section numbering system used by FHWA and TxDOT, the geographical characteristics (length, start/end points, etc.), as well as the AADT values differed between the two datasets/GIS systems. The cardinal rule followed, however, was common between the two; intercity corridors excluded inner loop control sections in order to avoid accounting for intracity traffic that would artificially raise the AADT level for each corridor.

In traditional transportation planning analyses for intercity highways, the lowest AADT along the corridor is typically assumed to represent the AADT between the two extreme ends of the corridor and is adopted as the design traffic level. In addition, origin-destination surveys at both ends are typically conducted in order to obtain trip interchange data (numbers, frequency, trip purpose, mode choice, route choice, etc.) that would allow a more accurate estimation of potential intercity transit ridership levels. However, this project prescribed a macroscopic examination of longer stretches of intercity corridors that, naturally, comprise smaller—but not insignificant—urban areas along their lengths. The research team felt that the scope and data examined in this project, could not justify disregarding intra-corridor AADT (potential transit ridership). For this reason the typical highway design assumption could not be supported in this case. On the other hand, specific origin-destination surveys were well beyond the scope of this project. Origin-destination studies will, however, be integral future activities to more accurately estimate potential transit ridership levels through this project.

Therefore, data constraints and the macroscopic perspective of this research necessitated the development of an overall weighted (by length) AADT for each intercity corridor in the study (as compared to a simple numerical average) in order to avoid biases in the corridor

AADTs that would be introduced by the unequal lengths of the control sections comprising each corridor.

Note that the forecast AADT and Volume to Capacity Ratios forecast on Texas roadways for 2035 show that there will be increasing demand, far beyond recent historic trends in the provision of expanded lane miles. For example, Table 3 shows that, based upon the 2035 FAF forecasts, with traffic at those expected levels, 13 of the 19 selected study corridors will have volume-to-capacity ratios (V/C ratios) averaging at or over 1.0 on a weighted average basis. This means that while some parts of each corridor may have some sections where traffic may be flowing, but other segments where volume (i.e., demand) is expected to exceed the current capacity of the roadway. The busiest intercity travel corridors, Dallas/Fort Worth to San Antonio is projected to have an average V/C ratio of 1.90—almost double the corridor average capacity—and Dallas/Fort Worth to Houston is projected to have a V/C ratio of 1.28. Other, less traveled corridors will have even higher V/C ratios when the 2035 traffic volume forecasts are reached. Some examples of this are the 1.68 V/C ratio for the Houston-Austin corridor and the 1.71 V/C ratio calculated for the Houston-San Antonio corridors. The speed column in Table 3 is an indicator that slower average intercity corridor speeds on existing highway routes can be expected unless additional transportation capacity is added.

The obvious or intuitive answer, based on past state transportation decisions, is to add additional lane miles to existing roadways or to add additional intercity flights to address this looming capacity shortfall. Billions of dollars will need to be spent by the public sector in order to preserve mobility and economic activity, but the state must also look at other options in order to maximize the benefits of its expenditures, then determine whether to spend a portion of the funding on building a rail/express bus intercity transit network. New highways, expansion of existing highways, and the addition of capacity to the commercial air system will be required also, however highways, airports, and transit capacity must all be added in the proper mix to maintain quality of life and encourage continued expansion of the state economy into the future.

Table 3. Corridor Traffic Data & Projections 2002 and 2035 – FHWA Freight Analysis Framework 2.2.

CORRIDOR TRAFFIC DATA & PROJECTIONS - FHWA FREIGHT ANALYSIS FRAMEWORK (FAF 2.2)

	Corridor*	Length	2002									2035								
			AADT	AADTT	FAF	Non-FAF	CAP	SF	VCR	SPEED	DELAY	AADT	AADTT	FAF	Non-FAF	CAP	SF	VCR	SPEED	DELAY
		Miles	Vehicles per Day	Trucks per Day**	Trucks per Day***		Vehicles per Hour****		SF/CAP	Mph	Hours	Vehicles per Day	Trucks per Day**	Trucks per Day***		Vehicles per Hour****		SF/CAP	Mph	Hours
1	AMALBB	227	10,801	1,127	762	366	3,549	645	0.17	57	0.01	24,693	2,860	1,606	1,255	3,540	1,471	0.38	53	0.03
2	DFWABI	587	17,476	6,837	5,876	961	2,996	931	0.28	68	0.01	36,715	17,561	15,468	2,093	2,841	1,965	0.63	63	0.04
3	DFWAMA	320	13,688	3,695	867	2,828	2,740	877	0.31	47	0.00	29,279	8,236	2,065	6,171	2,749	1,881	0.66	45	0.01
4	DFWHOU	220	47,178	9,102	4,850	4,253	4,438	2,885	0.60	59	0.02	106,475	21,423	15,602	5,821	4,601	6,499	1.28	39	0.19
5	DFWLBB	299	16,381	5,332	4,663	668	3,087	942	0.31	61	0.00	34,723	13,018	11,407	1,611	3,032	1,999	0.67	56	0.02
6	DFWLOU	156	31,089	8,534	5,633	2,900	3,378	1,629	0.49	65	0.00	69,292	19,983	12,347	7,636	3,538	3,635	1.05	43	0.07
7	DFWSAT	251	71,952	11,588	6,950	4,638	4,619	3,715	0.80	55	0.02	178,452	30,069	18,347	11,722	4,810	9,190	1.90	15	0.46
8	DFWSATb	263	16,195	1,157	169	988	2,579	1,305	0.47	39	0.08	39,497	3,075	349	2,727	2,858	3,308	1.10	29	0.28
9	DFWSNA	651	10,624	2,923	2,278	645	2,358	653	0.24	55	0.02	22,835	8,123	6,701	1,422	2,203	1,419	0.53	50	0.08
10	DFWTXK	159	28,007	8,482	6,783	1,699	3,331	1,613	0.48	66	0.00	67,367	20,903	17,864	3,039	3,452	3,880	1.07	47	0.09
11	HOUAUS	150	38,920	4,261	619	3,642	3,479	2,363	0.60	48	0.04	109,037	12,226	2,899	9,327	3,591	6,621	1.68	33	0.41
12	HOUBMT	86	62,682	11,149	5,388	5,761	5,087	3,701	0.69	52	0.02	141,082	24,980	15,602	9,378	5,206	8,359	1.47	29	0.28
13	HOUBVN	356	33,700	3,884	1,524	2,360	3,442	2,311	0.57	44	0.04	77,625	9,225	3,890	5,336	3,522	5,310	1.27	36	0.21
14	HOUSAT	195	49,613	7,073	4,071	3,002	4,136	3,596	0.79	57	0.04	105,052	18,390	14,421	3,969	4,206	7,730	1.71	19	0.37
15	HOUTXK	292	29,604	5,383	1,911	3,471	3,330	1,622	0.44	49	0.01	69,934	13,213	6,128	7,085	3,333	3,821	0.98	42	0.12
16	HOUWAC	177	33,773	3,915	560	3,355	3,143	2,242	0.65	44	0.05	92,762	11,060	1,665	9,395	3,241	6,100	1.71	27	0.44
17	SATBVN	278	22,391	3,052	2,434	618	3,483	1,677	0.46	58	0.01	49,173	6,864	5,537	1,327	3,567	3,692	1.00	45	0.11
18	SATELP	549	15,319	4,422	4,163	258	2,727	876	0.25	71	0.01	33,159	12,647	12,204	443	2,404	1,915	0.59	66	0.08
19	SATLRD	358	23,783	3,397	1,689	1,708	3,240	1,484	0.44	53	0.04	60,529	9,349	5,320	4,028	3,276	3,720	1.05	37	0.23

*All corridor calculations weighted by section length

**Based on FAF, originally based on Highway Performance Monitoring System data (HPMS)

***Based on FAF, which disaggregates HPMS trucks into long distance (FAF) and local (non-FAF) trucks (< 50 mi)

****Peak Hour, Peak Direction

Table 4. Corridor 10-YEAR AADT – TxDOT RHiNo Data 2006.

Corridor		Length (miles)	CORRIDOR 10-YEAR AADT (Vehicles per Day)*									
			2006	2005	2004	2003	2002	2001	2000	1999	1998	1997
1	**AMALBB**	219	8,684	9,090	8,904	8,592	8,163	7,995	8,022	8,192	7,631	7,433
2	**DFWABI**	624	20,777	20,794	20,313	18,990	18,765	18,074	18,077	17,682	17,134	16,028
3	**DFWAMA**	322	15,252	15,076	14,824	14,240	13,692	13,558	12,878	12,706	12,431	11,816
4	**DFWHOU**	231	53,634	52,342	51,502	48,769	44,635	42,778	42,111	39,931	39,944	36,816
5	**DFWLBB**	346	16,434	16,351	15,976	15,445	15,459	15,089	14,655	13,961	13,724	13,292
6	**DFWLOU**	160	32,713	32,659	32,292	31,738	31,055	29,528	30,125	28,908	26,936	25,761
7	**DFWSAT**	285	66,939	66,562	65,231	62,968	64,485	62,101	61,081	59,836	56,098	54,147
8	**DFWSATb**	293	21,214	18,935	18,515	18,231	17,899	16,724	16,579	15,748	15,265	14,145
9	**DFWSNA**	714	12,884	12,894	12,529	11,726	11,241	11,067	11,112	10,650	10,561	9,608
10	**DFWTXK**	161	29,070	29,807	28,800	28,830	27,552	27,223	28,951	25,423	24,563	23,641
11	**HOUAUS**	165	36,441	37,591	36,316	35,270	36,422	34,329	33,501	31,834	31,600	27,119
12	**HOUBMT**	88	72,525	67,929	67,036	67,123	63,402	62,953	61,308	61,070	62,338	59,130
13	**HOUBVN**	372	32,689	33,448	32,587	32,266	32,327	29,373	28,636	27,600	28,898	26,222
14	**HOUSAT**	202	54,071	50,948	50,023	48,852	48,634	46,665	44,138	43,093	44,664	41,888
15	**HOUTXK**	348	28,616	29,010	28,151	28,846	27,191	27,237	24,386	23,082	23,271	22,111
16	**HOUWAC**	208	33,112	33,170	32,367	31,893	31,990	30,184	28,703	27,222	26,900	23,904
17	**SATBVN**	308	24,829	24,739	24,405	23,723	23,200	21,704	21,625	21,105	20,163	19,621
18	**SATELP**	566	20,222	19,395	19,286	17,982	17,283	17,332	17,552	17,157	16,722	15,384
19	**SATLRD**	381	28,689	25,603	25,020	24,313	23,574	23,068	21,894	20,438	19,818	19,005

*All corridor calculations weighted by section length

The AADT figures for the state's major highways along intercity study corridors from the FHWA's FAF are shown in Figures 6 and 7. Figure 6 shows the AADT in the 2002 base year of the study while Figure 7 shows the FAF projected AADT along the same highway sections in 2035. From these two figures, the rapid increase in projected travel along the roadways, especially in the eastern half of the state where the largest population growth is expected, can be seen.

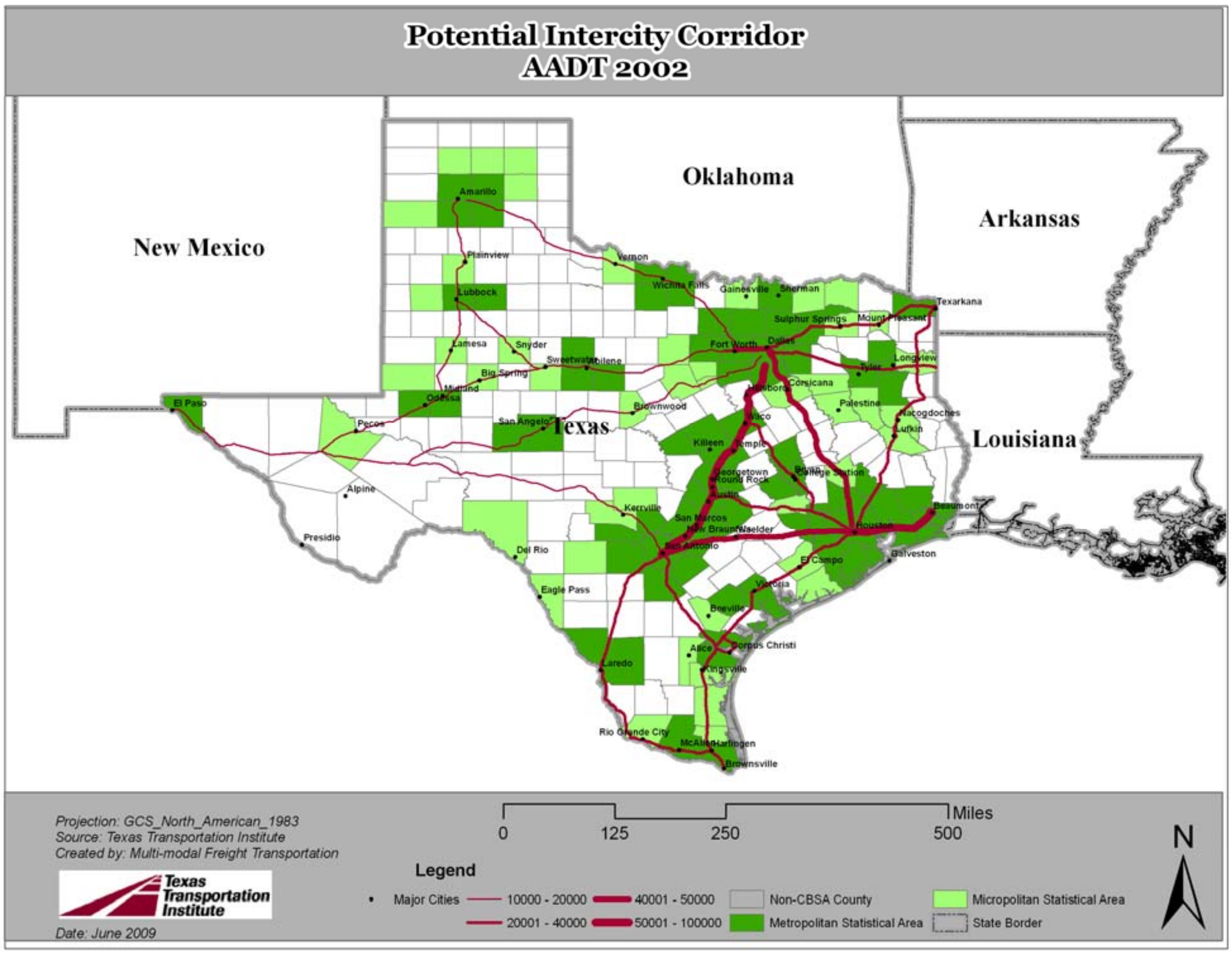


Figure 6. FHWA FAF 2.2 AADT along Texas Intercity Corridors in 2002.

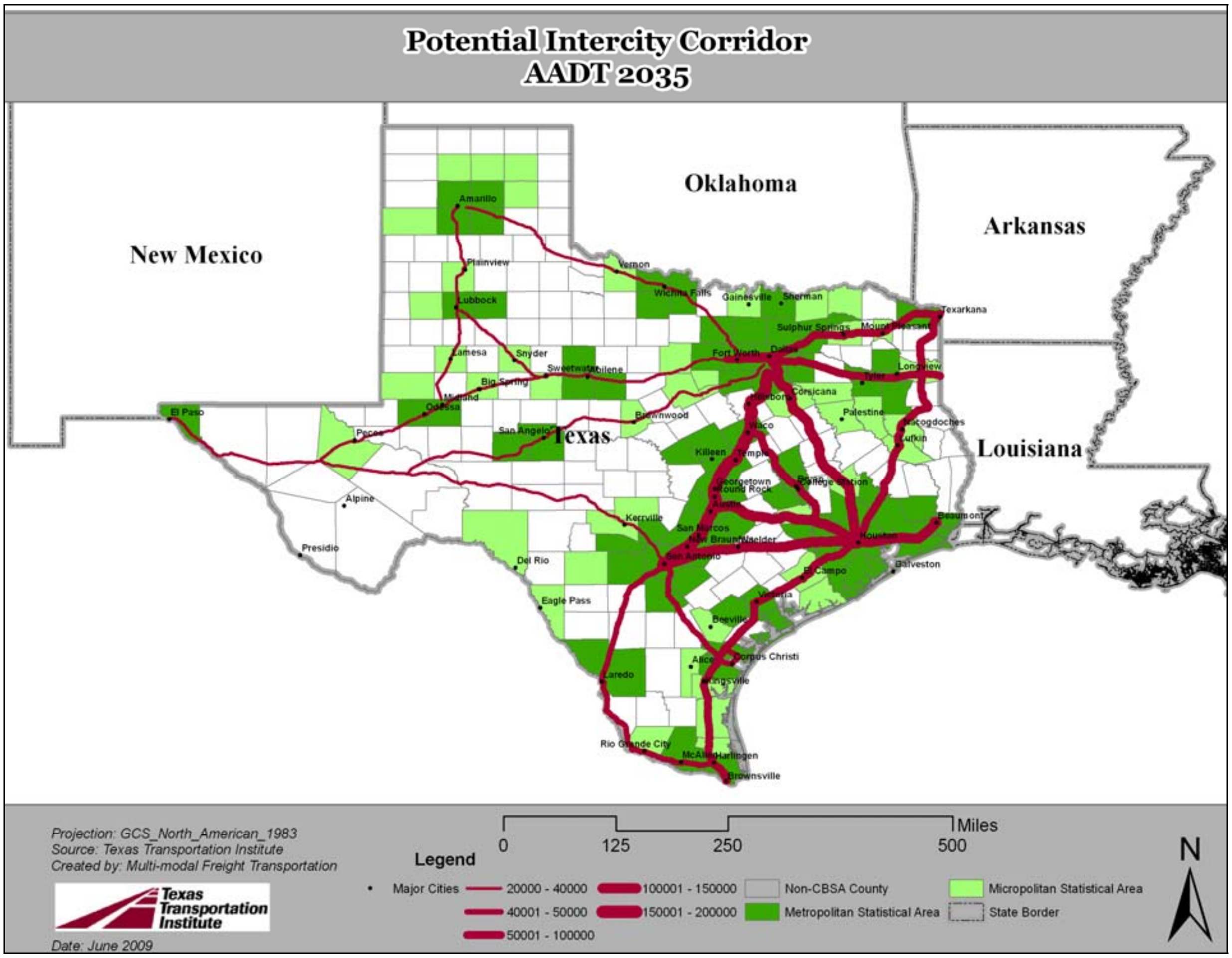


Figure 7. FHWA FAF 2.2 Projected AADT along Texas Intercity Corridors in 2002.

POPULATION GROWTH IN CORRIDORS

In addition to examining projected traffic growth along existing transportation corridors, the TTI researchers also looked into projected population growth and demographic patterns. The effective planning of future transportation corridors, especially transit corridors, will require that an understanding of how the future population of the state will be distributed. The Texas State Demographer has performed many studies in the past decade, in order to determine what population growth pattern and levels can be expected. In addition, the Texas State Water Board has also made projections of population in all Texas counties in order to determine the need for additional water resources such as lakes and reservoirs might be needed to meet future demand for water in the state. Using these two sources for data, the researchers developed the following series of maps, Figures 8–12, which show projected population increases from a 2000 census base population to 2030, 2040, 2050, and 2060, respectively.

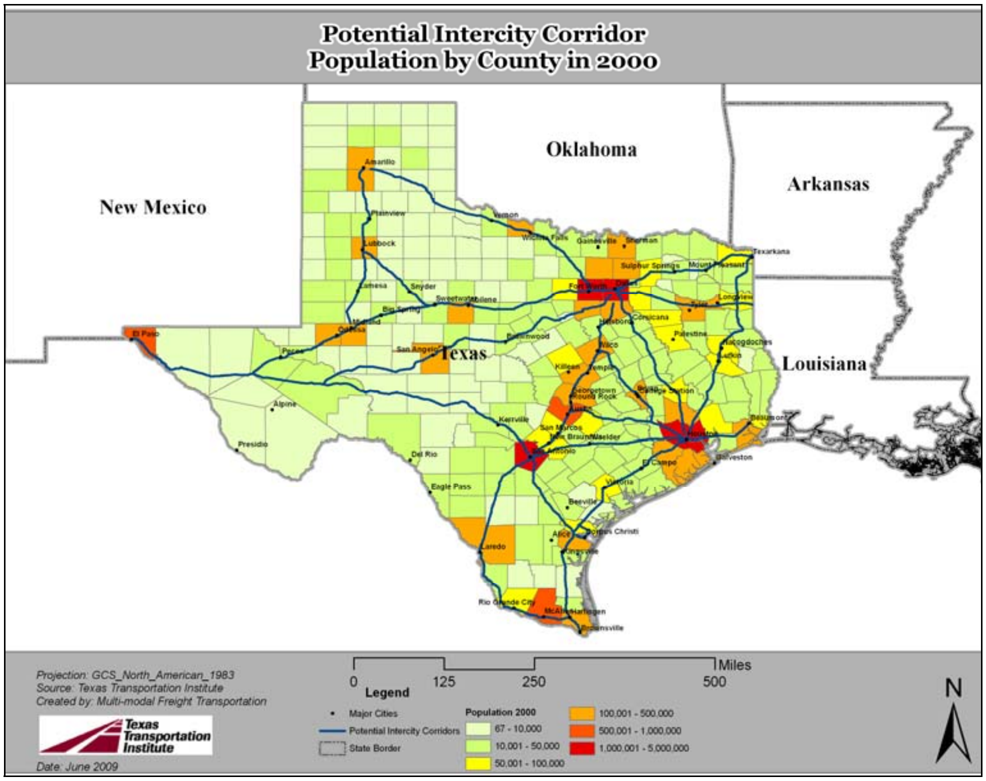


Figure 8. Texas Population by County, 2000.

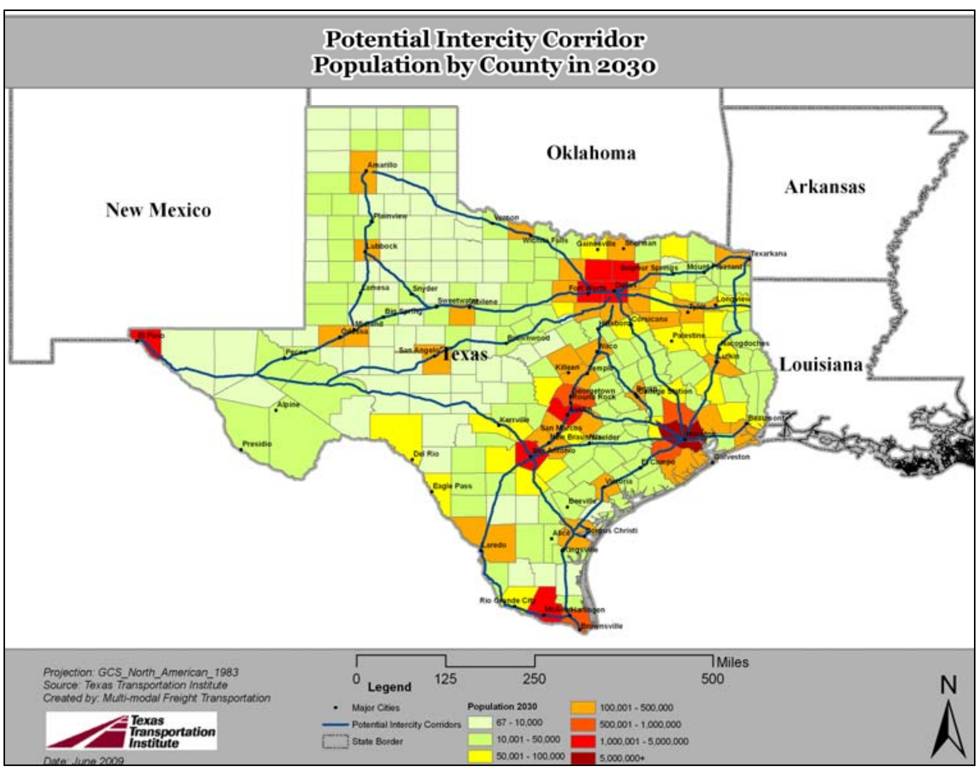


Figure 9. Texas Population by County, 2030.

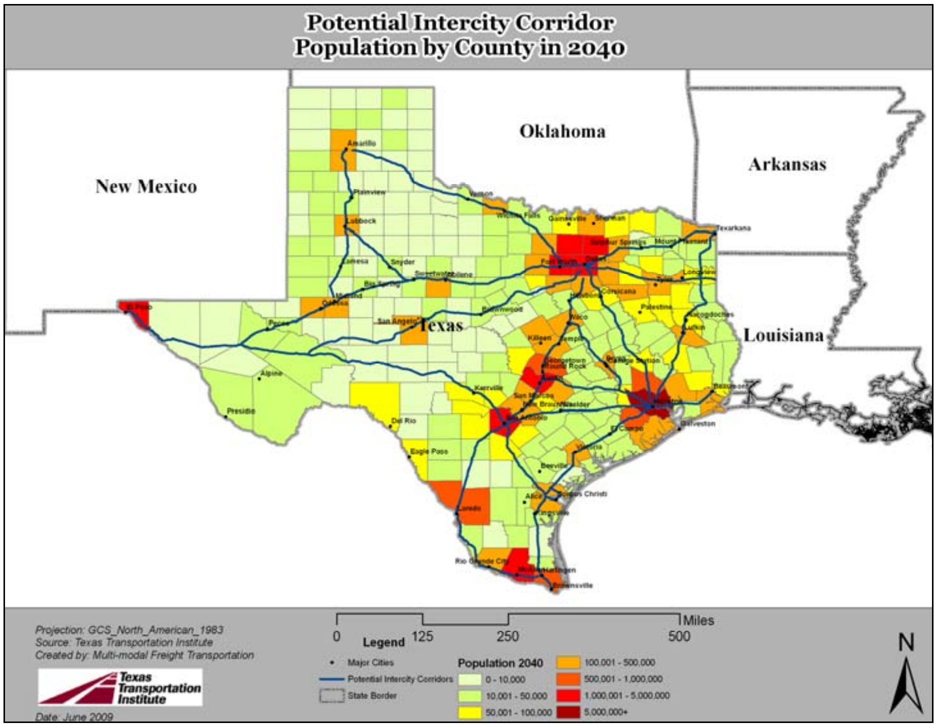


Figure 10. Texas Population by County, 2040.

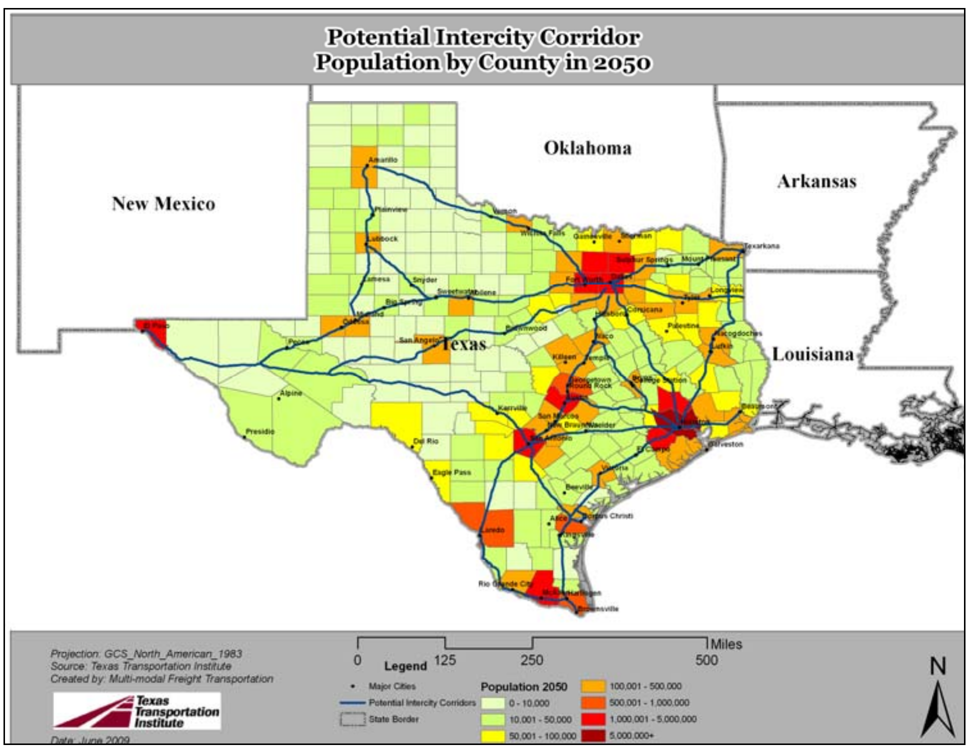


Figure 11. Texas Population by County, 2050.

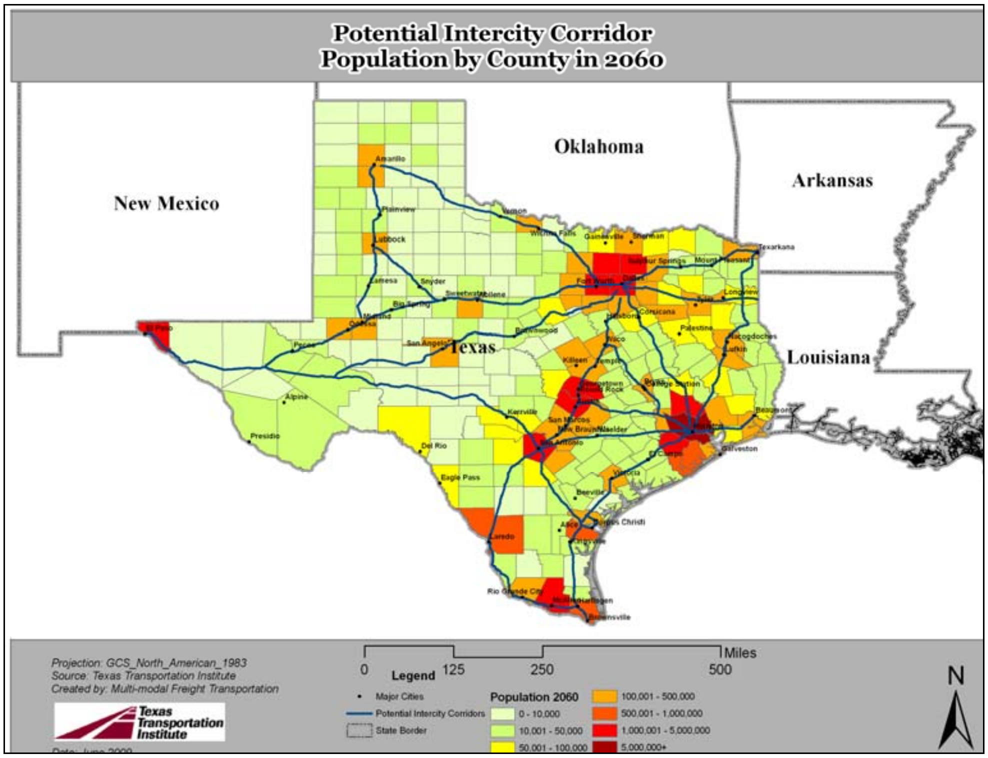


Figure 12. Texas Population by County, 2060.

These maps show that the highest population growth will be centered in the Dallas/Fort Worth and Houston areas, with the state's other major urbanized areas in Austin, San Antonio, the Valley Region of south Texas, and the El Paso region following closely behind. More figures on projected growth in each urban region are included in the tables in the following chapters. The GIS maps on AADT and population growth in the preceding two sections were submitted to TxDOT as a separate project deliverable as TxDOT 0-5930- P2. These maps may be used by TxDOT in future planning efforts.

CORRIDOR POPULATION AND DEMOGRAPHICS

Some of the key factors influencing the success or impact of planned transit improvements in a particular travel corridor include elements related to the current population size, projected growth, and other demographic characteristics of the travel market. When evaluating the population and other demographic characteristics of the intercity travel corridors, the research team explored many different alternatives for the geographic scale (i.e., city, county, or other unit) by which to measure the population and demographic characteristics on the corridor level. The challenge faced by the research team when selecting the geographic scale for the measurement of population and demographics was selecting a scale that reflected, as accurately as possible, the geographic areas that would be served by a proposed intercity rail and express bus corridor transit system. A full discussion of several of the options the research team considered is included in TxDOT Report 0-5930-1. Part of this discussion on project methodology is also included as Appendix D in this report.

As a result of its investigation of several possible methods, the research team determined that the federal Office of Management and Budget (OMB) standards for defining core-based statistical areas (CBSAs) provided the best geographic unit to estimate the population and demographic characteristics of the intercity travel corridors in this initial statewide study. In its *Federal Register* notice on December 27, 2000, OMB defined a CBSA as a "geographic entity associated with at least one core of 10,000 or more population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties" (*5*).

There are two classifications of CBSAs: metropolitan statistical areas (MSAs), which are defined as CBSAs with a population core of 50,000 or greater, and micropolitan statistical areas (µSAs), which are CBSAs with a population core between 10,000 and 49,999. In Texas, the geographic entity used to define a CBSA is the county, or a combination of adjacent counties. Figure 13 is a map of the existing CBSAs in Texas with the initial intercity travel study corridors for this research project shown. Using CBSAs as the basic geographic unit from which to analyze population and demographic characteristics for each of the intercity travel corridors in this study allowed the research team to utilize county-level data, while only including populations that are expected to generate a significant amount of intercity travel (that is, population cores greater than 10,000 and the surrounding area with a high degree of interaction with those cores).

During the course of the analysis, it was determined that two of the originally proposed evaluation corridors, Corridor 7, DFW to San Antonio along I-35, and Corridor 8, DFW to San Antonio along U.S. 377 and U.S. 281, should be combined for the purposes of evaluating intercity rail and express bus needs. These two corridors serve the same endpoints; however, Corridor 7 passes through many highly populated CBSAs along its route around the Austin, Temple, and Waco areas. Corridor 8 bypasses many of these urban CBSAs along I-35 making it much less likely to support future transit. As a result, Corridor 8 was eliminated from analysis and the 18 remaining corridors were ultimately taken into final analysis during the remaining stages of the project. The two DFW to El Paso corridors, Corridors 2 and 9, via Midland/Odessa and San Angelo were both kept in the analysis, however, because each served alternative metropolitan and micropolitan CBSA areas along its route despite having the same endpoints. Similar determinations were made to keep and analyze the two corridors between San Antonio and Brownsville, Corridors 17 and 19, since they each very take different routes through completely different CBSAs—one southwest via Laredo and the serving the urban centers in the lower Valley region of the state and the other route southeast via Corpus Christi before going south along the coast to Brownsville.

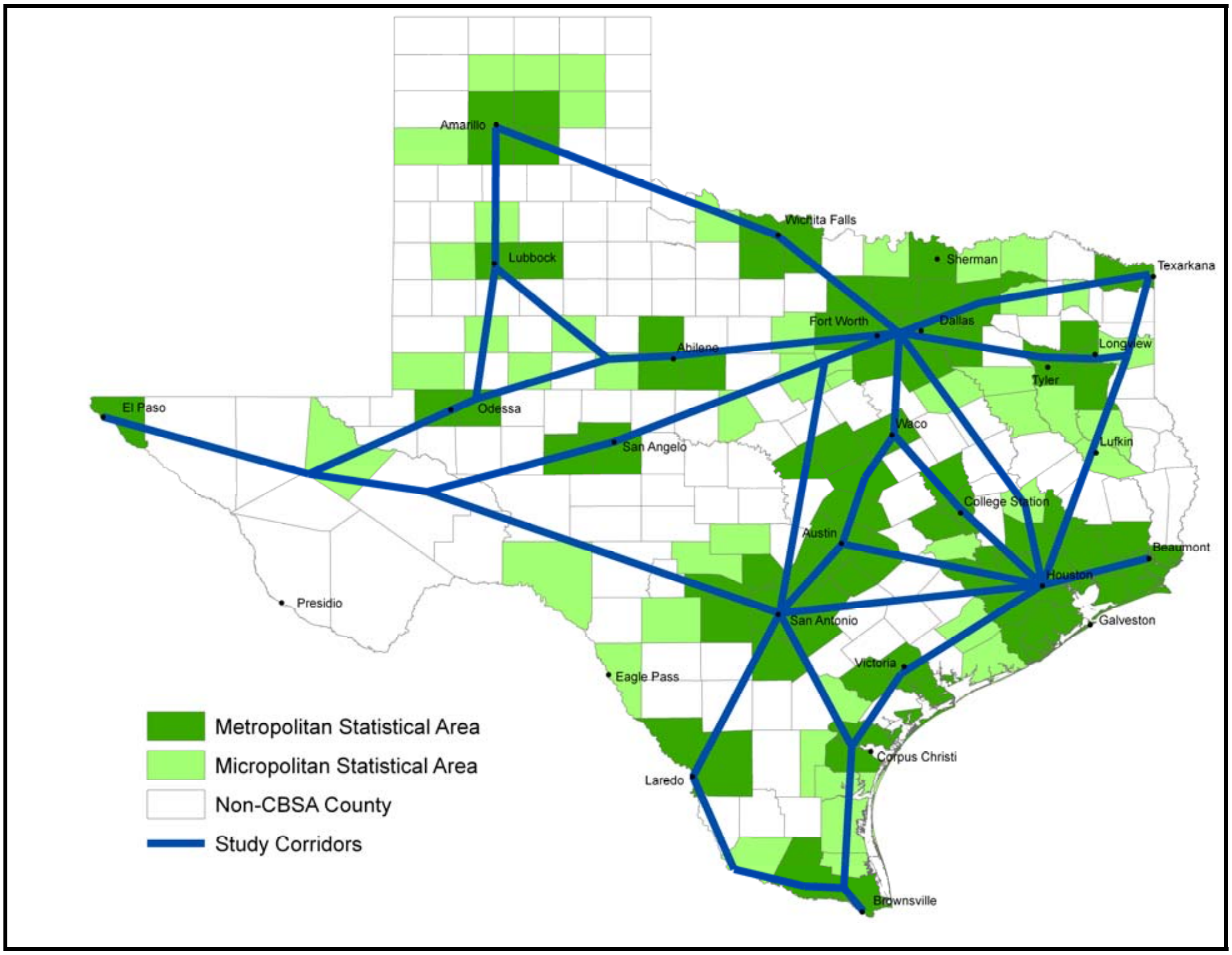


Figure 13. Map of Core-Based Statistical Areas in Texas.

ANALYSIS OF TEXAS INTERCITY TRAVEL DEMAND

This section describes the criteria that the research team developed in conjunction with, and with input and approval from, the TxDOT Project Monitoring Committee (PMC). The PMC for Project 0-5930 was made up of TxDOT division and district personnel and stakeholders from transit agencies and metropolitan planning organizations (MPOs) from throughout the state. Throughout this process, the research team and the PMC developed evaluation criteria in three categories upon which to rank the intercity corridors. Those three categories are:

- population and demographics,
- intercity travel demand, and
- intercity travel capacity.

Table 5 shows a summary description of each of these categories and definitions of the individual criteria developed under each category. TxDOT Report 0-5930-1 and in Appendix D of this report provide additional detail on how each criterion was determined and evaluated.

Table 5. Evaluation Criteria for Project 0-5930 Study Corridors Evaluation.

Category	Ref.	Criteria
Population & Demographics (P)	P.1	Number of core-based statistical areas along corridor.
	P.2	Total population of CBSA counties along corridor, 2000.
	P.3	Growth in total population of CBSA counties along corridor, 2000–2040.
	P.4	Total population per mile of the corridor, 2000.
	P.5	Percent of total corridor population age 65 and older, 2040.
	P.6	Total employees, 2005.
	P.7	Total enrollment at public or private universities along corridor, Fall 2006.
Intercity Travel Demand (D)	D.1	Average corridor AADT, 2006.
	D.2	Percent annual growth in average corridor AADT, 1997–2006.
	D.3	Air passenger travel between corridor airports, 2006.
	D.4	Percent annual growth in air travel between corridor airports, 1996–2006.
Intercity Travel Capacity (C)	C.1	Average volume-capacity ratio on subject highways in corridor, 2002
	C.2	Average percent trucks on subject highways in corridor, 2002.
	C.3	Load factor on corridor flights, weighted by boarding passengers, 2006.
	C.4	Average number of corridor flights per day, 2006.

Population and Demographics

Travel Corridor Evaluation

The first category of criteria used in the evaluation of Texas intercity travel corridors is an evaluation of the market for intercity rail or express bus service based on measures of population and demographics. Table 6 shows the seven criteria (numbered P.1 through P.7) selected to measure population and demographics and the units of measurement for each.

Table 6. Population and Demographics Criteria for Project 0-5930 Evaluation.

Ref.	Criteria	Units
P.1	Number of CBSAs along corridor	Number
P.2	Total population of CBSA counties along corridor, 2000	Persons
P.3	Growth in total population of CBSA counties along corridor, 2000–2040	Percent
P.4	Total population per mile of the corridor, 2000	Persons/mile
P.5	Percent of total corridor population age 65 and older, 2040	Percent
P.6	Total employees, 2005	Employees
P.7	Total enrollment at public or private universities along corridor, fall 2006	Students

Definitions of Population and Demographics Criteria

The first population and demographics evaluation criterion is the number of CBSAs through which the route of each intercity travel corridor under study passes, shown for each corridor under column P.1 in Table 7. This criterion was selected because the research team believed that the population centers represented by CBSAs are the primary generators of intercity travel and could also be potential station locations depending on further detailed studies. As such, an intercity travel corridor with a larger number of CBSA-designated areas increases the potential for intercity travel in that corridor, which would then indicate a greater need for the provision of intercity rail or express bus service.

The second population and demographics criterion is the total population of CBSA-designated areas through which the route of each study corridor passes, shown for each corridor under column P.2 in Table 5. Population data from the 2000 decennial census were used in the computation of the total corridor populations. This criterion was selected because the total corridor population is a measure of the market size from which ridership on a statewide rail or express bus network will be drawn. A larger total corridor population indicates a greater need for the provision of intercity rail or express bus service in that corridor.

Table 7. Population and Demographics Evaluation Data for Project 0-5930 Study Corridors.

Corridor	P.1*	P.2*	P.3*	P.4*	P.5*	P.6*	P.7*
AMALBB 5		643,818	0.77%	2627.8	18.10%	252,192	41,922
DFWELP1 9		6,328,135	2.18%	10190.2	17.83%	2,849,134	163,141
DFWAMA 4		5,554,266	2.28%	15343.3	18.07%	2,622,788	144,352
DFWHOU 4		9,983,833	2.17%	39618.4	17.81%	4,503,956	233,169
DFWLBB 7		5,663,679	2.23%	17110.8	18.04%	2,659,182	179,230
DFWLOU 4		5,592,402	2.28%	30559.6	18.08%	2,654,034	137,752
DFWSAT 5		8,667,241	2.15%	32461.6	18.62%	3,908,853	280,359
DFWELP2 6		6,065,531	2.26%	9360.4	17.86%	2,748,544	168,053
DFWTXK 4		5,310,928	2.34%	27952.3	18.09%	2,534,325	132,428
HOUAUS 3		5,995,543	2.13%	36782.5	18.30%	2,593,949	173,438
HOUBMT 2		5,100,497	1.84%	58626.4	17.62%	2,127,555	105,779
HOUBVN 7		5,658,810	1.90%	15546.2	17.30%	2,287,155	109,511
HOUSAT 2		6,427,110	1.74%	32297.0	18.01%	2,667,813	131,021
HOUTXK 6		5,200,198	1.83%	16938.8	17.70%	2,173,525	105,258
HOUWAC 3		5,113,809	1.88%	27792.4	17.46%	2,145,207	146,702
SATBVN 5		2,502,255	1.37%	8936.6	18.17%	904,126	65,965
SATELP 3		2,434,978	1.32%	3828.6	18.42%	879,606	66,266
SATLRD 5		2,863,107	2.11%	8203.7	16.25%	975,101	73,451

* Criteria P.1-P.7 are defined in Table 6 and in the text.

The third population and demographics evaluation criterion, P.3, is the annual percentage growth in total corridor population between the 2000 census and projections of total corridor population for the year 2040. Population projections for the year 2040 for each study corridor were computed using projections developed by the Population Estimates and Projections Program of the Texas State Data Center at the Office of the Texas State Demographer. For the projected corridor populations, the research team used data from the one-half 1990–2000 migration scenario (also known as the 0.5 scenario), which was the scenario recommended by the Texas State Demographer for long-term planning applications. Just as the total corridor population is a measure of the current market for intercity travel, the projected growth in total corridor population was selected as a criterion to measure the forecast potential for growth in size of each study corridor's market for intercity travel. Higher annual percentage growth in total corridor population indicates a greater need for the provision of intercity rail or express bus service in a particular corridor.

The fourth population and demographics evaluation criterion is the total corridor population per mile of corridor, shown for each corridor under column P.4 in Table 7. The population per mile of the corridor is computed by dividing the total corridor population from measure P.2 by the total route-miles for each travel corridor from Table 2. As an evaluation criterion, including the total corridor population per mile adds a measure to the evaluation process that considers the total population but also incorporates the impact of corridor length in determining the need for intercity rail or express bus service. A higher total corridor population per mile indicates a greater need for the provision of intercity rail or express bus service in that corridor.

The fifth population and demographics evaluation criterion, P.5, is the percentage of the total corridor population that, in the year 2040, will be aged 65 and older. Projections of population by age group from the Texas State Demographer, utilizing the 0.5 migration scenario, were used to compute these percentages. This criterion was included in the evaluation methodology based on the literature findings of Task 1 of the project, which found that persons aged 65 and older were a target market for transit ridership. However, the percentage of population aged 65 and older is essentially projected to grow at the same rate for each of the study corridors by the State Demographer; as such, the research team determined that this criterion cannot be used to conclude that a particular corridor has a greater need for improved intercity transit on the basis that it has more growth in persons 65 and older. As a result, the research team later removed this criterion from the overall evaluation methodology.

The sixth population and demographics evaluation criterion, P.6, is the total number of persons employed by business establishments located in the CBSA-designated areas along each corridor. These data were obtained from the U.S. Census Bureau's survey of county business patterns, 2005 update. This criterion was included in the evaluation because it is assumed that as the number of persons employed along a corridor increases, the potential for intercity business travel (and the need for improved intercity connections) will increase as well. Therefore, a higher total number of persons employed along a corridor indicates a greater need for intercity rail or express bus service in that corridor.

The seventh population and demographics evaluation criterion is the total enrollment of public or private universities in CBSA-designated areas along each corridor, shown for each corridor under column P.7 in Table 7. Enrollment data were obtained from the Texas Higher Education Coordinating Board's certified fall 2006 enrollment counts for two classes of higher education institutions: Texas public universities and Texas independent senior colleges and universities. This criterion was included in the evaluation because intercity travel by students was identified in Task 1 of this project as a target market for transit ridership. Enrollments from other classes of higher educational institutions, such as junior colleges, community colleges, or medical centers, were not included since it was assumed that these types of institutions would not generate a significant amount of intercity traffic. A higher total student enrollment at public or private universities along the corridor indicates a greater need for intercity rail or express bus service in a corridor.

Intercity Travel Demand

Travel Corridor Evaluation

The second category of criteria used in the evaluation of Texas intercity travel corridors is an estimation of the demand for intercity travel along each of the study corridors. The research team selected four criteria to evaluate the demand for travel along the project's study corridors, shown in Table 8. The criteria selected to evaluate the demand for intercity travel along the study corridors (numbered D.1 to D.4) focus on the demand for automobile travel and air travel. While other modes are available in the form of intercity passenger rail and bus, travel by these modes comprises only a small portion of all intercity travel in Texas. Data for the intercity travel demand criteria for each study corridor can be found in Table 9.

Definitions of Intercity Travel Demand Criteria

Two of the intercity travel demand criteria are measures of intercity automobile travel along the subject highways. They are related to the AADT along each intercity travel corridor in this study. The first criterion (D.1) is the AADT for each study corridor for the year 2006, which is included to evaluate existing highway traffic conditions on each travel corridor. The second criterion (D.2) is the percentage annual growth in the travel corridor AADT between 1997 and 2006, which is included with the purpose of being an estimate of the growth in demand for highway travel in each travel corridor. AADT data for this project were obtained from the 2006 TxDOT Roadway Highway Inventory Network (RHiNo) database. For each of the two AADT-based criteria, a higher value indicates a greater demand for travel in an intercity corridor and thus indicates a greater need for investment in intercity rail or express bus service in that corridor. These AADT values include traffic internal to the study corridors (i.e., vehicles that are not traveling between the corridor endpoint cities). Despite this, the research team determined that these two AADT-based measures were appropriate early planning-level surrogate measures of travel demand in an intercity corridor acceptable for transit analysis since shorter distance, intra-corridor trips would be taken by either by intercity rail or express bus passengers. In the future, more detailed formal ridership studies can more accurately measure and isolate intercity travel demand between specific endpoint city pairs.

Table 8. Intercity Travel Demand Criteria for Project 0-5930 Evaluation.

Ref.	Criteria	Units
D.1	Corridor average annual daily traffic (AADT), 2006	Vehicles/day
D.2	Annual growth in average corridor AADT, 1997–2006	Percent
D.3	Air passenger travel between corridor airports, 2006	Person-trips
D.4	Annual growth in air passenger travel between corridor airports, 1996–2006	Percent

Table 9. Intercity Travel Demand Evaluation Data for Project 0-5930 Study Corridors.

Corridor	D.1	D.2	D.3	D.4
AMALBB	8,684	1.68%	20	–95.45%
DFWELP1	20,777	2.96%	606,870	–2.75%
DFWAMA	15,252	2.91%	260,240	–1.46%
DFWHOU	53,634	4.57%	1,643,640	–2.45%
DFWLBB	16,434	2.36%	336,520	–1.28%
DFWLOU	32,713	2.70%	4,170	–22.65%
DFWSAT	88,153	2.91%	1,407,110	–1.24%
DFWELP2	12,884	3.41%	364,710	–2.94%
DFWTXK	29,070	2.30%	3,590	–12.38%
HOUAUS	36,441	3.44%	217,520	–6.90%
HOUBMT	72,525	2.27%	800	–14.77%
HOUBVN	32,689	2.47%	342,680	–3.59%
HOUSAT	54,071	2.91%	265,760	–4.64%
HOUTXK	28,616	2.94%	1,300	–23.08%
HOUWAC	33,112	3.85%	2,070	–21.56%
SATBVN	24,829	2.65%	74,620	–2.61%
SATELP	20,222	3.14%	132,890	–0.58%
SATLRD	28,689	5.10%	77,410	–3.24%

* Criteria D.1-D.4 are defined in Table 8 and in the text.

The other two intercity travel demand criteria are measures of the demand for intercity air travel in the study corridors. The first criterion (D.3) is the total number of airline trips between airport pairs within a travel corridor in 2006. The second criterion (D.4) is the growth in the total number of airline trips between airport pairs within a travel corridor between 1996 and 2006. These data were obtained from the research team's analysis of the Bureau of Transportation Statistics' Airline Origin and Destination Survey (DB1B), which is a 10 percent sample of airline tickets sold by reporting carriers. The raw number of tickets for each commercial airport pair in the state was identified, and the number of tickets for each airport pair in a corridor were added together to find the total air travel for a particular corridor. This value was multiplied by 10 to determine the actual number of air passengers for each corridor. As with the AADT-based intercity demand measures, a higher value for each of the air travel demand criteria indicates a greater need for the provision of intercity rail or express bus service in a corridor.

Intercity Travel Capacity

Travel Corridor Evaluation

The third category of criteria used in the evaluation of Texas intercity travel corridors is an approximation of the intercity travel capacity of each of the study corridors. The research team selected four criteria (numbered C.1 to C.4) to evaluate each study corridor's intercity travel capacity, shown in Table 10. As with the criteria for measuring intercity travel demand, the criteria selected for evaluating intercity travel capacity focus on the capacity of the highway and air modes. Table 11 shows the data calculated for intercity travel capacity criteria.

Definitions of Intercity Travel Capacity Criteria

The first two intercity travel capacity criteria are measures of roadway travel capacity. The first intercity travel capacity criterion (C.1) is the weighted average volume-capacity ratio on subject highways along each travel corridor. The second intercity travel capacity criterion (C.2) is the average percentage of trucks traveling on highway segments along each study corridor. Data for these measures were derived from the research team's analysis of the Freight Analysis Framework utilizing its most recent (2002) data. While the volume-capacity ratio is a traditional measure of highway capacity, the percentage trucks criterion is included as more of a measure of impedance to intercity travel; that is, if more trucks are on an intercity corridor, it is more difficult to introduce additional intercity passenger travel into that roadway traffic mix. For each of these measures of intercity travel capacity, a high value for a corridor indicates a deficiency in travel capacity along that corridor and thus a greater need for the provision of intercity rail or express bus service in that corridor.

Table 10. Intercity Travel Capacity Criteria for Project 0-5930 Evaluation.

Ref.	Criteria	Units
C.1	Average volume-capacity ratio on subject highways in corridor, 2002	Ratio
C.2	Average percent trucks on subject highways in corridor, 2002	Percent
C.3	Load factor on corridor flights, weighted by boarding passengers, 2006	Ratio
C.4	Average number of corridor flights per day, 2006	Flights/day

Table 11. Intercity Travel Demand Evaluation Data for Project 0-5930 Study Corridors.

Corridor	C.1	C.2	C.3	C.4
AMALBB 0.17	4	10.44%	0.000	0
DFWELP1 0.28	4	39.12%	0.663	67
DFWAMA 0.30	9	27.00%	0.620	45
DFWHOU 0.60	2	19.29%	0.710	130
DFWLBB 0.30	8	32.55%	0.686	47
DFWLOU 0.49	3	27.45%	0.685	15
DFWSAT 0.63	1	14.46%	0.755	155
DFWELP2 0.23	6	27.52%	0.689	36
DFWTXK 0.47	7	30.28%	0.555	12
HOUAUS 0.60	2	10.95%	0.717	35
HOUBMT 0.68	9	17.79%	0.621	9
HOUBVN 0.56	8	11.53%	0.706	73
HOUSAT 0.79	2	14.26%	0.712	38
HOUTXK 0.43	7	18.18%	0.480	7
HOUWAC 0.64	5	11.59%	0.572	20
SATBVN 0.46	2	13.63%	0.647	3
SATELP 0.249		28.86%	0.696	7
SATLRD 0.43	9	14.28%	0.647	3

* Criteria C.1-C.4 are defined in Table 10 and in the text.

The other two measures that the research team selected to evaluate the travel capacity of statewide intercity corridors are measures of air travel capacity. The first air travel capacity criterion (C.3) is the load factor on all flights between airports located along a travel corridor. The load factor was computed as the percentage of seats on an aircraft that are occupied for a particular segment of flight; for corridors with multiple airport pairs, the corridor average was weighted by the number of passengers on each route. A higher load factor for a corridor indicates that access to air service for intercity flights is more difficult and thus would indicate a greater need for investment in an intercity rail or express bus service in that corridor. The second air travel capacity criterion (C.4) is the average number of scheduled flights per day between airports in a corridor. Values for these air travel measures were computed from the research team's analysis of flight segment data obtained from the Bureau of Transportation Statistics' Air

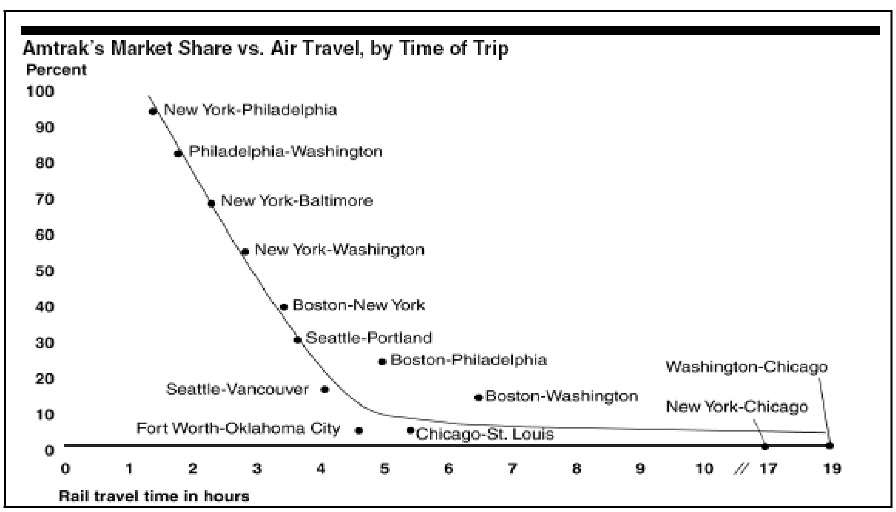
Carrier Statistics (T-100) form data for the year 2006. A higher average number of corridor flights per day shows that air travel is easily accessible on that corridor; therefore, corridors with fewer average flights per day are locations where improved intercity travel options are needed.

It is important to note that one of the advantages of intercity air transportation is that capacity can be easily added or removed from city pairs based on economic conditions and demand for travel. These cycles result in a very dynamic network, especially for the smaller city markets for air travel. The majority of the analysis of the Texas aviation network for this project took place in 2007 and early 2008 prior to the economic slowdown and dramatic increase in fuel prices which affected both individuals' desire to travel and the airline companies' desire to serve unprofitable markets. An updated chapter on the air transportation system, showing its changes between 2006 and 2008 regarding several criterion assumptions is included as Appendix B to this final report; however, the corridor analysis and ranking was done using the peak 2006 data.

CHAPTER 4:
CORRIDOR BY CORRIDOR ANALYSIS

CORRIDOR CHARACTERISTICS CONDUCIVE TO RAIL/EXPRESS BUS RIDERSHIP

In addition to identification of the study corridors and determining the criteria upon which each would be ranked, the research team also undertook another line of investigation to identify what characteristics would make a corridor conducive to intercity passenger rail or express bus service. One of the primary factors in determining what percentage of current highway or air market share that rail can attract is the trip time between city pairs, rather than the specific speed of rail service. Figure 7 shows the market share that conventional and high-speed services of the U.S. national rail carrier, the National Passenger Railroad Company (Amtrak) has captured in markets where the modes compete. Similar capture by express bus in corridors where rail service cannot be justified due to costs or limited ridership can be expected to depend more on the trip time between destination cities, rather than on the actual speed itself of the transit vehicle. Tables later in this chapter showing the time between various city pairs along each corridor give an idea of how long the trip segments would take at 60, 80, and 110 mph average speeds. As Figure 14 demonstrates, rail service can capture a reasonable market share of 20 percent or higher if travel time can be limited to 4 hours or less. Beyond this amount of travel time, air travel tends to be the choice preferred by most intercity travelers.



Source: Government Accountability Office, Washington, DC.

Figure 14. Amtrak Rail Service Market Share vs. Air Travel, by Time of Trip.

STATEWIDE POPULATION CENTERS DISTRIBUTION

Another primary consideration in determining the value and success of a statewide intercity transit system is the distribution and size of the urban population centers where potential riders live or work, as well as the distance between stations that would likely be located in these centers. Too many stations would decrease average speed due to frequent stops. Too few stations, would not allow the service to maximize ridership along each route. Figure 15 shows the general configuration and relative size and distance of the population centers along the study corridors that were advanced in this research project. More details on individual corridors follows in the remainder of this chapter.

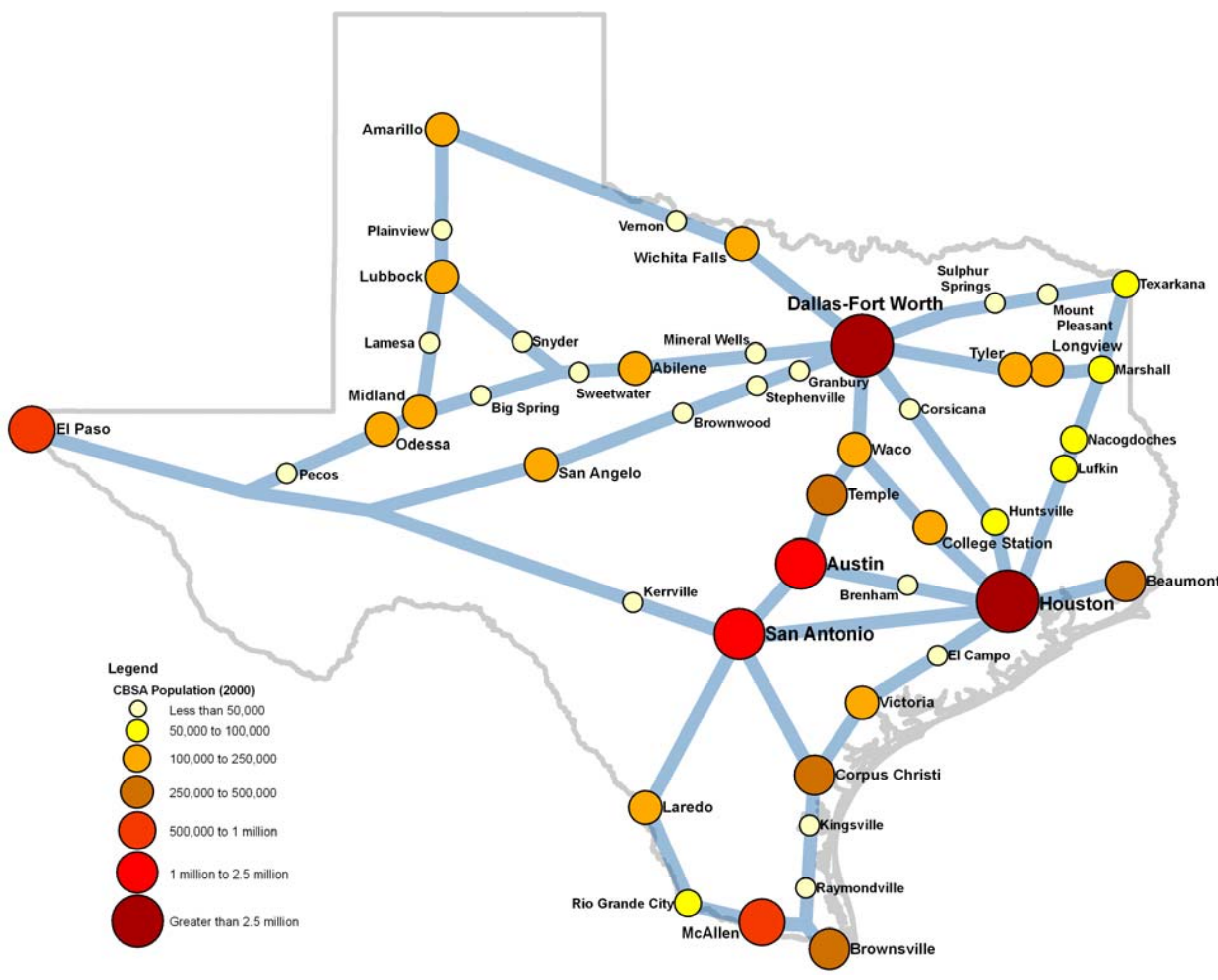


Figure 15. Relative Size and Distance of Texas Population Centers along Study Corridors.

CORRIDORS BY LENGTH

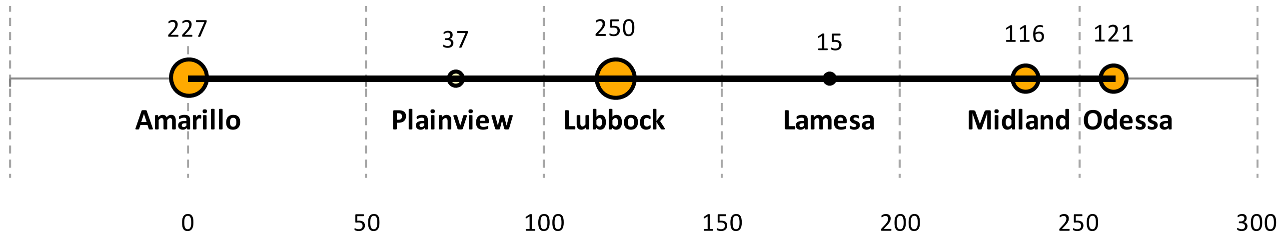
The identified study corridors are divided into three classifications for the remainder of this chapter as follows:

- less than 250 miles in length- 7 corridors,
- longer than 250 miles but less than 500 miles in length- 8 corridors, and
- greater than 500 miles in length- 3 corridors.

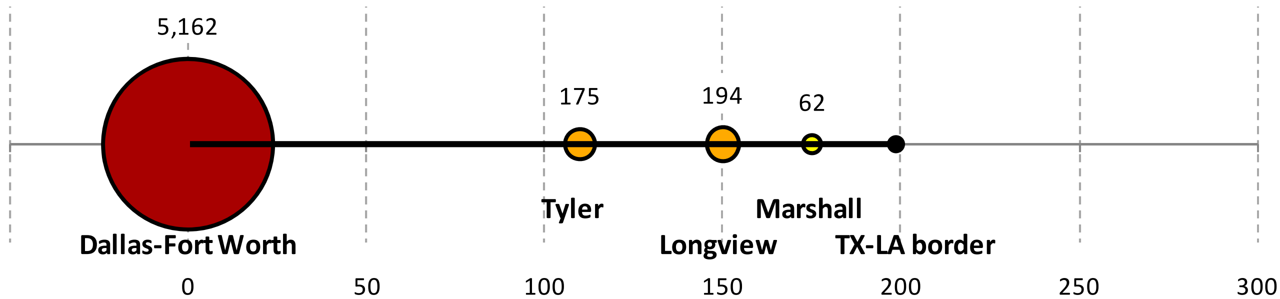
The corridors are described in more detail in the graphs and tables in the following sections of the report. Since trip time and relative distance is so critical to the success of intercity transit, each corridor has been described using a graduated chart showing the distance in miles (by the classification groups above) showing circles based on size of current population and using the legend from Figure 15. Each colored circle is labeled with the name of the city and its population in shown in thousands above the circle. Within each classification grouping, the distance scales of the graphs are identical so that corridor characteristics can be easily compared against the others. Figure 16 shows the population distribution along corridors less than 250 miles in length. Figure 17 shows the population distribution along corridors between 250 and 500 miles in length. Figure 18 shows population distribution along corridors over 500 miles in length.

Corridors Less than 250 Miles in Length

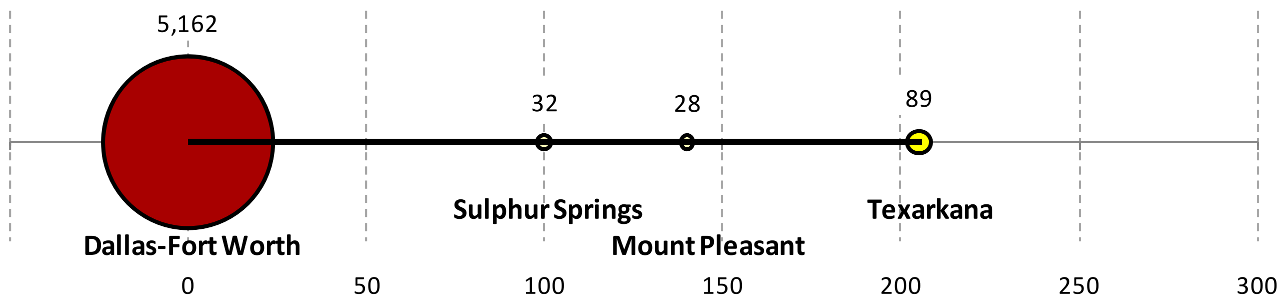
Corridor 1 – Amarillo to Midland-Odessa via Lubbock



Corridor 6 – Dallas-Fort Worth to Louisiana Border



Corridor 10 – Dallas-Fort Worth to Texarkana



Corridor 11 – Houston to Austin

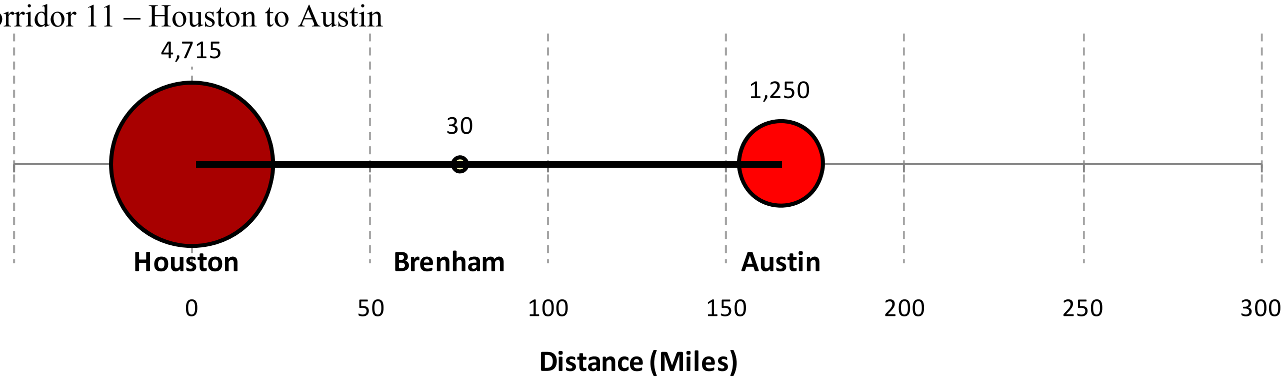


Figure 16. Corridor Population Distributions for Corridors under 250 Miles in Length

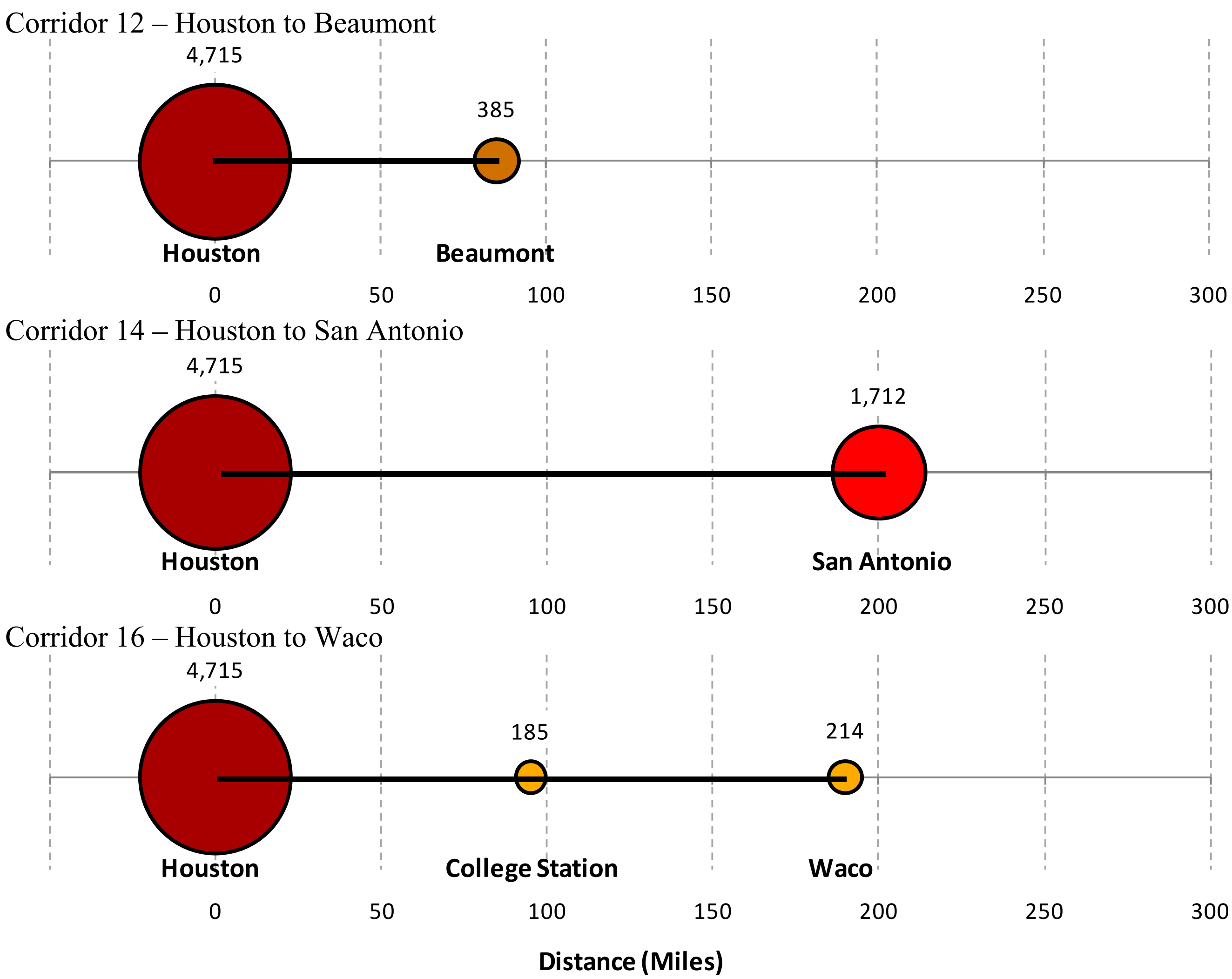
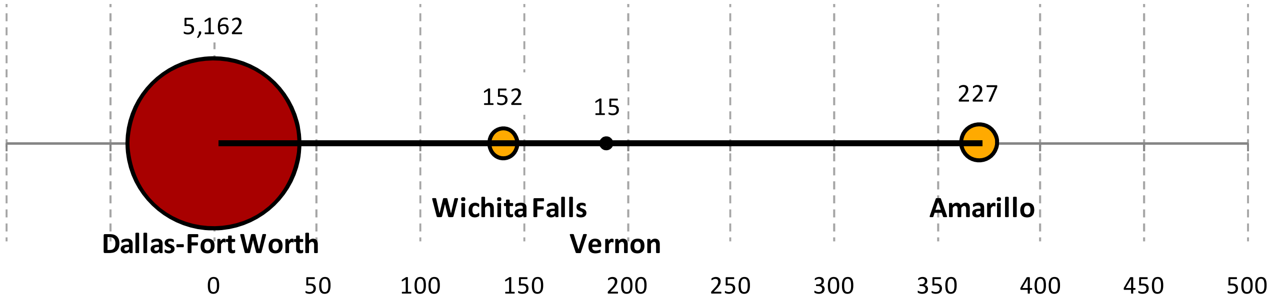


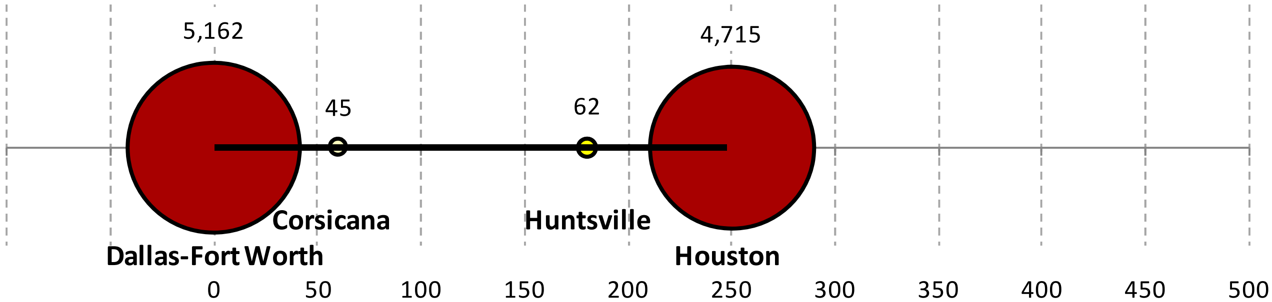
Figure 16. Corridor Population Distributions for Corridors under 250 Miles in Length (continued)

Corridors Longer than 250 Miles but Less than 500 Miles in Length

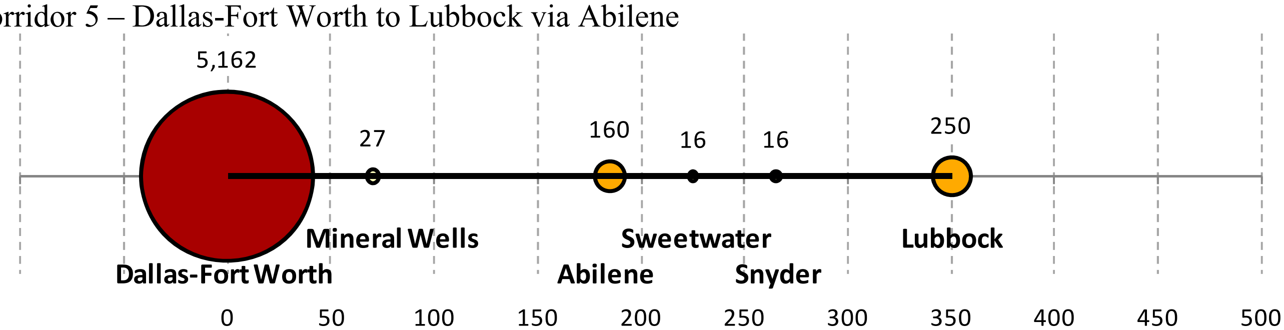
Corridor 3 – Dallas-Fort Worth to Amarillo via Wichita Falls



Corridor 4 – Dallas-Fort Worth to Houston



Corridor 5 – Dallas-Fort Worth to Lubbock via Abilene



Corridor 7 – Dallas-Fort Worth to San Antonio

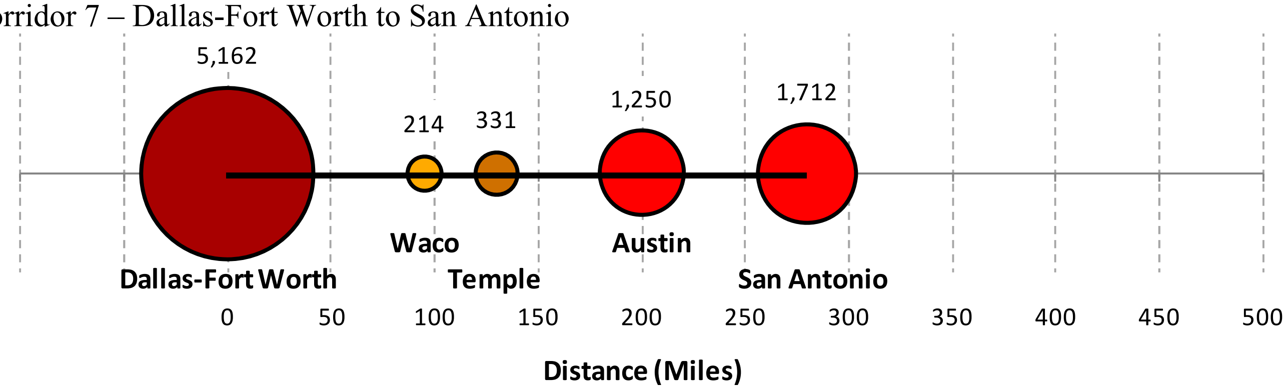
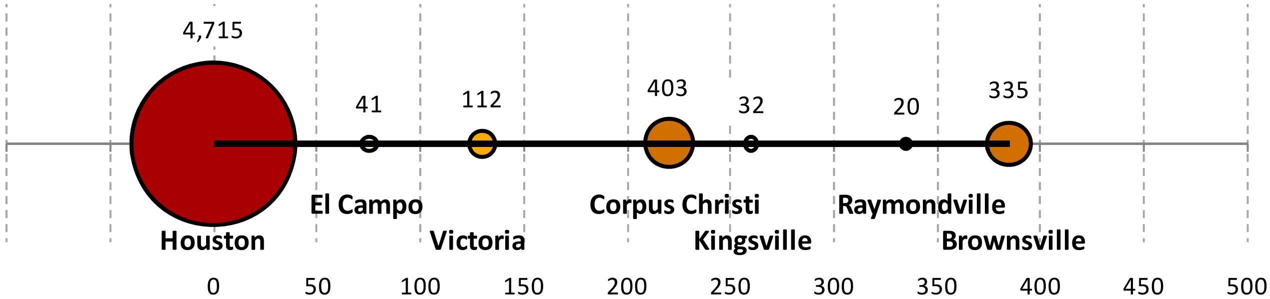
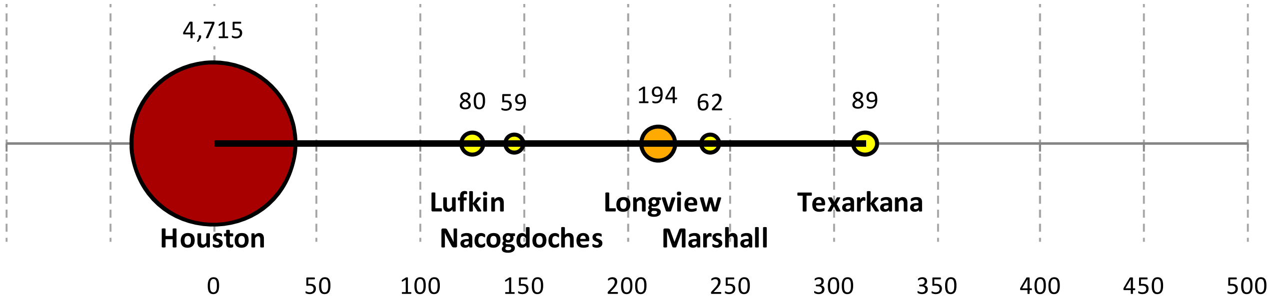


Figure 17. Corridor Population Distributions for Corridors between 250 and 500 Miles in Length

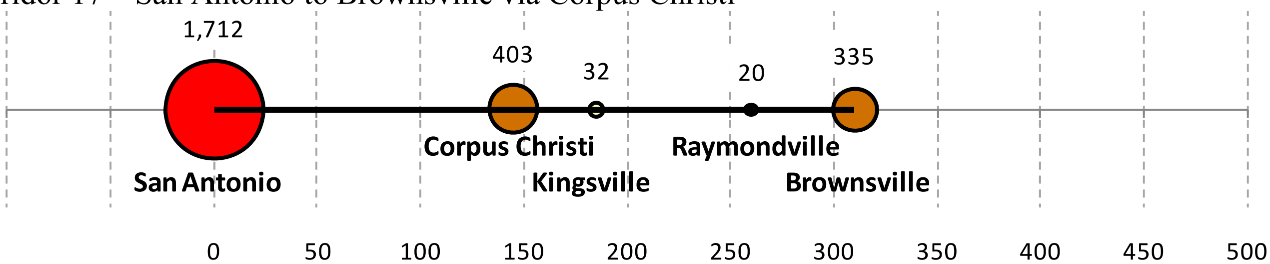
Corridor 13 – Houston to Brownsville



Corridor 15 – Houston to Texarkana



Corridor 17 – San Antonio to Brownsville via Corpus Christi



Corridor 19 – San Antonio to Brownsville via Laredo

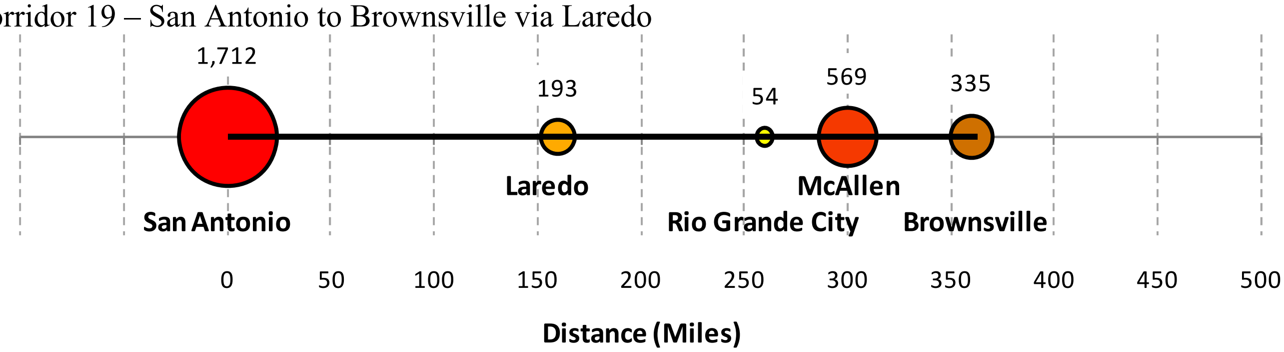


Figure 17. Corridor Population Distributions for Corridors between 250 and 500 Miles in Length (continued)

Corridors Greater than 500 Miles in Length

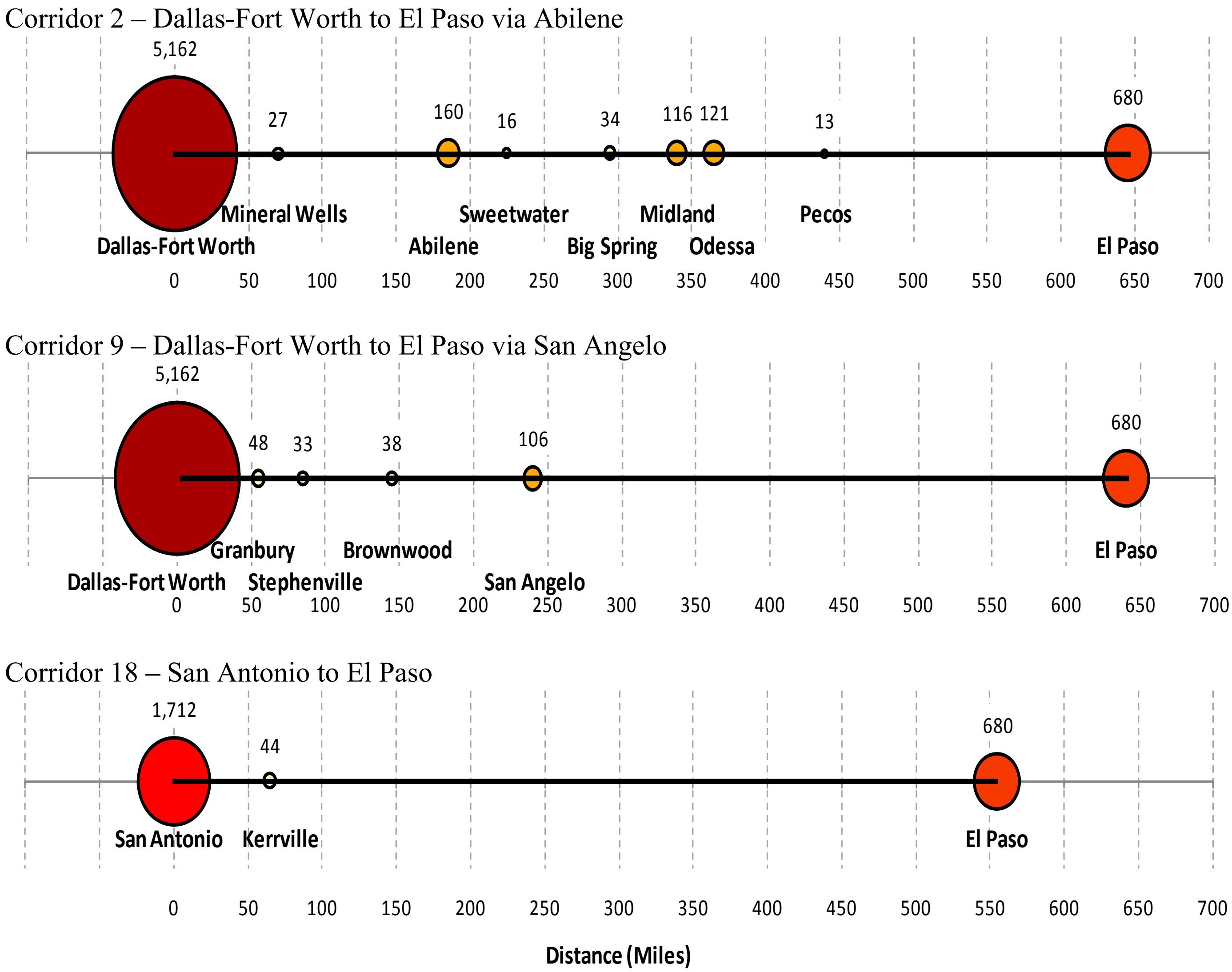


Figure 18. Corridor Population Distributions for Corridors over 500 Miles in Length

CORRIDOR PROJECTED POPULATION GROWTH/PROJECTED TRAVEL TIMES AT VARIOUS AVERAGE SPEEDS

Similar to the previous section, Tables 14-29 describe other characteristics of the individual corridors related to demographic and trip times between urban areas. For each CBSA along the corridor, the population in the 2000 census and projected 2040 population projections from the State Demographer are shown along with the percent growth expected over the 40 year period. Distances of each segment and cumulative distance between the endpoint cities are also

110 mph are shown. It is important to remember that these speeds are average for the trip (i.e., would include time for stop time, acceleration, and deceleration around stations, etc.).

Corridors Less than 250 Miles in Length

Table 12. Corridor 1 – Amarillo to Midland-Odessa via Lubbock

AMALBB	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	**2000**	**2040**	**Total % Growth**	**Segment**	**Cumulative**	**60 mph**	**80 mph**	**110 mph**
Amarillo	226,500	330,700	46	-	-	-	-	-
Plainview	36,600	47,800	31	75	75	1:15	0:56	0:40
Lubbock	249,700	300,300	20	45	120	2:00	1:30	1:05
Lamesa	15,000	17,600	17	60	180	3:00	2:15	1:38
Midland	116,000	145,200	25	55	235	3:55	2:56	2:08
Odessa	121,100	163,100	35	25	260	4:20	3:15	2:21

Table 13. Corridor 6 – Dallas-Fort Worth to Louisiana Border

DFWLOU	Population			Distance (Miles)		Travel Time (hours:minutes)		
CBSA	**2000**	**2040**	**Total % Growth**	**Segment**	**Cumulative**	**60 mph**	**80 mph**	**110 mph**
Dallas-Fort Worth	5,161,500	10,106,800	96	-	-	-	-	-
Tyler	174,700	240,300	38	110	110	1:50	1:22	1:00
Longview	194,000	249,800	29	40	150	2:30	1:52	1:21
Marshall	62,100	85,500	38	25	175	2:55	2:11	1:35
TX-LA Border	- -		-	20	195	3:15	2:26	1:46

Table 14. Corridor 10 – Dallas-Fort Worth to Texarkana

DFWTXK	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Dallas-Fort Worth	5,161,500	10,106,800	96	-	-	-	-	-
Sulphur Springs	32,000	38,500	20	100	100	1:40	1:15	0:54
Mount Pleasant	28,100	43,100	53	40	140	2:20	1:45	1:16
Texarkana	89,300	84,300	-6	65	205	3:25	2:33	1:51

Table 15. Corridor 11 – Houston to Austin

HOUAUS	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Houston	4,715,400	8,400,100	78	-	-	-	-	-
Brenham	30,400	39,500	30	75	75	1:15	0:56	0:40
Austin	1,249,800	2,658,500	113	90	165	2:45	2:03	1:30

Table 16. Corridor 12 – Houston to Beaumont

HOUBMT	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Houston	4,715,400	8,400,100	78	-	-	-	-	-
Beaumont	385,100	455,500	18	85	85	1:25	1:04	0:46

Table 17. Corridor 14 – Houston to San Antonio

HOUSAT	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Houston	4,715,400	8,400,100	78	-	-	-	-	-
San Antonio	1,711,700	2,512,000	47	200	200	3:20	2:30	1:49

Table 18. Corridor 16 – Houston to Waco

HOUWAC	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Houston 4,71	5,400	8,400,100	78	-	-	-	-	-
College Station	184,900 2	67, 700	45	95	95	1:35	1:11	0:51
Waco 213,	500	285,500	34	95	190	3:10	2:22	1:43

Corridors Longer than 250 Miles but Less than 500 Miles in Length

Table 19. Corridor 3 – Dallas-Fort Worth to Amarillo via Wichita Falls

DFWAMA	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Dallas-Fort Worth	5,161,500 1	0,1 06,800	96	-	-	-	-	-
Wichita Falls	151,500 1	72, 400	14	140	140	2:20	1:45	1:16
Vernon 14,7	00	16,500	12	50	190	3:10	2:22	1:43
Amarillo 226,	500	330,700	46	180 370		6:10	4:37	3:21

Table 20. Corridor 4 – Dallas-Fort Worth to Houston

DFWHOU	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Dallas-Fort Worth	5,161,500 1	0,1 06,800	96	-	-	-	-	-
Corsicana 45,1	00	70,900	57	60	60	1:00	0:45	0:32
Huntsville 61	800	77,800	26	120 180		3:00	2:15	1:38
Houston 4,71	5,400	8,400,100	78	70	250	4:10	3:07	2:16

Table 21. Corridor 5 – Dallas-Fort Worth to Lubbock via Abilene

DFWLBB	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Dallas-Fort Worth	5,161,500	10,106,800	96	-	-	-	-	-
Mineral Wells	27,000	36,700	36	70	70	1:10	0:52	0:38
Abilene	160,200	181,600	13	115	185	3:05	2:18	1:40
Sweetwater	15,800	17,700	12	40	225	3:45	2:48	2:02
Snyder	16,400	17,500	7	40	265	4:25	3:18	2:24
Lubbock	249,700	300,300	20	85	350	5:50	4:22	3:10

Table 22. Corridor 7 – Dallas-Fort Worth to San Antonio

DFWSAT	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Dallas-Fort Worth	5,161,500	10,106,800	96	-	-	-	-	-
Waco	213,500	285,500	34	95	95	1:35	1:11	0:51
Temple	330,700	553,700	67	35	130	2:10	1:37	1:10
Austin	1,249,800	2,658,500	113	70	200	3:20	2:30	1:49
San Antonio	1,711,700	2,512,000	47	80	280	4:40	3:30	2:32

Table 23. Corridor 13 – Houston to Brownsville

HOUBVN	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	**2000**	**2040**	**Total % Growth**	**Segment**	**Cumulative**	**60 mph**	**80 mph**	**110 mph**
Houston 4,71	5,400	8,400,100	78	-	-	-	-	-
El Campo	41,200	51,000	24	75	75	1:15	0:56	0:40
Victoria 111,	700	153,800	38	55	130	2:10	1:37	1:10
Corpus Christi	403,300	606,100	50	90	220	3:40	2:45	2:00
Kingsville 32,000		47,400	48	40 260		4:20	3:15	2:21
Raymondville 20,1	00	30,500	52	75	335	5:35	4:11	3:02
Brownsville 335,	200	675,700 102		50	385	6:25 4:48		3:30

Table 24. Corridor 15 – Houston to Texarkana

HOUTXK	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	**2000**	**2040**	**Total % Growth**	**Segment**	**Cumulative**	**60 mph**	**80 mph**	**110 mph**
Houston 4,71	5,400	8,400,100	78	-	-	-	-	-
Lufkin 80,1	00	111,200	39	125	125	2:05	1:33	1:08
Nacogdoches 59,2	00	75,800	28	20	145	2:25	1:48	1:19
Longview 194,	000	249,800	29	70	215	3:35	2:41	1:57
Marshall 62,1	00	85,500	38	25	240	4:00	3:00	2:10
Texarkana 89,3	00	84,300	-6	75	315	5:15	3:56	2:51

Table 25. Corridor 17 – San Antonio to Brownsville via Corpus Christi

SATBVN	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	**2000**	**2040**	**Total % Growth**	**Segment**	**Cumulative**	**60 mph**	**80 mph**	**110 mph**
San Antonio	1,711,700	2,512,000	47	-	-	-	-	-
Corpus Christi	403,300	606,100	50	145	145	2:25	1:48	1:19
Kingsville 32,000		47,400	48	40 185		3:05	2:18	1:40
Raymondville 20,1	00	30,500	52	75	260	4:20	3:15	2:21
Brownsville 335,	200	675,700	102	50 310		5:10	3:52	2:49

Table 26. Corridor 19 – San Antonio to Brownsville via Laredo

SATLRD	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	**2000**	**2040**	**Total % Growth**	**Segment**	**Cumulative**	**60 mph**	**80 mph**	**110 mph**
San Antonio	1,711,700	2,512,000	47	-	-	-	-	-
Laredo 193,	100	542,600	181	160	160	2:40	2:00	1:27
Rio Grande City	53,600	112, 700	110	100	260	4:20	3:15	2:21
McAllen 569,	500	1,439,500	153	40	300	5:00	3:45	2:43
Brownsville 335,	200	675,700	102	60	360	6:00	4:30	3:16

Corridors Greater than 500 Miles in Length

Table 27. Corridor 2 – Dallas-Fort Worth to El Paso via Abilene

DFWELP1	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	**2000**	**2040**	**Total % Growth**	**Segment**	**Cumulative**	**60 mph**	**80 mph**	**110 mph**
Dallas-Fort Worth	5,161,500	10,1 06,800	96	-	-	-	-	-
Mineral Wells	27,000	36,7 00	36	70	70	1:10	0:52	0:38
Abilene 160,	200	181,600	13	115	185	3:05	2:18	1:40
Sweetwater 15,8	00	17,700	12	40	225	3:45	2:48	2:02
Big Spring	33,600	35,500	6	70	295	4:55	3:41	2:40
Midland 116,	000	145,200	25	45	340	5:40	4:15	3:05
Odessa 121,100		163,100	35	25	365	6:05	4:33	3:19
Pecos 13,1	00	15,100	15	75	440	7:20	5:30	4:00
El Paso	679,600	1,153,100	70	205	645	10:45	8:03	5:51

Table 28. Corridor 9 – Dallas-Fort Worth to El Paso via San Angelo

DFWELP2	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	**2000**	**2040**	**Total % Growth**	**Segment**	**Cumulative**	**60 mph**	**80 mph**	**110 mph**
Dallas-Fort Worth	5,161,500	10,106,800	96	-	-	-	-	-
Granbury	47,900	83,500	74	55	55	0:55	0:41	0:30
Stephenville	33,000	50,200	52	30	85	1:25	1:03	0:46
Brownwood	37,700	42,000	11	60	145	2:25	1:48	1:19
San Angelo	105,800	123,900	17	95	240	4:00	3:00	2:10
El Paso	679,600	1,153,100	70	400	640	10:40	8:00	5:49

Table 29. Corridor 18 – San Antonio to El Paso

SATELP	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	**2000**	**2040**	**Total % Growth**	**Segment**	**Cumulative**	**60 mph**	**80 mph**	**110 mph**
San Antonio	1,711,700	2,512,000	47	-	-	-	-	-
Kerrville	43,700	51,000	17	65	65	1:05	0:48	0:35
El Paso	679,600	1,153,100	70	490	555	9:15	6:56	5:02

Appendix E provides maps of each corridor along with a listing of each operating transit agency, intermodal facilities, and daily intercity bus and rail services for each of the study corridors. Appendix F is a compilation of data on each study corridor presented as Corridor Information Sheets. Each corridor sheet has a map of the corridor, its population distribution chart, and its population growth and travel time chart presented on a single page for reference.

CHAPTER 5: PRELIMINARY INTERCITY RAIL AND EXPRESS BUS CONCEPTUAL PLAN AND ALTERNATIVE ROUTES

CONCEPTUAL CORRIDOR BACKGROUND

Task 5 of the project work plan called for the research team to present a preliminary concept configuration for an improved intercity rail and express bus transit system based upon the analysis completed in Tasks 1–4. At the time the project was initially conceived, it was thought that, at this point in the study, some determination could be made regarding the proposed bus/rail system configuration based on intercity travel demand patterns and demographic projections. While this was somewhat true, the answers to the question were not as clear as originally hoped. The research team found that several political and geographic interest factors which are yet to be explored, as well as the specific criteria used by the team's analysis (population and demographics, intercity travel demand, and the capacity of alternative intercity modal systems) will ultimately determine the configuration of the future intercity rail system in Texas. Public input will be an important part of this process as TxDOT works with stakeholders and citizens to update the Texas Rail System Plan (state rail plan) in 2010 and beyond.

The results of this research project provide only an initial tool for TxDOT to use in making decisions related to the state's future role in that development. Other corridor factors not included in the scope of the analysis of this project (such as air quality nonattainment areas) may also have an impact on which routes and in which order a rail/express bus system might be developed or implemented. The conceptual plan presented at the end of the first year of the project was the result of the corridor ranking analysis described earlier in this chapter and is made with the following assumptions, as outlined in previous technical memoranda and reports for Project 0-5930:

- The purpose of this work is to determine the most likely intercity travel corridors within the state needing to be served by an intercity rail/express bus system.
- Factors included in the analysis were based on the development of statewide travel needs and not on local/regional travel demand within any one region of the state.
- The concept of this project was based on previous studies carried out by TTI on the conventional intercity passenger rail system (Amtrak service of up to 79 mph and in some places up to 110 mph) in California, Pennsylvania, and other states throughout

the United States within existing rail rights of way. This does not preclude the consideration of higher speed rail systems to meet the travel demand identified in existing highway and rail corridors, but these systems would require new, fully grade-separated corridors to operate above 125 mph in almost all cases.

- Local and regional development of improved bus, light rail, and commuter rail systems would continue within the major urban areas of the state to allow for distribution of travelers from stations potentially served by the statewide transit system conceptualized in this project.

INTERCITY TRAVEL DEMAND BY CORRIDOR RANKING RESULTS

Figure 19 shows the result of the ranking of the 18 intercity travel corridors. As can be seen from the chart, two corridors—Dallas/Fort Worth to San Antonio and Dallas/Fort Worth to Houston—ranked highest in need for intercity passenger or express bus service according to the factors and equal weighting of each of those factors, as directed by the PMC.

The next two highest ranking corridors link west Texas and the Panhandle to the DFW area and would converge to the same corridor between Abilene and the DFW Metroplex. The next two link Houston to San Antonio and Houston to Austin. Most of the other interregional corridors ranked basically equally beyond those few corridors. This allows them to be weighed by transportation planners in future studies to determine in what order additional corridors might be added to any existing network. Figure 20 shows a graduated, graphical representation of corridor ranking based on this analysis.

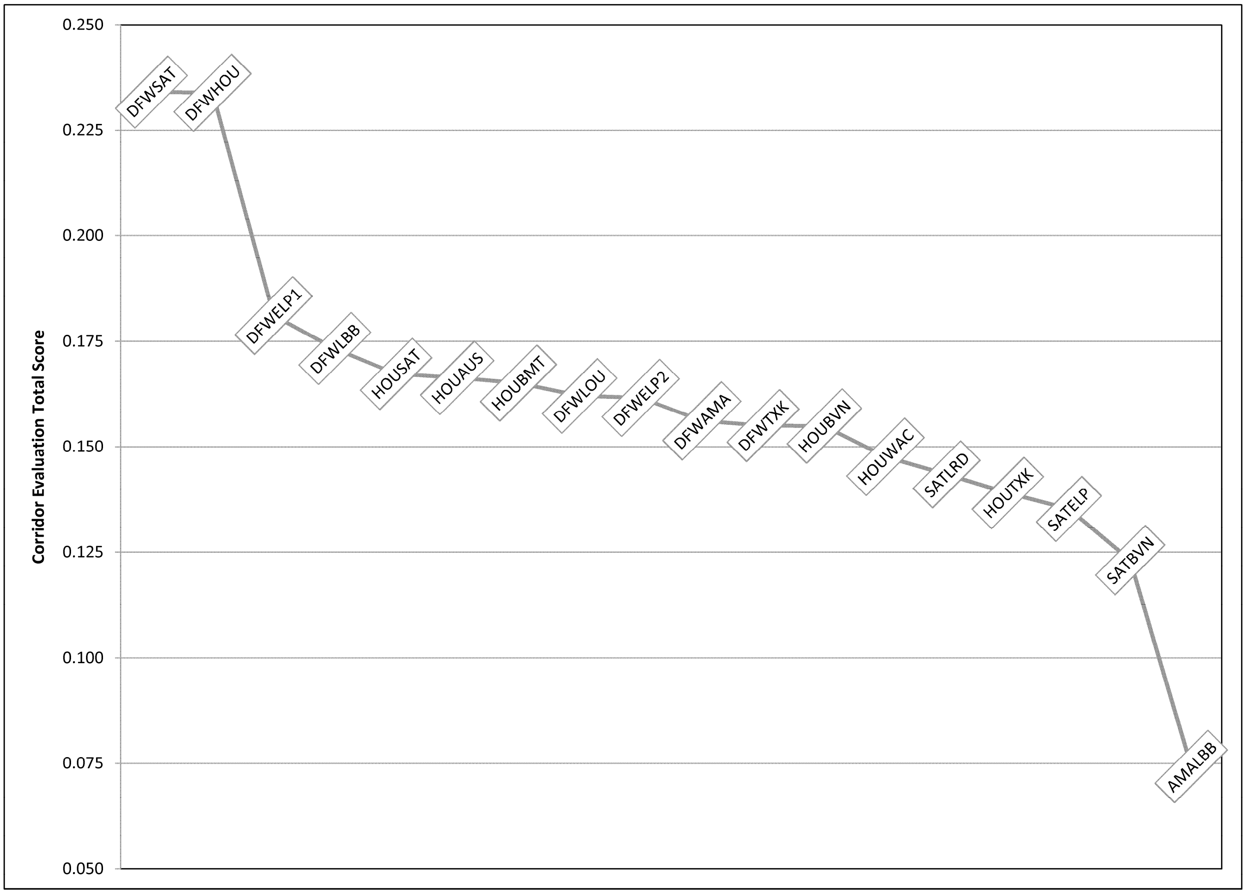


Figure 19. Corridor Ranking Chart with All Evaluation Factors Equally Weighted.

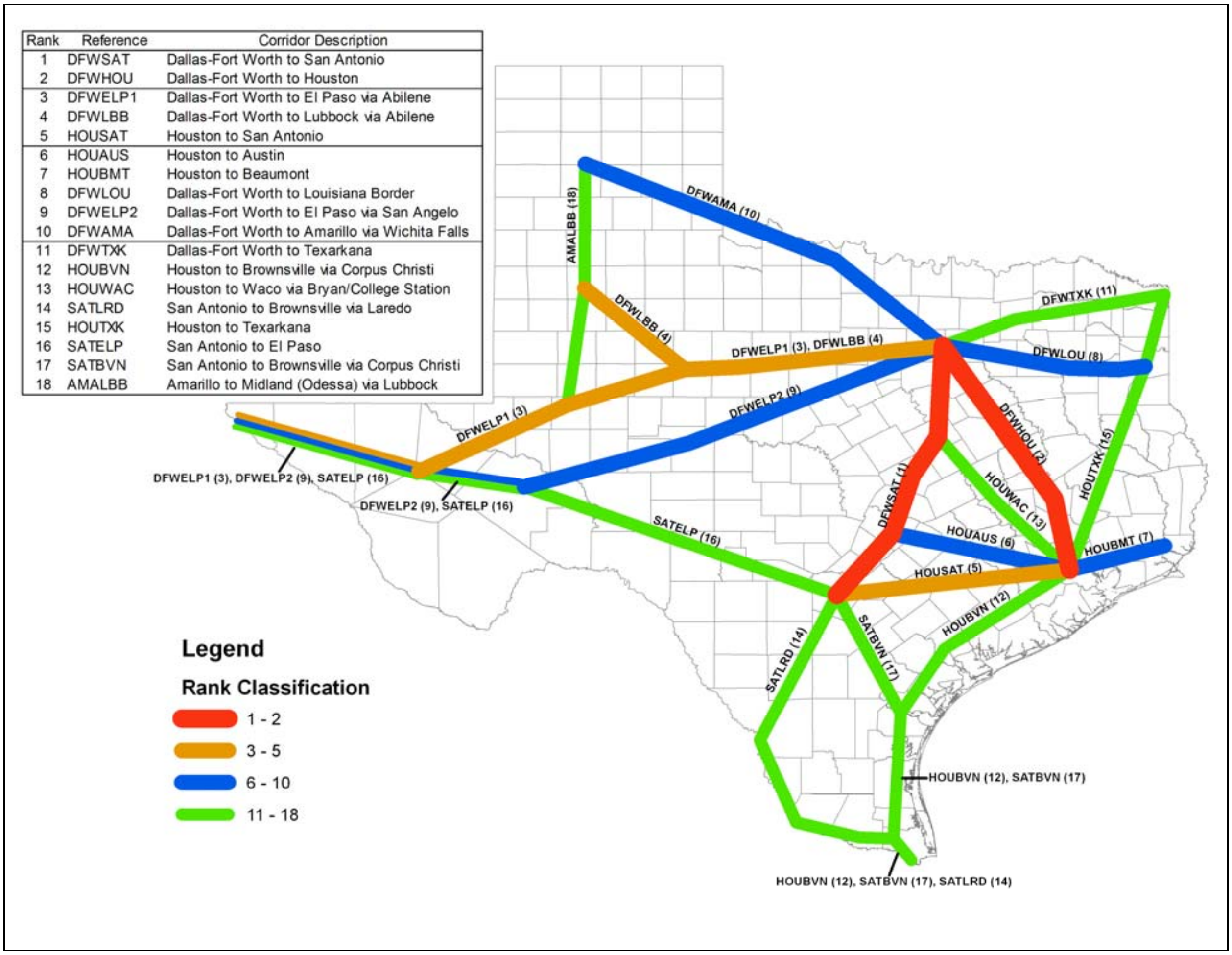


Figure 20. Graphical Representation of Grouped Corridor Rankings.

DISCUSSION OF CORRIDOR RANKING RESULTS

Initial analysis of these results indicates that an improved rail system connecting DFW with San Antonio and DFW with Houston are the priority corridors for TxDOT to consider in developing a statewide transit system. This result is consistent with previous intercity passenger rail studies within Texas, which identified these as the two major growth corridors. Questions still remain that must be answered through the state rail planning process: is it best to have rail service in an "inverted V" configuration (or the Greek letter lambda, "Λ")—directly linking the four major urban areas of the state via two lines from DFW as I-35 and I-45 do at present—or would a "T-shaped" configuration linking Houston to the DFW-San Antonio corridor somewhere between Austin and Waco serve an even larger constituency by bringing the Bryan/College Station urban area into the proposed alignment? Another alternative configuration would be to build Houston to Austin or Houston to San Antonio routes as well as the "inverted V" to create a "triangle-shaped" service that more directly serves the state's four largest urban areas. The answer to which of these is more effective would largely be a tradeoff between the higher ridership generated by improved direct service and the cost to construct the additional infrastructure mileage that such a system would require.

Differences of opinion have also been expressed among public and private sector leaders as to where the connection to Houston should be along the I-35 corridor, should a T-shaped system be selected. While many in San Antonio and on the southern end of the corridor would like to see the connection point to Houston in a two-corridor system be no farther north than the Austin area, the results of this study, thus far, indicate that a more northern connection point connecting Dallas/Fort Worth and Houston in Waco or Hillsboro would more fully address the two highest ranked corridor intercity demand routes and better serve the growing DFW and Houston populations. Further study and public input through the update process for the Texas Rail System Plan is needed to determine the most efficient connection point between the two corridors for a T-shaped system, should that configuration be chosen.

The addition of an improved intercity bus service from El Paso to DFW is also indicated from the research results, until ridership grows to the point that rail service along all or some of the route could be supported. For example, rail service from DFW to Abilene could potentially be added with feeder express bus services to and from Abilene to El Paso, San Angelo, Lubbock, and Amarillo in order to better serve the needs of West Texas. Because of the length of the corridor, it is more difficult (and costly) for rail or bus to compete for most intercity trips at that distance.

Phasing options for implementing the service also exist and should be based upon the segments of this conceptual intercity system that might be economically feasible to undertake first as starter segments. For example, the completion of the Austin-San Antonio commuter rail service planned by the Lone Star Commuter Rail District might suggest building the segments north of Austin as part of a statewide transit system prior to implementing service on the statewide system between those two cities. Likewise, if the efforts of the East Texas Corridor Council and the North Central Texas Council of Governments are successful in developing an intercity rail link in East Texas, the statewide system could instead focus on connections between the major urban areas, leaving regional rail systems to connect internal destinations. Alternatively, the same East Texas corridor to Louisiana and the one from Houston to Beaumont might be determined to be more vital since they can potentially connect the statewide system to improved interstate rail corridors being planned in the southeastern United States and/or other regions.

CHAPTER 6: CORRIDOR IMPLEMENTATION

ESTIMATING CORRIDOR COSTS

Determining unit cost estimates for various aspects of system development proved to be one of the most difficult parts of the project. As identified in past TTI reports on intercity passenger rail for TxDOT, costs for both the initial capital investment and on-going operations vary widely due to many factors. The following sections discuss several cost aspects to be considered in implementing rail or express bus transit in the study corridors and regarding interconnection with existing and planned transit systems.

Since this project is largely a scoping study for identification of potential intercity rail corridors, with express bus serving others, the most relevant, recent rule-of-thumb cost estimates for capital expenditures come from the 2007 report developed by the Passenger Rail Working Group as input to the National Surface Transportation Policy and Revenue Commission entitled, "*Vision for the Future, U.S. Passenger Rail in 2050*." Table 30 shows the PRWG figures for capital cost estimates.

Table 30. Capital Cost Estimates for Implementation of Various Types of Intercity Passenger Rail Service.

Passenger rail level of service characteristics	
Level of service	**Average cost per mile (millions)**
Long distance	$2
Low (shared right-of-way, speed up to 79 mph)	$4
Medium (separate track/shared right-of-way,[54] speed 79-110 mph)	$7
High (dedicated right-of-way, speed > 110 mph)	$35

Source: Passenger Rail Working Group (PRWG), *Vision for the Future*, 2007.

On-going costs of operations and maintenance cannot be determined without knowing which type of service and transit vehicle technologies (and from that derived costs for staffing, maintenance, etc.) would be selected for each corridor. Based upon the capital cost figures given by the PRWG report, the research team developed the gross estimates in Table 31 as an attempt to give some method of comparison on the capital costs to develop each corridor or corridor segment. As stated above, these costs do not include operational costs, nor does the research team claim their accuracy for any given corridor. Costs of real estate for new rights of way, while accounted for to some degree in the higher PRWG cost estimates, will vary widely, especially in the largest urban areas. While PRWG reports $35 million per mile for high speed rail lines (>110 mph) in new rights of way, this is the low end of the estimate for certain types of high speed rail which can raise costs to $100 million per mile in some cases. This estimated cost seems relatively accurate as light rail transit can cost $25–30 million per mile in urban applications today. The estimates in Table 31 are not meant to be authoritive, as they are based only upon rule-of-thumb estimates in the PRWG report. The cost estimates shown here are only meant to give planners an idea of the magnitude of investment required for differing desired intercity rail speeds.

Table 31. Gross Cost Estimates for Full Corridor Intercity Rail Implementation Based on PRWG Reported Unit Costs.

Corridor Reference Number	Name	Distance (mi)	Est. Cost for Long Distance (M$)	Est. Cost for up to 79 mph (M$)	Est. Cost for 79-110 mph (M$)	Est. Cost for > 110 mph (M$)
1	AMALBB	245	490	980	1715	8575
2	DFWELP1	621	1242	2484	4347	21735
3	DFWAMA	362	724	1448	2534	12670
4	DFWHOU	252	504	1008 1764	8820	
5	DFWLBB	331	662	1324	2317	11585
6	DFWLOU	183	366	732	1281	6405
7	DFWSAT	267	534	1068 1869	9345	
8	DFWSATb	294	*	* * *		
9	DFWELP2	648	1296	2592	4536	22680
10	DFWTXK	190	380	760	1330	6650
11	HOUAUS	163	326	652	1141	5705
12	HOUBMT	87	174 348		609	3045
13	HOUBVN	364	728	1456	2548	12740
14	HOUSAT	199	398	796	1393	6965
15	HOUTXK	307	614	1228	2149	10745
16	HOUWAC	184	368 736		1288	6440
17	SATBVN	280	560	1120 1960	9800	
18	SATELP	636	1272	2544	4452	22260
19	SATLRD	349	698	1396	2443	12215

* Eliminated from Analysis

DEVELOPMENT COSTS FOR PASSENGER RAIL, EXPRESS BUS, AND BUS RAPID TRANSIT

The costs of intercity or regional passenger transit systems vary widely, even when comparing costs of their various components. The following are just some of the many variables that influence the ultimate cost of a passenger transit project:

- Project type and scope
- Site conditions
- Existing infrastructure
- Operational factors
- Right-of-way costs
- Regional cost differences for materials and labor
- Vehicle types/costs (*5*)

Many of these variables apply to bus transit services as well as to passenger rail, particularly express or rapid bus services that use dedicated lanes or busways. The project and component costs shown in this section are from transit plans, studies, and completed or in-progress projects which were reviewed by the research team members. The costs and the types of projects are by no means comprehensive; they are intended simply to provide some examples and rough cost ranges.

Passenger Rail Projects and Infrastructure

The passenger rail project costs shown in this section are mostly from commuter rail projects that utilize conventional railroad tracks. Table 32 shows example total costs of recently developed or proposed passenger rail projects. Tables 33 through 35 show example break-out costs for some of the major components of passenger rail projects – right-of-way (ROW) acquisition, track and signal improvements, and construction of new track and associated infrastructure. Costs associated with stations, multi-modal terminals, and vehicles are summarized later in this chapter. Other project costs described in some of the selected passenger rail projects included the following:

- Construction of maintenance facilities
- Provisions for connecting transit service from rail stations (sometimes included in station costs)

- Contingency and project development costs
- Dispatch and communication costs (sometimes included in signal improvement costs)

Table 32. Sample Development Costs for Recent Passenger/Commuter Rail Projects.

Project	Type and Description	Total Cost (Year) (millions)	Cost per Mile (millions)
Rail Runner Express Commuter Rail Phase 1 (Belen to Bernalillo) (*6*)	Passenger rail on 54 miles of existing track	$135 (2004-2005)	$2.5
Rail Runner Express Commuter Rail Phase 2 (Bernalillo to Santa Fe) (*6*)	Passenger rail on mix of existing and new track (alignment TBD, ~ 47 miles by highway)	$254.8 allocated (2004-2005)	$5.4
Austin-San Antonio Commuter Rail (*7*)	112 miles on existing track, 15 stations.	$613 (2006)	$5.5
Trinity Railway Express (TRE) Phase II (Dallas-Fort Worth) (*8*)	25 miles (mostly existing track; 1.5 miles of new track on new alignment in downtown Fort Worth); 5 stations	$160.6 (1999)	$6.4
Central Florida Commuter Rail (*9*)	Commuter rail on 61miles of existing freight rail tracks, 16 stations with enhanced bus connections, 11 park-and-ride lots, 2 intermodal centers.	$473.5 (2005)	$7.8
Northstar Commuter Rail final phase, Minneapolis-Big Lake, MN (*10*)	40 miles (using existing railroad tracks); 5 stations; top speed 79 mph	$317.4 (2007)	$7.9 (including stations)
Greenbush Commuter Rail (segment of MBTA, Boston) (*11*)	18 miles, including 1.5 miles of shared freight track, 26 grade crossings, 16 bridges, shallow cut trench, tunnel, 7 stations	$512 (2007)	$28.4

Right-of-way (ROW) acquisition is sometimes included as part of the total cost of improvements to existing rail infrastructure or new rail construction. Table 33 lists ROW costs that have been broken out in some project budgets.

Table 33. Example Costs for Right-of-Way Acquisition

Project	Type and Description	Total Cost (Year) (millions)	Cost per Mile (millions)
Rail Runner Express Commuter Rail Phase 1 (Belen to Bernalillo) (6)	Purchase of track and ROW from BNSF	$50 (2004-2005)	$0.9
Rail Runner Express Commuter Rail Phase 2 (Bernalillo to Santa Fe) (6)	ROW only (track must be built/improved)	$2.8 (2004-2005)	$0.06
Austin-San Antonio Commuter Rail (7)	ROW acquisition (at passenger stations and maintenance facility only)	$6.0 (2004)	n/a
Central Florida Commuter Rail (*12*)	ROW acquisition, 61 miles	$30.6 (2005)	$0.5

When existing freight rail track will be used for passenger rail services, improvements to the track and signals must often be made in order to expand the track's carrying capacity and improve travel speeds. Table 34 lists some example costs for track and signal improvements that have been made or proposed for passenger rail services on existing rail infrastructure.

Table 34. Example Costs for Track & Signal Improvements

Project	Type and Description	Total Cost (Year) (millions)	Cost per Mile (millions)
Nebraska Transit Corridors Study (5)	Addition of centralized traffic control signaling to sections of rail lines (totaling 2.4 miles)	$0.24 (2004)	$0.1
Rail Runner Express Commuter Rail Phase 1 (Belen to Bernalillo) (6)	Track and signal improvements (existing freight track, 54 miles)	$10 (2004-2005)	$0.2
Proposed Amtrak service (60 mph) between Quad Cities and Chicago (*13*)	Track and signal improvements to 88.5 miles of freight track for proposed Amtrak passenger rail service at 60 mph maximum speed	$78.4 (2008)	$0.9
Proposed Amtrak service (79 mph) between Quad Cities and Chicago (13)	Track and signal improvements to 88.5 miles of freight track for proposed Amtrak passenger rail service at 79 mph maximum speed	$93.8 (2008)	$1.1
California Intercity Rail Capital Program (2004) (5)	Realignment of four tracks, additional switches and signals, new platform and pedestrian facilities at station	$2.2 (2004)	n/a
Washington State DOT – Amtrak Cascades track improvements (5)	Upgrades to three crossovers to allow 60 mph crossovers and faster running times.	$11.65 (2004)	$3.875-3.9 per crossover
Amtrak Northeast Corridor, Virginia (5)	Crossover improvements in Stafford County	$5.5 (2004)	n/a
Harris County Freight Rail Grade Crossing Study (5)	8 grade separations (5 overpasses, 3 underpasses) to improve rail trip times	$184.6 (2004)	Per crossing: $8.9 (low) $57.7 (high)
Amtrak Northeast Corridor, Virginia (5)	Improvements to interlocking where two sets of tracks join in Alexandria; decreased train delays by 47%	$14.4 (2004)	n/a

Some of the projects in Table 35 involve adding new track alongside or connecting existing rail infrastructure, while others involve constructing rail infrastructure for an entirely new rail line.

Table 35. Example Costs for Track/Guideway Construction

Project	Type and Description	Total Cost (Year) (millions)	Cost per Mile (millions)
Austin-San Antonio Commuter Rail (7)	Guideway and track construction	$97 for initial service $222 for full service (both 2004)	$0.87 (initial) $1.98 (full)
Amtrak Northeast Corridor, Virginia (5)	Construction of third track, 7.6 miles, into Fairfax County, VA	$11.5	$1 .5
California Intercity Rail Capital Program (2004) (5)	Construction of new track between existing railyard and new station (2900 feet)	$1.4 (2004)	$2.55
Amtrak Northeast Corridor, Virginia (5)	Construction of third track (1.0 mile)	$3.9	$3.9
Amtrak Northeast Corridor, Virginia (5)	Construction of third track (unspecified length; near L'Enfant Plaza)	$4.9 (2004)	n/a
Mid-Atlantic Rail Operations Study (5)	Construction of double track; 8 projects in New Jersey and Pennsylvania; track lengths from 1.0 to 25 miles	$2.6 (low) $61.8 (high) (2004)	$1.59 (low) $3.75 (high)
Rail Runner Express Commuter Rail Phase 2 (Bernalillo to Santa Fe) (6)	Track/signal construction/ improvements (~ 47 miles, part existing track, part new track)	$188.1 (2004-2005)	$4.0
California Intercity Rail Capital Program (2004) (5)	Construction of track and signal enhancements for 9 different segments totaling 63.5 miles	$187.9 (2004)	$1.8 (low) $5.9 (high)
Central Florida Commuter Rail (9)	Construction (includes 16 stations)	$409.8 (2005)	$6.72 (combined: track and stations)
Mid-Atlantic Rail Operations Study (5)	Construction of double track in Maryland; 6.6 miles	$124.5 (2004)	$18.8
Mid-Atlantic Rail Operations Study (5)	Construction of elevated double track segment (0.5 mile)	$20.0 (2004)	$40.0
U.S. 90A Corridor Rail Feasibility Study (5)	Construction of a single track ballasted bridge.	n/a	$6 8.6
U.S. 90A Corridor Rail Feasibility Study (5)	Construction of a double track ballasted bridge	n/a	$9 5.0

Express Bus, Enhanced Bus, and BRT Projects and Infrastructure

Express bus service, in its broadest definition, is bus service with a limited number of stops that is intended to provide faster travel times than more traditional bus service would. In a regional bus system, express bus service might serve only one stop/station per county or city. In longer corridors (such as this study's Dallas-to-El Paso corridor), an "express" intercity bus might stop, at maximum, in only one or two cities between the two end points in order to minimize the travel time between these two metropolitan areas. Per-passenger operating costs are likely to be higher for express bus service than for more traditional service (whether local or intercity), for the simple reason that fewer stops often means fewer boardings and therefore fewer fares collected.

Bus rapid transit (BRT) is a concept more closely associated with urban transportation than with long-distance travel. However, some of BRT's strategies for expediting bus travel times through dense urban traffic, such as exclusive busways/bus ramps and traffic signal priority, could be applied to intercity bus service to reduce its travel times through urban areas.

"Enhanced bus" service generally refers to upgrades such as bus stop improvements, expedited travel via signal priority or other BRT-type technologies, real-time information for passengers, and other amenities. Enhanced bus, express bus, and BRT can be overlapping terms and categories. All of these services, regardless of the terminology and the details of operation, tend to be marketed to commuters and "choice" riders, and as such often utilize upscale buses with more passenger amenities. Many of these buses have low floors and are designed to look like light-rail or passenger rail cars, which transit riders tend to view as more appealing than traditional bus transit.

Costs for these bus services may include infrastructure or technologies that help to reduce travel times in congested traffic areas, specialized vehicles, and passenger amenities at transit stops and/or onboard vehicles to attract choice riders. Several of these cost categories could be applied to express intercity bus transportation, particularly when it travels through urban areas. Table 36 lists some example costs for express bus, enhanced bus, and BRT services.

Table 36. Sample Development Costs for Express Bus, Enhanced Bus, and BRT Services.

Project	Type and Description	Total Cost (Year) (millions)	Cost per Mile (millions)
Rapid 522 Service, Santa Clara County (*14*)	Express bus, precursor to BRT service; 26 miles, transit signal priority, queue jump lanes, low floor buses	$3.5 (2005)	$0.13 total
Kansas City Metcalf/ Shawnee Mission Pkwy (*15*)	Express bus on Metcalf Avenue in Kansas City, 15 route miles, mixed traffic operation with signal priority	$21 to build $2/year to operate	$1.4
GRTA Regional Transit Action Plan, Regional Express Bus (*16*)	Regional express bus expansion for 13 counties (37 routes) by 2010 in Atlanta area. Buses operate on existing HOV lanes. Total daily revenue miles for all routes: 24,000	$325 (2003) (estimated development costs)	n/a
GRTA Regional Transit Action Plan BRT system (16)	BRT: 139 route miles of high-speed busways, 261 miles of arterial bus priority projects, unspecified number of stations/stops	$5000 (2003)	$12.5
East Bay BRT, San Francisco (*17*)	BRT: 17 miles, 85% on dedicated bus lanes; signal priority; 49 stations – total cost estimates as of Sept. 2008; breakout below	$199 (2008) $234.6 (YOE; 2009-2015)	$11.7 (2008) $13.8 (YOE)

Transit signal priority (TSP) can be accomplished with different types of technology (e.g., optical emitters, transmitted radio frequencies, amplifiers attached to loop detectors), each with associated per-intersection and per-bus costs. TSP systems that are integrated into a centralized control system, such as a traffic management center, tend to be more expensive than systems that operate independently or along a single corridor due to added communication costs. Table 37 provides some typical costs associated with different TSP technologies.

Table 37. Costs of TSP System Technologies (*18*)

System	Cost per Intersection	Cost per Bus
Optical $15,000		$2000
Wayside reader (radio based)	$20,000 $250	
Loop detector amplifiers	$2500 with existing detector	$500

Costs of queue jump or bus bypass lanes depend partly on existing infrastructure; i.e., the cost of repurposing an existing lane versus widening a road to add a lane at the intersection. Bus detection via loop detectors or video detection is another cost factor. Some typical costs associated with queue jump lanes:

- Re-signing and re-striping of existing lane: $500 to $2500
- Queue jump signal: $5000 to $15,000 (*18*)

Table 38 provides example costs for TSP and queue jump systems used in BRT services.

Table 38. Example Costs for TSP and Queue Jump Lanes.

Project	Type and Description	Total Cost (Year) (millions)	Cost per Mile (unless otherwise stated) (millions)
Rapid 522 Service, Santa Clara County (*14*)	TSP and queue jump lanes for express bus, 26 miles	$1.6 (2005)	$0.06
Express Bus Capital Costs (estimated), Contra Costa County (*19*)	Arterial rapid bus corridor improvements (queue jump lanes, signal prioritization) for 49 miles	$24.5-$34.3 (2002)	$0.5-$0.7
Central and Southern Marin Transit Study (Marin County, CA) (*20*)	Ramp transit signal priority (6 locations)	$.84	$.14 per location
Central and Southern Marin Transit Study (Marin County, CA) (*16*)	Arterial transit signal priority (13 locations)	$5.46	$.42 per location

Exclusive bus lanes or separate, dedicated busways allow express or BRT transit vehicles to bypass traffic completely on freeways or arterials. In some urban areas, HOV lanes could be a complete or partial substitute for an exclusive busway. Table 39 lists costs associated with the development and construction of exclusive bus lanes and busways from planned or implemented BRT systems.

Table 39. Example Costs for Bus Lanes and Busways

Project	Type and Description	Total Cost (Year) (millions)	Cost per Mile (unless otherwise stated) (millions)
East Bay BRT, San Francisco Bay Area (13)	Approx. 14.5 miles of dedicated bus lanes (out of 17-mile total route)	$19.6 (2008)	$1.4
South Miami Dade busway (14)	Off-street, busway, at grade, 8.2 miles	$59.0 (1996)	$7.2
Hartford: New Britain (proposed BRT project) (14)	Off-street busway, at grade, 9.6 miles	$145.0 (2007)	$15.1
Cleveland: Euclid Avenue Bus Lane (14)	On-street exclusive busway, at grade, 10.7 miles	$168.4 (2008)	$15.7
Express Bus Capital Costs (estimated), Contra Costa County (15)	20 bus-only or HOV ramps (single direction)	$84-$124 (2002)	$4.2-$6.2 per ramp
Pittsburgh East Busway Extension (14)	Elevated exclusive busway, 2.3 miles	$68.8 (2003)	$29.9
Pittsburgh West Busway (14)	Elevated exclusive busway, 5.0 miles	$249.9 (2000)	$50.0
Boston Silver Line (14)	Bus tunnel, 4.1 miles	$1350.0 (2005)	$329.3
Seattle BRT (14)	Bus tunnel, 2.1 miles	$450.0 (1989)	$214.3

Transit Centers and Vehicles

Table 40 lists some sample costs for construction of new rail and bus transit centers and improvements to existing transit centers, park and ride facilities, and bus stops. Table 41 shows some typical costs for vehicles for rail and bus transit services.

Table 40. Example Costs for Stations, Terminals, Park-and-Rides, and Bus Stops.

Project	Type and Description	Total Cost (Year) (millions)	Cost per Stop/Station, unless otherwise noted (millions)
Parking Facilities			
U.S. 90A Corridor Rail Feasibility Study (1)	Estimated cost for park-and-ride spaces (surface lot)	n/a	$0.004/space
U.S. 90A Corridor Rail Feasibility Study (1)	Estimated cost for park-and-ride spaces (parking structure)	n/a	$0.01/space
Express Bus Capital Costs (estimated), Contra Costa County (15)	Estimated cost for addition of 3000 park-and-ride spaces over four corridors (surface or garage TBD)	$63-123 (2002)	$0.021 -$0.041/space
California Intercity Rail Capital Program (2004) (1)	Construction of three parking structures along rail line; total of 1587 spaces.	$30.7 (2004)	$8.8-11.5 per structure ~$0.02/space
Station/Stop Improvements			
Express Bus Capital Costs (estimated), Contra Costa County (15)	Improvements to 16 bus stops	$0.32-0.48	$0.02-$0.03
Central and Southern Marin Transit Study (Marin County, CA) (16)	Facilities for 16 express bus stops	$1.008	$0.045
California Intercity Rail Capital Program (2004) (1)	Construct access facilities for new station	$0.8 (2004)	$0.8
Amtrak Station Renovations (1)	Rehabilitate 3 historic stations in Kansas, New Mexico, Oklahoma	$3.54 (2004)	$1.18
Amtrak Station Renovations (1)	Rehabilitate historic station, ticket office, waiting room	$1.6 (2004)	$1.6
California Intercity Rail Capital Program (2004) (1)	Station improvement including 300-space parking structure, passenger shelters, benches, lighting	$4.4 (2004)	$4.4
California Intercity Rail Capital Program (2004) (1)	Track and platform improvements at existing station	$4.9 (2004)	$4.9

Table 40 (continued). Example Costs for Stations, Terminals, Park-and-Rides, and Bus Stops.

Project	Type and Description	Total Cost (Year) (millions)	Cost per Stop/Station, unless otherwise noted (millions)
Station/Terminal Construction			
East Bay BRT, San Francisco (13)	Construction of 49 BRT stations	$38.1 $45.3	$0.78-$0.92
U.S. 90A Corridor Rail Feasibility Study (1)	Estimated cost of new at-grade transit center	$0.9 (2004)	$0.9
Harris County Freight Rail Grade Crossing Study (1)	Construction of new station (estimate)	n/a	$1.1 (2004)
U.S. 90A Corridor Rail Feasibility Study (1)	Estimated cost of new at-grade transit center with pedestrian overpass	$1.9 (2004)	$1.9
Rail Runner Express Commuter Rail Phase 1 (Belen to Bernalillo) (2)	Construction of 7 stations	$18 (2004-2005)	$2.6
Rail Runner Express Commuter Rail Phase 2 (Bernalillo to Santa Fe) (2)	Construction of 3 new stations plus improvements to existing station (additional parking, pedestrian facility)	$16.5 (2004-2005)	n/a
North Carolina Railroad – Station in Kannapolis (1)	Construction of new station	$2.67 (2004)	$2.67
Austin-San Antonio Commuter Rail (3)	Construction of 14 stations	$42 (2004)	$3.0
U.S. 90A Corridor Rail Feasibility Study (1)	Estimated cost of new elevated transit center	$3.44 (2004)	$3.44
California Intercity Rail Capital Program (2004) (1)	Construction of new rail station (including parking)	$4.6 (2004)	$4.6
California Intercity Rail Capital Program (2004) (1)	Construction of new rail station, (including parking and realignment of existing track)	$6.0 (2004)	$6.0
North Carolina Railroad – Multimodal Terminal in Durham (1)	Construct multi-modal terminal (rail, intercity and local bus, taxi) in existing warehouse building along existing tracks	$10-12 (2004)	$10-12
North Carolina Railroad – Multimodal Terminal in Charlotte (1)	Acquire 27 acres, construct multi-modal terminal (conventional rail, high-speed rail, local and regional bus, bicycle/pedestrian traffic), realign existing tracks	$110-207 (2004)	$110-207

Table 41. Example Costs for Vehicles/Rolling Stock (Bus and Rail)

Project	Type and Description	Total Cost (Year) (millions)	Cost per Vehicle (millions)
No project named: summary information (14)	Typical prices for 40-45 foot conventional or stylized standard bus		$ 0.30-$0.40 (2005)
	Typical prices for 60 foot conventional or stylized articulated bus		$ 0.50-$0.95 (2005)
	Typical prices for 60-80 foot specialized BRT bus		$ 0.95-$1.6 (2005)
Express Bus Capital Costs (estimated), Contra Costa County (15)	Purchase of 103 buses	$36.7-$44.8 (2002)	$0.36-$0.43
California Intercity Rail Capital Program (2004) (1)	16 bi-level cars (5 coach-baggage cabs, 7 coaches, 3 coach-café, 1 custom-class car	$20.4 (2004)	$1.3
California Intercity Rail Capital Program (2004) (1)	6 locomotives	$12.1 (2004)	$2.0
Rail Runner Express Commuter Rail Phase 1 (Belen to Bernalillo) (2)	10 rail cars	$22 (+ $0.9 option for spare parts)	$2.2
	5 locomotives	$11.5 (+$0.6 option for spare parts)	$2.3
Rail Runner Express Commuter Rail Phase 2 (Bernalillo to Santa Fe) (2)	12 rail cars, 4 locomotives	$36.1	$2.3
Altamont Commuter Express (new vehicle purchase) (16)	4 bi-level trailer cars	$8.4 (2007)	$2.1
Austin-San Antonio Commuter Rail (3)	Initial service: 6 trains, each with (a) 2 coaches and 1 locomotive or (b) 2 bi-level self-powered vehicles (DMUs)	$102 (initial service) $122 (full service) (both 2004)	$10.2/train $3.4-$5.1/vehicle, depending on type selected
Harris County Freight Rail Grade Crossing Study (1)	Estimated cost of commuter passenger car	$2.0 (2004)	$2.0
U.S. 90A Corridor Rail Feasibility Study (1)	Estimated cost of cab car for commuter rail	$1.9 (2004)	$1.9
U.S. 90A Corridor Rail Feasibility Study (1)	Estimated cost of coach car for commuter rail	$1.5 (2004)	$1.5
U.S. 90A Corridor Rail Feasibility Study (1)	Estimated cost of DMU double-deck trailer with cab	$2.9 (2004)	$2.9

INTERCONNECTIONS WITH EXISTING TRANSIT SYSTEMS

Another major facet of the analysis performed by the research team was to examine the interconnections between proposed statewide transit system corridors and existing transit operations in both the urban and rural areas of the state. Identification of the existing transit operations (as described earlier in this report and in Appendix A) allows for better trip planning and use of the statewide system by using common facilities and stations when possible to make connections, transfers, and alternative transportation modes more readily available. Appendix G compiles a list of potential transit technologies with which the statewide transit system could potentially use or with which it could connect in other areas of the state. Appendix G also describes the features of transit systems that encourage high transit ridership as identified in a recent national study. Structuring local and regional transit connections to bring people to ride intercity transit is also an important feature of ensuring success of any statewide system. Without robust public transportation options to and from station locations, the ridership of such a potential system may never be realized. The following sections describe several other important features and considerations that must be taken into account once determining where intercity transit might best serve state needs.

STRATEGIES FOR PHASED IMPLEMENTATION OF PROPOSED SYSTEM

When originally conceived, one task of this project called for the research team to propose a plan for phased implementation of a intercity passenger transit system—suggesting which corridors might be initial starter segments for long-term development. Several factors have prevented that element of the proposed research from being completed. First and foremost, new state and federal rail planning legislation were passed during the course of the research project, requiring that TxDOT conduct and produce separate passenger rail plan with very specific requirements. Among these requirements are the more detailed investigation of engineering and environmental issues and more detailed ridership studies along with public input from open public meetings. Because this detailed planning effort is on-going at the time that this report is being published, it would not be appropriate for this report to suggest that its findings should supersede those determined through this traditional and more rigorous planning process.

In the discussion of intercity corridor rankings found in Chapter 5 of this report, several of the issues regarding configuration of a core statewide rail system and the potential for phasing certain segments of the corridors based upon development of other, new transit systems, both within the state and nationally, was addressed. For example, implementation of successful commuter rail service between Austin and San Antonio could allow an intercity system to focus on the portion of the DFW to San Antonio corridor north of Austin in its initial stages. Passage of the Federal Passenger Rail Improvement and Investment Act (PRIIA) in late 2008 could also impact phasing of any Texas intercity passenger system. An example would be that federal grant funding for a High Speed Rail (HSR) or higher speed rail (incremental) improvement in an adjacent state could drive different decisions to be made within Texas on priority corridors. By concentrating on its own internal intercity passenger travel needs as has been done in this research, however, TxDOT can more readily make decisions regarding which of those multi-state projects have the potential to benefit travel within Texas. Consideration of the multimodal, systemwide nature of such planning (i.e. impacts on airports, highways, rail, and transit systems) must also be a part of these decisions.

IDENTIFICATION AND DEFINITION OF ROLES AND RESPONSIBILITIES IN SYSTEM DEVELOPMENT

Clarifying the roles that various levels of government and local transit agencies could play in the development of a statewide rail and express bus systems is vital in determining how such a system might be funded and implemented. For example, capital funding for infrastructure may be largely a federal and state role while right-of-way acquisition in urbanized areas may be a local government role of the MPO that would be funded with TMMP funds. Defining such roles to enable implementation of the proposed transit system is vital in order for it to become a reality. Several recent TxDOT research projects have focused on aspects of determining the proper role for the state DOT in provision and/or development of transit within the state. The most recent of these was TxDOT 0-5652 “Transportation, Social and Economic Impacts of Light and Commuter Rail” which was published in September 2009.

TxDOT 0-5652 contained two sections pertinent to the role of the state DOT and local, regional transportation agencies in expansion of interconnected transit systems—Section 3 which described rail and the role of DOTs in relation to other transportation entities and Section 8 which described potential roles for TxDOT in rail development throughout the state based upon case studies of other states. TxDOT 0-5652 built upon previous research from TxDOT Report 0-4723-1, “Funding Strategies and Project Costs for State-Supported Intercity Passenger Rail: Selected Case Studies and Cost” and TxDOT Report 0-5322-1, “Rail Relocation Projects in the

U.S.: Case Studies and Lessons for Texas Rail Planning" which were published in June 2005 and March 2007, respectively, as well as other sources.

The PRIIA legislation also defines new roles for both the state and federal government in the development of an intercity passenger system. TxDOT's on-going state rail planning efforts will also add definition to how state and local/regional transportation entities relate to one another and the roles that each might take in implementing a statewide system. It is important to remember that the structure of any project and roles associated with implementation may vary from project to project based upon its scope, funding sources, and a variety of other factors. As a result, the defined partnership roles that are a result of the statewide rail planning process must be flexible enough to change as needed to further promising projects.

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APPENDIX A: EXISTING INTERCITY TRANSIT SERVICES IN TEXAS

This appendix describes the current intercity rail and bus transit services in the state and summarizes local transit services and intermodal facilities in each of Texas' 24 transit planning regions. The research team collected the information contained in this appendix primarily during in Tasks 1 and 3 of the research project in FY 2008 and early FY 2009. It reflects the services offered at that time.

INTERCITY PASSENGER RAIL SERVICE

Amtrak currently operates three routes through Texas—the Heartland Flyer, the Sunset Limited, and the Texas Eagle, as described in Table A-1 and shown graphically in Figure A-1. Amtrak also provides through ticketing and coordinated schedules for rail passengers to additional destinations via connecting bus service known as Thruway Motorcoach service, which is also described in Table A-1.

Table A-1. Current Amtrak Routes and Connecting Bus Service in Texas.

Route Name	Description
Heartland Flyer	Operates between Fort Worth and Oklahoma City, OK, once daily in each direction, southbound in the morning, returning northbound in the evening.
Sunset Limited	Operates three days per week in each direction between New Orleans, LA, and Los Angeles, CA. Westbound stops: Beaumont and Houston on Mon, Weds, Fri. San Antonio, Del Rio, Sanderson, Alpine, and El Paso on Tues, Thurs, and Sat. Eastbound stops: El Paso, Alpine, Sanderson, Del Rio, and San Antonio on Mon, Thurs, and Sat. Houston and Beaumont on Tues, Fri, and Sun. Thruway Motorcoach connections are provided to Galveston via Houston, Brownsville, and Laredo via San Antonio, and Albuquerque, NM, via El Paso.
Texas Eagle	Operates between Chicago, IL, and San Antonio daily and between Chicago and Los Angeles, CA, three days per week in conjunction with the Sunset Limited. Stations west of San Antonio are served on the same schedule as the Sunset Limited. Thruway Motorcoach connections are provided to Shreveport and Houston via Longview, Ft. Hood, and Killeen via Temple, Brownsville, and Laredo via San Antonio, and Albuquerque, NM, via El Paso.

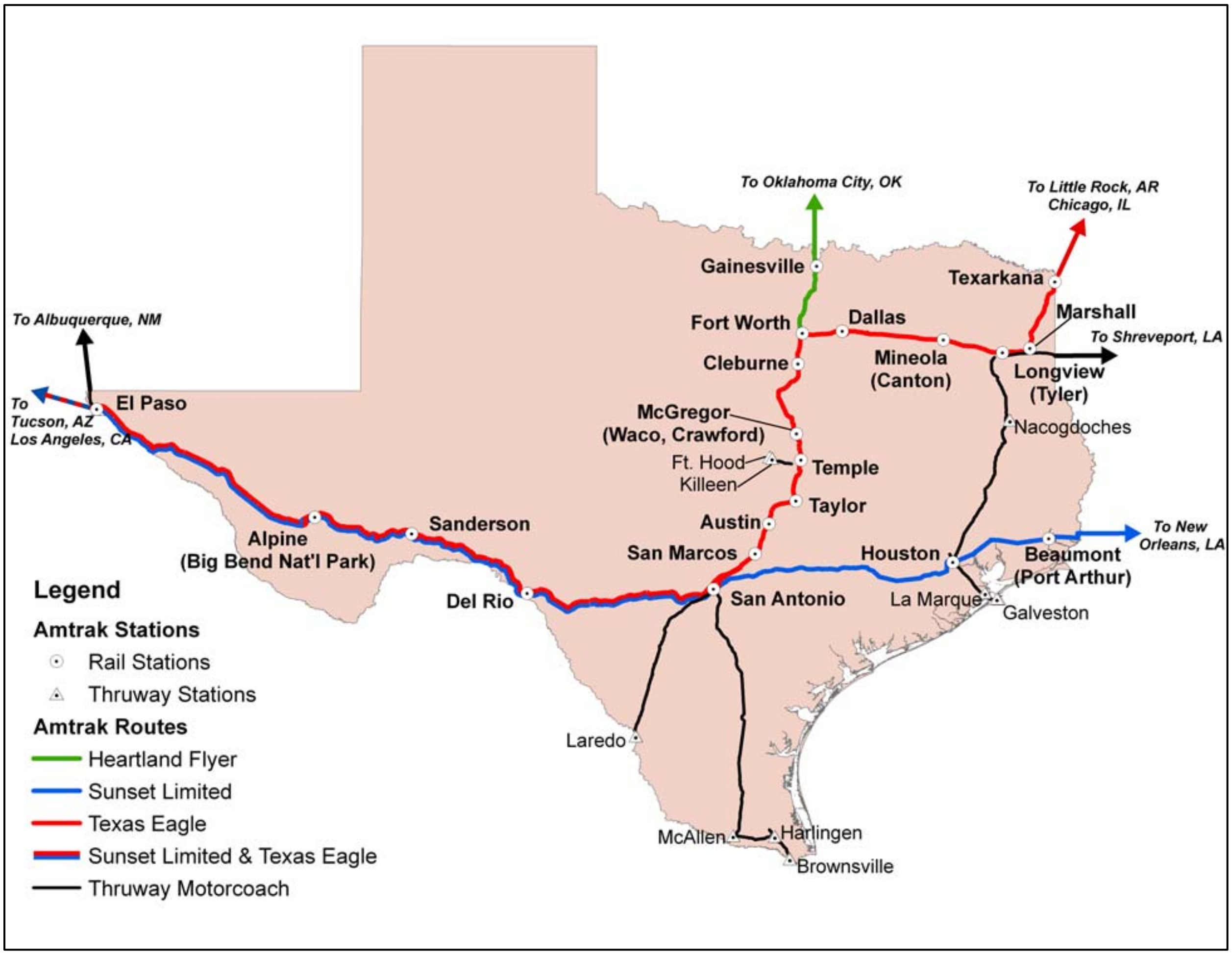


Figure A-1. Texas Amtrak Passenger Rail and Thruway Motorcoach Service.

Detailed Amtrak ridership data were provided to the research team by Amtrak in late 2007 regarding origin and destination pairs on the intercity passenger rail network in Texas for the period from September 2006 to August 2007. Analysis of these data shows the following facts. The total number of passengers with a destination in Texas during this period was 214,424. Of these trips only 49,341, or approximately 23 percent, originated and ended within the state. This indicates that the remaining 77 percent of trips that ended somewhere within the state of Texas originated outside of the state.

Part of this number can be accounted for easily by the success of the Heartland Flyer. The origin-destination pair of Fort Worth and Oklahoma City served by the Heartland Flyer had the highest ridership of any pair at 35,663 during this period. Other interstate trips also rank high in the most popular city pairs as shown in Table A-2. In fact, the first five city pairs with one endpoint in Texas originate or end at a location outside the state.

Table A-2. Most Popular (Ridership >3000) Amtrak Intercity Passenger City-Pairs with at Least One Endpoint in Texas for the Period Sept. 2006-Aug. 2007.

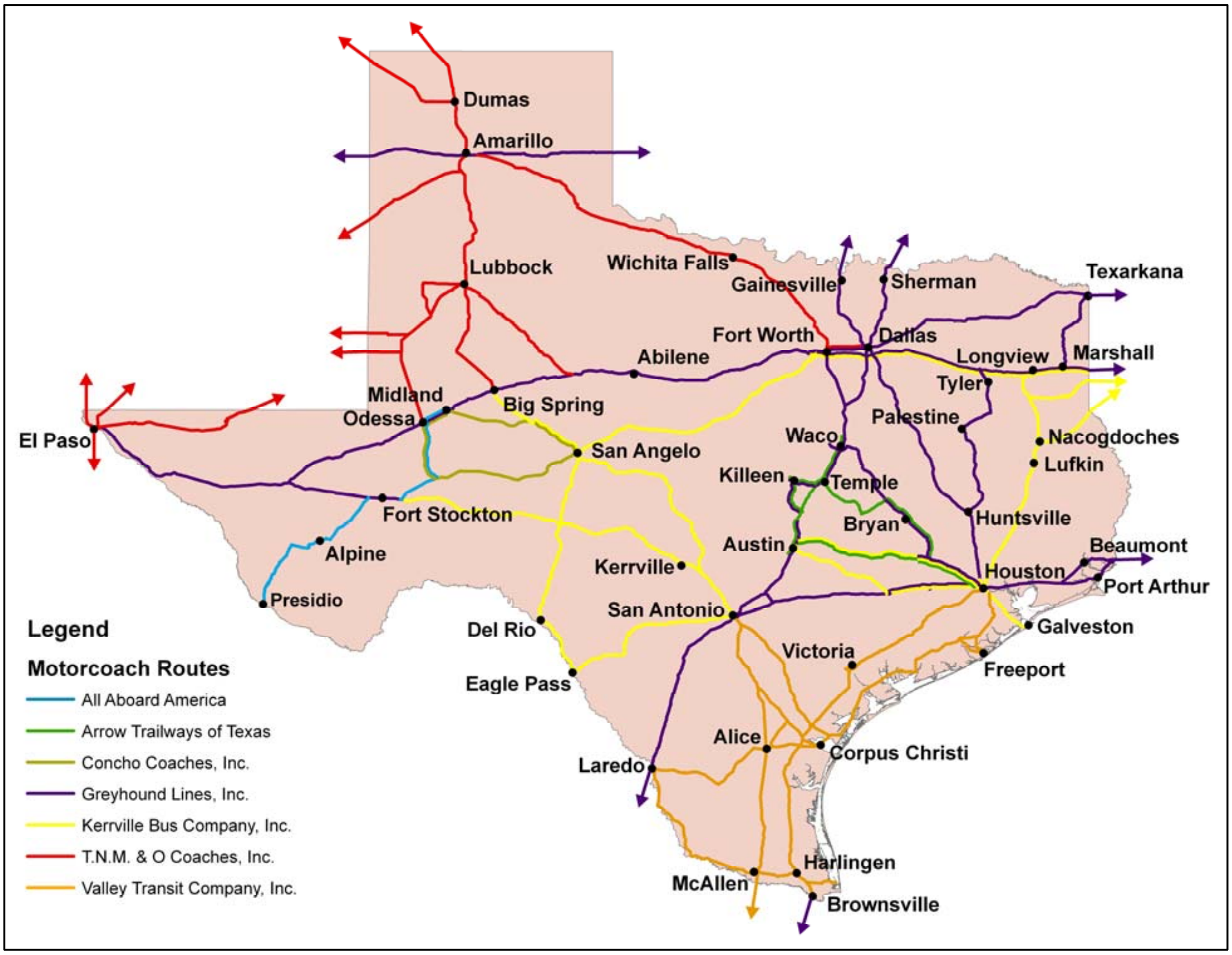
Train	Station Codes	Station Names	Ridership
Heartland Flyer	FTW-OKC	Fort Worth, TX - Oklahoma City, OK	35,663
Texas Eagle	CHI-LVW	Chicago, IL - Longview, TX	10,132
Texas Eagle	CHI-DAL	Chicago, IL - Dallas, TX	9,292
Texas Eagle	CHI-SAS	Chicago, IL - San Antonio, TX	8,144
Heartland Flyer	FTW-NOR	Fort Worth, TX - Norman, OK	7,924
Texas Eagle	FTW-SAS	Fort Worth, TX - San Antonio, TX	7,192
Sunset Ltd.	LAX-SAS	Los Angeles, CA - San Antonio, TX	6,391
Texas Eagle	AUS-FTW	Austin, TX - Fort Worth, TX	5,721
Texas Eagle	CHI-FTW	Chicago, IL - Fort Worth, TX	4,942
Sunset Ltd.	HOS-LAX	Houston, TX - Los Angeles, CA	4,869
Sunset Ltd.	HOS-NOL	Houston, TX - New Orleans, LA	3,934
Texas Eagle	AUS-CHI	Austin, TX - Chicago, IL	3,909
Heartland Flyer	GLE-OKC	Gainesville, TX - Oklahoma City, OK	3,675
Heartland Flyer	ADM-FTW	Ardmore, OK - Fort Worth, TX	3,282
Sunset Ltd.	ELP-LAX	El Paso, TX - Los Angeles, CA	3,120

INTERCITY BUS SERVICE

The bus service in Texas provides extensive coverage throughout the state. The map presented in Figure A-2 represents the existing intercity bus services provided in Texas, as indicated by the Texas Bus Association, Inc., an industry organization representing several major intercity bus service providers. The existing bus service travels over almost 8,000 miles of Texas roadways and services an estimated 190 stations.

Greyhound Lines, Inc. provides coordinated schedules and through ticketing services for passengers along routes served by the following companies:

- All Aboard America;
- Kerrville Bus Company, Inc.;
- Valley Transit Company, Inc.; and
- T.N.M. & O Coaches, Inc.



Source: TTI Map created in GIS based on information provided by Texas Bus Association, Inc.

Figure A-2. Intercity Scheduled Motorcoach Service Local Intercity Transit Services.

The remaining two lines shown in Figure A-2, Arrow Trailways of Texas and Concho Coaches, do not participate in this arrangement with Greyhound; therefore, passengers wishing to travel on these carriers must obtain schedules and purchase tickets from the individual bus company.

In addition to the U.S.-based intercity carriers listed for each region, several Mexican intercity bus companies provide service in the state, particularly along the Laredo-Dallas corridor. El Conejo, El Expreso, Tornado, Autobus Adame, and Americanos USA are a few of the carriers operating in Texas cities. Finding route and schedule information for these carriers is more difficult than for the larger U.S.-based carriers; they advertise primarily in Spanish-language newspapers and only some of them provide information on the Web. Table A-3 shows some of the Texas cities served by the Mexico-based carriers.

Table A-3. Mexican Bus Companies and Cities Served in Texas.

Bus Company	Cities Served
Tornado Bus Company	• Austin • Brownsville • Dallas • El Paso • Houston • Laredo • McAllen • San Antonio • Waco
El Conejo Bus Company	• Dallas • El Paso • Laredo
El Expreso Bus Company	• Brownsville • Houston • Laredo • McAllen • Nacogdoches • Texarkana
Autobuses Americanos	• Laredo • San Antonio • Austin • Dallas • Fort Worth • Houston • El Paso
Autobus Adame	• Brownsville • Hidalgo • Laredo • San Antonio • Houston

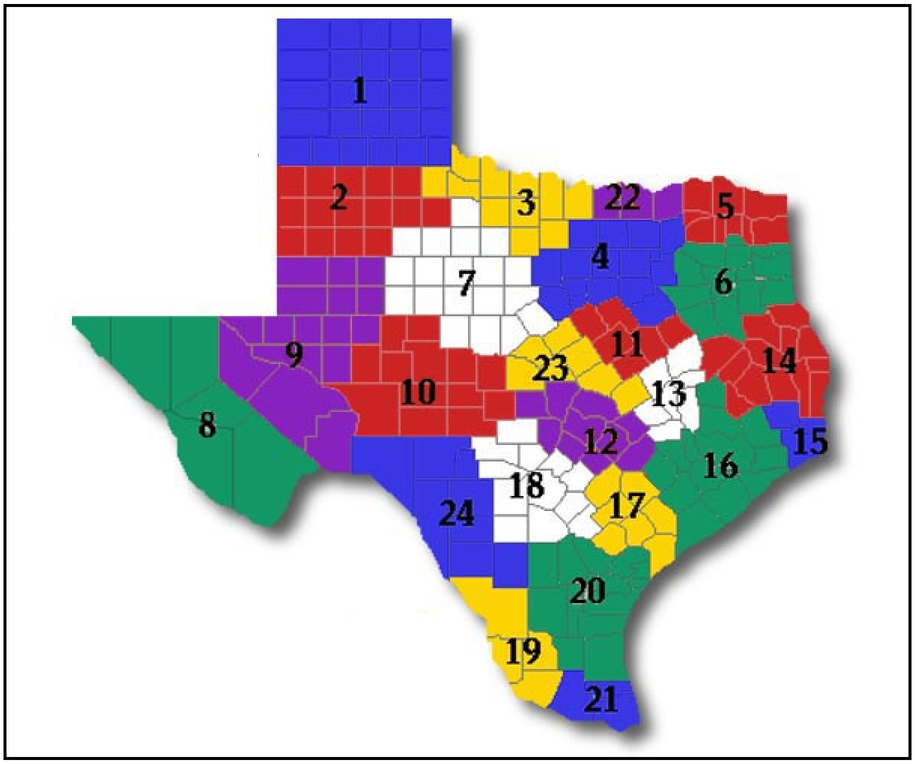
Most of the Mexico-based carriers continue intercity service farther north and east within the U.S. beyond Texas. El Expreso, for instance, has stops throughout the southeastern states and a route that travels north to Chicago, Illinois. Tornado also travels to Chicago, as well as to Waukeegan, Illinois; Milwaukee, Wisconsin; Nashville, Tennessee; Charlotte, North Carolina; Atlanta, Georgia; and Fort Myers, Florida. Autobuses Americanos U.S. destinations include El Paso to Phoenix and Los Angeles, Kansas City; El Paso to Denver via Albuquerque; Laredo to

Chicago via San Antonio, Dallas, and Kansas City; and Laredo to Houston via San Antonio. Another route connects El Paso to Dallas allowing travel from the western U.S. to Chicago. These U.S. routes connect to an extensive network within Mexico. Additional destinations in the southeastern U.S. such as Atlanta, the Carolinas, and Florida are served on a more infrequent basis or through partnerships with other bus companies.

PUBLIC PASSENGER TRANSIT SERVICES IN TEXAS

There are currently seven metropolitan transit systems, 29 urban transit systems, and 39 rural transit providers operating in Texas. In 2006, public transit accounted for 247 million trips statewide. Local transit plans, regional transit coordination plans, and metropolitan plans were examined for information about intercity transit availability, local and commuter transit services, and intermodal transit facilities.

Beginning in the fall of 2005, 24 planning regions in the state began development of regional transit coordination plans, with the intent of improving and expanding transit services to Texans. Several of these regional plans addressed intercity and other regional travel via coordination among not only local transit providers, but also between publicly funded local providers and private-sector intercity providers such as Greyhound and Amtrak. A map of the regions can be found in Figure A-3.



Source: http://txregionalcouncil.org/display.php?page=regions_map.php

Figure A-3. Texas Regional Council's Map of 24 Planning Regions in Texas.

Table A-4 summarizes the intercity and local transit services in each of these planning regions. Several regions in the state already actively support or pursue increased intercity transit options, providing connecting service to existing intercity providers such as Amtrak and Greyhound, and/or developing commuter rail, bus rapid transit, or other regional transit services. Some of these areas are described in more detail in the following sections. This appendix provides detailed information on intercity and local transit services in all 24 planning regions.

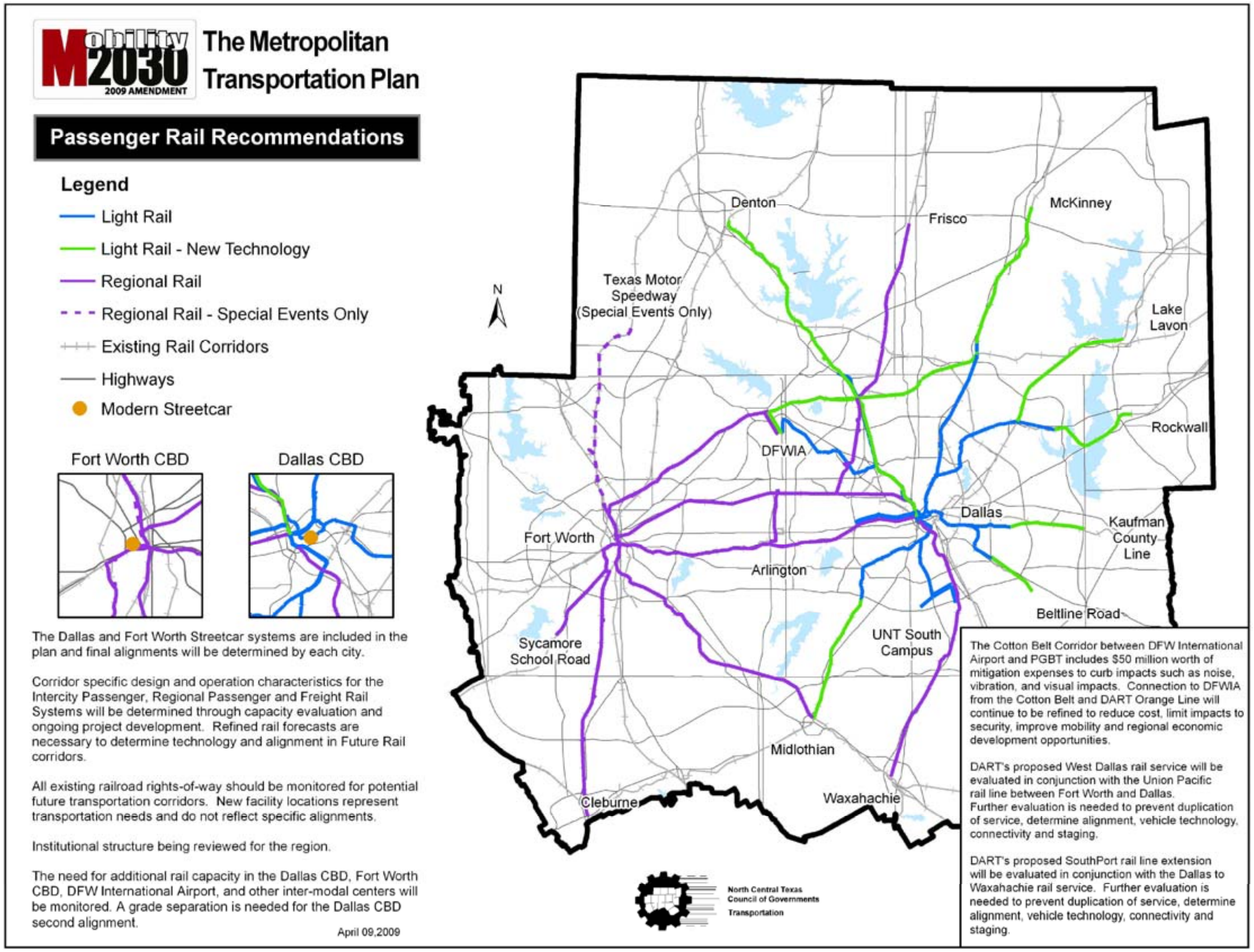
Table A-4. Transit Services in 24 Planning Regions in Texas.

Region Number	Major Urban Areas in Region	Intercity Service (* indicates proposed new intercity rail service)	Local Transit Service
1	Amarillo	Greyhound	Amarillo City Transit, Panhandle Transit
2	Lubbock, Plainview	Greyhound	Citibus, SPARTAN, CapTrans
3	Wichita Falls, Gainesville	Amtrak, Greyhound	Wichita Falls Transit, TAPS, Rolling Plains Management Rural Transit
4	Dallas, Fort Worth, Arlington, Cleburne, Corsicana, Denton	Amtrak, Greyhound, Kerrville Bus Company, Trinity Railway Express, City County Transportation Express Bus, Regional Rail Corridors*	DART, The T (Fort Worth), Denton County Transportation Authority, Cletran, Collin County Area Regional Transit
5	Texarkana	Greyhound	T-Line, Ark-Tex Rural Transit District
6	Tyler, Longview	Amtrak, Greyhound	Tyler Transit, Longview Transit, East Texas Rural Transit
7	Abilene, Sweetwater	Greyhound	Citylink, CARR, SPARTAN, Double Mountain Coach
8	El Paso	Amtrak, Greyhound, All Aboard American, Rail Runner extension*	Sun Metro
9	Midland, Odessa	Greyhound	EZ Rider, TRAX
10	San Angelo, Kerrville	Kerrville Bus Lines, Concho Coaches	Thunderbird Transit, San Angelo Street Railroad Company
11	Waco	Greyhound	Waco Transit, Waco Streak, HOTCOG Rural Transit
12	Austin, Bastrop, Round Rock, Georgetown, San Marcos	Amtrak, Greyhound, Arrow Trailways, Kerrville Bus Company, Austin-San Antonio Commuter Rail*	Capital Metro, CARTS
13	Bryan, College Station, Navasota, Brenham	Greyhound	Brazos Transit
14	Crockett, Lufkin, Nacogdoches	Amtrak (bus service), Greyhound, Kerrville Bus Company	Brazos Transit
15	Beaumont, Port Arthur	Amtrak, Greyhound	Beaumont Municipal Transit, Port Arthur Transit, SETT Rural Transit
16	Houston, Galveston, Conroe, Katy	Amtrak, Greyhound/Valley Transit, Kerrville Bus Company, Galveston-Houston Commuter Rail*	METRO, METRORail, Connect Transportation, Island Transit, Fort Bend County Transit, Brazos Transit
17	Victoria	Valley Transit/Greyhound	Victoria Transit, RTransit
18	San Antonio, Kerrville	Amtrak, Greyhound, Austin-San Antonio Commuter Rail*	VIA Transit, CARTS, Alamo Area Regional Transit
19	Laredo	Amtrak (bus), Greyhound	El Metro, El Aguila, Rainbow Lines
20	Corpus Christi, Kingsville	Greyhound	The B (Corpus Christi), rural transit services in surrounding counties
21	Brownsville, Harlingen, McAllen	Valley Transit/Greyhound, Valley Commuter Rail District*	Harlingen Express, Brownsville Urban Transit, McAllen Express
22	Sherman, Denison	Greyhound	TAPS
23	Killeen, Temple, Fort Hood	Amtrak, Arrow Trailways	Hill Country Transit
24	Del Rio, Eagle Pass, Uvalde	Kerrville Bus Company, Greyhound	Southwest Transit, Del Rio Transit

Region 4: North Central Texas (Dallas/Fort Worth and Vicinity)

The North Central Texas region covers 16 counties and includes the cities of Dallas, Fort Worth, and Arlington, among many others. Extensive intercity and local transit options are available, particularly across the Dallas/Fort Worth metroplex. Services include:

- Amtrak's Heartland Flyer and Texas Eagle routes both stop in Fort Worth; the Texas Eagle also stops at Union Station in Dallas and in Cleburne and the Heartland Flyer stops in Gainesville.
- Greyhound makes several stops in the area, including Union Station and three additional stops in Dallas and two stops in Fort Worth. Additional Greyhound stations are located in Arlington, Corsicana, Denton, Dublin, Garland, Lewisville, Richardson, Stephenville, Terrell, Waxahachie, and Weatherford.
- The Kerrville Bus Company also provides intercity service out of Dallas and Fort Worth. Additional intercity/regional bus service is provided by the privately owned City County Transportation Express Bus route, connecting the cities of Cleburne, Joshua, Burleson, and Fort Worth.
- The Trinity Railway Express (TRE), a 35-mile commuter rail service with 10 stations connects downtown Dallas and downtown Fort Worth, via the mid-cities, and DFW International Airport via Centreport.
- Additional rail transit service may be coming to the area as a result of Rail North Texas, the latest rail planning effort to identify transit needs in the North Central Texas region. North Central Texas Councils of Government (NCTCOG) built on its previous efforts of the Regional Transit Initiative and the Regional Rail Corridor Studies focusing on transit needs. Proposed rail corridors would total over 250 miles, with passenger rail service reaching as far as Cleburne, Midlothian, Waxahachie, Denton, McKinney, and North Frisco, with numerous stops throughout the region (see Figure A-4).



Source: http://www.nctcog.org/trans/mtp/2030/Railrecommendationsmap.pdf

Figure A-4. Map of Existing and Potential Rail Service in NCTCOG Area.

Local Transit Services in the Region

Dallas Area Rapid Transit (DART) serves the cities of Addison, Carrollton, Cockrell Hill, Dallas, Farmers Branch, Garland, Glenn Heights, Highland Park, Irving, Richardson, Rowlett, Plano, and University Park. DART's services include 45 miles of light rail and 130 bus routes. DART Light Rail connects with the TRE for service to the DFW International Airport and to Fort Worth. DART's 2030 system plan includes an additional 43 miles of light rail service, 77 miles of enhanced bus service corridors, and 20 miles of rapid bus service corridors.

The Fort Worth Transit Authority (The T) offers fixed route and express bus service within Fort Worth, plus a "Rider Request" demand-response circulator service in Richland Hills. Many of The T's bus routes connect with the TRE at either the Intermodal Transportation Center or the T&P Station (historic former Texas and Pacific station). The T's strategic plan includes expanded regional bus and rail service, including a TRE express train, potential bus rapid transit corridors, and high-capacity circulators for downtown and uptown Fort Worth. The T is also developing a new commuter rail corridor called the "Southwest to Northeast Corridor" or "SW2NE Rail" that will connect southwestern Fort Worth to the northern end of the DFW airport along existing freight rail corridors through North Richland Hills, Colleyville, and Grapevine. At DFW the line will connect with DART Light Rail and planned commuter rail service along the Cotton Belt Line from Dallas. SW2NE Rail is currently in the environmental study stage and is planned to enter service in the 2012–2013 timeframe.

The Denton County Transportation Authority (DCTA) provides fixed-route service in the cities of Denton, Lewisville, and Highland Village. DCTA's Commuter Express bus service travels from park-and-rides in Denton and Lewisville to downtown Dallas, the DART North Carrollton Transit Center, Texas Women's University, and the University of North Texas. A regional passenger rail line connecting Carrollton and Denton began construction in June 2009. The line will connect to the DART Northwest Corridor rail line, which is planned to terminate in Carrollton.

Handitran provides demand-response paratransit service for seniors and persons with disabilities in the cities of Arlington and Pantego. Handitran also shares transfer points with The T and with two of TRE's stations. Cletran provides urban transit service with the Cleburne city limits and connects with Amtrak and with City County Transportation regional bus at the

Cleburne Intermodal Terminal. Collin County Area Regional Transit provides demand-response transit service in Collin County, fixed-route transit in the cities of McKinney and Plano, and DART-On-Call flex-route service in the city of Plano.

Multimodal stations in the area include Union Station in Dallas (DART light rail and bus, TRE commuter rail, Amtrak, close to Greyhound station), the Fort Worth Intermodal Transportation Center (The T, TRE, Amtrak, taxi), and the Cleburne Intermodal Terminal (Amtrak, Cletran urban bus, City County Transportation regional express bus).

Regions 12 and 18: Capital Area and Alamo Area (Austin-San Antonio Corridor)

While these two metropolitan areas and their surrounding counties have separate transit providers and service areas, the amount of intercity travel between Austin and San Antonio creates demand for intercity transit services. Planned intercity services for this region include the Austin-San Antonio Commuter Rail, which will potentially travel from Georgetown to San Antonio (110 miles, with 13 stations), as well as a commuter rail line connecting downtown Austin with Leander, which is now scheduled to open in Spring 2009.

Amtrak stops in Austin, San Marcos, and San Antonio. All three stops are on Amtrak's Texas Eagle Route, which travels north to Dallas/Fort Worth and on to Chicago (or connects in Dallas/FortWorth to the Heartland Flyer route to continue to Oklahoma City). San Antonio is also on Amtrak's Sunset Limited route, which extends east to New Orleans and west to Los Angeles. (Amtrak service east of New Orleans is currently suspended.) Greyhound has several stops throughout the area, including terminals in Austin, Bastrop, Kerrville, San Antonio, San Marcos, and Round Rock. Arrow Trailways (terminal in Round Rock) and the Kerrville Bus Company (terminal in Bastrop) are two other intercity bus providers that serve the area. Commuter bus services also provide connections between cities in this region.

Local Transit Services in the Region

The Capital Metropolitan Transportation Authority (Capital Metro) provides urban transit service in the cities of Austin, Manor, San Leanna, Leander, Jonestown, Lago Vista, Point Venture, Volente, and some of the incorporated areas of Travis and Williamson Counties. A variety of bus services serve different travel markets; options include local, limited-stop and "flyer," crosstown, and express bus routes, feeder routes that connect selected neighborhoods to Capital Metro Transit Centers, airport shuttles, downtown circulators, and a dial-a-ride route serving Lago Vista, Jonestown, and Leander. Planned future transit services within the Capital Metro service area include 10 new rapid bus lines and 10 new or expanded express bus routes.

The Capital Area Rural Transportation System (CARTS) offers commuter bus service into Austin from Smithville and from Bastrop. The CARTS County Connector bus route links Bastrop, Elgin, and Smithville. CARTS has additional express bus routes planned to link destinations in Hays and Williamson Counties with Travis County destinations. CARTS has a long history of partnering with intercity bus services and is developing service routes specifically connecting to intercity transit services in Round Rock, San Marcos, and Bastrop. The first of these routes began service in late 2008. In addition to intercity and feeder service, CARTS provides general transportation services throughout Williamson, Hays, Travis, Bastrop, Blanco, Burnet, Caldwell, Fayette, and Lee Counties.

VIA Metropolitan Transit (VIA) provides public transportation services to the City of San Antonio, 13 suburban cities and the unincorporated areas of Bexar County. Services currently include 85 fixed routes and four downtown circulator routes. "Starlight" late-night service is provided on a demand-response basis within Loop 410 and the Medical Center area between 1:00 and 4:00 a.m. VIA also sponsors commuter vanpools in partnership with Enterprise Rent-a-Car; some of these vanpools travel between San Antonio and Austin. Finally, the VIATrans Paratransit system provides demand-response service to riders with disabilities. Bus Rapid Transit (BRT) is among the proposed transit options described in the San Antonio Mobility 2030 Plan. Plans for a BRT system in the San Antonio area, operated by VIA, are underway with service expected to begin in 2012. The primary BRT corridor will follow Fredericksburg Road, linking San Antonio's central business district with the South Texas Medical Center. Buses will operate in a dedicated busway for part of the corridor and in mixed traffic close to downtown.

Alamo Regional Transit (ART), operated by the Alamo Area Council of Governments, provides demand-response rural public transportation in Atascosa, Bandera, Comal, Frio, Gillespie, Karnes, Kendall, Kerr, Medina, and Wilson Counties. Public transportation in Guadalupe County is provided through ART's subcontractor, the Community Council of South Central Texas. The rural transit service also connects with the intercity Kerrville Bus Company at the Kerrville Intermodal Facility.

Multimodal terminals along the Austin-San Antonio corridor include several CARTS stations: the CARTS Central Terminal in Austin (also serving Capital Metro); and CARTS stations in Round Rock (Greyhound, Arrow Trailways); San Marcos (Greyhound, Amtrak); and Bastrop (Greyhound, Kerrville Bus Company). Additional intermodal transit centers are planned for the cities of Taylor and Georgetown, as well as in south and west Williamson County and in Hays County. San Antonio's West Side Multimodal Center, to be constructed in the near west of San Antonio's central business district, will serve VIA bus and BRT initially, and later expand to serve Greyhound, the Austin-San Antonio commuter rail, Amtrak, taxi, and auto rental services. The Kerrville Intermodal Facility (in the City of Kerrville) serves Alamo Regional Transit as well as the Kerrville Bus Company.

Region 16: Gulf Coast (Houston-Galveston)

The Gulf Coast planning region includes 13 counties. Houston, Galveston, Conroe, and Katy are some of the many urban areas in the region. Amtrak's Sunset Limited route serves the Houston area; the Amtrak station in downtown Houston, close to the intersection of I-45 and I-10, also serves as a stop for Greyhound. Amtrak's bus service stops in La Marque and Galveston. Greyhound stops in Houston as well as in Galveston, Katy, and Conroe. Greyhound's affiliate Valley Transit connects Houston with Bay City, Corpus Christi, and Victoria, along with other cities along US-59 and TX-35. The Kerrville Bus Company shares a station with Greyhound and one with Coach USA in Houston, and also has stops in Katy, Humble, Galveston, and other cities in the region.

Local Transit Services in the Region

Houston METRO provides bus and light rail transit service to the Houston metropolitan area, including over two-thirds of Harris County and portions of Fort Bend and Montgomery Counties. METRO's bus services include local routes and park-and-ride routes that utilize the city's high occupancy vehicle lanes. The METRORail light rail currently operates along a single 7.5-mile corridor from the Fannin South Park-and-Ride to the University of Houston Downtown campus. An additional 30 miles of light rail is planned for implementation by 2012, including a continuation of the north end of the Red Line to a new Northern Intermodal Facility. Additionally, the 2035 Metro Solutions plan calls for 28 miles of commuter rail along U.S. Highways 90A and 290 and toward Galveston. Planned bus service expansions include

"Signature Bus" and suburban bus rapid transit to provide further connections to rail lines and city activity centers.

Connect Transportation, operated by the Gulf Coast Center, provides rural and medical transportation services in Brazoria County and on the mainland of Galveston County, as well as demand-response transit from Galveston Island to the mainland. Island Transit operates fixed-route bus and trolley service on Galveston Island. A proposed Galveston-Houston Commuter Rail line is under evaluation.

Fort Bend County Transit provides commuter park-and-ride service from University of Houston-Sugar Land campus to Greenway Plaza and the Galleria, rural transit service, and urban demand-response service in portions of Fort Bend county that are within the Houston urbanized area but outside the METRO service area.

Brazos Transit District provides transit services in Liberty County, including local circulators in Ames, Liberty, Dayton, and Cleveland. Preliminary engineering and environmental analyses have been completed for a possible park-and-ride facility in Dayton that would support commuter service into the Houston central business district. The Brazos Transit District and Coach USA operate the Woodlands Express commuter park-and-ride from The Woodlands to the Houston central business district, the Texas Medical Center, and Greenway Plaza.

Fort Bend County Transit provides commuter park-and-ride service from UH-Sugar Land to Greenway Plaza and the Galleria, rural transit service, and urban demand-response service in portions of Fort Bend county that are within the Houston urbanized area but outside the METRO service area. Colorado Valley Transit provides rural transit and medical transportation service to Austin and Colorado Counties.

The Houston-Galveston Area Council (H-GAC) 2035 Metropolitan Transportation Plan (MTP) includes further recommendations for regional and intercity transit service in the 13-county planning region, including the consideration of high-capacity transit corridors (light rail, commuter rail, express bus or BRT) extending outside the current METRO service area (see Figure A-5). Potential corridors include State Highways 249, 288, 225, 146, and 35, and FM 521. H-GAC is conducting a regional commuter rail accessibility study to evaluate high-traffic corridors in the region for possible commuter rail service (*21*). The 2035 MTP also supports the efforts of the Texas High Speed Rail and Transportation Corporation (THSRTC) to develop high-speed rail service linking Dallas/Fort Worth, San Antonio, Killeen/Temple, Bryan/College Station, and Houston in a configuration called the "Texas T-Bone" (see Figure A-6).

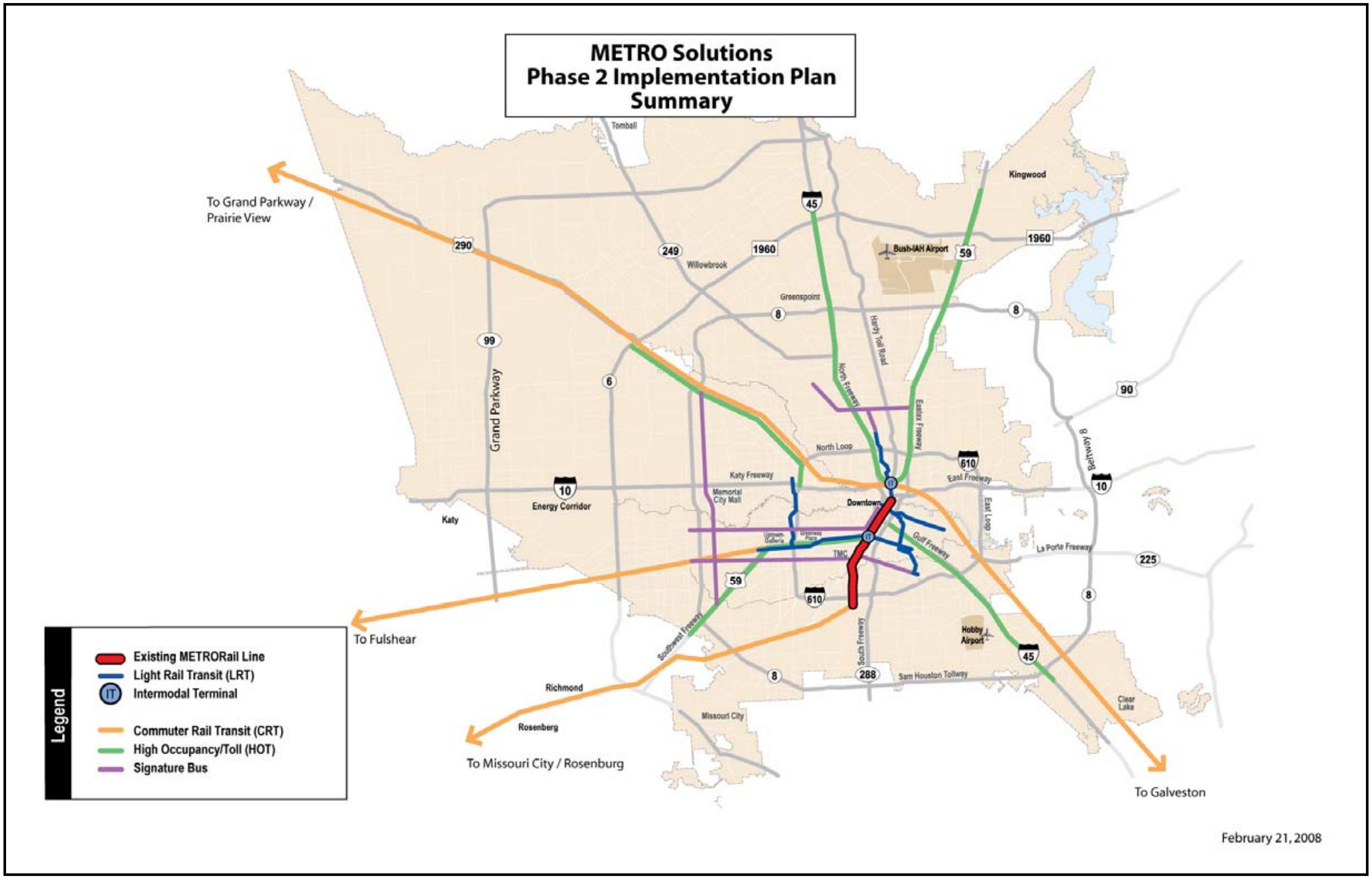
The planned Northern Intermodal Facility (to be constructed in the vicinity of North Main and Burnett Streets, just north of downtown) will serve future commuter rail service, Amtrak, freight rail, light rail, intercity bus carriers, and local bus routes. The station will replace the current Amtrak station for the city. While not specified as multimodal facilities, five new METRO transit centers and four new Park-and-Rides are planned as part of the overall expansion of transit services in the Houston area.

Region 8: Rio Grande (El Paso)

Outside of the City of El Paso and El Paso County, transit service is limited throughout this large six-county region. Amtrak's Sunset Limited route serves Alpine and El Paso. El Paso is also a stop for Amtrak's thruway bus service heading north to Albuquerque, New Mexico. Greyhound operates along the I-10 corridor with stops in Alpine, El Paso, Marfa, Presidio, and Van Horn. All Aboard American/Industrial Bus Lines, Inc. provides limited intercity service from Midland-Odessa to Ft. Stockton, Marfa, Presidio, and Alpine.

Local Transit Services in the Region

Locally, Sun Metro provides service within the city limits of El Paso. El Paso County Transit operates rural public transportation for the cities, town and colonias in El Paso County, including five fixed routes connecting non-urbanized areas of El Paso County to the city of El Paso. El Paso County Transit and Sun Metro allow passengers to transfer between the two services. Sun Metro buses stop close to Amtrak's Union Depot in El Paso, though there is no shared facility. No local transit service currently operates in Brewster, Culberson, Hudspeth, Jefferson Davis, or Presidio Counties.



Source: http://metrosolutions.org/posted/1068/MS022108_Summary_.194783.jpg

Figure A-5. Map of Planned METRO Light Rail, Commuter Rail, HOT Lanes, and Signature Bus Routes.

Source: http://www.thsrtc.com/articles.asp?id=241

Figure A-6. Map of High-Speed Corridors in Southeast United States, including the THSRTC's Proposed Brazos Express Corridor Forming the "Texas T-Bone."

As part of the El Paso Metropolitan Planning Organization's Transborder 2035 Metropolitan Transportation Plan, Sun Metro has developed a plan for expanding and improving transit service in the El Paso area that includes improved local bus service as well as bus rapid transit. The first BRT corridor will provide service from the international bridges to the University of Texas-El Paso and other downtown locations. Four additional corridors are planned for implementation over the next 7–12 years. Depending on passenger growth, one or more of the planned BRT corridors may be converted to light rail or commuter rail in the future. Three downtown transit terminals currently serve local bus routes and will become part of the BRT network. Proposed future regional transit service includes an extension of New Mexico's Rail Runner commuter rail line from its current terminus in Belen, New Mexico, to El Paso. The Rail Runner currently extends north to Santa Fe.

Regions 11 and 23: Central Texas and Heart of Texas (Waco-Temple-Killeen)

The Central Texas planning region (Killeen, Temple, Fort Hood) and the Heart of Texas region (Waco and surrounding area) have separate transit systems but have a history of informal service coordination, particularly for paratransit service needs. Amtrak's Texas Eagle route stops in McGregor, in Temple, and in Taylor. Amtrak's bus service also connects Fort Hood and Killeen with the rail station in Temple. Greyhound serves the area with stops in downtown Waco (Waco Intermodal Center), Hillsboro, Buffalo, and Fairfield (drop-off point only; no boardings).

Local Transit Services in the Region

The Hill Country Transit District provides demand-response transit service to Bell, Coryell, Hamilton, Lampasas, Llano, Mason, Milam, Mills, and San Saba Counties and fixed-route service in the cities of Copperas Cove, Killeen, Harker Heights, Nolanville, and Temple. Waco Transit provides fixed-route service within the Waco city limits and connects to Greyhound at the Waco Intermodal Center. The Waco Streak bus line provides three roundtrips per day from the Waco urbanized area to the Dallas/Fort Worth International Airport. The Heart of Texas Council of Governments (HOTCOG) provides demand-response rural transit in Bosque, Falls, Freestone, Hill, Limestone, and McLennan Counties. The Waco Intermodal Transit Center serves Waco Transit as well as Greyhound.

Region 21: Lower Rio Grande Valley (Brownsville)

Valley Transit Company, a Greyhound affiliate company, provides intercity transit service to all three counties, with stops in the three primary cities (Brownsville, Harlingen, and McAllen). The Valley Transit/Greyhound service connects the Lower Rio Grande Valley to Houston, San Antonio, and Laredo.

The Valley Transit "Main Line" through the Lower Rio Grande Valley also operates as express bus service along U.S. Highway 83 from Brownsville to McAllen. As part of the 2006 regional transit coordination plan, the Lower Rio Grande Valley Development Council (LRGVDC) negotiated with Valley Transit to provide additional "runs" of this route, to supplement Valley Transit's schedule, and to initiate some direct intercity transit connections from Raymondville to Harlingen and McAllen. LRGVDC's Rio Metro now operates five intercity routes in partnership with Valley Transit and McAllen Express Transit:

- Intercity Route 1 connecting McAllen and Edinburgh;
- Intercity Route 2 connecting McAllen and Mission;
- Intercity Route 3 connecting McAllen, Pharr, San Juan, and Alamo;
- Intercity Route 4 connecting McAllen, La Joya, Penitas, Palmview, and Mission; and
- The Rio Metro Career Link.

The Rio Metro Career Link or JARC (Job Access and Reverse Commute) Route provides three clockwise and three counterclockwise loops per day along U.S. 83 and connecting FM roads, with stops in 15 urbanized areas throughout the Lower Rio Grande Valley. The primary function for the service is bringing workers to jobs in the Valley.

The Harlingen Express, a flex-route bus service, began in the spring of 2008 in the City of Harlingen. The Brownsville Urban System (BUS) provides urban transit service within the City of Brownsville. McAllen Express Transit provides urban transit service within the City of McAllen. Specific multimodal facilities are not named in local plans, but planned coordination of feeder routes and Valley Transit along U.S. 83 will likely include timed stops at existing Valley Transit stations.

Region 6: East Texas (Tyler-Longview)

Amtrak's Texas Eagle route includes stations in Marshall, Longview, and Mineola. Amtrak's Lone Star Coach bus service and Greyhound also serve the area. The East Texas

Regional Transportation Coordination Plan (2006 version) recommends increasing the use of these services through public outreach and promotion, as well as through agreements to interconnect these services with those of local transit providers. The plan also recommends the construction of multimodal transit centers located throughout the East Texas area to connect urban, rural, and intercity services. The region is planning a feasibility study on the construction of a rail system that would be integrated into the planned Dallas/Fort Worth rail system.

Currently, Tyler Transit provides urban fixed-route service within the Tyler city limits, as well as Job Access – Reverse Commute (JARC) service that extends beyond the city limits. Longview Transit provides urban fixed-route service within the Longview city limits. The East Texas Rural Transit District provides demand-response rural service to the 14-county region. Tables A-5 and A-6 list existing and planned intermodal transit facilities within the state, respectively.

Table A-5. Existing Intermodal Transit Stations in Texas.

Region	City/Terminal Name	Transit Providers Served
12	Austin Central Terminal	Capital Metro CARTS
	Round Rock	CARTS Greyhound Arrow Trailways
	San Marcos	CARTS Greyhound Amtrak
	Bastrop	CARTS Greyhound Kerrville Bus Company
18	Kerrville Intermodal Facility	Kerrville Bus Company Alamo Regional Transit
4	Dallas Union Station	DART light rail TRE commuter rail Local bus Amtrak
	Fort Worth Intermodal Transportation Center	The T TRE Amtrak
	Cleburne Intermodal Terminal	Amtrak Cletran urban bus City County Transportation (regional bus)
22	Sherman: TAPS intermodal terminal	Local bus (including TAPS) Greyhound
11	Waco Intermodal Transit Center	Waco Transit Greyhound
24	Del Rio Multimodal Transit Center	Del Rio Transit Greyhound
5	Texarkana Greyhound Terminal	Greyhound T-Line (local bus)

Table A-6. Planned or Proposed Intermodal Transit Stations in Texas.

Region	City/Terminal Name	Transit Providers Served
12	Taylor	CARTS Intercity (TBD)
	Georgetown	CARTS Intercity (TBD)
	South Williamson County	CARTS Intercity (TBD)
	West Williamson County	CARTS Intercity (TBD)
	Hays County	CARTS Intercity (TBD)
18	San Antonio West Side Multimodal Center	VIA and VIA BRT (later) Greyhound Austin-San Antonio Commuter Rail Amtrak
16	Houston: Northern Intermodal Facility	Commuter rail Amtrak Freight rail METRORail light rail Intercity bus carriers Local bus
6	East Texas area (one or more facilities)	Local bus Intercity carriers
4	City of Krum/City of Denton	Amtrak DCTA TBD
10	San Angelo – feasibility study conducted	TBD
8	El Paso Union Plaza (proposed)	Sun Metro (local bus) Amtrak
7	Abilene – feasibility study conducted	TBD
17	Victoria – feasibility study conducted	TBD

Twelve counties in the state are not currently served by local urban or rural transit services: Brewster, Culberson, Hudspeth, Jeff Davis, and Presidio Counties in Region 8; Jasper, Newton, Sabine, San Augustine, Shelby, and Tyler Counties in Region 14; and Chambers County in Region 16.

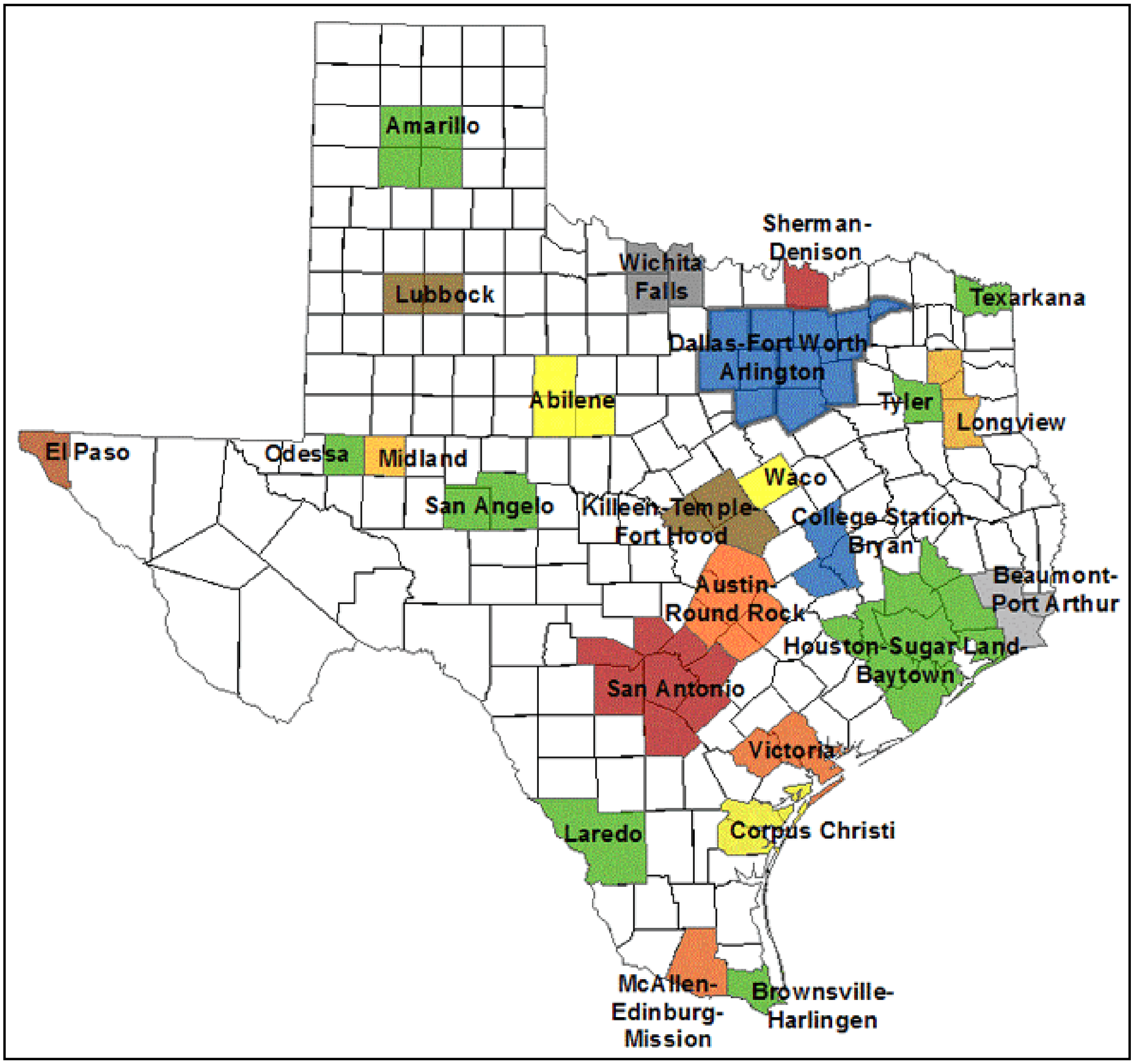
APPENDIX B. INTERCITY COMMERCIAL AIR PASSENGER TRAVEL IN TEXAS- UPDATE THROUGH CURRENT DATA OF 0-5930-1 REPORT CHAPTER

This appendix reports the TTI research team's findings regarding intercity air service in Texas and describes the issues surrounding air service demand and capacity. This appendix contains updated information that was originally collected and analyzed in Task 2 of the research project. It has been updated to include more recent activity and forecast data and revised to reflect changes in intrastate air service in Texas. It also reflects additions made as a part of work the efforts in Task 11.

COMMERCIAL AIR SERVICE IN TEXAS

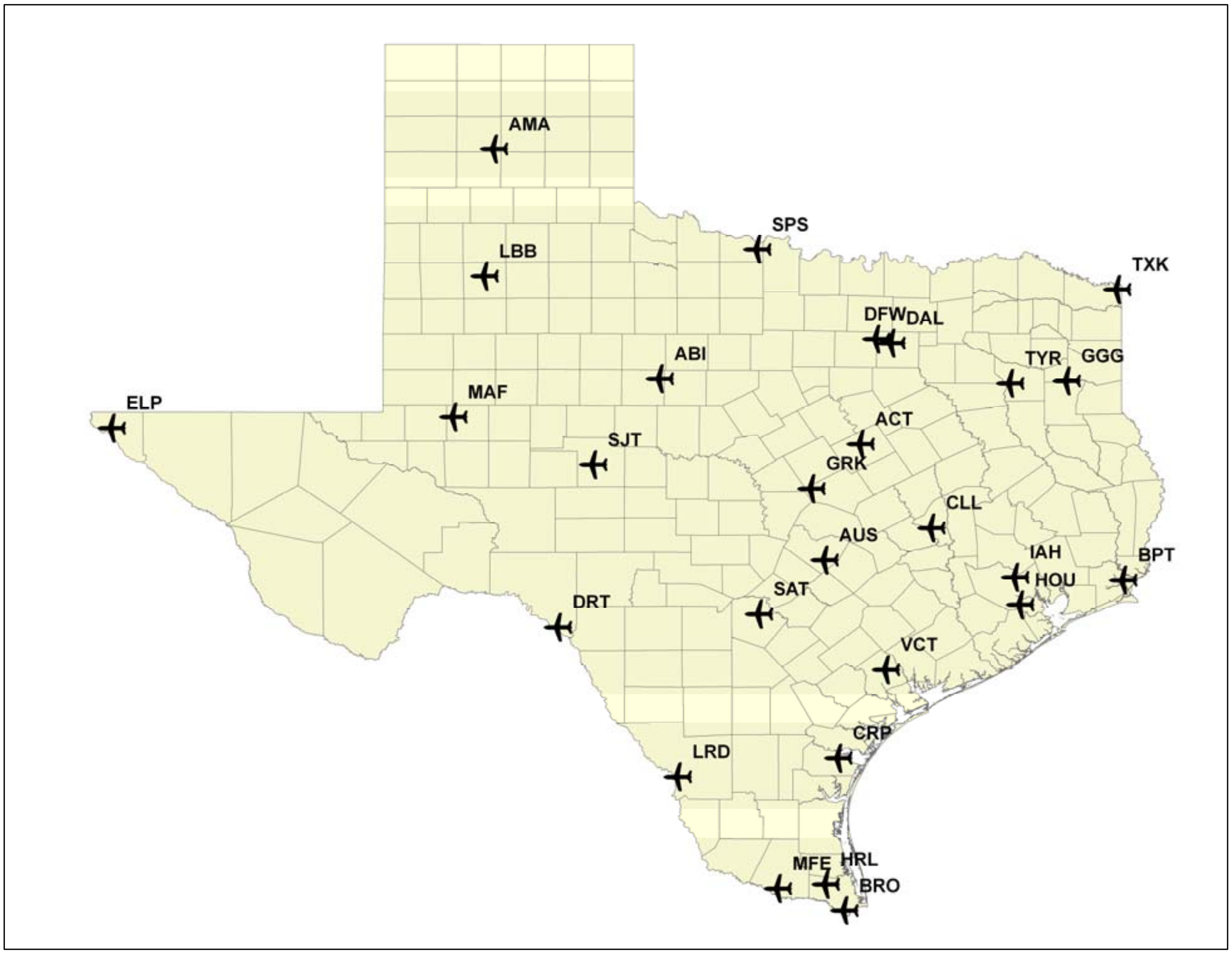
Air service in the identified major intercity corridors in Texas is well established. Population centers in the state continue to enjoy adequate access to the air transportation system with the major population centers having a choice of airports and airlines from which to choose. Commercial service airports are located in Texas' 25 metropolitan statistical areas (MSAs) that together include more than 85 percent of the state's population. Figure 3-1 shows the state's MSAs. Figure 3-2 shows the locations of the 27 commercial service airports serving Texas. Among states in the U.S., Texas is unique in that it is home to three major airlines—American Airlines, Continental Airlines, and Southwest Airlines. Southwest Airlines serves secondary airports within the state's two largest metropolitan areas. Southwest's operations at Houston Hobby Airport and Dallas Love Field have maintained for consumers an alternative to legacy carriers such as Continental Airlines and American Airlines, who themselves have significant operations at Houston George Bush Intercontinental Airport and Dallas/Fort Worth International Airport, respectively.

Texas residents make frequent use of commercial aviation services for both intrastate and interstate travel. In 2008, 680 million passengers traveled by air domestically within the United States (*22*). This number is expected to increase by an average annual rate of 2.0 percent per year from 2009 through 2025 reaching 952.1 million passengers per year through the national system in 2025. In Texas, nearly 71 million passengers were enplaned in 2007 and that number is expected to grow to more than 104 million per year by 2025 (*23*). Dallas/Fort Worth International, Dallas Love Field, Houston George Bush Intercontinental, and Houston's William P. Hobby together accounted for 81 percent of these enplanements in 2007. According to the Air Transport Association (ATA), the Houston-Dallas/Fort Worth market continues to be one of the most heavily traveled airline route segments in the nation, ranking 13th among domestic airline markets in 2008 while the Dallas/New York market ranked 17th and the Dallas/Chicago market ranked 27th (*24*).



Source: Texas State Data Center.

Figure B-1. Texas Metropolitan Statistical Areas.



Source: Texas Transportation Institute

Figure B-2. Location of Texas Commercial Service Airports.

Air service to smaller communities is no less important to those they serve but is much more susceptible to the economic and financial condition of the country and the airline industry itself. Smaller Texas communities have, for the most part, enjoyed suitable levels of air service to the larger hubs in the state. This service is predominantly to and from airports in the Dallas and Houston areas where connections to other locations within the state or longer distances across the country can be made. This service is provided, for the most part, by regional airlines that are either owned by or partner with the larger air carriers.

Regional airlines feed passengers from smaller communities into larger hubs. They provide short- and medium-haul scheduled airline service connecting smaller communities with larger cities and hub airports operating nine to 74 seat turboprops and 37 to 106 seat regional jets. Their operations tend to be of a smaller scale and more regionally geographic in nature. According to the Regional Airline Association, 25 percent of all domestic passengers fly on a regional airline. With nearly 14,000 regional airline flights every day, one in four domestic airline passengers now travel on regional airlines. Operating approximately 2,500 aircraft, the regional fleet comprises about one-third of the U.S. commercial airline fleet (*25*).

Within Texas, regional carriers play a major role in intercity transportation. In addition to being the home of three major air carriers, Texas is also home to two of the largest regional carriers in the country, American Eagle and ExpressJet. Other regional airlines that serve Texas communities include Chautauqua Airlines and Republic Airlines (both part of Republic Holdings) as well as Pinnacle Airlines' subsidiary Colgan Air. For passengers, the use of these regional carriers is not always evident as they often fly under the banner of a major carrier. The primary regional aircraft used in Texas are the Saab 340 turboprop (34 seats) and the Embraer 135/145 regional jets (37/50 seats). Table 3-1 shows the airports in Texas and the percentage of regional flights at the airport in 2007, 2008, and 2009. Thirteen airports in Texas are currently served exclusively by regional flights/carriers; these flights currently account for 19 percent of the state's enplaned passengers and 40 percent of statewide aircraft departures. Figure B-3 shows the two major regional airline partnership arrangements in the state.

Table B-1. Percentage of Regional Flights at Texas Airports.

Source: Regional Airline Association, Annual Report 2007, 2008, and 2009.

Airport	Percentage of Flights Provided by Regional Airline		
	2007	2008	2009
Abilene 97		100	100
Amarillo 57		52	52
Austin 27		24	24
Beaumont 100		100	100
Brownsville	100	100	100
College Station	100	100	100
Corpus Christi	78	76	76
Dallas Love	16	10	10
Dallas/Fort Worth	35	36	36
Del Rio International	100	100	100
El Paso	22	25	25
Fort Hood/Killeen (Robert Gray)	98	100	100
Harlingen 29		30	30
Houston Hobby	8	7	7
Houston Intercontinental	56	57	57
Laredo 97		96	96
Longview 100		100	100
Lubbock 52		52	52
McAllen 33		18	18
Midland 48		55	55
San Angelo	100	100	100
San Antonio	20	25	25
Texarkana 100		100	100
Tyler 100		100	100
Victoria 100		100	100
Waco 100		100	100
Wichita Falls	100	100	100

American Airlines	American Eagle	American Eagle
		American Eagle/ Executive
	American Connection	Chautauqua Airlines
Continental Airlines	Continental Express	Chautauqua Airlines
		ExpressJet
	Continental Connection	Cape Air
		Colgan Air
		CommutAir
		Gulfstream International Airlines

Source: Regional Airline Association Annual Report 2009.

Figure B-3. Texas' Major Airline Partnerships: Mainline Carrier, Regional Brand, and Operating Partners.

MODE CHOICE AND MARKET DISTANCE

Understanding the travel behavior of intercity passengers is a key factor in determining their choice of mode. Critical to understanding this decision process is the distance of the travel. Table B-2 shows mode share for various trip lengths for all trip purposes. Personal vehicle is the dominant mode until travel distances reach 750 miles. If a work/business trip purpose were disaggregated from these data, one would expect personal vehicle travel to drop off more as trip distance increased. This would also be a function of the air transportation network and how well it serves the needed market. Nevertheless, there seems to be clear demarcations in how far travelers are willing to drive and what distance will get them to choose other modes.

Table B-2. Mode Share for Various Trip Lengths.

Percentage of Trips by Mode by Distance Group					
Transportation Mode	**50-499 miles**	**500-749 miles**	**750-999 miles**	**1000-1499 miles**	**1500+ miles**
Personal Vehicle	95.4	61.8	42.3	31.5	14.8
Air 1.6		33.7	55.2	65.6	82.1
Bus 2.1		3.3	1.5	1.5	1.4
Train 0.8		1.0	0.9	0.7	0.8
Other 0.2		0.1	0.1	0.7	1.0
Total 89.8		**3.1**	**2.0**	**2.3**	**2.8**

NOTE: Only trips in which the transportation mode and trip distance could be identified are included.
SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Federal Highway Administration, National Household Travel Survey, long distance file, 2001 (Washington, D.C.).

Within Texas, the airlines serve markets that vary in distance from 74 miles to 677 miles. Figure B-4 shows the distribution of Texas air service markets by distance. Table B-3 lists each of the individual city-pairs for Texas and their respective distances. Figure B-4 shows, in summary form, the existing intrastate air service markets served in Texas in 2007 and 2009. The figure reveals that eight intrastate city-pairs were eliminated and one was added. Those that were eliminated ranged in distance from 167 miles to 352 miles with all but one between 246 and 352 miles. The one city-pair that was added was 482 miles. These changes will be addressed in more detail later in the report.

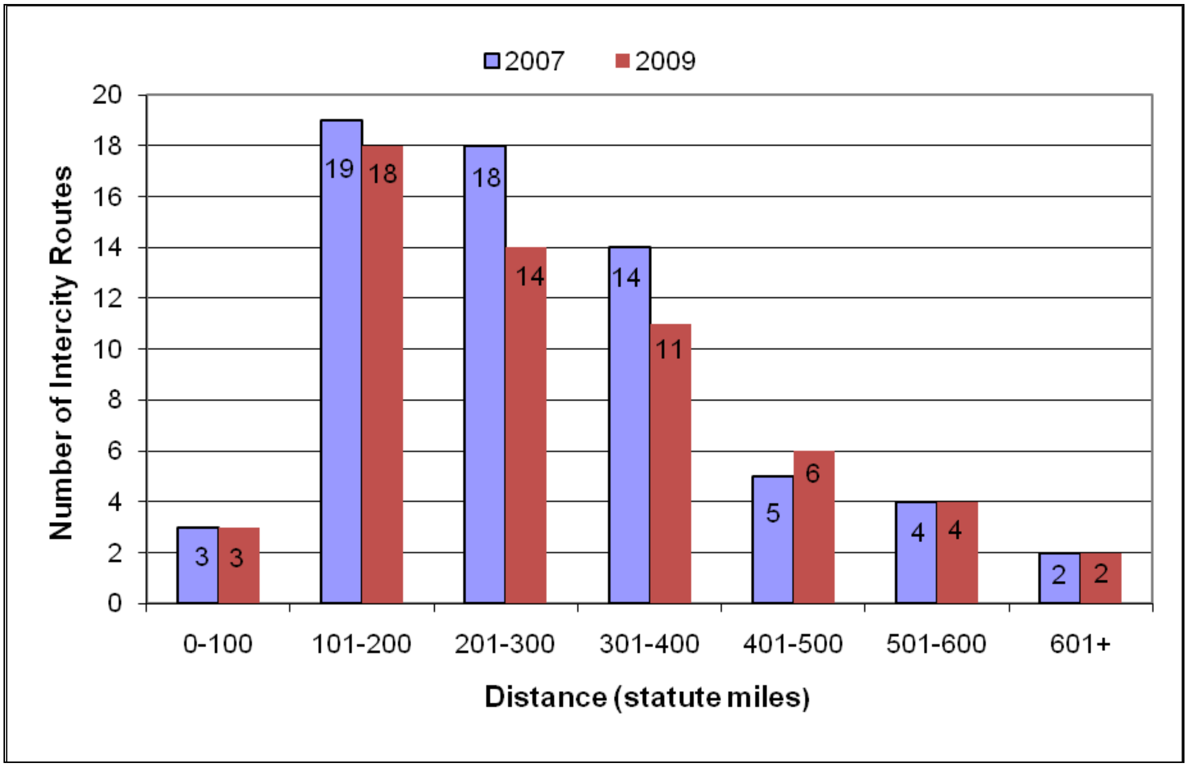


Figure B-4. Texas Intrastate Air Service Markets by Distance.

Table B-3. Texas Intrastate Passenger Air Service City-Pair Market Distances (Statute Miles).

Origin	Destination	Distance
Abilene Dallas/DFW		157
Amarillo Dallas	/DFW	313
Amarillo Dallas	/DAL	324
Amarillo Houston/IA	H	518
Austin Dallas/DAL		189
Austin Dallas/DFW		190
Austin	El Paso	529
Austin Harlingen		273
Austin Houston/HOU		148
Austin Houston/IA	H	140
Austin Lubbock		341
Beaumont Houston/IA	H	79
Brownsville Houston/IA	H	308
Brownsville Dallas	/DFW	482
College Station	Dallas/DFW	164
College Station	Houston/IAH	74
Corpus Christi	Austin	167
Corpus Christi	Dallas/DFW	354
Corpus Christi	Houston/IAH	201
Corpus Christi	Houston/HOU	187
Dallas Love	Amarillo	324
Dallas Love	Austin	189
Dallas Love	El Paso	561
Dallas Love	Houston/HOU	239
Dallas Love	Houston/IAH	217
Dallas Love	Lubbock	293
Dallas Love	Midland/Odessa	319
Dallas Love	San Antonio	248
Dallas/Fort Worth International	Abilene	157
Dallas/Fort Worth International	Amarillo	313
Dallas/Fort Worth International	Austin	190
Dallas/Fort Worth International	Brownsville	482
Dallas/Fort Worth International	College Station	164
Dallas/Fort Worth International Corpus	Christi	354
Dallas/Fort Worth International	El Paso	551
Dallas/Fort Worth International Houston/HOU		247
Dallas/Fort Worth International Houston/IA	H	224

Table B-3 (Continued). Texas Intrastate Passenger Air Service City-Pair Market Distances (Statute Miles).

Origin	Destination	Distance
Dallas/Fort Worth International	Killeen	134
Dallas/Fort Worth International	Laredo	394
Dallas/Fort Worth International	Longview	140
Dallas/Fort Worth International	Lubbock	282
Dallas/Fort Worth International	Midland/Odessa	309
Dallas/Fort Worth International	McAllen	468
Dallas/Fort Worth International	San Angelo	228
Dallas/Fort Worth International	San Antonio	247
Dallas/Fort Worth International	Texarkana	181
Dallas/Fort Worth International	Tyler	103
Dallas/Fort Worth International	Waco	89
Dallas/Fort Worth International	Wichita Falls	113
Del Rio	Houston/IAH	343
El Paso	Austin	529
El Paso	Dallas/DAL	561
El Paso	Dallas/DFW	551
El Paso	Houston/HOU	677
El Paso	Houston/IAH	668
El Paso	San Antonio	497
Harlingen/South Padre Island	Austin	273
Harlingen/South Padre Island	Houston/HOU	276
Harlingen/South Padre Island	Houston/IAH	295
Harlingen/South Padre Island	San Antonio	233
Houston Hobby	Austin	148
Houston Hobby	Corpus Christi	187
Houston Hobby	Dallas/DAL	239
Houston Hobby	Dallas/DFW	247
Houston Hobby	El Paso	677
Houston Hobby	Harlingen	276
Houston Hobby	Midland/Odessa	441
Houston Hobby	San Antonio	192
Houston Intercontinental	Amarillo	518
Houston Intercontinental	Austin	140
Houston Intercontinental	Beaumont	79
Houston Intercontinental	Brownsville	308
Houston Intercontinental	College Station	74
Houston Intercontinental	Corpus Christi	201
Houston Intercontinental	Dallas/DAL	217
Houston Intercontinental	Dallas/DFW	224

Table B-3 (Continued). Texas Intrastate Passenger Air Service City-Pair Market Distances (Statute Miles).

Origin	Destination	Distance
Houston Intercontinental	Del Rio	343
Houston Intercontinental	El Paso	668
Houston Intercontinental	Killeen	166
Houston Intercontinental	Harlingen	295
Houston Intercontinental	Lubbock	458
Houston Intercontinental	Laredo	301
Houston Intercontinental	Midland/Odessa	429
Houston Intercontinental	McAllen	316
Houston Intercontinental	San Antonio	191
Houston Intercontinental	Tyler	163
Houston Intercontinental	Victoria	123
Houston Intercontinental	Waco	159
Killeen Dallas/DFW		134
Killeen Houston/IA	H	224
Laredo Dallas/DFW		394
Laredo Houston/IA	H	301
Longview Dallas/DFW		140
Lubbock Austin		341
Lubbock Dallas/DAL		293
Lubbock Dallas/DFW		282
Lubbock Houston/IA	H	458
Midland/Odessa Dallas/DAL		319
Midland/Odessa Dallas/DFW		309
Midland/Odessa Houston/HOU		441
Midland/Odessa Houston/IA	H	429
McAllen Dallas/DFW		468
McAllen Houston/IA	H	316
San Angelo	Dallas/DFW	228
San Antonio	Dallas/DAL	248
San Antonio	Dallas/DFW	247
San Antonio	El Paso	497
San Antonio	Harlingen	233
San Antonio	Houston/HOU	192
San Antonio	Houston/IAH	191
Texarkana Dallas/DFW		181
Tyler Dallas/DFW		103
Tyler Houston/IA	H	163
Victoria Houston/IA	H	123
Waco Dallas/DF	W	89
Waco Houston/IA	H	159
Wichita Falls	Dallas/DFW	113

Source: Bureau of Transportation Statistics (airport-to-airport/statute miles calculator).

Table B-4. Existing Intrastate Air Passenger Markets Served in Texas.

	ABI	AMA	AUS	BPT	BRO	CLL	CRP	DAL	DFW	DRT	ELP	HRL	HOU	IAH	GRK	LRD	GGG	LBB	MAF	MFE	SJT	SAT	TXK	TYR	VCT	ACT	SPS
ABI									X																		
AM A								X	X					X													
AUS								X	X		X	X	X	X				X									
BPT														X													
BRO									X					X													
CLL									X					X													
CRP									X				X	X													
DAL	X		X								X		X	X			X		X		X						
DFW	X X		X		X X		X				X		X X		X X		X X		X X		X X		X X			X	X
DRT														X													
ELP			X				X		X				X	X								X					
HRL			X										X	X								X					
HOU		X				X		X	X	X		X							X			X					
IAH		X X		X X		X X		X X		X X		X			X	X		X	X	X		X		X	X	X	
GRK									X					X													
LRD									X					X													
GGG									X																		
LBB			X					X	X					X													
MAF								X	X				X	X													
MFE									X					X													
SJT									X																		
SAT								X	X		X	X	X	X													
TXK									X																		
TYR									X					X													
VCT														X													
ACT									X					X													
SPS									X																		

Note: As of November 2009.

FUTURE AIR SERVICE ISSUES AND CHALLENGES

A discussion of air service issues in the state would not be complete without some mention of the issues and challenges facing the industry today. The future of air service in Texas, like that in many states across the country, is unpredictable. This is even more so for small communities. The current economic difficulties facing the country and the increasing cost of fuel have placed significant burdens upon airlines. Airlines have been reducing capacity in their networks for some time and they continue to reduce flights and in some cases eliminate service altogether. In the last year, "nearly 30 cities across the United States have seen their scheduled service disappear (*26*)." In addition, "more than 400 airports, in cities large and small, have seen flights cut (*26*)." The Official Airline Guide reports that the total number of flights has decreased in the last year by 3 percent. Texas service has not been immune. In May 2008, American Airlines announced it would no longer serve Austin from Dallas Love Field cutting its eight daily flights between the two airports (*27*). These cuts were part of a larger number affecting cities outside of Texas as well. At the same time, ExpressJet cut flights to San Antonio and Austin from Tulsa International Airport (*28*). But while these changes did not effectively eliminate air service between cities in Texas, some changes have occurred since the Year 1 Report was written in 2007 that did eliminate intrastate air service between some city-pairs. Figure B-4 prefaced some of these changes while noting differences from 2007 and 2009. Table B-5 shows the eight city-pairs that lost air service and the one city-pair that was added since 2007. It should be noted that while Corpus Christi lost service to Dallas Love Field, it continues to serve Dallas Fort/Worth International Airport. Therefore, it can be said that a city-pair was not necessarily lost but rather service has been reduced.

Table B-5. Changes in Texas Intrastate Air Service since 2007.

Texas City-Pairs Losing Air Service	Market Distance (statute miles)
Abilene – Houston Intercontinental	307
Austin – Corpus Christi International	167
Austin – Midland International	295
Corpus Christi International – Dallas Love	352
El Paso International – Lubbock International	296
El Paso International – Midland International	246
Houston Intercontinental – San Angelo Regional	321
Houston Intercontinental – Texarkana Regional	252
Texas City-Pair Adding Air Service	**Market Distance (statute miles)**
Brownsville – Dallas/Fort Worth International	482

The airlines have and continue to reduce capacity in their respective systems in an effort to increase efficiency and cut costs. Any gains in this effort are seemingly offset by either steep increases in fuel costs or economic downturn (*26*). Subsequently, many airlines are financially distressed, have entered or contemplated bankruptcy, and put off ordering new aircraft. While fuel prices have subsided some in the fall of 2008, and rebounded somewhat in 2009, airlines continue to restructure fleets and schedules. The industry continues to struggle in the midst of a weakened economy with no clear understanding of how long it will last and when oil prices may spike again. The past has shown that a variety of factors, rational and otherwise, can drive the oil market over short periods of time.

Complicating the air service issue is the emerging trend in the reduction of 50-and-less seat regional jets (*29*). Once seen as the solution for small community air service, they are now being pulled from smaller airports to provide service on mainline routes in their efforts to reduce costs, save fuel, and reduce capacity (seats). The current economics of the aircraft no longer work for shorter distances. The impact on air service for smaller communities is the reduction or complete elimination of service. This has already been recognized to some extent as shown above in the eliminated city-pair service where the most vulnerable markets are those less than 300 mile-range. This trend has led to the re-emergence of turboprop aircraft, which not too long ago had nearly ceased production. “The market for new 50-seat jets has all but disappeared and aircraft in the 70-seat category have dominated turboprop sales (*30*).”

Over the years, some communities have benefited from essential air service programs and other grants and subsidies designed to keep small communities connected to the air transportation system. In Texas, Victoria Regional Airport benefits from such an assistance program but they have seen their enplanements decrease drastically over the last decade. These programs have kept air service in some communities and have done little in others. Debate at the federal level continues regarding their effectiveness and future.

The resurgence of turboprop production is good news for smaller communities as the new-generation aircraft are capable of sustaining markets that jet aircraft cannot. In addition to increased comfort, new turboprop aircraft (i.e., Bombardier Q-400) offer 30 percent lower seat costs, which add to airlines' financial viability. Some of these aircraft are beginning to show up in service in other states but regional airlines in Texas still predominantly utilize the older, less efficient Saab 340 aircraft. This is due to the individual fleets of the airlines and their regional partners that serve the state. More recently, American Airlines implemented plans to eliminate the Saab 340 aircraft from American Eagle's fleet. American Eagle is now operating regional jet aircraft on most, if not all, flights within Texas. Jet service is preferred and perceived to be safer by customers resulting in a positive impression with potential passengers. The downside is that if the airline decides to cut costs and eliminate inefficient routes (turboprops are more efficient on shorter routes), many market pairs in Texas could be vulnerable to service reductions if not outright eliminations.

While levels of service have been reduced and service eliminated in smaller communities across the country, Texas has fared better than most. None of the state's 27 commercial airports have seen complete elimination of service. Air service to and from Victoria, Texas, remains vulnerable and is currently supported by an essential air service program grant through June 2009. This grant helps support two flights per day to Houston Intercontinental Airport. Additionally, Del Rio was recently the recipient of new air service. Under a Continental Airlines partnership arrangement, three flights per day are now provided from Del Rio International Airport to Houston Intercontinental Airport.

Texas has benefited from a stronger economy than most parts of the country during this recent economic downturn and has subsequently seen fewer impacts, including those on its air service, than many other parts of the country. Texas, however, remains vulnerable to further service reductions and eliminations. Concerns over this possibility have sparked debate over the development of additional air service models to provide air travel within the state. Some concepts have this "intra-state" airline based in Austin with hub-and-spoke operations serving smaller communities across the state. At this time, this is only conceptual. There are no plans or concrete ideas about how this service would be operated or who would be capable of providing it.

AVIATION TRAVEL DEMAND

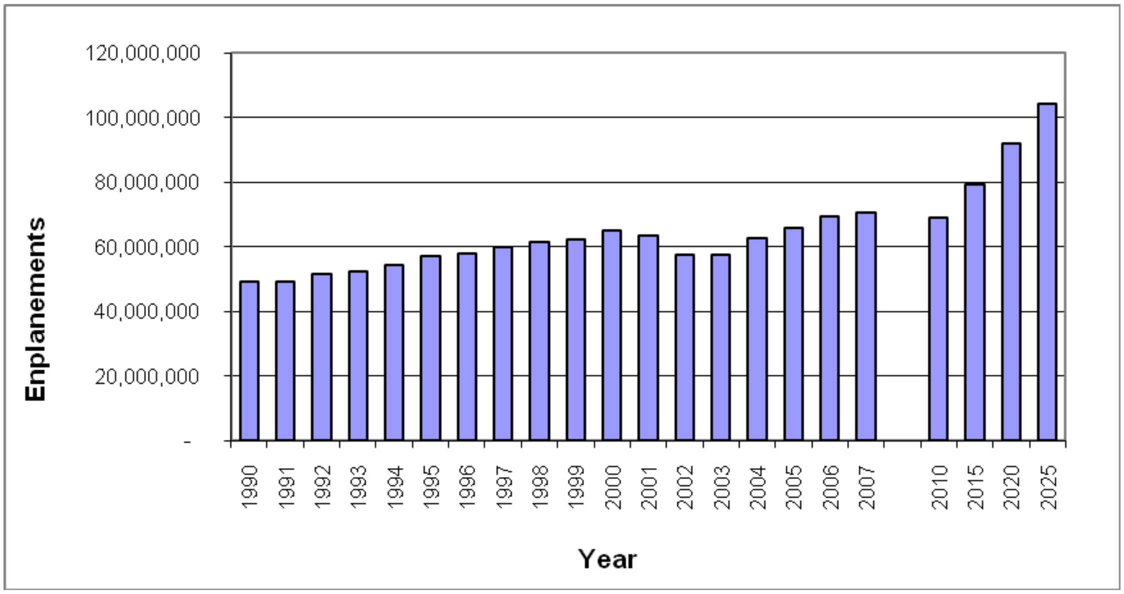
Activity at commercial service airports in Texas has been increasing since the terrorist events of September 2001. Demand in 2005 surpassed that of 2000 for the first time. This trend is expected to continue as passenger enplanements at the state's 27 commercial service airports are projected to hit 104,226,923 in 2025 (*31*). This represents a 59 percent increase over 2005 levels. The Terminal Area Forecast data represent the unconstrained demand and make no consideration of the airport's or the air traffic control system's ability to accommodate it. Table B-6 provides a summary of past and projected enplanements at each of the commercial service airports in Texas. Figure B-5 charts the total past and projected enplanements.

The FAA's Terminal Area Forecast shows that most of the increased enplanements will occur at the seven busiest airports. These airports are: Dallas/Fort Worth International (DFW), George Bush Intercontinental in Houston, Houston Hobby, Dallas Love, San Antonio International, El Paso International, and Austin-Bergstrom International Airport. According to the Air Transport Association, Dallas/Fort Worth International ranked as the fourth busiest domestic airport in passenger enplanements and George Bush Intercontinental ranked as the eighth busiest in 2008 in enplaned passengers.

Table B-6. Forecast of Domestic and International Passenger Enplanements at Texas Commercial Service Airports.

Airport	1990	1995	2000	2003	2005	2007	2010	2015	2020	2025
Abilene	74,063	67,631	55,236	46,166	75,414	90,507	88,193	92,457	96,908	101,605
Amarillo	453,233	465,713	445,463	384,829	442,327	455,539	478,841	503,545	532,154	565,292
Austin	2,137,905	2,652,309	3,585,357	3,157,961	3,600,331	4,111,614	3,895,251	4,442,702	5,068,780	5,785,128
Beaumont	113,117	112,033	92,174	43,931	55,484	35,352	37,303	41,566	46,317	51,611
Brownsville	179	78,749	67,790	60,087	73,361	91,262	95,633	105,531	116,460	128,526
College Station	79,825	85,281	92,645	67,459	84,039	89,830	89,610	97,524	106,155	115,567
Corpus Christi	455,629	507,839	444,632	358,843	413,363	418,674	409,749	446,003	487,425	534,754
Dallas Love	2,884,504	3,418,261	3,544,454	2,783,787	2,977,048	3,912,738	4,060,885	5,264,567	7,638,616	8,450,647
Dallas/Ft. Worth	24,269,536	26,947,281	28,661,863	24,601,481	27,960,344	28,400,719	27,667,672	31,350,765	35,210,964	39,408,764
Del Rio	-	941	-	-	7,638	17,386	17,743	17,743	17,743	17,743
El Paso	1,675,459	1,861,059	1,684,368	1,418,974	1,614,404	1,676,693	1,562,091	1,729,718	1,916,033	2,123,226
Fort Hood/Killeen (Robert Gray)	-	-	18,395	3,159	153,930	193,722	189,831	189,831	189,831	189,831
Harlingen	532,404	500,336	468,371	392,733	429,541	440,332	463,575	505,659	554,000	609,910
Houston Ellington Field	19,505	47,105	42,069	44,797	-	-	-	-	-	-
Houston Hobby	3,989,708	3,925,461	4,331,462	3,691,967	3,947,543	4,219,850	4,351,020	4,745,507	5,176,243	5,646,623
Houston Intercontinental	8,127,228	11,494,226	16,182,975	15,934,088	18,638,471	20,680,973	19,706,911	23,357,955	27,460,023	32,121,784
Killeen	47,331	56,979	98,012	92,106	-	-	-	-	-	-
Laredo	59,279	64,198	90,647	73,210	93,541	110,751	111,734	130,728	153,434	180,576
Longview	38,617	33,891	34,376	29,022	23,250	26,076	28,353	30,695	33,231	35,975
Lubbock	619,613	594,641	578,429	504,916	545,377	575,774	602,497	660,176	723,777	793,944
McAllen	230,168	328,835	320,008	263,431	341,910	411,610	405,660	452,820	505,588	564,650
Midland	584,255	563,308	475,752	399,334	439,507	489,845	481,181	529,601	591,247	669,728
San Angelo	54,809	52,920	44,329	42,688	63,785	69,738	65,309	67,746	70,276	72,904
San Antonio	2,681,958	3,066,256	3,535,268	3,121,545	3,521,538	3,903,642	3,846,268	4,378,823	4,988,262	5,686,477
Texarkana	41,627	43,545	40,802	25,634	33,573	35,280	40,540	45,211	50,424	56,237
Tyler	60,311	74,993	72,654	53,854	81,723	77,117	87,722	99,250	112,291	127,048
Victoria	22,609	18,686	19,321	10,775	11,115	8,829	9,191	9,917	10,703	11,555
Waco	41,372	59,974	63,462	49,915	70,942	75,456	80,935	94,294	109,913	128,177
Wichita Falls	59,664	62,078	55,965	39,608	47,126	46,297	48,641	48,641	48,641	48,641
Total	**49,353,908**	**57,184,529**	**65,146,279**	**57,696,300**	**65,746,625**	**70,665,606**	**68,922,339**	**79,438,975**	**92,015,439**	**104,226,923**

Source: FAA APO Terminal Area Forecast Summary Report – 2008 Scenario (historical data through 2007)
Note: - signifies no commercial flights that year or none forecast for future year ;*Killeen Municipal flights have shifted to Ft. Hood-Killeen (Robert Gray) airfield.



Source: FAA Aerospace Forecasts Fiscal Years 2009-2025 and Texas Transportation Institute, TASP Forecasts, 2009.

Figure B-5. Texas Airport System Plan Commercial Service Passenger Enplanements.

A simple measure of capacity on an air route does not exist in the sense of a volume-to-capacity ratio for a highway segment. However, some measures do allow for an understanding of how much travel on a corridor is possible given the specific origin-destination airport pairs and the equipment selected by the airlines that serve it. Since the individual capacity analysis for all 27 commercial service airports in Texas is beyond the scope of this study, load factor will be used as a measure of capacity. The load factor is simply the percentage of available seats that are filled on a flight. For example, if a flight has 100 seats available and 75 passengers, the load factor is 0.75 or 75 percent. The load factor can also be calculated for a particular route or corridor for a period of time longer than one flight. Load factors were calculated for all of the corridors for 1996 and 2006 as well as the average annual percent change. Tables B-7 and B-8 show the load factors for 1996 and 2008, respectively. Table B-9 shows the percent change for each corridor.

Unlike the demand itself, load factors have been increasing. The air carriers' efforts to become more efficient and draw capacity out of the system are reflected in this trend. This has resulted in fewer available seats and better utilization on each flight. A reduction of seats could be achieved by reducing the number of flights or changing the type of aircraft serving the route from a larger to a smaller aircraft. These are the types of complexities that make capacity measurement in commercial aviation difficult. Airline management makes these decisions based on the financial interests of the company and its stakeholders. Capacity on a particular route can change literally overnight. Load factors, for the most part, are a fair representation of the capacity on a particular route at any given time given existing operational constraints. As a note of caution, a high load factor could be representative of a low frequency, underserved market and a low load factor could indicative of an over served market. Either one could indicate a need for an alternative mode or propensity to divert to another mode. A high load factor could indicate a need for more service or choice, and a low load factor may indicate a service that is not going to be continued by the airlines.

Bureau of Transportation Statistics (BTS) data were used in the analysis of intrastate air travel corridors. Specifically, they are data from the T-100 section of Form 41, which includes "non-stop segment and on-flight market data (*32*)." Air carriers are required to file a Form 41 with the Bureau of Transportation Statistics on a quarterly basis. The data used are segment data and not market data. Segment data are defined as a pair of points served by a single stage of at least one flight. Market data are defined by the first departure airport on a ticket and the ultimate arrival airport. The market origin and destination airports differ from segment origin and destination airports in that there may be intermediate destinations and more than one plane may be used (*32*). There are some differences in the types of data included in each database. Using segment data, TTI researchers examined the passenger demand for the airports in the state and the corridors under study.

The trend line from 1996 to 2008 for intrastate travel is less encouraging than the statewide airport activity forecasts (intra- and inter-state activity) made by the Federal Aviation Administration in their Terminal Area Forecasts mentioned above. Tables B-6 and B-7 show these trends. These data represent a sum of the air passenger traffic from airports along the corridor. For the 18 air corridors analyzed, 16 realized decreases in flights and 12 realized decreases in passengers over the 10-year period as measured on an annual percent change basis. One of the corridors that showed an increase did not have existing passenger service in 1996. There was also a decrease in available seats as 16 corridors saw that measure of capacity fall as well. Earlier in the project analysis of the first 11 years from 1996 to 2006 showed a faster growth trend, as intercity travel dropped a bit due to the economic downturn and changes in flight capacity. (Note: In Tables B-7 to B-9, only 18 corridors are listed since two of the highway corridors are alternate routes for DFWSAT travel via I-35 and via U.S. 281, while only one air market between the two exists between the two cities.)

Table B-7. Intrastate Air Passenger Travel Demand by Corridor, 1996 .

Corridor	Travel Corridor Name	Number of Flights	Number of Passengers	Number of Seats	Load Factor
AMALBB	Amarillo to Midland (Odessa) via Lubbock	366	6,789	23,156	0.29
DFWELP1	Dallas/Fort Worth to El Paso via Abilene	27,968	1,711,258	2,779,780	0.62
DFWAMA	Dallas/Fort Worth to Amarillo via Wichita Falls	20,406	789,291	1,411,121	0.56
DFWHOU	Dallas/Fort Worth to Houston	68,265	4,328,035	6,822,809	0.63
DFWLBB	Dallas/Fort Worth to Lubbock via Abilene	21,164	869,377	1,564,051	0.56
DFWLOU	Dallas/Fort Worth to Louisiana Border	6,408	98,939	210,611	0.47
DFWSAT	Dallas/Fort Worth to San Antonio	66,155	4,779,512	7,016,205	0.68
DFWELP2	Dallas/Fort Worth to El Paso via San Angelo	19,386	1,103,547	1,759,281	0.63
DFWTXK	Dallas/Fort Worth to Texarkana	5,830	42,470	181,548	0.23
HOUAUS	Houston to Austin	15,439	1,176,925	1,942,879	0.61
HOUBMT	Houston to Beaumont	4,086	68,890	141,093	0.49
HOUBVN	Houston to Brownsville via Corpus Christi	29,713	1,424,015	2,451,097	0.58
HOUSAT	Houston to San Antonio	17,460	1,406,112	2,239,373	0.63
HOUTXK	Houston to Texarkana	-	-	-	0.00
HOUWAC	Houston to Waco via Bryan/College Station	6,295	67,618	157,106	0.43
SATBVN	San Antonio to Brownsville via Corpus Christi	1,825	131,327	210,115	0.63
SATELP	San Antonio to El Paso	3,051	285,736	405,710	0.70
SATLRD	San Antonio to Brownsville via Laredo	1,453	125,663	186,552	0.67

Source: TTI Analysis

Table B-8. Intrastate Air Passenger Travel Demand by Corridor, 2008.

Corridor	Travel Corridor Name	Number of Flights	Number of Passengers	Number of Seats	Load Factor
AMALBB	Amarillo to Midland (Odessa) via Lubbock	- -		-	0.00
DFWELP1	Dallas/Fort Worth to El Paso via Abilene	23,396	1,707,253	2,340,477	0.73
DFWAMA	Dallas/Fort Worth to Amarillo via Wichita Falls	14,243	725,422	1,125,272	0.64
DFWHOU	Dallas/Fort Worth to Houston	43,007	3,021,462	4,295,927	0.70
DFWLBB	Dallas/Fort Worth to Lubbock via Abilene	16,866	885,075	1,298,376	0.68
DFWLOU	Dallas/Fort Worth to Louisiana Border	5,180	127,587	189,298	0.67
DFWSAT	Dallas/Fort Worth to San Antonio	52,473	4,476,962	6,031,329	0.74
DFWELP2	Dallas/Fort Worth to El Paso via San Angelo	13,074	1,121,020	1,507,875	0.74
DFWTXK	Dallas/Fort Worth to Texarkana	- -		-	0.00
HOUAUS H	ouston to Austin	12,032	1,128,924	1,652,443	0.68
HOUBMT	Houston to Beaumont	3,378	55,688	116,419	0.48
HOUBVN	Houston to Brownsville via Corpus Christi	16,616	972,437	1,555,586	0.63
HOUSAT	Houston to San Antonio	12,671	1,174,425	1,737,314	0.68
HOUTXK	Houston to Texarkana	- -		-	0.00
HOUWAC	Houston to Waco via Bryan/College Station	7,617	130,893	260,464	0.50
SATBVN	San Antonio to Brownsville via Corpus Christi	1,331	107,729	175,228	0.61
SATELP	San Antonio to El Paso	2,679	234,590	365,853	0.64
SATLRD	San Antonio to Brownsville via Laredo	1,331	107,729	175,228	0.61

Source: TTI Analysis

Table B-9. Annual Percent Change in Intrastate Air Passenger Travel Demand by Corridor, 1996–2008.

Corridor	Travel Corridor Name	Number of Flights	Number of Passengers	Number of Seats	Load Factor
AMALBB	Amarillo to Midland (Odessa) via Lubbock	-7.69	-7.69	-7.69	-7.69
DFWELP1	Dallas/Fort Worth to El Paso via Abilene	-1.26	-0.02	-1.22	1.42
DFWAMA	Dallas/Fort Worth to Amarillo via Wichita Falls	-2.32	-0.62	-1.56	1.17
DFWHOU	Dallas/Fort Worth to Houston	-2.85	-2.32	-2.85	0.84
DFWLBB	Dallas/Fort Worth to Lubbock via Abilene	-1.56	0.14	-1.31	1.74
DFWLOU	Dallas/Fort Worth to Louisiana Border	-1.47	2.23	-0.78	3.34
DFWSAT	Dallas/Fort Worth to San Antonio	-1.59	-0.49	-1.08	0.69
DFWELP2	Dallas/Fort Worth to El Paso via San Angelo	-2.50	0.12	-1.10	1.42
DFWTXK	Dallas/Fort Worth to Texarkana	-7.69	-7.69	-7.69	-7.69
HOUAUS H	ouston to Austin	-1.70	-0.31	-1.15	0.98
HOUBMT	Houston to Beaumont	-1.33	-1.47	-1.35	-0.16
HOUBVN	Houston to Brownsville via Corpus Christi	-3.39	-2.44	-2.81	0.58
HOUSAT	Houston to San Antonio	-2.11	-1.27	-1.72	0.59
HOUTXK	Houston to Texarkana	0.00	0.00	0.00	0.00
HOUWAC	Houston to Waco via Bryan/College Station	1.62	7.20	5.06	1.29
SATBVN	San Antonio to Brownsville via Corpus Christi	-2.08	-1.38	-1.28	-0.13
SATELP	San Antonio to El Paso	-0.94	-1.38	-0.76	-0.69
SATLRD	San Antonio to Brownsville via Laredo	-0.65	-1.10	-0.47	-0.67

Source: TTI Analysis

Table B-10. Supplemental Information (% Change 06-08 Data, 3 Years).

Corridor	Travel Corridor Name	Number of Flights	Number of Passengers	Number of Seats	Load Factor
AMALBB	Amarillo to Midland (Odessa) via Lubbock	0.00	0.00	0.00	0.00
DFWELP1	Dallas-Fort Worth to El Paso via Abilene	-1.58	3.72	-0.08	3.81
DFWAMA	Dallas-Fort Worth to Amarillo via Wichita Falls	-4.53	2.03	0.17	1.85
DFWHOU	Dallas-Fort Worth to Houston	-3.13	-1.74	-1.45	-0.30
DFWLBB	Dallas-Fort Worth to Lubbock via Abilene	-1.17	1.34	1.24	0.09
DFWLOU	Dallas-Fort Worth to Louisiana Border	-2.14	0.32	0.72	-0.39
DFWSAT	Dallas-Fort Worth to San Antonio	-2.45	1.14	1.18	-0.03
DFWELP2	Dallas-Fort Worth to El Paso via San Angelo	-0.56	4.48	1.39	2.97
DFWTXK	Dallas-Fort Worth to Texarkana	-33.33	-33.33	-33.33	-33.33
HOUAUS H	ouston to Austin	-2.53	-2.36	-1.78	-0.61
HOUBMT	Houston to Beaumont	-0.06	-9.64	-2.61	-7.62
HOUBVN	Houston to Brownsville via Corpus Christi	-12.58	-10.39	-8.06	-3.07
HOUSAT	Houston to San Antonio	-3.03	-3.68	-3.40	-0.32
HOUTXK	Houston to Texarkana	-33.33	-33.33	-33.33	-33.33
HOUWAC	Houston to Waco via Bryan/College Station	1.33	-3.56	0.14	-3.69
SATBVN	San Antonio to Brownsville via Corpus Christi	-1.57	-2.69	-1.07	-1.68
SATELP	San Antonio to El Paso	0.56	-2.04	0.63	-2.62
SATLRD	San Antonio to Brownsville via Laredo	-1.57	-2.69	-1.07	-1.68

Additionally, the research team compiled air passenger demand data for city-pairs in Texas using the 10 percent ticket sample database available from the BTS. This provides a reasonable measure of intercity travel in Texas via scheduled airline service. While total passenger traffic increased at Texas' airports according to the FAA's Terminal Area Forecast, 21 of the 27 airports in Texas saw decreases in intrastate traffic. The forecasted demand by airport and the growth rates used by the FAA are available through the year 2025. This trend may indicate that more people are driving for intrastate intercity trips and flying for longer interstate trips. Increased shorter distance intrastate trips are also trips that can be more readily served by mass transit options such as rail and express bus.

AIRPORT CAPACITY ISSUES

An airport's capacity can be measured in different ways and can be affected by a variety of factors. Capacity constraints can be related to the airfield or airside of the airport as well as the terminal or landside of the airport. These factors include:

- the number and layout of runways;
- the number and layout of taxiways;
- the airspace restrictions surrounding the airport;
- any separation requirements imposed by air traffic control;
- the existing weather conditions (wind, ceiling, visibility);
- the fleet mix of aircraft using the facility;
- any noise or environmental mitigation practices; and
- the ability of passenger terminal (number of gates) to service passengers/planes for processing, security screening, and baggage claim.

The Federal Aviation Administration recently made an effort to assess future capacity needs through a study entitled *Capacity Needs in the National Airspace System, 2007-2025*. This analysis, referred to as "FACT2" since it is the second Future Airport Capacity Task report, highlighted the airports and the metropolitan areas determined to have the greatest need for additional capacity. The study examined capacity needs for U.S. airports in the years 2007, 2015, and 2025. No Texas airports showed a capacity improvement need for 2007. Three airports, San Antonio International, Houston-Bush Intercontinental, and Houston Hobby airport showed a need for additional capacity if planned improvements do not occur. The same was true for the 2025 timeframe. Also, the Houston Metropolitan area was determined to be in need of capacity in 2025 if planned improvements were not made. These capacity needs reflect both airport and airspace capacity needs. Figure B-6 shows the 27 airports and 15 metropolitan areas in need of capacity enhancements in 2025 if none of the planned improvements are made.

It is worth revisiting the previously mentioned notion of unconstrained forecasts as given in the FACT2 report. While every airport will ultimately reach the limits of how many passengers it can serve, it is expected that over time additional airports will begin to serve some passengers previously served by existing system airports. Some smaller community airports may begin service to other airports, both in and out of state. This, in turn, will free up capacity at a larger airport. For example, passengers connecting to Las Vegas or Washington, D.C. through Houston or Dallas may see direct service from their own local airport once the market grows enough. This may reduce the need for flights to those destinations from the larger cities and may, in fact, draw passengers from the larger airport to the smaller one. This will free up space at the larger hubs for service elsewhere including internationally.

Figure B-6. Airports and Metropolitan Areas Needing Capacity in 2025 if Planned Improvements Do Not Occur (*33*).

In essence, airports within a leakage area could be seen as absorbing overflow demand and/or becoming a new hub for some destinations. Leakage in this case refers to the loss of passengers to other airports in the surrounding area as some passengers, for a variety of reasons—not limited only to cost or scheduling—are willing to drive to other airports in lieu of utilizing the airport closest to them. While this type of scenario is likely years away, it must be considered when evaluating future intercity travel demand. This logic is similar to the development of secondary airport systems that is going on in many communities across the country. At some point, the existing airport system will not be able to accommodate demand without adding significant capacity whether at the existing airport or at an entirely different or new one. Land use planning would point to an existing airport being utilized or expanded or constructing a new one, which would need to be constructed far away from the urban center of the metropolitan area it serves.

THE INTERDEPENDENCIES BETWEEN INTERCITY TRANSPORTATION AND AIRPORTS

The development of a comprehensive intercity transportation system, in the larger picture, includes airports and the air service they provide despite the fact that intercity service within the state conjures up bus and rail transportation. But more importantly, airports should be considered as part of the system not only for the intercity service it provides but also for the connectivity to the other modes that complement a comprehensive intercity passenger network. Such transit connections provide access to other cities not served by air as well as round out service to other parts of the cities that are served by air. Additionally, it is conceived that at some point, rail or bus connections can provide communities with access to airports outside of their urban area with the purpose of gaining access to market pairs not currently served by the local airport. This could, in essence, free up capacity at a larger airport for more international or long-range service while funneling shorter-range service to underutilized airports via intercity rail service.

Such an arrangement would make better use of airports with the additional infrastructure while increasing utilization at other airports. Larger international airports would serve more international markets with larger aircraft moving more people. Shorter markets would be served by smaller planes at the smaller airports where passengers could use rail systems that would provide timely and cost-effective service. Linking such airports by rail would even add to the seamless nature of the experience as if the passenger were only using one airport.

Currently, only the Dallas/Fort Worth International Airport is served by rail (indirectly). Both the Trinity Rail Express (TRE) and DART provide access to the airport. Passengers flying into the airport can access the city centers of Dallas and Fort Worth as well as stops along the rail routes. The link from the airport to the rail station is provided by bus (DART) or shuttle bus (TRE). DART has plans to open a DFW Airport Station in December 2013 and a Love Field station in December 2010 (*34*). Current maps of Houston Metro's rail system do not currently show any plans for rail stations at either of the airports that serve the city. Metro does offer shuttle service to Houston Intercontinental from Downtown Houston through its Airport Direct service (*35*). This downtown location provides easy access to Metro's rail line. Currently, according to Houston Metro's Phase 2 Implementation Plan (Program Scope To 2012) there are no planned stations at either of Houston's commercial service airports (*35*).

In estimating projected benefits of an improved or enhanced intercity passenger travel network in Texas, one should consider the benefits related to the potential reduction in short distance flights—those that are most likely to be replaced with rail service. With an increase in airlines' use of smaller regional jets and the large percentage of regional airline operations at Texas' airports such a benefit can be real. This could potentially include a reduction in airport congestion by allowing landing slots to go to larger aircraft operating on longer, international flights. This would essentially provide for the ability to accommodate more passengers, utilizing larger aircraft that typically operate on longer routes, without adding additional infrastructure. While bus service is not realistically perceived as an alternative to air travel, even on shorter routes, rail service conversely may prove acceptable. While congestion is not currently an issue at Texas' commercial service airports, a growing population and limited room for expansion at current facilities may force the more efficient use of smaller regional commercial airports for some domestic flights.

The routes that are potential candidates for such an alternative service are expected to be those less than 300 miles. It is no coincidence that the intrastate routes cut in the last two years in Texas have centered on this distance as it has proven economically challenging for airlines to serve markets in this range. These were noted earlier in Table B-5.

The research team examined the number of flights in this 300-mile range in the state's largest cities. This was done for both 2007 and 2008 for airports in Austin, Dallas, Houston, and San Antonio. Tables B-11 and B-12 show the number of domestic flights for each of the airports in those cities that are less than and more than 300 miles for 2007 and 2008, respectively. The data reveal a high percentage of flights at these airports serving markets less than 300 miles away. The percentages are particularly high for Dallas Love Field, which is undoubtedly a result of current Wright Amendment restrictions that require its flights to, for the most part, serve only Texas and its neighboring states. Aside from Love Field, Austin-Bergstrom International, Houston Hobby, and San Antonio International all have more than a third of their flights serving markets less than 300 miles away. These airports, all within the "Texas Triangle" area, cumulatively have approximately 27 percent of their domestic flights serving markets that could potentially be served by alternative modes of intercity transportation, most notably rail.

Table B-11. Number of Domestic Flights Less than 300 Miles in Distance, 2007.

Airport	Number of Flights Greater than 300 Miles	Number of Flights Less than 300 Miles	Total Number of Flights	Percent Less than 300 Miles
Austin-Bergstrom International	36,317	20,950	57,267	36.58
Dallas Love Field	19,773	35,338	55,111	64.12
Dallas Fort Worth International	251,976	61,937	313,913	19.73
Houston Hobby	35,818	22,784	58,602	38.88
Bush Intercontinental	193,758	51,563	245,321	21.02
San Antonio International	31,762	19,720	51,482	38.30

Source: TTI analysis using BTS data.

Table B-12. Number of Domestic Flights Less than 300 Miles in Distance, 2008.

Airport	Number of Flights Greater than 300 Miles	Number of Flights Less than 300 Miles	Total Number of Flights	Percent Less than 300 Miles
Austin-Bergstrom International	35,863	19,722	55,585	35.48
Dallas Love Field	21,184	33,058	54,242	60.95
Dallas Fort Worth International	241,514	58,784	300,298	19.58
Houston Hobby	35,805	21,989	57,794	38.05
Bush Intercontinental	185,463	49,463	234,926	21.05
San Antonio International	32,212	18,999	51,211	37.10

Source: TTI analysis using BTS data.

CONCLUDING COMMENTS CONCERNING INTERCITY AIR SERVICE

Predicting the demand and capacity in air travel has been challenging. Industry turmoil caused by a variety of factors—not the least of which is high fuel prices—has made this difficult to do more than a few years into the future. Air travel is a vital component of our intercity transportation system and our economy and it always will be. A certain level of demand will always be present despite modal alternatives offered by public or private entities, and the airlines and airports will adjust their capacity based on their own financial and operational constraints in order to accommodate demand as best they can. It is much easier for airlines to add or reduce flights at a given airport on short notice—much quicker than highway miles can be built—as long as the airport and its surrounding airspace has the physical capacity to handle additional flights. The airlines can add flights using similar or larger aircraft or they can reduce the number of existing flights and utilize larger or smaller aircraft, whichever suits their business model at the time. They can also alter the city-pairs they serve and add flights to new destinations or eliminate flights to others. Overall, capacity enhancements or reductions can be made fairly quickly in air travel with little or short notice. Pricing of the flights can also be managed much more actively to meet a planned return in the number of passengers projected.

The ability to predict these factors is very difficult as characterized in recent news reports. Within the span of one recent week, airlines were reporting that 41 million fewer passengers flew domestically in the last 12 months and that American Eagle was increasing capacity, but not necessarily frequency, on its College Station, Texas, to Dallas, Texas, route (37, *38*). The frequency could actually be reduced as the switch involves the use of a larger aircraft. This action is counter to current trends of increasing capacity in smaller markets.

Future physical capacity enhancements at commercial service airports across the county and technological advancements in air traffic management associated with the Next Generation Air Transportation System (NextGen) are planned by the FAA and underway in an effort to accommodate the projected demand. The Joint Planning and Development Office is the governmental agency charged with managing this process. They describe NextGen in the following manner:

> NextGen is a leveraging of technologies that already exist. The vision for NextGen is a system that is based on satellite navigation and control, digital non-voice communication and advanced networking. It is a shifting of decision making from the ground to the cockpit. Flight crews will have increased control over their flight trajectories and ground controllers will become traffic flow managers (*39*).

This program is critical to the future of air transportation given the highly constrained environment in which airports operate regarding safety, financing, and environmental compliance. How officials respond to capacity needs in air transportation could affect our intercity travel behavior with respect to other modes.

APPENDIX C. FREIGHT RAIL CAPACITY IN TEXAS

This appendix describes the TTI research team's findings regarding freight rail capacity in the state, with a focus on the rail lines along the identified intercity study corridors. The information contained in this appendix was collected and analyzed as part of Task 2 of the research project.

Texas currently has 44 freight railroads operating on over 10,000 miles of track (*40*). Texas' position along the U.S.-Mexico border, on the Gulf Coast, and along both north-south and east-west intercontinental trade routes make it a major contributor to national freight rail operations. Several recent reports focus on the existing and forecast freight rail capacity conditions throughout the U.S. This section describes these conditions and discusses the freight rail lines in Texas that are generally associated with the potential rail and/or express bus transit corridors within the state. It is important to examine the freight rail capacity situation given that most of the current U.S. intercity passenger rail, all of the current Texas passenger rail routes, and most federal rail planning for future passenger rail routes are located along existing freight rail corridors.

NATIONAL CONDITION OF RAIL CAPACITY

Rail corridor capacity is affected by a large number of factors, both localized and system wide. Some of these drivers include:

- volume levels,
- train density,
- train mix (i.e., intermodal, merchandise, passenger, etc.),
- physical plant elements, such as:
  - single versus double track,
  - siding lengths,
  - distance between sidings,
  - signal type and spacing,
  - yard capacity,
- productivity, and
- people.

The dominant factors utilized to estimate capacity in the *National Rail Freight Infrastructure Capacity and Investment Study* are number of tracks, type of signal system, and the mix of train types (*41*).

Future capacity on the freight rail network is a major concern, especially considering the expected growth in freight volumes. One report projects an increase of 69 percent by tonnage and 84 percent by ton-miles between 2005 and 2035 (*42*). The rail industry has mostly been able to keep pace with the increase in freight demand over the past couple of decades despite large reductions in rail network route miles over the past half century. The total amount of freight rail miles is about half the size of the system that existed in the early 1900s. This is a result of trimming unprofitable low-volume lines primarily through rail line abandonment and spinning off lines to short line railroad operators. This downsizing of the network in combination with the growth in demand creates the rail capacity concern. Recent testimony before the National Surface Transportation Policy and Revenue Study Commission (NSTPRSC) has succinctly stated this problem as "increasing demand has caught up with the downsized rail system, resulting in rail congestion and deteriorating service levels in many rail corridors and at interchange locations" (*42*).

The Class I railroad companies over the past five years have spent an average of $8.02 billion per year on capacity (*43*). The *National Rail Freight Infrastructure Capacity and Investment Study* estimates about $148 billion must be invested between 2005 and 2035 on infrastructure expansion to adequately handle future demand. It also states that annually there would be an amount not covered by the marketplace of $1.4 billion (*44*).

The investment study, submitted to the NSTPRSC, investigates current rail line capacity of over 50,000 miles of primary Class I trackage in the U.S. rail system, along with the expected condition of the network in 2035. In order for the charts in the study to be more readily understood, and in-line with highway transportation planning nomenclature, the consultant that completed the study developed an A through F classification system for rail that is similar to the one used by highway planners to describe the Level of Service (LOS) for highway congestion. LOS A, B, or C means that the rail is generally free of congestion and below its theoretical capacity with existing infrastructure. LOS D means that the line is operating near its theoretical capacity. LOS E is at theoretical capacity due to physical and operational limitations while LOS

F means that the line is moving rail traffic over its theoretical limitation and traffic flow is continually breaking down as a result.

The study calculated that (*44*):

- Currently:
  - 88 percent of the primary freight rail corridors operate below their theoretical capacity, meaning there is sufficient capacity to accommodate periodic maintenance activities and to recover from incidents that interfere with routine operations;
  - 9 percent operates near its theoretical capacity;
  - 3 percent operates at its theoretical capacity limit, meaning there is limited ability to accommodate maintenance needs or accommodate incidents; and
  - Less than 1 percent above its theoretical capacity limit.
- Under growth projections, without additional capacity by 2035:
  - 45 percent of the primary freight rail corridors will operate below their theoretical capacity;
  - 10 percent will operate near its theoretical capacity limit;
  - 15 percent will operate at its theoretical capacity limit; and
  - 30 percent will operate above its theoretical capacity limit.

These results are mapped in Figure C-1, which reflects the current situation, and Figure C-2 shows future conditions without improvements.

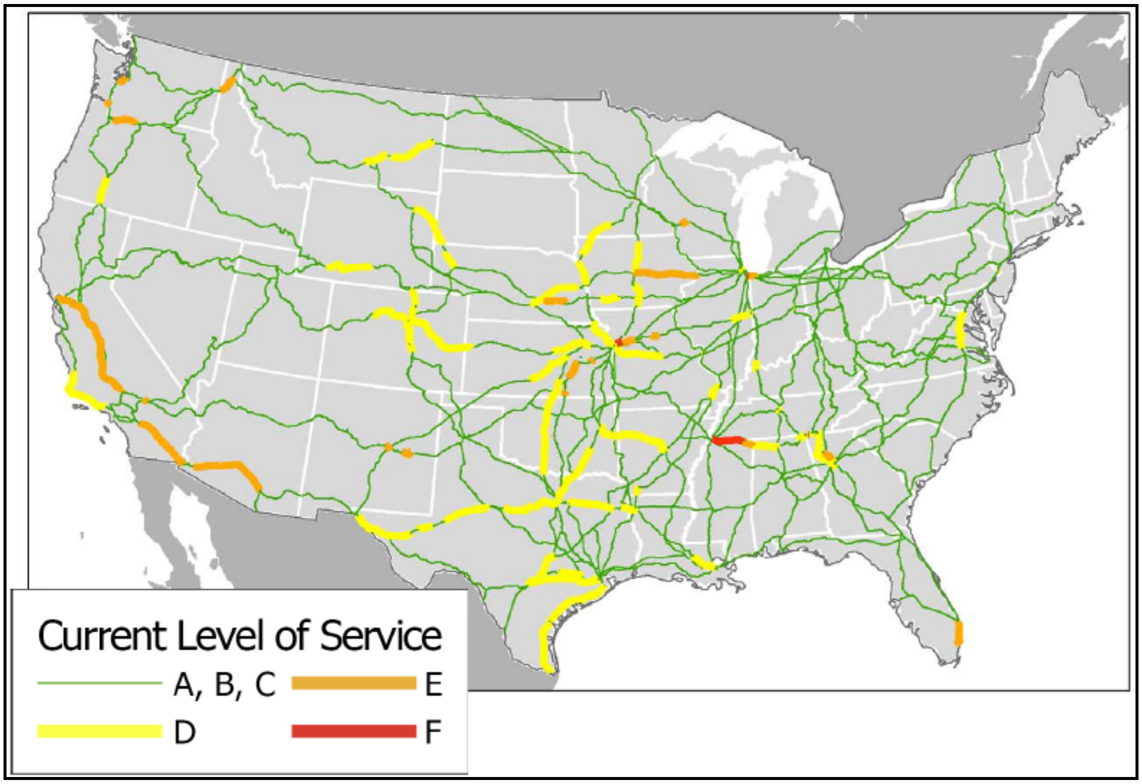


Figure C-1. Current Volumes Compared to Current Capacity.

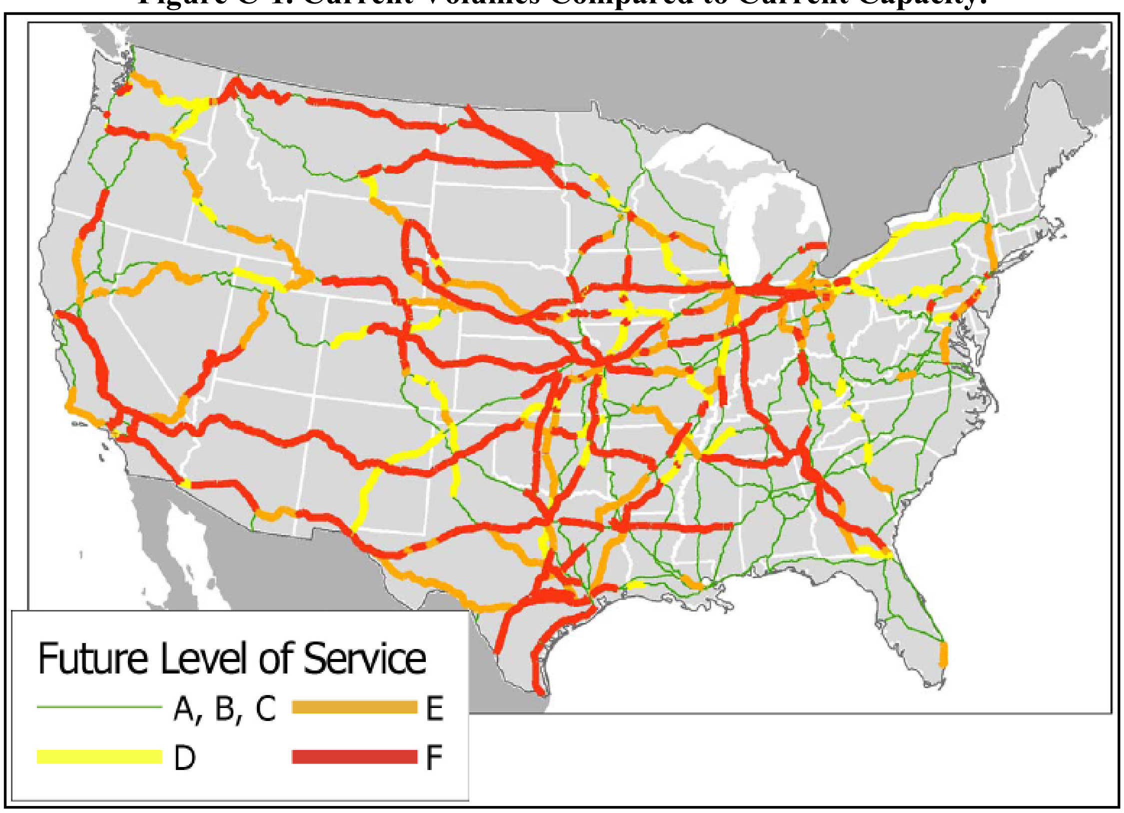


Figure C-2. Future Volumes Compared to Current Capacity in 2035 without Improvements.

TEXAS FREIGHT RAIL CORRIDOR EVALUATION

Utilizing the National Rail Freight Infrastructure Capacity and Investment Study along with several additional sources, the Texas freight rail line network and capacity was analyzed for the proposed rail and express bus transit corridors and presented in the following section. The defined corridors for this project follow primary highway routes between the coordinating origins and destinations. In Texas, most of these routes also closely parallel an existing rail line. In some instances, more than one rail line travels between origin and destination pairs, especially where more than one railroad company serves both locations. In the following tables, each rail line that generally follows the designated corridor is evaluated where possible.

Table C-1 provides general descriptions of the rail lines and segments associated with each study corridor. Several of the corridors contain multiple rail lines generally traversing the entire corridor. For example, the Dallas to Houston corridor describes four possible rail routes that traverse the corridor. Table C-2 presents the current and future levels-of-service as indicated by the National Rail Freight Infrastructure Capacity and Investment Study for lines within Texas. This information is taken from the above figures, which indicate that the current rail conditions in Texas are near or below capacity. Looking at the study corridors, the Dallas to El Paso corridor through Abilene and the Houston to San Antonio corridor are the only corridors with current rail conditions nearing capacity. As demonstrated in Figure C-2, the situation worsens for the Texas rail network by 2035 without making needed improvements to handle anticipated freight volume growth. This is indicated in Table C-2, where the majority of the rail line segments in 2035 reflect levels-of-service nearing or exceeding capacity. With the proposed improvements in the study, the freight rail capacity results in widespread operations below capacity.

Table C-3 presents the current and future train volumes per rail line segment according to the National Rail Freight Infrastructure Capacity and Investment Study along with the estimated rail line density, noted from the 2007 National Transportation Atlas Database (NTAD). Several rail line segments have current daily train activities approaching 100 trains per day, with many of these projected to see between 100 and 200 daily trains in 2035. Most of the rail line segments in the study network are expected to experience between 50 and 100 trains per day by 2035.

Table C-1. Freight Rail Lines Associated with Study Corridors – General Segment Description.

Corridor	Corridor Name	General Description of Rail Lines	Segment Detail	Segment RR
AMALBB	Amarillo to Midland through Lubbock	Parallels I-27	Amarillo to Lubbock	BNSF
		Parallels U.S.-84	Lubbock to Sweetwater	BNSF
		Parallels I-20	Sweetwater to Midland	UP
DFWABI	DFW to El Paso through Abilene Parallels	I-20	DFW to Sweetwater	UP
		Parallels I-20 & I-10	Sweetwater to Sierra Blanca	UP
		Parallels I-20 & I-10	Sierra Blanca to El Paso	UP
DFWAMA	DFW to Amarillo		DFW to Wichita Falls	BNSF
		Parallels US-287	Wichita Falls to Amarillo	BNSF
DFWHOU	DFW to Houston, Option 1	Parallels I-35	DFW to Waco	UP
		Parallels Hwy 6	Waco to Navasota	UP
		Parallels U.S.-290	Navasota to Houston	UP
	DFW to Houston, Option 2	Parallels U.S.-287 until Corsicana	DFW to Waco	UP
			Waco to Hearne	UP
		Parallels Hwy 6	Hearne to Navasota	UP
		Parallels U.S.-290	Navasota to Houston	UP
	DFW to Houston, Option 3	Parallels I-35	DFW to Temple	BNSF
			Temple to Sealy	BNSF
			Sealy to Houston	BNSF
	DFW to Houston, Option 4	Parallels US-287	DFW to Corsicana	BNSF
		Parallels I-45	Corsicana to Houston	BNSF
DFWLBB	DFW to Lubbock through Abilene	Parallels I-20	DFW to Abilene	UP
		Parallels I-20	Abilene to Sweetwater	UP
		Parallels US-84	Sweetwater to Lubbock	BNSF
DFWLOU	DFW to Louisiana (I20), Option 1	Parallels I-20	DFW to Shreveport	UP
	DFW to Louisiana (I20), Option 2	Parallels I-20	DFW to Shreveport	KCS
DFWSAT	DFW to San Antonio (I35), Option 1	Parallels I-35	DFW to Waco	UP
		Parallels I-35	Waco to Austin	UP
		Parallels I-35	Austin to San Antonio	UP
	DFW to San Antonio (I35), Option 2	Parallels I-35	DFW to Temple	BNSF
		Parallels I-35	Temple to Austin	UP
		Parallels I-35	Austin to San Antonio	UP
DFWSATb	DFW to San Antonio (US281)	Same as DFWSAT		

Table C-1 (Continued). Freight Rail Lines Associated with Study Corridors – General Segment Description.

Corridor	Corridor Name	General Description of Rail Lines	Segment Detail	Segment RR
DFWSNA	DFW to El Paso through San Angelo	Parallels US-377	DFW to San Angelo	FWWR
		Parallels US-377 & US-67	San Angelo to Alpine	TXPF
		Parallels US-90	Alpine to Sierra Blanca	UP
		Parallels I-10	Sierra Blanca to El Paso	UP
DFWTXK	DFW to Texarkana (I30)	Parallels I-30	DFW to Sulphur Springs	KCS, DGNO, BLR
		Parallels I-30	Sulphur Springs to Winfield	BLR
		Parallels US-67	Winfield to Texarkana	UP
HOUAUS	Houston to Austin	Parallels US-290	Houston to Sealy	BNSF
			Sealy to Taylor	UP
			Taylor to Austin	UP
HOUBMT	Houston to Beaumont	Parallels I-10; Two distinct UP rail lines connect cities	Houston to Beaumont	UP
HOUBVN	Houston to Brownsville	Houston South to coast	Houston to Algoa	UP
		Southwest along coast	Algoa to Lolita	UP
		Alternate Houston along coast (Parallels US-59)	Rosenberg to Victoria	KCS
		Parallels US-77	Lolita to Brownsville	UP
HOUSAT	Houston to San Antonio, Option 1	Parallels US-59	Houston to Rosenberg	UP
			Rosenberg to Seguin	UP
		Parallels I-10	Seguin to San Antonio	UP
	Houston to San Antonio, Option 2	Parallels US-59	Houston to Rosenberg	UP
			Rosenberg to San Marcos	UP
		Parallels I-35	San Marcos to San Antonio	UP
HOUTXK	Houston to Texarkana, Option 1	Parallels I-45, Turns NE at Palestine to Longview	Houston to Longview	UP
		Parallels I-20	Longview to Marshall	UP
		Parallels US-59	Marshall to Texarkana	UP
	Houston to Texarkana, Option 2	Parallels I-45, Turns NE at Palestine to Longview	Houston to Longview	UP
		Parallels I-20	Longview to Big Sandy	UP
		Big Sandy N to Mt. Pleasant, Parallels I-30 from Mt. Pleasant	Big Sandy to Texarkana	UP
	Houston to Texarkana, Option 3	Parallels US-59 to Tenaha, through Shreveport	Houston to Lewisville	UP
		Parallels US-82	Lewisville to Texarkana	UP
HOUWAC	Houston to Waco through Bryan	Parallels US-290, Turns N just E of Brenham	Houston to Navasota	UP
		Parallels Hwy 6	Navasota to Waco	UP

Table C-1 (Continued). Freight Rail Lines Associated with Study Corridors – General Segment Description.

Corridor	Corridor Name	General Description of Rail Lines	Segment Detail	Segment RR
SATBCN	San Antonio to Brownsville through Corpus Parallels	I-37	San Antonio to Corpus Christi UP	
		Parallels US-77	Corpus Christi to Brownsville UP	
SATELP	San Antonio to El Paso	Parallels US-90	San Antonio to Sierra Blanca	UP
		Parallels I-10	Sierra Blanca to El Paso	UP
SATLRD	San Antonio to Brownsville through Laredo Parallels	I-35	San Antonio to Laredo	UP
			Laredo to Brownsville	

Table C-2. Freight Rail Lines Associated with Study Corridors – Current and Future Levels-of-Service.

Corridor	Segment Detail	Segment RR	Current LOS	Future LOS - Unimproved	Future LOS - Improved
AMALBB	Amarillo to Lubbock	BNSF	A, B, C	D	A, B, C
Lubbock	to Sweetwater	BNSF	A, B, C	A, B, C	A, B, C
S	weetwater to Midland	UP	D	F	A, B, C
DFWABI	DFW to Sweetwater	UP	D	F	A, B, C
	Sweetwater to Sierra Blanca	UP	D	F	A, B, C
	Sierra Blanca to El Paso	UP	D	F	A, B, C
DFWAMA	DFW to Wichita Falls	BNSF	A, B, C	F	A, B, C
	Wichita Falls to Amarillo	BNSF	A, B, C	A, B, C	A, B, C
DFWHOU	DFW to Waco	UP	A, B, C	D	A, B, C
	Waco to Navasota	UP	A, B, C	F	A, B, C
Navasota	to Houston	UP	A, B, C	A, B, C	A, B, C
	DFW to Waco	UP	A, B, C	E	A, B, C
	Waco to Hearne	UP	A, B, C	A, B, C	A, B, C
	Hearne to Navasota	UP	A, B, C	F	A, B, C
	Navasota to Houston	UP	A, B, C	A, B, C	A, B, C
	DFW to Temple	BNSF	A, B, C	D	A, B, C
	Temple to Sealy	BNSF	A, B, C	F	A, B, C
	Sealy to Houston	BNSF	D	F	A, B, C
	DFW to Corsicana	BNSF			
	Corsicana to Houston	BNSF			
DFWLBB	DFW to Abilene	UP	D	F	A, B, C
	Abilene to Sweetwater	UP	A, B, C	F	A, B, C
	Sweetwater to Lubbock	BNSF	A, B, C	A, B, C	A, B, C
DFWLOU	DFW to Shreveport	UP	D	F	A, B, C
	DFW to Shreveport	KCS			
DFWSAT	DFW to Waco	UP	A, B, C	E	A, B, C
	Waco to Austin	UP	A, B, C	F	A, B, C
	Austin to San Antonio	UP	D	F	A, B, C
	DFW to Temple	BNSF	A, B, C	D	A, B, C
Tem	ple to Austin	UP	A, B, C	F	A, B, C
	Austin to San Antonio	UP	D	F	A, B, C
DFWSATb	Same as DFWSAT				

Table C-2 (Continued). Freight Rail Lines Associated with Study Corridors – Current and Future Levels-of-Service.

Corridor	Segment Detail	Segment RR	Current LOS	Future LOS - Unimproved	Future LOS - Improved
DFWSNA	DFW to San Angelo	FWWR			
	San Angelo to Alpine	TXPF			
	Alpine to Sierra Blanca	UP	A, B, C	E	A, B, C
	Sierra Blanca to El Paso	UP	D	F	A, B, C
DFWTXK	DFW to Sulphur Springs	KCS, DGNO, BLR			
	Sulphur Springs to Winfield	BLR			
	Winfield to Texarkana	UP	A, B, C	E	A, B, C
HOUAUS	Houston to Sealy	BNSF	D	F	A, B, C
	Sealy to Taylor	UP	A, B, C	E	A, B, C
	Taylor to Austin	UP	A, B, C	F	A, B, C
HOUBMT	Houston to Beaumont	UP	A, B, C	F	A, B, C
HOUBVN	Houston to Algoa	UP	A, B, C	A, B, C	A, B, C
	Algoa to Lolita	UP	D	F	A, B, C
	Rosenberg to Victoria	KCS			
	Lolita to Brownsville	UP	D	F	A, B, C
HOUSAT	Houston to Rosenberg	UP	D	F	A, B, C
	Rosenberg to Seguin	UP	D	F	A, B, C
	Seguin to San Antonio	UP	D	F	A, B, C
	Houston to Rosenberg	UP	D	F	A, B, C
	Rosenberg to San Marcos	UP	D	F	A, B, C
	San Marcos to San Antonio	UP	D	F	A, B, C
HOUTXK	Houston to Longview	UP	A, B, C	A, B, C	A, B, C
Longview	to Marshall	UP	A, B, C	A, B, C	A, B, C
	Marshall to Texarkana	UP	A, B, C	A, B, C	A, B, C
	Houston to Longview	UP	A, B, C	A, B, C	A, B, C
	Longview to Big Sandy	UP	D	F	A, B, C
	Big Sandy to Texarkana	UP	A, B, C	E	A, B, C
	Houston to Lewisville	UP	A, B, C	E	A, B, C
	Lewisville to Texarkana	UP	A, B, C	A	A, B, C
HOUWAC	Houston to Navasota	UP	A, B, C	A, B, C	A, B, C
Navasota	to Waco	UP	A, B, C	F	A, B, C
SATBCN	San Antonio to Corpus Christi	UP			
	Corpus Christi to Brownsville	UP	D	F	A, B, C

Table C-2 (Continued). Freight Rail Lines Associated with Study Corridors – Current and Future Levels-of-Service.

Corridor	Segment Detail	Segment RR	Current LOS	Future LOS - Unimproved	Future LOS - Improved
SATELP	San Antonio to Sierra Blanca	UP	A, B, C	E	A, B, C
	Sierra Blanca to El Paso	UP	D	F	A, B, C
SATLRD	San Antonio to Laredo	UP	A, B, C	F	A, B, C
	Laredo to Brownsville				
Data Source:	*National Rail Freight Infrastructure Capacity and Investment Study*				

Table C-3. Freight Rail Lines Associated with Study Corridors – Segment Density and Volumes.

Corridor	Segment Detail	Segment RR	Segment Density (MGTM/Mi)	Current Volume (trains per day)	Future Volume (trains per day)	Growth (trains per day)	Percent Growth
AMALBB	Amarillo to Lubbock	BNSF	10-19.9	0-15	25-50	0-30	50-100
Lubbock	to Sweetwater	BNSF	20-39.9	0-15	50-100	0-30	50-100
Sweetwater	to Midland	UP	20-39.9	25-50	100-200	30-80	100-2500
DFWABI	DFW to Sweetwater	UP	20-39.9	15-25	100-200	0-30	100-2500
	Sweetwater to Sierra Blanca	UP	20-39.9	25-50	100-200	30-80	100-2500
	Sierra Blanca to El Paso UP		40-59.9	25-50	100-200	30-80	100-2500
DFWAMA	DFW to Wichita Falls	BNSF	40-59.9	15-25	50-100	0-30	50-100
	Wichita Falls to Amarillo	BNSF	40-59.9	15-25	50-100	0-30	50-100
DFWHOU	DFW to Waco	UP	20-39.9	50-100	100-200	0-30	50-100
	Waco to Navasota	UP	20-39.9	50-100	100-200	30-80	100-2500
Navasota	to Houston	UP	20-39.9	25-50	100-200	0-30	100-2500
	DFW to Waco	UP	20-39.9	25-50	50-100	0-30	50-100
	Waco to Hearne	UP	20-39.9	25-50	50-100	30-80	100-2500
	Hearne to Navasota	UP	20-39.9	25-50	50-100	30-80	100-2500
	Navasota to Houston	UP	20-39.9	25-50	100-200	0-30	100-2500
	DFW to Temple	BNSF	40-59.9	50-100	100-200	0-30	50-100
Temple	to Sealy	BNSF	60-99.9	50-100	100-200	0-30	100-2500
	Sealy to Houston	BNSF	20-39.9	25-50	100-200	0-30	50-100
	DFW to Corsicana	BNSF	5-9.9				
	Corsicana to Houston	BNSF	40-59.9				
DFWLBB	DFW to Abilene	UP	20-39.9	15-25	50-100	0-30	100-2500
	Abilene to Sweetwater	UP	20-39.9	15-25	50-100	0-30	100-2500
	Sweetwater to Lubbock	BNSF	20-39.9	0-15	50-100	0-30	50-100
DFWLOU	DFW to Shreveport	UP	40-59.9	50-100	50-100	30-80	100-2500
	DFW to Shreveport	KCS	10-19.9				
DFWSAT	DFW to Waco	UP	20-39.9	50-100	50-100	0-30	50-100
	Waco to Austin	UP	10-19.9	50-100	50-100	0-30	50-100
	Austin to San Antonio	UP	20-39.9	15-25	50-100	0-30	100-2500
	DFW to Temple	BNSF	40-59.9	50-100	100-200	0-30	50-100
Temple	to Austin	UP	20-39.9	50-100	50-100	0-30	50-100
	Austin to San Antonio	UP	20-39.9	15-25	50-100	0-30	100-2500

Table C-3 (Continued). Freight Rail Lines Associated with Study Corridors – Segment Density and Volumes.

Corridor	Segment Detail	Segment RR	Segment Density (MGTM/Mi)	Current Volume (trains per day)	Future Volume (trains per day)	Growth (trains per day)	Percent Growth
DFWSATb	Same as DFWSAT						
DFWSNA	DFW to San Angelo	FWWR					
	San Angelo to Alpine	TXPF					
	Alpine to Sierra Blanca	UP	20-39.9	15-25	50-100	0-30	50-100
	Sierra Blanca to El Paso UP		40-59.9	25-50	100-200	30-80	100-2500
DFWTXK	DFW to Sulphur Springs	KCS, DGNO, BLR	5-9.9				
	Sulphur Springs to Winfield	BLR	10-19.9				
	Winfield to Texarkana	UP	20-39.9	15-25	25-50	0-30	100-2500
HOUAUS	Houston to Sealy	BNSF	20-39.9	25-50	100-200	0-30	50-100
Sealy	to Taylor	UP	10-19.9	25-50	100-200	0-30	100-2500
	Taylor to Austin	UP	20-39.9	15-25	50-100	30-80	100-2500
HOUBMT	Houston to Beaumont	UP	20-39.9	25-50	100-200	0-30	100-2500
HOUBVN	Houston to Algoa	UP	40-59.9	15-25	25-50	0-30	0-50
	Algoa to Lolita	UP	20-39.9	15-25	50-100	0-30	50-100
	Rosenberg to Victoria	KCS					
	Lolita to Brownsville	UP	5-9.9	0-15	25-50	0-30	50-100
HOUSAT	Houston to Rosenberg	UP	20-39.9	25-50	50-100	0-30	50-100
	Rosenberg to Seguin	UP	20-39.9	15-25	25-50	0-30	50-100
	Seguin to San Antonio	UP	40-59.9	15-25	25-50	0-30	50-100
	Houston to Rosenberg	UP	20-39.9	25-50	50-100	0-30	50-100
	Rosenberg to San Marcos	UP	20-39.9	0-15	15-25	30-80	100-2500
	San Marcos to San Antonio UP		20-39.9	15-25	25-50	0-30	100-2500
HOUTXK	Houston to Longview	UP	10-19.9	0-15	0-15	0-30	100-2500
Longview	to Marshall	UP	60-99.9	15-25	50-100	0-30	50-100
	Marshall to Texarkana	UP	60-99.9	15-25	50-100	0-30	50-100
	Houston to Longview	UP	10-19.9	0-15	0-15	0-30	100-2500
	Longview to Big Sandy	UP	40-59.9	25-50	50-100	30-80	100-2500
	Big Sandy to Texarkana	UP	20-39.9	15-25	50-100	0-30	100-2500
	Houston to Lewisville	UP	10-19.9	15-25	50-100	0-30	50-100
	Lewisville to Texarkana	UP		15-25	50-100	0-30	50-100
HOUWAC	Houston to Navasota	UP	20-39.9	0-15	100-200	0-30	100-2500
Navasota	to Waco	UP	20-39.9	50-100	100-200	30-80	100-2500

Table C-3 (Continued). Freight Rail Lines Associated with Study Corridors – Segment Density and Volumes.

Corridor	Segment Detail	Segment RR	Segment Density (MGTM/Mi)	Current Volume (trains per day)	Future Volume (trains per day)	Growth (trains per day)	Percent Growth
SATBCN	San Antonio to Corpus Christi	UP	5-9.9				
	Corpus Christi to Brownsville	UP	5-9.9	0-15	15-25	0-30	50-100
SATELP	San Antonio to Sierra Blanca	UP	20-39.9	15-25	50-100	0-30	50-100
	Sierra Blanca to El Paso UP		40-59.9	50-100	100-200	30-80	100-2500
SATLRD	San Antonio to Laredo	UP	20-39.9	15-25	25-50	0-30	100-2500
	Laredo to Brownsville						
Data Source:			NTAD 2007	*National Rail Freight Infrastructure Capacity and Investment Study*			

APPENDIX D. CORRIDOR EVALUATION METHODOLOGY DESCRIPTION

To accomplish the objectives of Task 4, the research team developed a methodology for evaluating the need for the provision of rail or express bus transit services in the intercity travel corridors identified in previous tasks. The purpose of this evaluation was to provide the research team with an objective evaluation of the study corridors over a set of criteria that accurately measures some aspect of the purpose or need for the provision of intercity rail or express bus transit in the study corridors. The research team will then use the outcome of this evaluation as a tool to guide the development of a proposed rail and express bus network for the intercity travel corridors of Texas. The following sections describe the approach to developing the evaluation methodology, the details of the evaluation criteria, and how the methodology was utilized to guide the research team's formation of an intercity transit system for Texas.

DEVELOPMENT OF EVALUATION METHODOLOGY

The research team's presentation to the Project Monitoring Committee on June 12, 2008, included a discussion of the team's proposed evaluation criteria. Table 5-2 lists the criteria upon which the research team and the PMC agreed. Three broad categories of measures that are expected to impact the need for an intercity rail or express bus network are defined: population and demographics (P), intercity travel demand factors (D), and intercity travel capacity (C). Within each category, individual measures are listed by both a reference number and a more detailed description. The individual measures were selected by the project research team based on the review of current intercity travel literature performed in Task 1 of this project as well as the project team's own experience in this area. Some of the principles that guided the selection of the evaluation criteria included the following:

- Selected criteria must be able to demonstrate, in an objective fashion, the planning-level need for the provision of rail or express bus in an intercity travel corridor.
- Selected criteria must allow the research team to easily measure or observe the differences in the transit needs among the intercity travel corridors.

- Selected criteria must not contain inherent bias toward a particular socioeconomic group, region of the state, or political consideration.
- To ensure the transferability of the evaluation methodology as a research product, selected criteria must be related to data that are publicly available from a reliable source.

The research team considered other criteria in the areas of air quality nonattainment areas, the compatibility of existing railroad infrastructure, and the potential for connections to bordering states and Mexico; however, it was determined that these additional factors would not be included in this objective evaluation and would be best taken into account later in the project to differentiate between corridors that are similarly ranked. At this point, the research team felt that only the criteria in the three categories identified in Table D-1 should be used in ranking corridors.

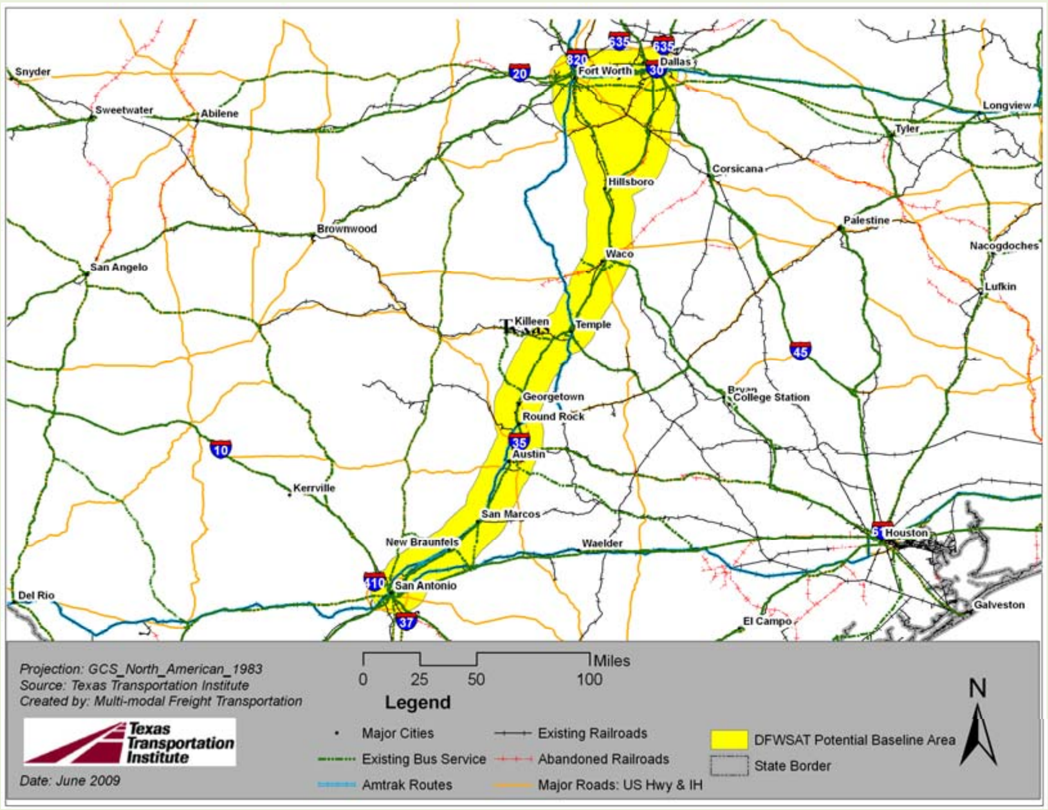
Table D-1. Evaluation Criteria for Project 0-5930 Study Corridors Evaluation.

Category	Ref.	Criteria
Population & Demographics (P)	P.1	Number of core-based statistical areas along corridor.
	P.2	Total population of CBSA counties along corridor, 2000.
	P.3	Growth in total population of CBSA counties along corridor, 2000–2040.
	P.4	Total population per mile of the corridor, 2000.
	P.5	Percent of total corridor population age 65 and older, 2040.
	P.6	Total employees, 2005.
	P.7	Total enrollment at public or private universities along corridor, Fall 2006.
Intercity Travel Demand (D)	D.1	Average corridor AADT, 2006.
	D.2	Percent annual growth in average corridor AADT, 1997–2006.
	D.3	Air passenger travel between corridor airports, 2006.
	D.4	Percent annual growth in air travel between corridor airports, 1996–2006.
Intercity Travel Capacity (C)	C.1	Average volume-capacity ratio on subject highways in corridor, 2002
	C.2	Average percent trucks on subject highways in corridor, 2002.
	C.3	Load factor on corridor flights, weighted by boarding passengers, 2006.
	C.4	Average number of corridor flights per day, 2006.

One issue that the research team encountered in its development of an evaluation methodology was the treatment of the Dallas/Fort Worth to San Antonio intercity travel corridor defined by U.S. 281. This corridor was added to the list of study corridors at the request of the PMC. After a review of this corridor, the project research team asserts that the emergence of U.S. 281 as an intercity travel corridor worthy of study is related to deteriorating traffic flow conditions on the I-35 corridor between Dallas/Fort Worth and San Antonio. Specifically, the demand for travel along U.S. 281 consists of travelers wishing to avoid these conditions on I-35 in their travel between Dallas/Fort Worth (particularly Fort Worth and other areas in the western part of the region) and San Antonio.

Consequently, if the corridor evaluation were to move forward with these two corridors as separate corridors, each of the corridors (I-35 and U.S. 281) would be evaluated against the other study corridors as well as themselves—thus diluting the true measure of demand in the Dallas/Fort Worth-San Antonio corridor. Given that the Dallas/Fort Worth to San Antonio intercity travel corridor aligns with one of the largest and most heavily traveled areas in the state, evaluating U.S. 281 and I-35 as separate corridors would diminish the true magnitude of the need for an intercity rail or express bus route in the corridor. Additionally, the provision of adequate intercity rail or express bus service between Dallas/Fort Worth and San Antonio would serve to improve traffic flow and functionality on both U.S. 281 and I-35. Given this situation, the research team determined to move forward with the evaluation with a single intercity travel corridor between Dallas/Fort Worth and San Antonio with combined data from each corridor (U.S. 281 and I-35) to reveal a complete picture of the need for a rail or express bus route on this intercity travel corridor.

APPENDIX E. CORRIDOR MAPS WITH EXISTING TRANSIT SERVICES, INTERMODAL FACILITIES, AND TRANSIT AGENCIES

<table>
<tr><th>Corridor</th><th>Location</th><th>Facilities</th></tr>
<tr><td>Dallas/Fort Worth to San Antonio (DFWSAT)</td><td>
</td><td>Current Intercity Rail/Bus Service:

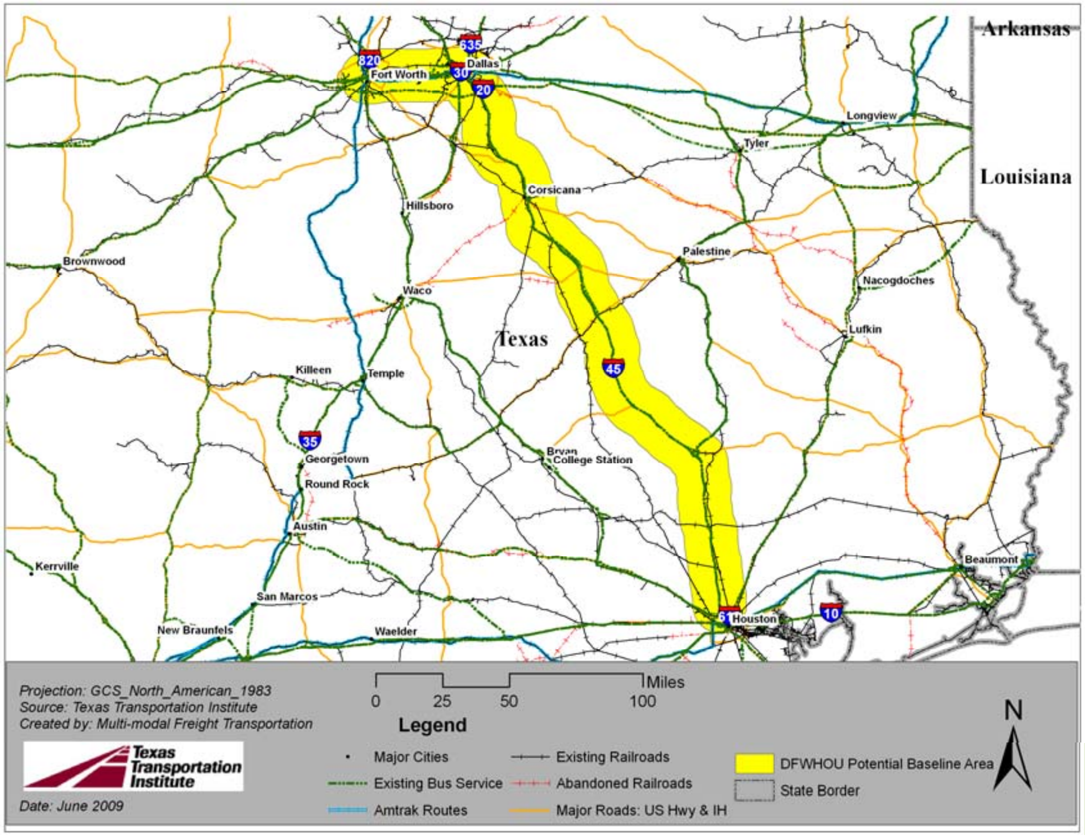
Amtrak Texas Eagle
Daily between Chicago and San Antonio, three days per week between Chicago and Los Angeles with the Sunset Limited
Greyhound
8 times daily
Kerrville Bus Company (Greyhound line sub)
1 time daily from Fort Worth
Americanos USA LLC (Greyhound Line sub)
10 times daily

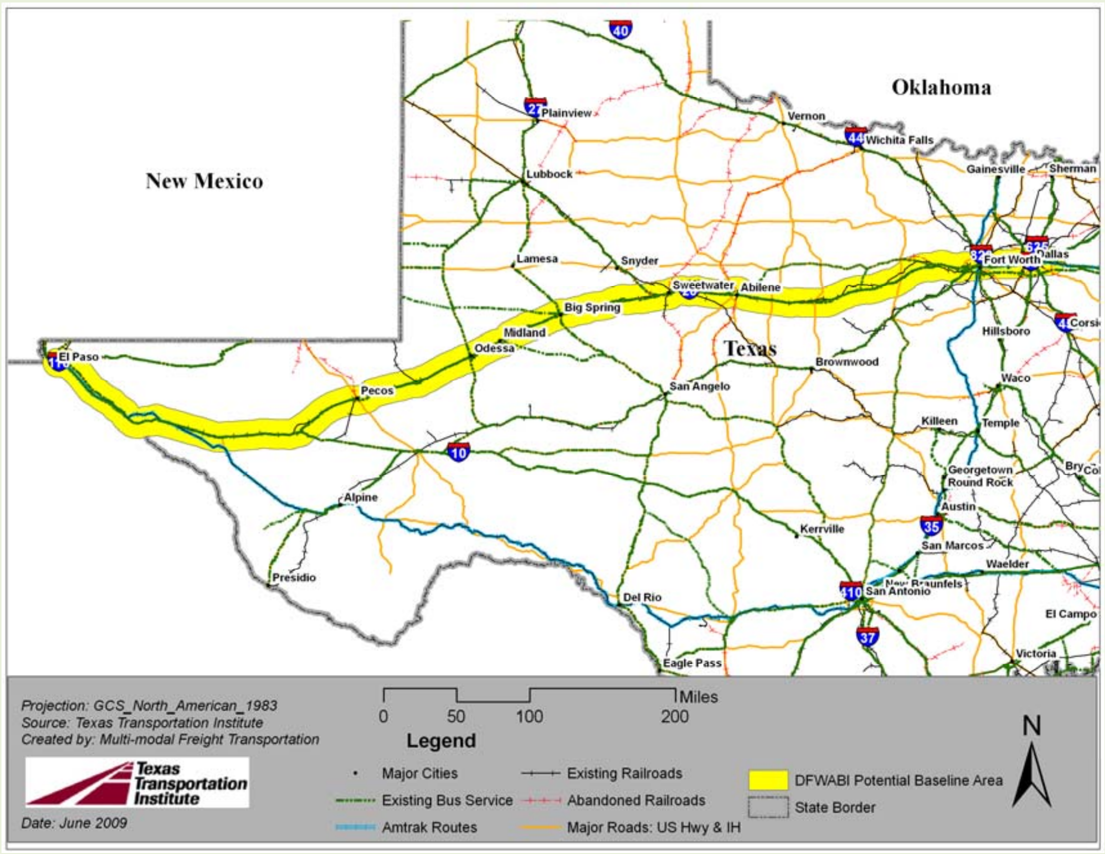
Intermodal Facilities:

Dallas Union Station
Fort Worth Intermodal Transportation Center
Cleburne Intermodal Terminal
Waco Intermodal Transit Center
Austin Central Terminal
Round Rock Greyhound Station
San Marcos Greyhound Station
Bastrop Greyhound Station
Kerrville Intermodal Facility
San Antonio Amtrak Station
San Antonio Greyhound Station

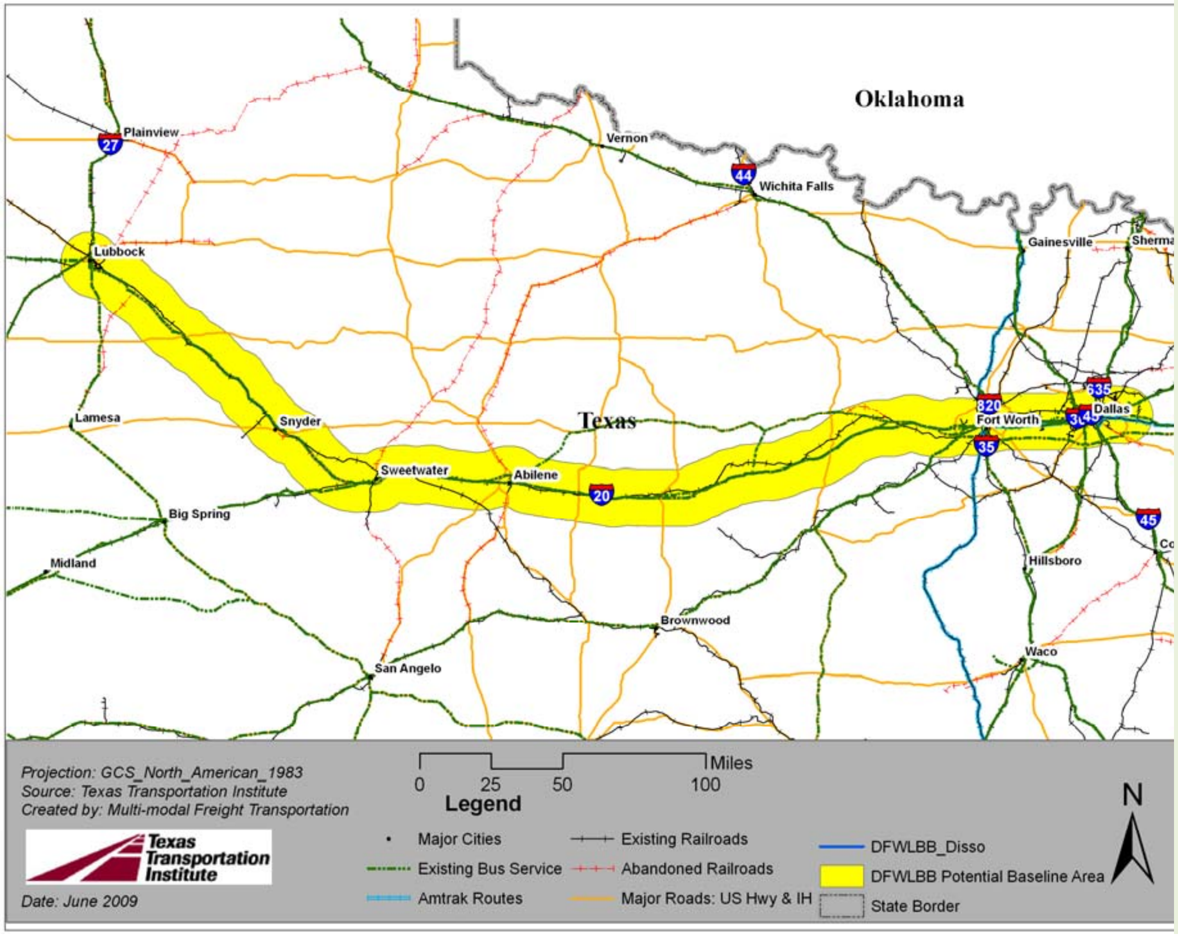
Transit Agencies:

Dallas Area Rapid Transit (DART)
The T (Fort Worth)
Denton County Transportation Authority
Cletran Transportation
Collin County Area Regional Transit
Waco Transit
Waco Streak
Heart of Texas Council of Government Rural Transit
Hill Country Transit
Capital Metro
Capital Area Rural Transit System (CARTS)
VIA Transit
Alamo Area Regional Transit
</td></tr>
</table>

Corridor	Location	Facilities
Dallas/Fort worth to Houston (DFWHOU)		**Current Intercity Rail/Bus Service:** • Greyhound o 6 times daily from Dallas **Intermodal Facilities:** • Dallas Union Station • Fort Worth Intermodal Transportation Center • Cleburne Intermodal Terminal • Corsicana Greyhound Station • Houston Amtrak Station • Houston Greyhound Stations **Transit Agencies:** • DART • The T (Fort Worth) • Denton County Transportation Authority • Cletran • Collin County Area Regional Transit • The District (Brazos Transit) • Harris County METRO/METRORail • Connect Transportation • Fort Bend County Transit

Corridor	Location	Facilities
Dallas/Fort Worth to El Paso Via Abilene (DFWELP1)		**Current Intercity Rail/Bus Service:** o Greyhound: 4 times daily • Americanos USA LLC (Greyhound Line sub) o 1 time daily from Dallas, and 1 time daily from Fort Worth • All Aboard America o Indirect routes between Midland-Odessa area and Dallas and San Antonio **Intermodal Facilities:** • Existing: o Dallas Union Station o Fort Worth Intermodal Transportation Center o Cleburne Intermodal Terminal o Abilene Greyhound Station o Midland Greyhound Station o El Paso Union Depot o El Paso Greyhound Station • Proposed: o El Paso Union Plaza o Abilene-feasibility study conducted **Transit Agencies:** • DART • The T (Fort Worth) • Denton County Transportation Authority • Cletran • Collin County Area Regional Transit • Citylink- Abilene Paratransit • Central Texas Rural Transit District (CARR) • Spartanburg Area Regional Transit Agency (SPARTA) • EZ Rider • Sun Metro

Corridor	Location	Facilities
Dallas/Fort Worth to Lubbock Via Abilene (DFWLBB)	see map below	see list below



Current Intercity Rail/Bus Service:

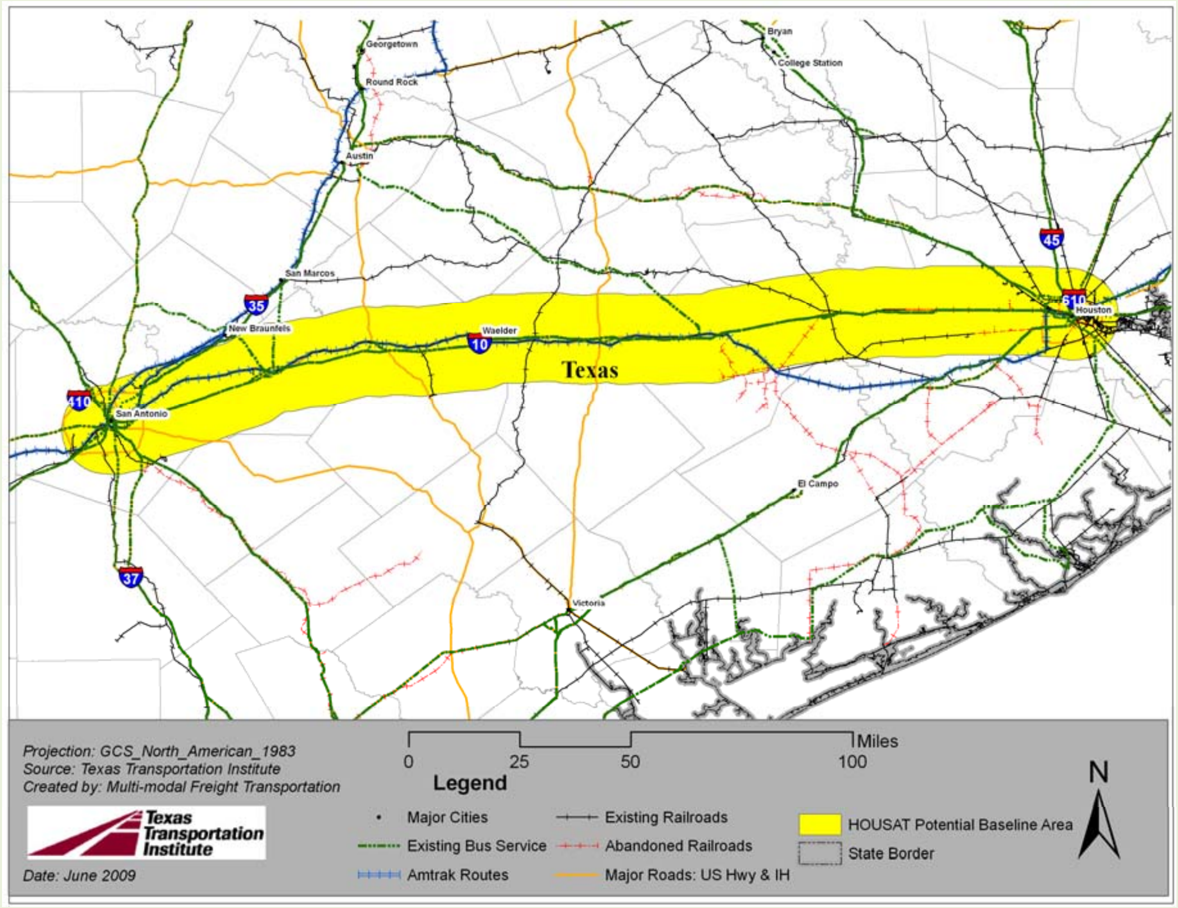
- Greyhound
  - 3 times daily

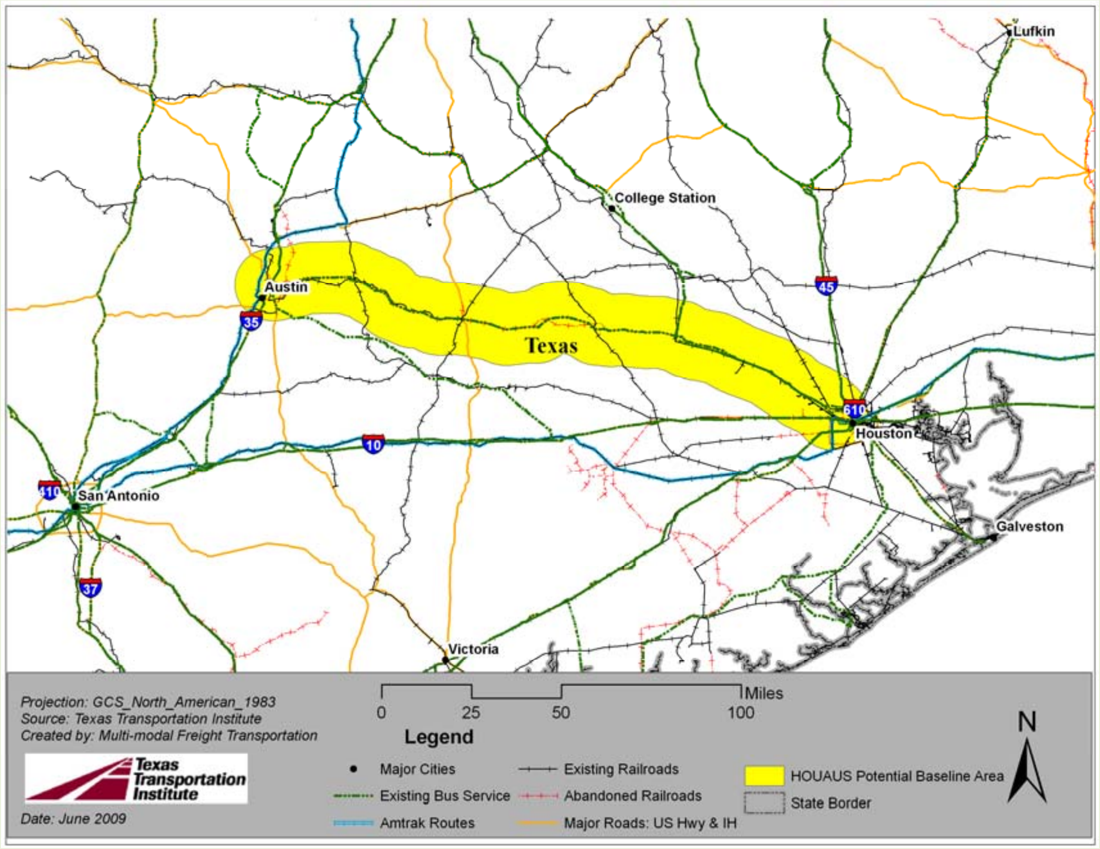
Intermodal Facilities:

- Existing:
  - Dallas Union Station
  - Fort Worth Intermodal Transportation Center
  - Abilene Greyhound Station
  - Sweetwater Greyhound Station
  - Snyder Greyhound Station
  - Lubbock Greyhound Station
- Planned or Proposed:
  - Abilene-feasibility study conducted

Transit Agencies:

- DART
- The T
- Denton County Transportation Authority
- Cletran
- Collin County Area Regional Transit
- Citylink
- CARR
- SPARTAN
- Citibus
- CapTrans

Corridor	Location	Facilities
Houston to San Antonio (HOUSAT)		**Current Intercity Rail/Bus Service:** • Amtrak: Sunset Limited o Operates three days per week in each direction between New Orleans, LA, and Los Angeles, CA. • Greyhound o 3 times daily • Americanos USA LLC (GreyhoundLine sub) o 6 times daily **Intermodal Facilities:** • Existing: o Kerrville Intermodal Facility o San Antonio Greyhound Station o San Antonio Amtrak Station o San Marcos CARTS intermodal facility • Planned or proposed: o Houston: Northern Intermodal Facility o San Antonio West Side Multimodal Center **Transit Agencies:** • Harris County METRO/METRORail • Connect Transportation • Fort Bend County Transit • The District (Brazos Transit) • CARTS • VIA Transit • Alamo Area Regional Transit

Corridor	Location	Facilities
Houston to Austin (HOUAUS)		See below

Current Intercity Rail/Bus Service:

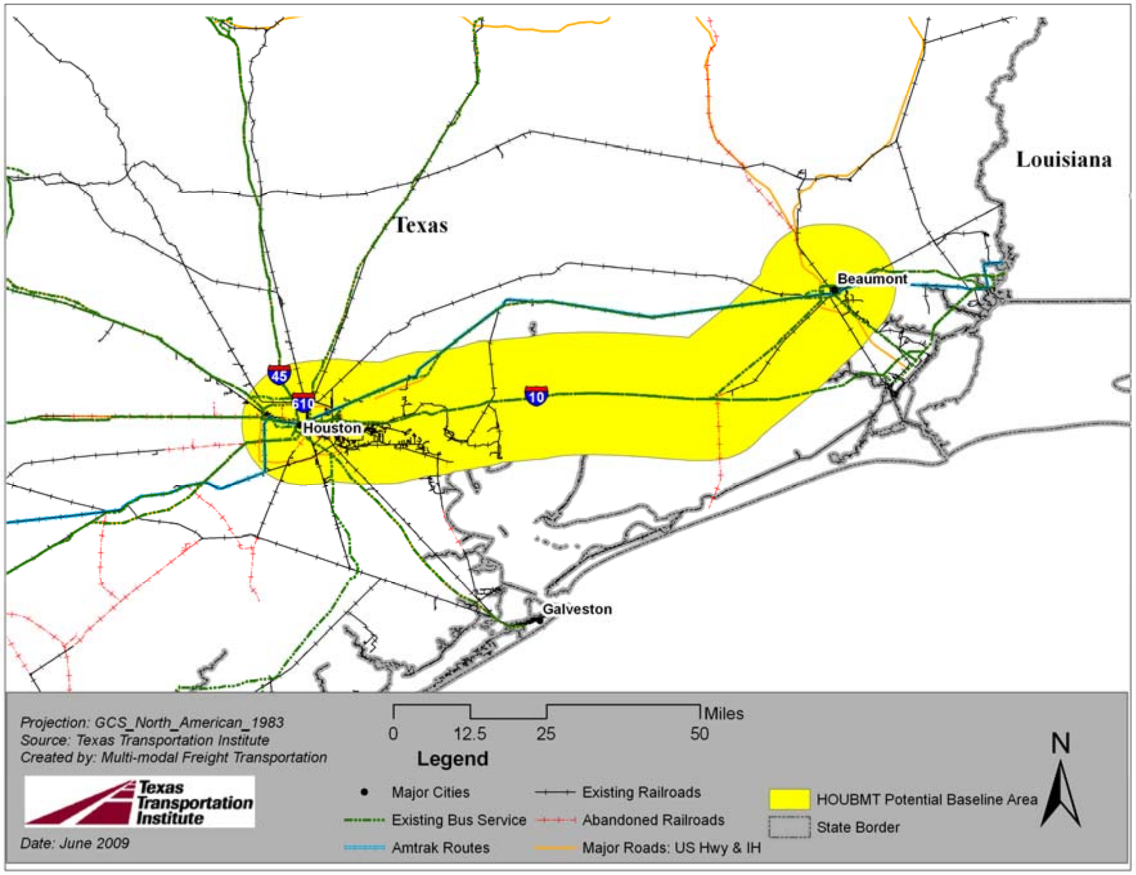
- Greyhound
  - o 1 time daily (Houston ↔ Prairie View only)
- Arrow Trailways of Texas
  - o 1 time daily indirect route; 1 trip per day between Waco and Killeen and 1 between Killeen and Houston
- Kerrville Bus Company, Inc.
  - o 4 times daily
  - o 1 time on I-10 and Hwy 71 rather than Hwy 290
- Commuter bus service of Texas State University – San Marcos
  - o Between Texas State campus in San Marcos and downtown Austin

Intermodal Facilities:

- Existing:
  - o Austin Greyhound Station
  - o Austin Amtrak Station
  - o CARTS Central Terminal in Austin
  - o Round Rock CARTS intermodal facility
- Planned or proposed:
  - o Houston: Northern Intermodal Facility

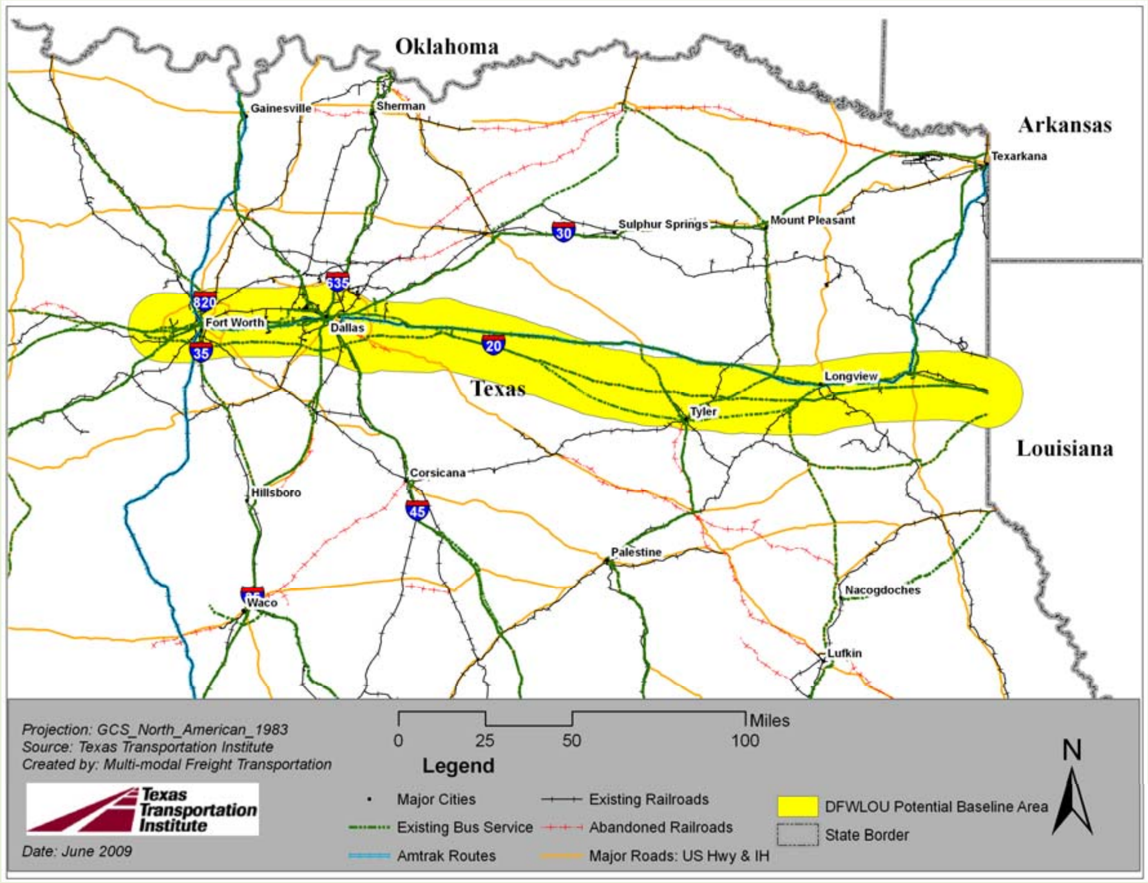
Transit Agencies:

- Harris County METRO/METRORail
- Connect Transportation
- Fort Bend County Transit
- The District (Brazos Transit)
- Capital Metro
- CARTS

Corridor	Location	Facilities
Houston to Beaumont (HOUBMT)		**Current Intercity Rail/Bus Service:** • Amtrak: Sunset Limited o Operates three days per week in each direction between New Orleans, LA, and Los Angeles, CA • Greyhound o 4-5 times daily **Intermodal Facilities:** • Existing: o Houston Amtrak Station o Houston Greyhound Stations o Beaumont Amtrak Station o Beaumont Greyhound Station • Planned or proposed: o Houston: Northern Intermodal Facility **Transit Agencies:** • Harris County METRO/METRORail • Connect Transportation • Fort Bend County Transit • The District (Brazos Transit) • Beaumont Municipal Transit • Port Arthur Transit • South East Texas Transit (SETT Rural Transit)

Corridor	Location	Facilities

Dallas/Fort Worth to Louisiana Border (DFWLOU)



Current Intercity Rail/Bus Service:

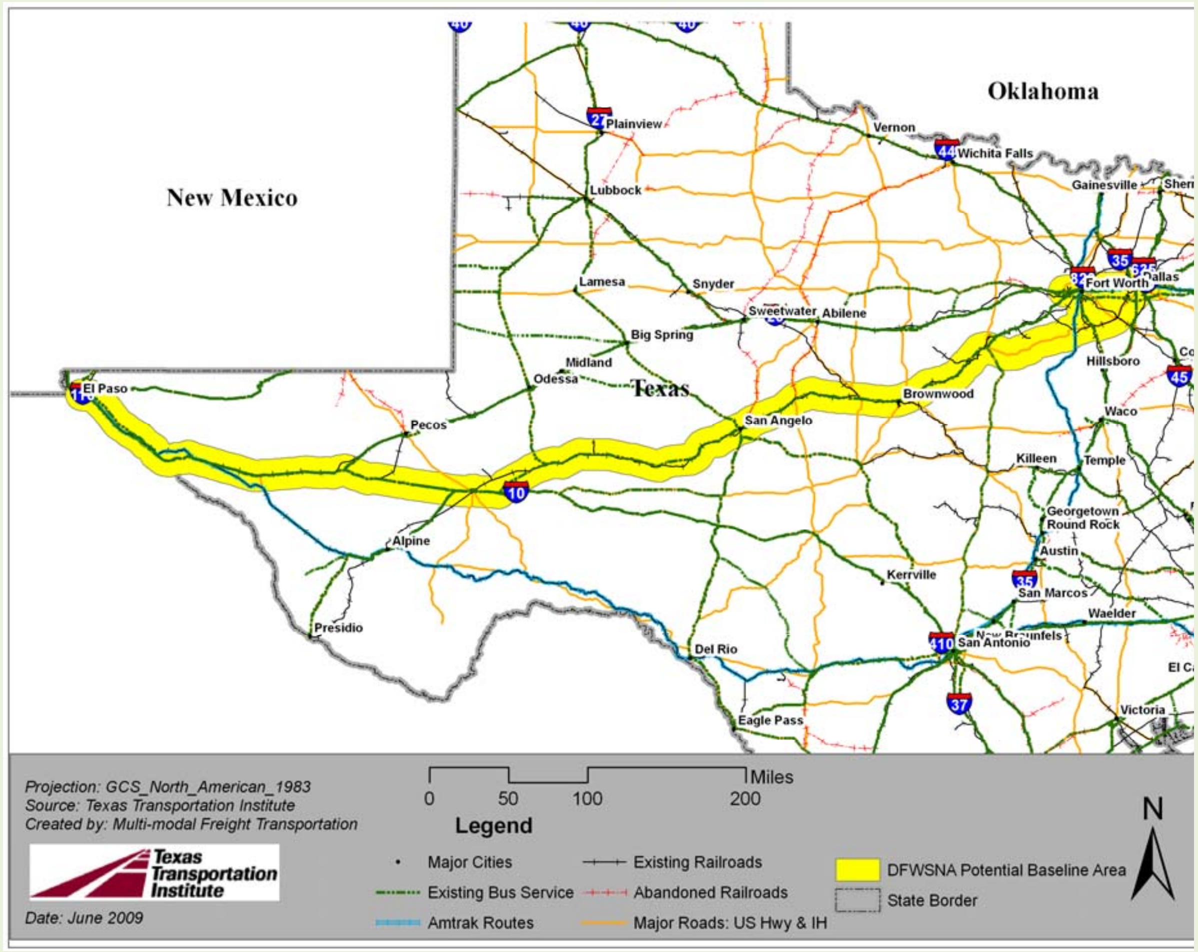
- Amtrak
  - Texas Eagle: Operates daily between Chicago and San Antonio, three days per week between Chicago and Los Angeles in conjunction with the Sunset Limited.
  - Heartland Flyer: Operates once daily between Fort Worth and Oklahoma City, OK in each direction.
- Greyhound
  - 5 times daily
- Americanos USA LLC (Greyhound Line sub)
  - 1 time daily

Intermodal Facilities:

- Existing:
  - Dallas Union Station
  - Fort Worth Intermodal Transportation Center
  - Mineola Amtrak Station
  - Longview Amtrak Station
  - Marshall Amtrak Station
  - Tyler Greyhound Station
- Planned or proposed:
  - East Texas area (one or more facilities)

Transit Agencies:

- DART
- The T
- Denton County Transportation Authority
- Cletran
- Collin County Area Regional Transit
- Tyler Transit
- Longview Transit
- East Texas Rural Transit

<table>
<tr><th>Corridor</th><th>Location</th><th>Facilities</th></tr>
<tr>
<td>Dallas/Fort Worth to El Paso Via San Angelo (DFWELP2)</td>
<td>
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<td>Current Intercity Rail/Bus Service:

Greyhound
Twice daily(El Paso ↔ Ft. Stockton)
All Aboard America
Concho Coaches, Inc.

Intermodal Facilities:

Existing:

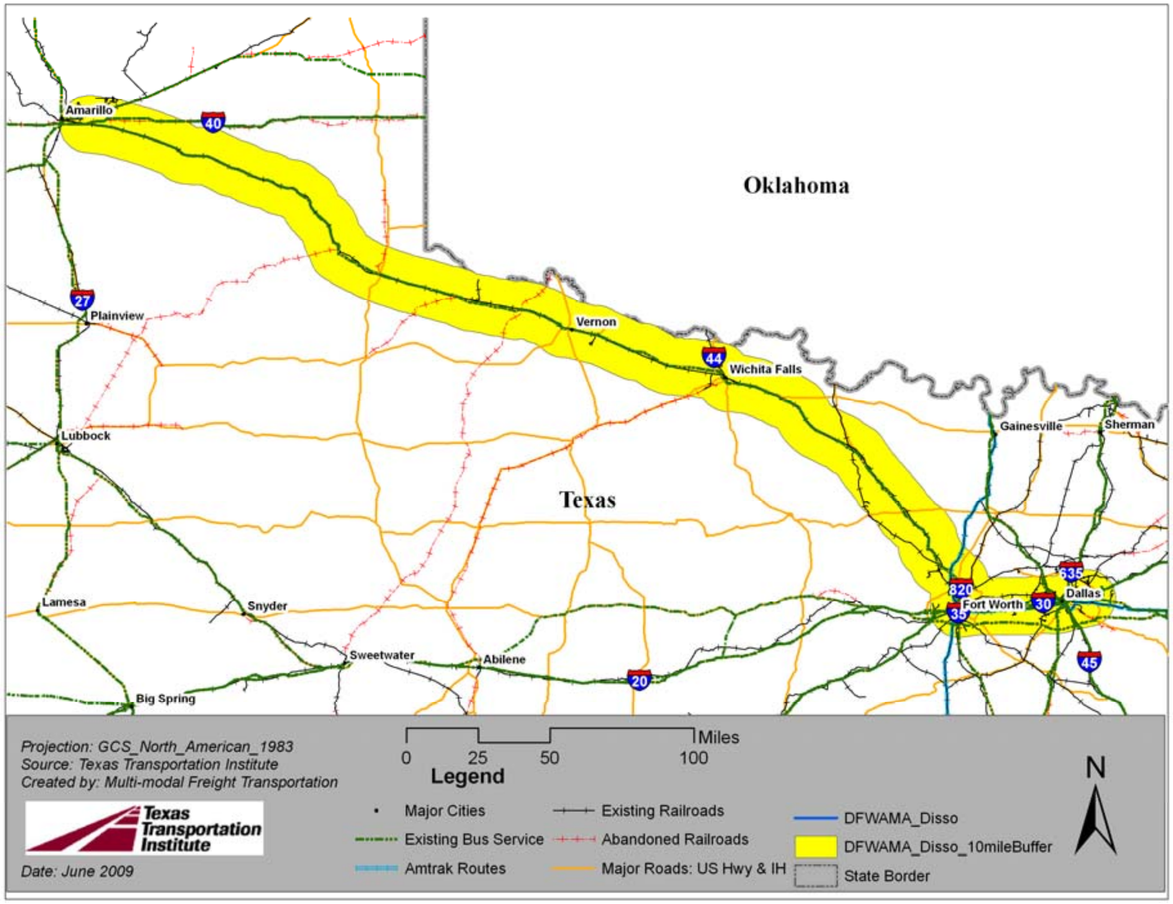
Dallas Union Station
Fort Worth Intermodal Transportation Center
Cleburne Intermodal Terminal
Brownwood Greyhound Station
San Angelo Greyhound Station
El Paso Union Depot
El Paso Greyhound Station

Planned or proposed:

San Angelo -- feasibility study conducted
El Paso Union Plaza

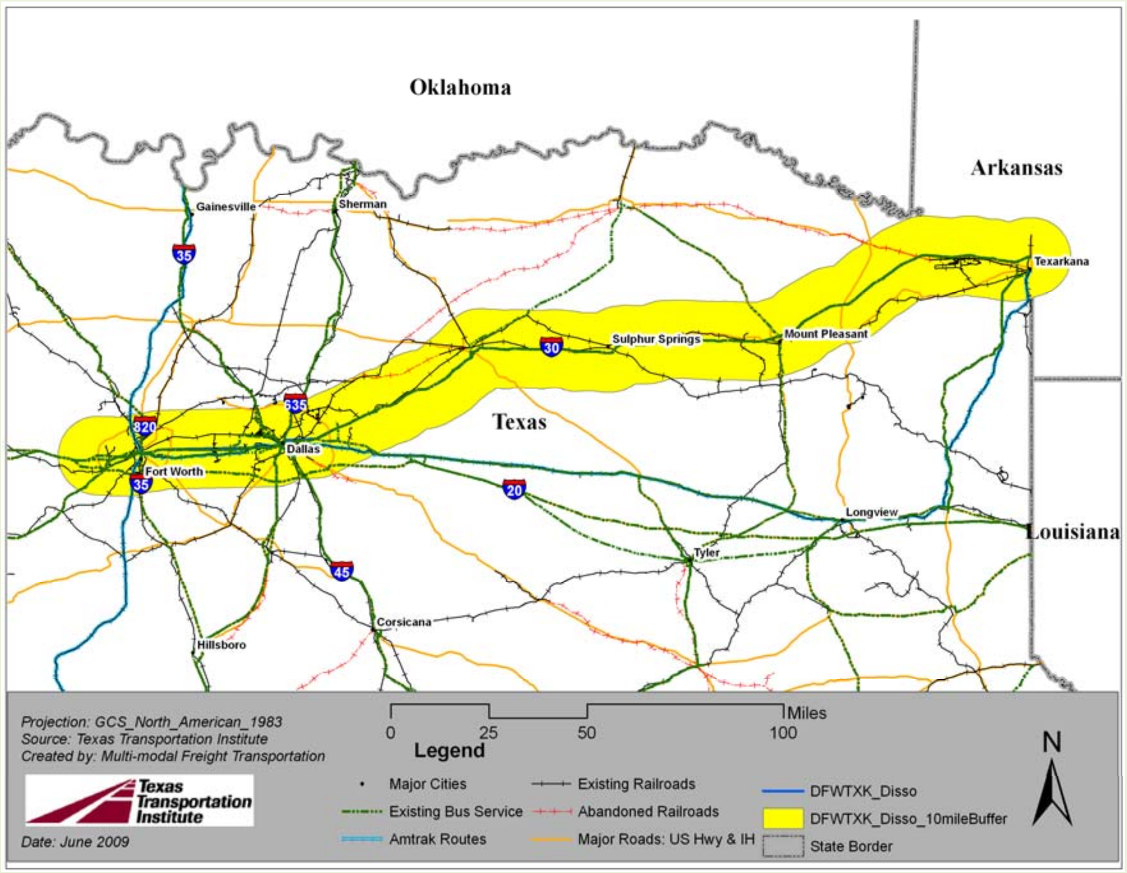
Transit Agencies:

Sun Metro
Thunderbird Transit
San Angelo Street Railroad Company
CARR
DART
The T
Denton County Transportation Authority
Cletran
Collin County Area Regional Transit
</td>
</tr>
</table>

Corridor	Location	Facilities
Dallas/Fort Worth to Amarillo Via Wichita Falls (DFWAMA)		**Current Intercity Rail/Bus Service:** • Greyhound o 3 times daily **Intermodal Facilities:** • Dallas Union Station • Fort Worth Intermodal Transportation Center • Cleburne Intermodal Terminal • Wichita Falls Greyhound Station • Vernon Greyhound Station **Transit Agencies:** • DART • The T (Fort Worth) • Denton County Transportation Authority • Cletran • Collin County Area Regional Transit • Wichita Falls Transit • Texoma Area Paratransit System • Rolling Plains Management Rural Transit • Amarillo City Transit • Panhandle Transit

Corridor	Location	Facilities

Dallas/Fort Worth to Texarkana (DFWTXK)



Current Intercity Rail/Bus Service:

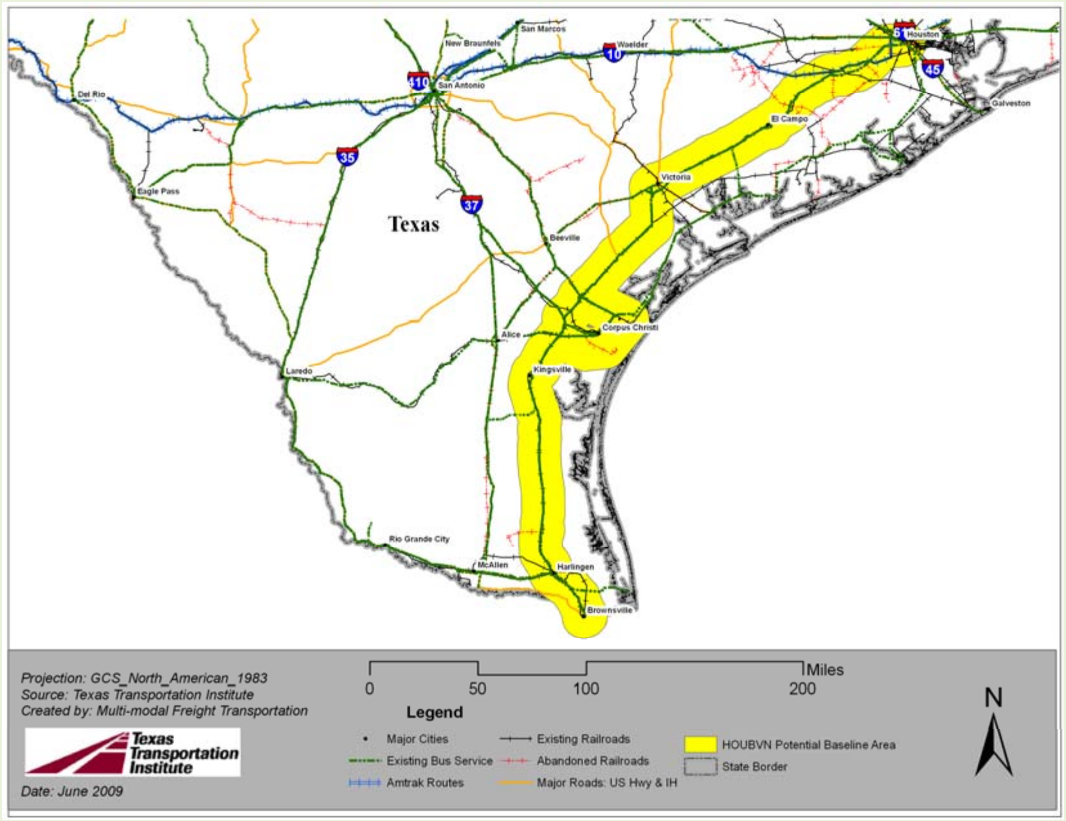
- Greyhound
    - 3 times daily
    - 2 times from Dallas via I-20 through Tyler/Longview to Texarkana
- Americanos USA LLC (Greyhound Line sub)
    - 1 time daily

Intermodal Facilities:

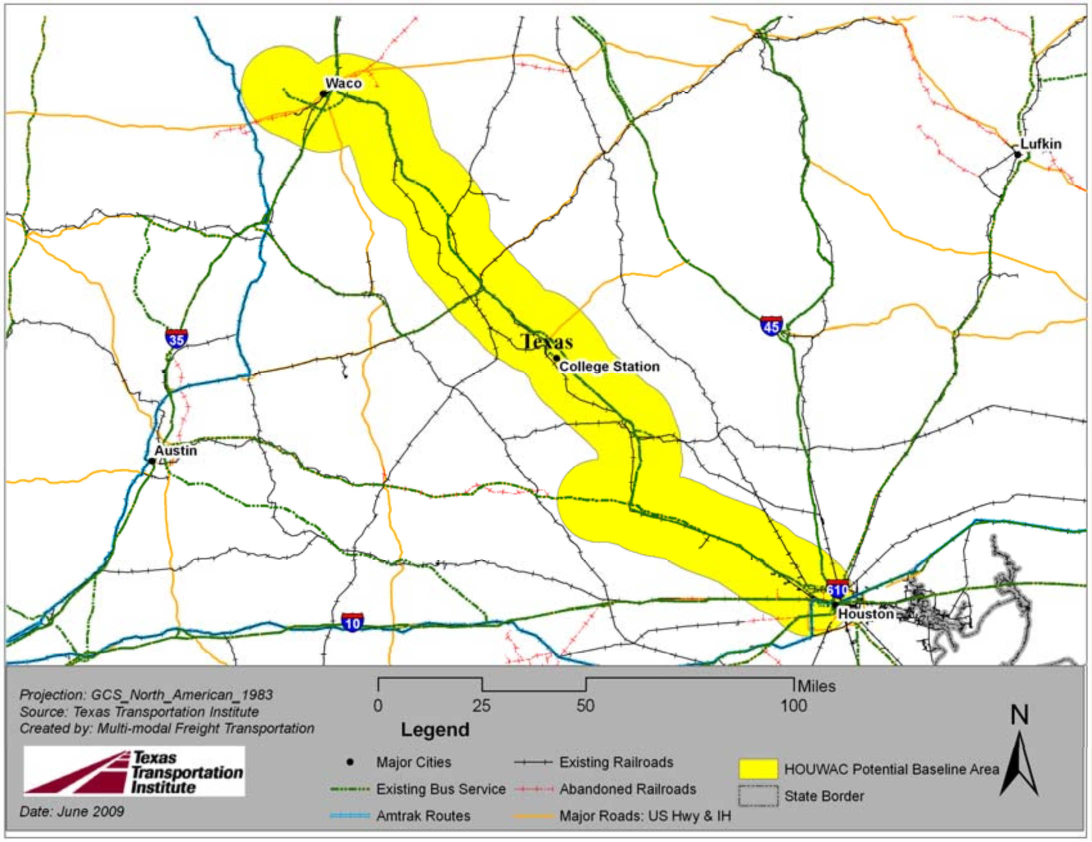
- Dallas Union Station
- Fort Worth Intermodal Transportation Center
- Cleburne Intermodal Terminal
- Sulphur Spring Greyhound Station
- Mt. Pleasant Greyhound Station
- Greenville Greyhound Station
- Texarkana Greyhound Terminal
- Texarkana Amtrak Station

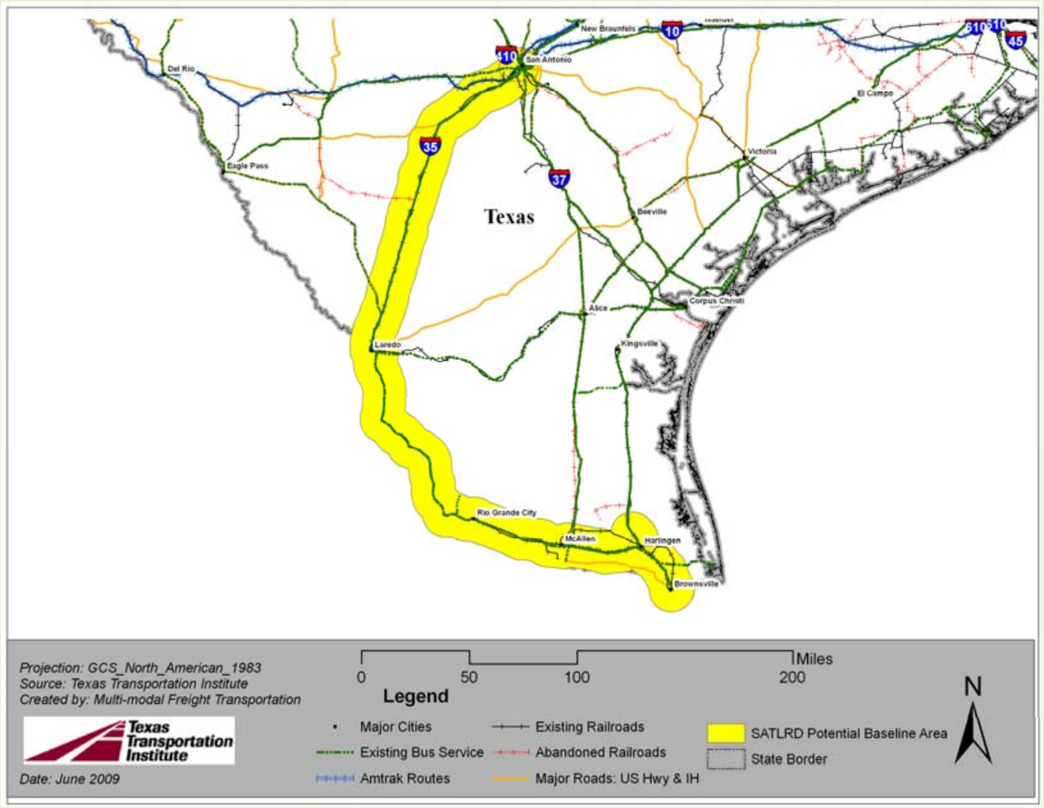
Transit Agencies:

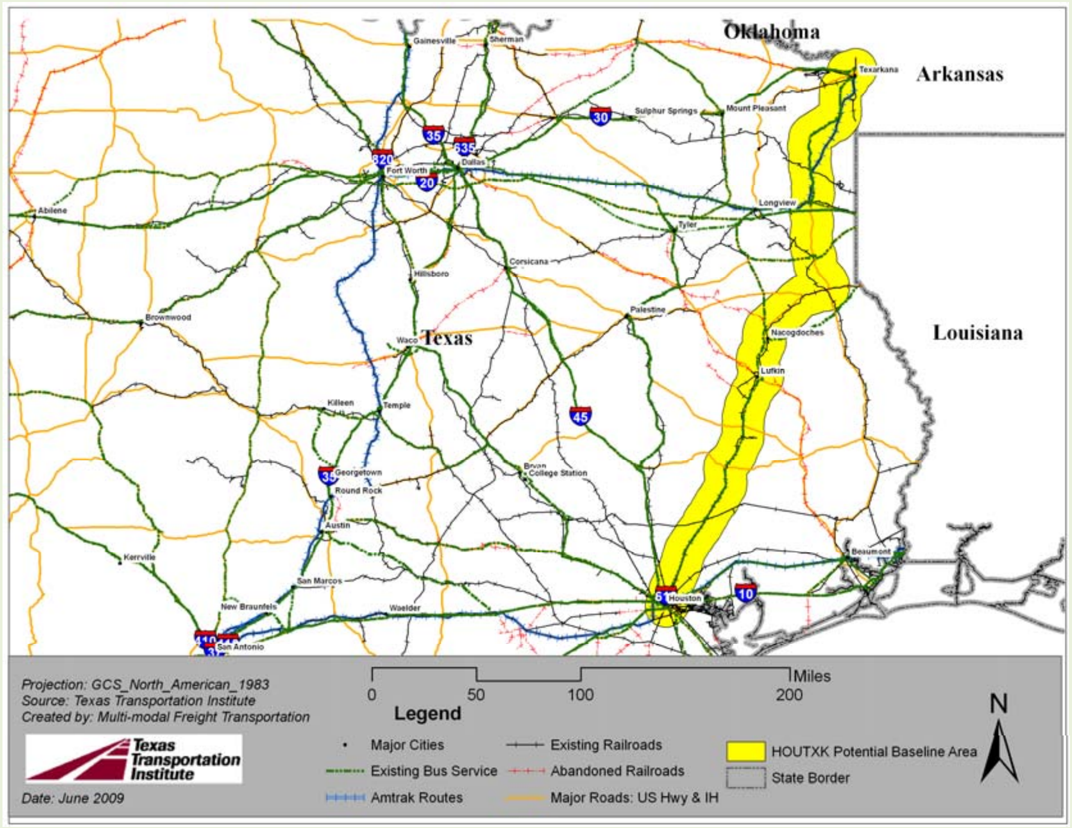
- DART
- The T (Fort Worth)
- Denton County Transportation Authority
- Cletran
- Collin County Area Regional Transit
- T-Line (Texarkana local transit)
- Ark-Tex Council of Governments Rural Transit

Corridor	Location	Facilities
Houston to Brownsville Via Corpus Christi (HOUBVN)		**Current Intercity Rail/Bus Service:** • Americanos USA LLC (Greyhound Line sub): 3 times daily • Valley Transit Company: 2 times daily **Intermodal Facilities:** • Existing: o Harlingen Amtrak Station o Corpus Christi VCA Station o Brownsville Greyhound/Amtrak Thruway bus station o Houston Amtrak Station o Galveston Greyhound/Amtrak Thruway bus station o Victoria Greyhound Station o El Campo Greyhound Station o Huntsville Greyhound Station • Planned or proposed: o Houston: Northern Intermodal Facility o Victoria – feasibility study conducted **Transit Agencies:** • Harris County METRO/METRORail • Connect Transportation • Fort Bend County Transit • The District (Brazos Transit) • Victoria Transit • RTransit • The B (Corpus Christi) • Corpus Christi Regional Transit Authority (CCRTA) • Kleberg County Human Services (KCHS) • Bee Community Action Agency (BCAA) • Rural Economic Assistance League • Harlingen Express • Brownsville Urban Transit • McAllen Express • Rio Metro • The Wave-South Padre Island • Rio Transit • Rainbow Lines

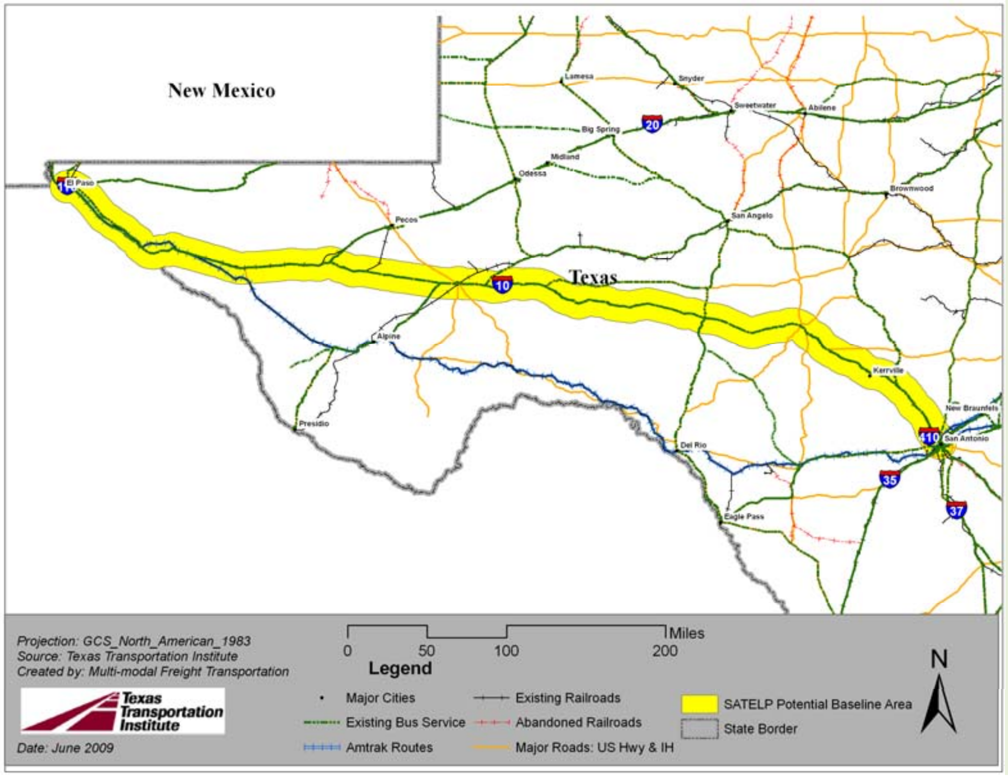
Corridor	Location	Facilities

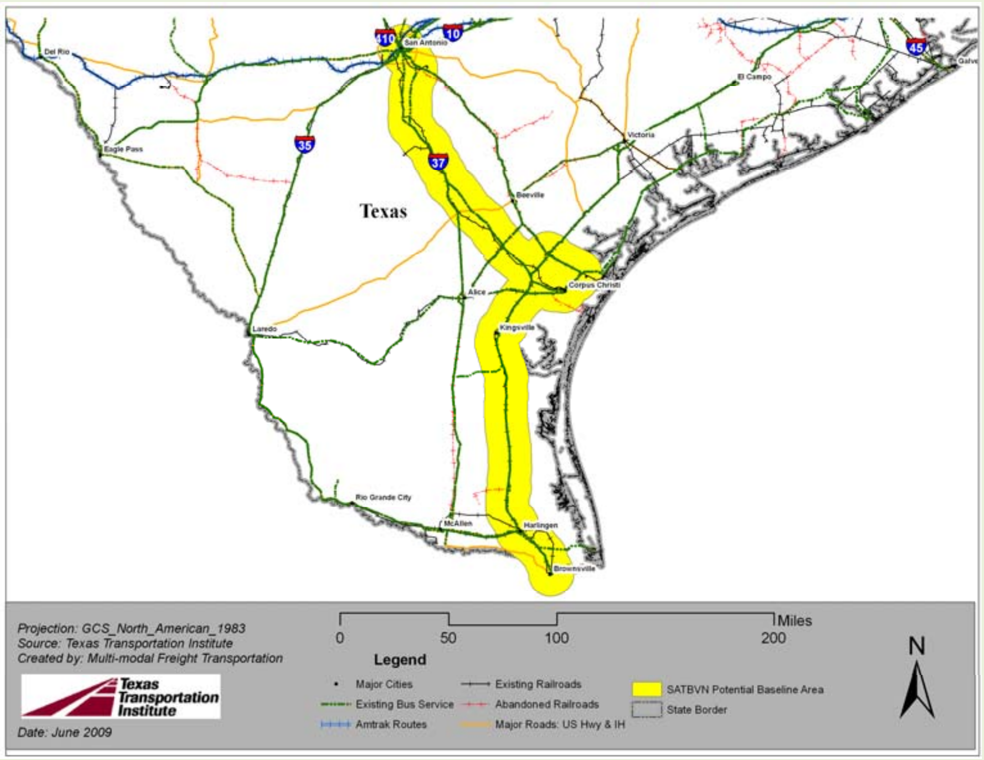
Houston to Waco Via College Station (HOUWAC)		**Current Intercity Rail/Bus Service:**
		• Greyhound
		  o 1 time daily
		• Kerrville Bus Company (Greyhound Line sub)
		  o 1 time daily from Houston to Waco Via Austin
		
		Intermodal Facilities:
		• Existing:
		  o Waco Intermodal Transit Center
		  o Bryan Greyhound Station
		  o Houston Amtrak Station
		  o Houston Greyhound Stations
		• Planned or proposed:
		  o Houston: Northern Intermodal Facility
		
		Transit Agencies:
		• Harris County METRO/METRORail
		• Connect Transportation
		• Fort Bend County Transit
		• The District (Brazos Transit)
		• Waco Transit
		• Waco Streak
		• HOTCOG Rural Transit

Corridor	Location	Facilities
San Antonio to Brownsville Via Laredo (SATLRD)		**Current Intercity Rail/Bus Service:** • Amtrak Thruway Connector o 1 time daily both direction on Laredo ↔ San Antonio o 1 time daily from Brownsville to San Antonio via Harlington and McAllen **Proposed Intercity Rail/Bus Service:** • Valley Commuter Rail **Intermodal Facilities:** • Existing: o Kerrville Intermodal Facility o Del Rio Multimodal Transit Center o Harlingen Greyhound Station o McKinney Greyhound Station o Rio Grande City Greyhound Station o Laredo Greyhound Station o San Antonio Amtrak Station o San Antonio Greyhound Station • Planned or proposed: o San Antonio West Side Multimodal Center **Transit Agencies:** • VIA Transit • CARTS • Alamo Area Regional Transit • El Metro • El Aguila • Rainbow Lines • Harlingen Express • Brownsville Urban Transit • McAllen Express • Rio Metro • The Wave-South Padre Island • Rio Transit • Rainbow Lines

Corridor	Location	Facilities
Houston to Texarkana (HOUTXK)	 	**Current Intercity Rail/Bus Service:** • Greyhound (Texarkana ↔ Longview only) o 1 time daily on I-45 and I-20 rather than Hwy 59 • Kerrville Bus Company (GLI sub) o 2 times daily • Amtrak Thruway Connector Service o 1 time daily both way on Houston ↔ Longview **Intermodal Facilities:** • Existing: o Texarkana Greyhound Terminal o Texarkana Amtrak Station o Longview Amtrak Station o Marshall Amtrak Station o Nacogdoches Amtrak Station • Planned or proposed: o East Texas area (one or more facilities were recommended by the Regional Transportation Coordination Plan) o Houston: Northern Intermodal Facility **Transit Agencies:** • T-Line • The District (Brazos Transit) • Harris County METRO/METRORail • Connect Transportation • Fort Bend County Transit • Ark-Tex Council of Governments • East Texas Rural Transit

Corridor	Location	Facilities

San Antonio to El Paso (SATELP)		**Current Intercity Rail/Bus Service:**
		• Greyhound (El Paso ⟷ Fort Stockton)
		  o 2 times daily
		
		Intermodal Facilities:
		• Existing:
		  o Kerrville Intermodal Facility
		  o Fort Stockton Greyhound Station
		  o El Paso Greyhound Station
		  o El Paso Amtrak Station
		  o Fort Stockton Greyhound Station
		• Planned or proposed:
		  o San Antonio West Side Multimodal Center
		  o San Angelo -- feasibility study conducted
		  o El Paso Union Plaza (proposed)
		
		Transit Agencies:
		• Sun Metro
		• VIA Transit
		• CARTS
		• Alamo Area Regional Transit

Corridor	Location	Facilities
San Antonio to Brownsville Via Corpus Christi (SATBVN)		**Current Intercity Rail/Bus Service:** • Valley Transit Company (Greyhound Line sub) o 2 times daily o 1 time daily via Alice and McAllen • Amtrak Thruway Connector o 1 time daily from Brownsville to San Antonio via Harlington and McAllen **Intermodal Facilities:** • Existing: o Kerrville Intermodal Facility o San Antonio Amtrak Station o San Antonio Greyhound Station o Corpus Christi Greyhound Station o Kingsville Greyhound Station o Brownsville Greyhound Station • Planned or proposed: o San Antonio West Side Multimodal Center **Transit Agencies:** • VIA Transit • CARTS • Alamo Area Regional Transit • The B (Corpus Christi) • Corpus Christi Regional Transit Authority (CCRTA) • Kleberg County Human Services (KCHS) • Bee Community Action Agency (BCAA) • Rural Economic Assistance League (REAL) • Harlingen Express • Brownsville Urban Transit • McAllen Express • Rio Metro • The Wave-South Padre Island • Rio Transit • Rainbow Lines

<table>
<tr><th>Corridor</th><th>Location</th><th>Facilities</th></tr>
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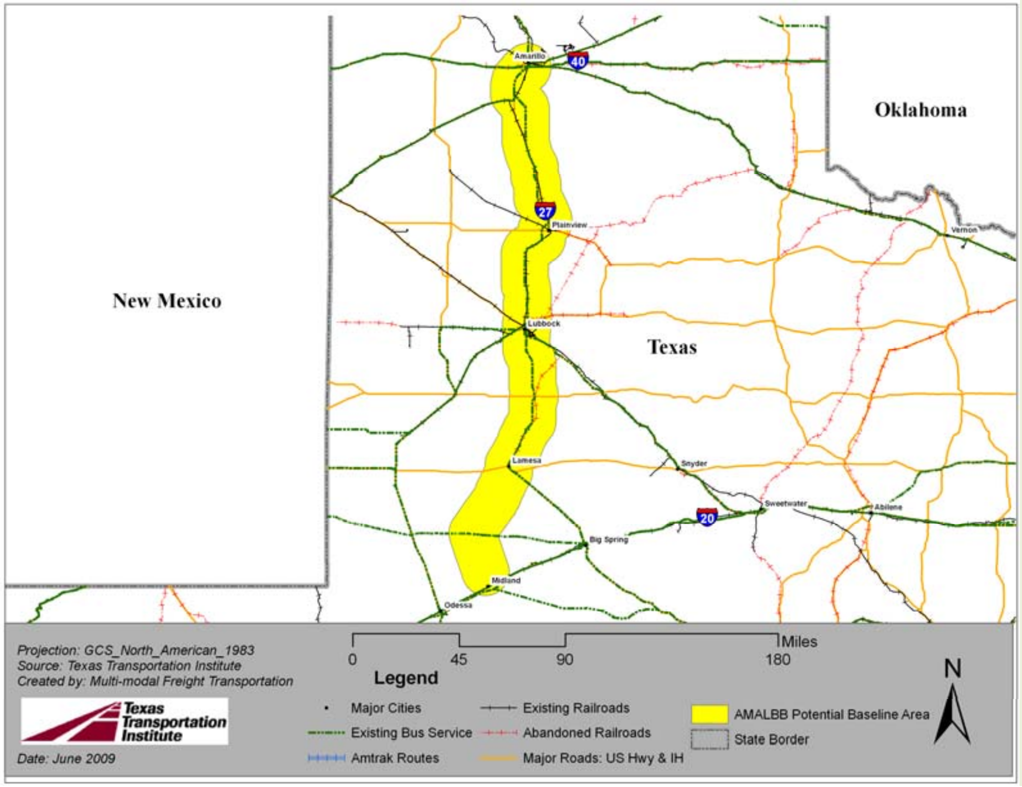
<td>Amarillo to Midland (Odessa) Via Lubbock (AMALBB)</td>
<td>
</td>
<td>Current Intercity Rail/Bus Service:
• Greyhound
o Twice daily from Amarillo to Midland-Odessa
o Once daily from Midland-Odessa to Amarillo

Intermodal Facilities:
• Amarillo Greyhound Station
• Plainview Greyhound Station
• Lubbock Greyhound Station
• Lamesa Greyhound Station
• Midland Greyhound Station

Transit Agencies:
• Amarillo City Transit
• Panhandle Transit
• Citibus
• SPARTAN
• CapTrans
• EZ Rider
• TRAX</td>
</tr>
</table>

Table E-1. Acronyms/Abbreviations for Transit Agencies Used in Appendix E.

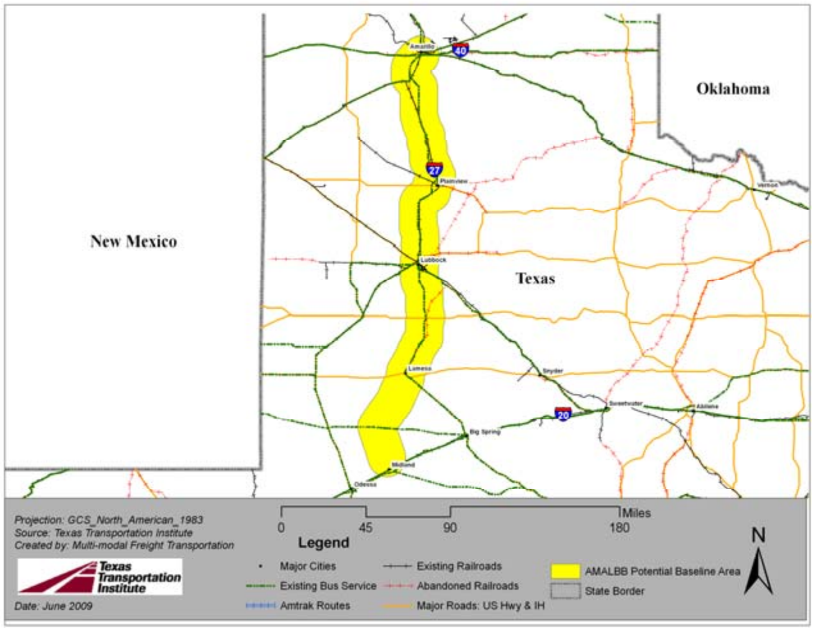
Acronym/Service Name	Agency Name
Alamo Regional Transit	Alamo Area Council of Governments
BCAA	Bee Community Action Agency
Capital Metro	Capital Metropolitan Transportation Authority (Austin)
CapTrans	Caprock Community Action Agency
CARR	City and Rural Rides, Erath County
CARTS	Capital Area Rural Transit System
CCART	Collin County Area Regional Transit
Central Texas HOP	Hill Country Transit District
Citibus City	of Lubbock
Citylink	City of Abilene Transit
Cletran	Cleburne City/County Transportation
Connect Transportation	Gulf Coast Center MHMR
DART	Dallas Area Rapid Transit
DCTA	Denton County Transportation Authority
East Texas Rural Transit (Minibus)	East Texas Council of Governments
El Aguila Rural Transportation	Webb County Community Action Agency
El Metro	Laredo Transit Management, Inc.
EZ Rider	Midland-Odessa Urban Transit District
HOTRTD	Heart of Texas Rural Transit District
Houston METRO/METRORail	Metropolitan Transit Authority of Harris County
Island Transit	City of Galveston
KCHS	Kleburg County Human Services
Panhandle Transit	Panhandle Rural Transit District
R Transit	Golden Crescent Regional Planning Commission
Rainbow Lines	Community Action Council of South Texas
REAL Transit	Rural Economic Assistance League
Rio Metro	Lower Rio Grande Valley Development Council
Rolling Plans Management Rural Transit (Sharp Lines Public Transportation)	Rolling Plains Management Corporation
SETT Rural Transit	South East Texas Transit
SPARTAN	South Plans Area Rural Transportation Assistance Network; South Plains Community Action Association
Sun Metro	City of El Paso
TAPS	Texoma Area Paratransit System
The B	Corpus Christi Regional Transit Authority
The T	Fort Worth Transportation Authority
The Wave	South Padre Island Transit
Thunderbird Rural Transit	Concho Valley Transit District
T-Line	Texarkana Urban Transit District
TRANSA Urban (was San Angelo Street Railroad Co.)	Concho Valley Transit District
TRAX	Ark-Tex Council of Governments
VIA Transit	VIA Metropolitan Transit, San Antonio
Waco Transit	City of Waco

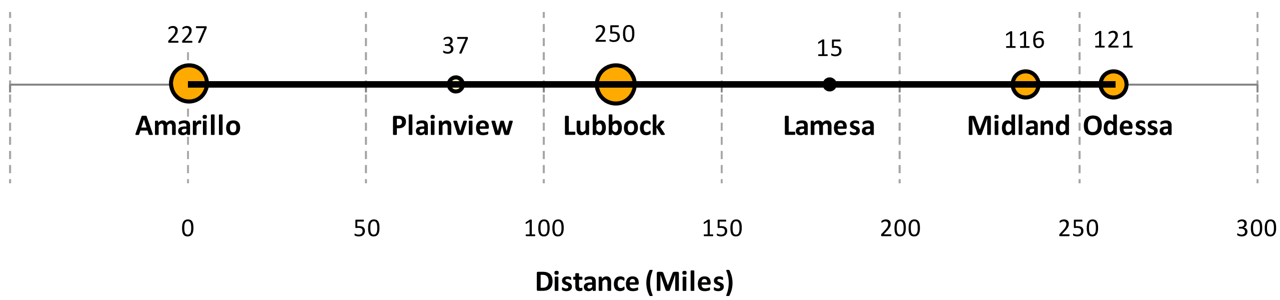
APPENDIX F. CORRIDOR INFO SHEETS

CORRIDOR MAPS WITH POPULATION CENTER CHARTS AND POPULATION/SPEED DATA TABLES

Corridors Less than 250 Miles in Length

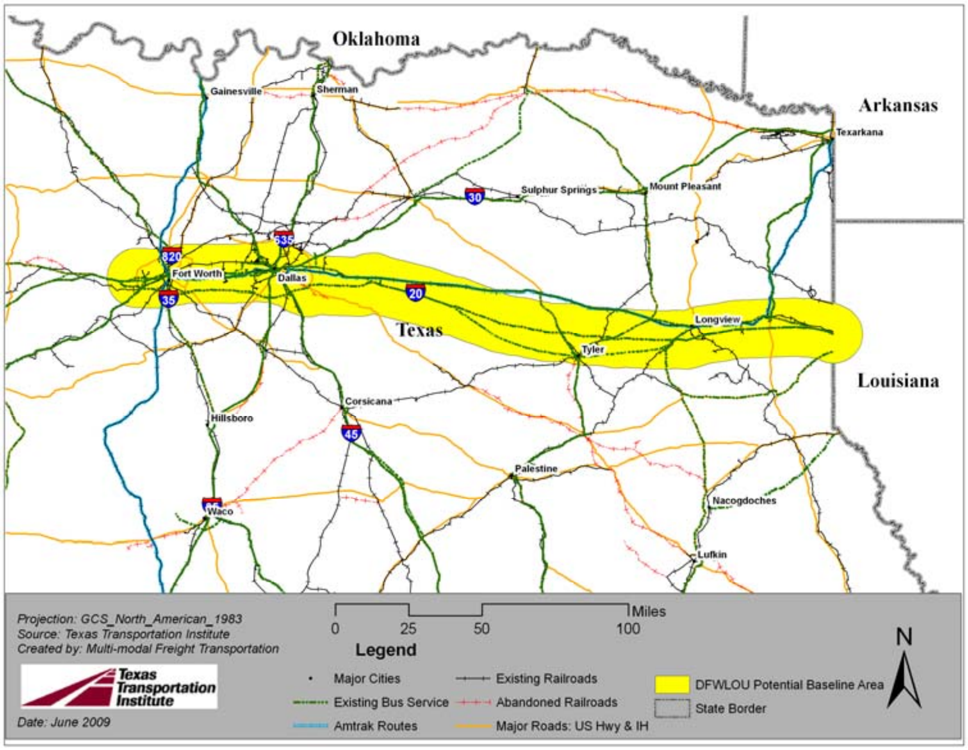
Corridor 1 – Amarillo to Midland-Odessa via Lubbock

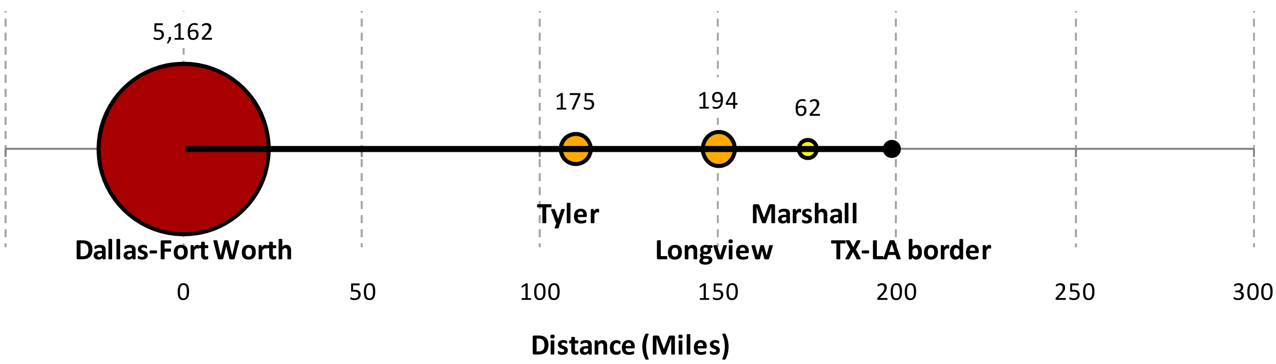




AMALBB	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Amarillo 2	26,500	330,700	46	-	-	-	-	-
Plainview 3	6,600	47,800	31	75	75	1:15	0:56	0:40
Lubbock 24	9,700	300,300	20	45	120	2:00	1:30	1:05
Lamesa 1	5,000	17,600	17	60	180	3:00	2:15	1:38
Midland 1	16,000	145,200	25	55	235	3:55	2:56	2:08
Odessa 1	21,100	163,100	35	25	260	4:20	3:15	2:21

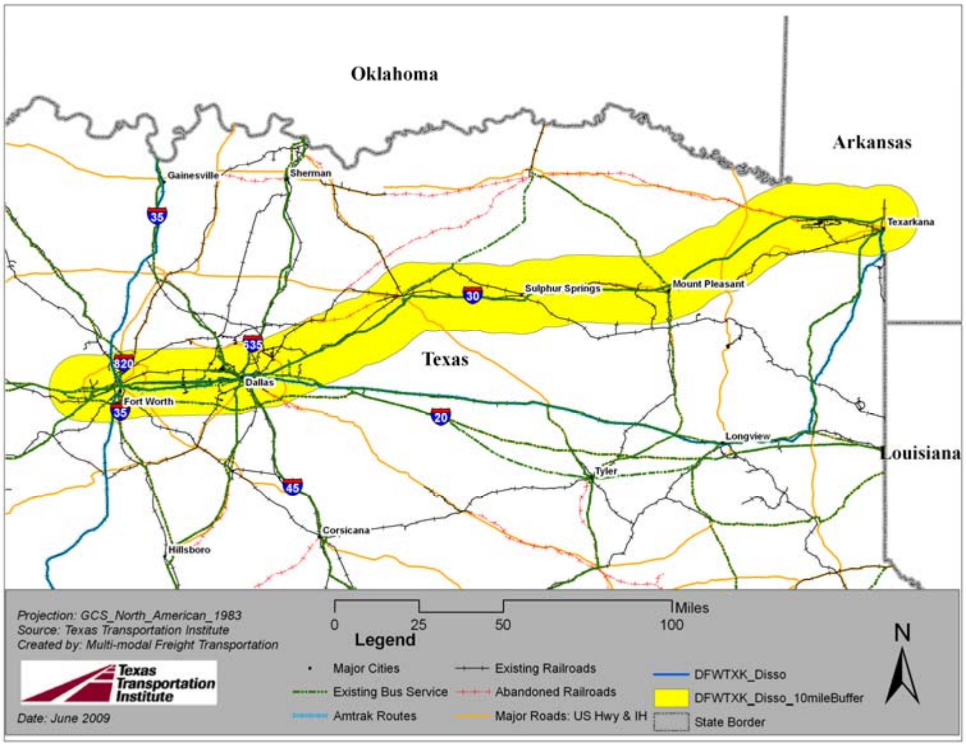
Corridor 6 – Dallas-Fort Worth to Louisiana Border

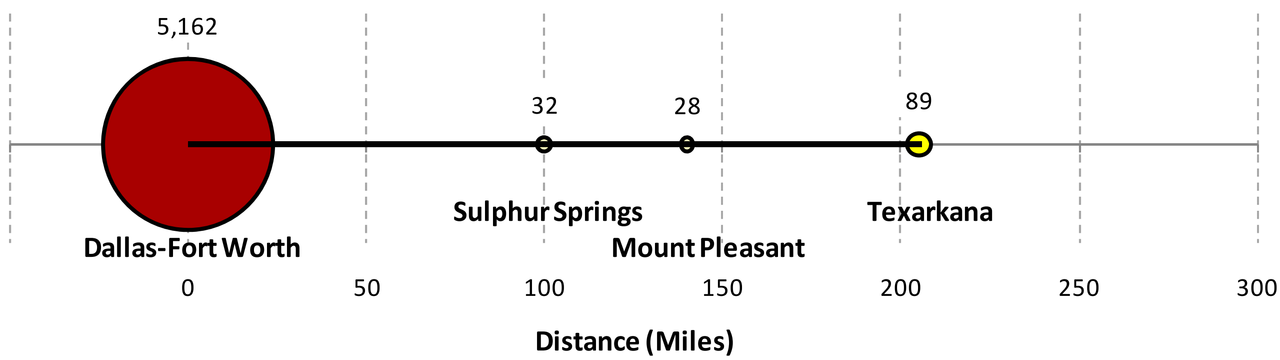




DFWLOU	Population			Distance (Miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Dallas-Fort Worth	5,161,500	10,106,800	96	-	-	-	-	-
Tyler 1	74,700	240,300	38	110	110	1:50	1:22	1:00
Longview 19	4,000	249,800	29	40	150	2:30	1:52	1:21
Marshall 6	2,100	85,500	38	25	175	2:55	2:11	1:35
TX-LA Border	-	-	-	20	195	3:15	2:26	1:46

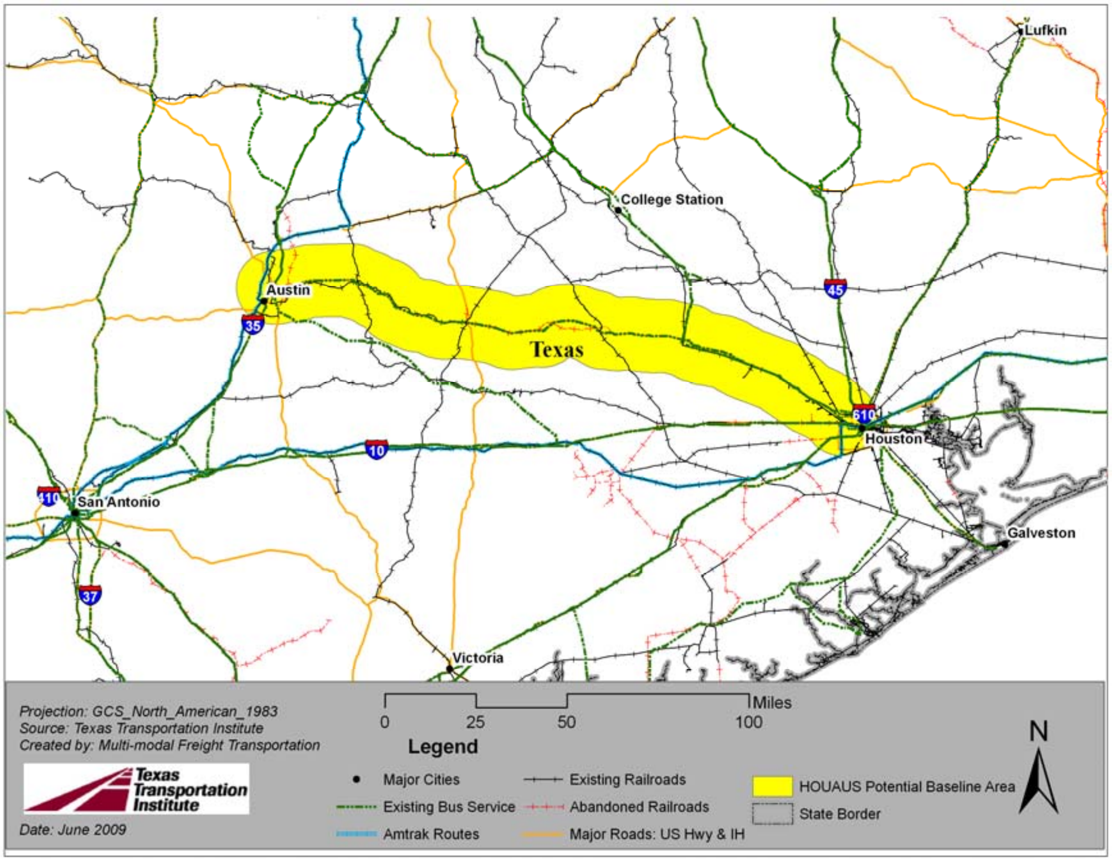
Corridor 10 – Dallas-Fort Worth to Texarkana

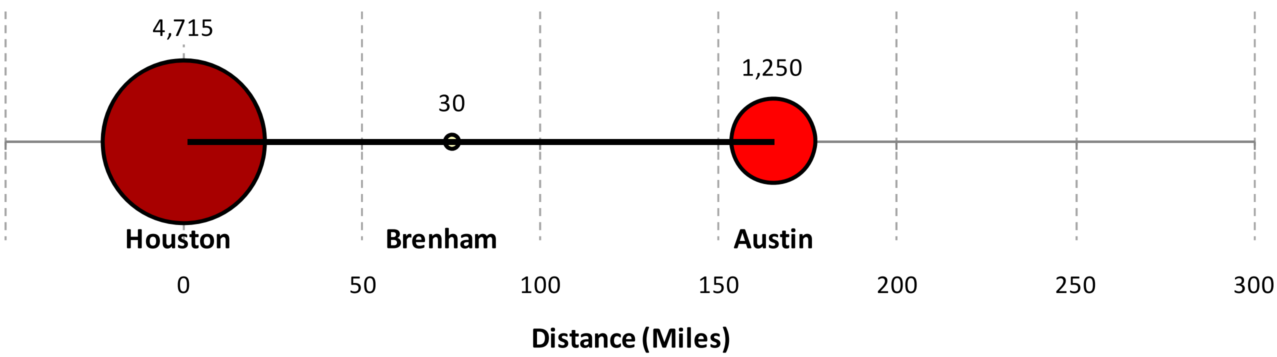




DFWTXK	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Dallas-Fort Worth	5,161,500	10,106,800	96	-	-	-	-	-
Sulphur Springs	32,000	38,500	20	100	100	1:40	1:15	0:54
Mount Pleasant	28,100	43,100	53	40	140	2:20	1:45	1:16
Texarkana 8	9,300	84,300	-6	65	205	3:25	2:33	1:51

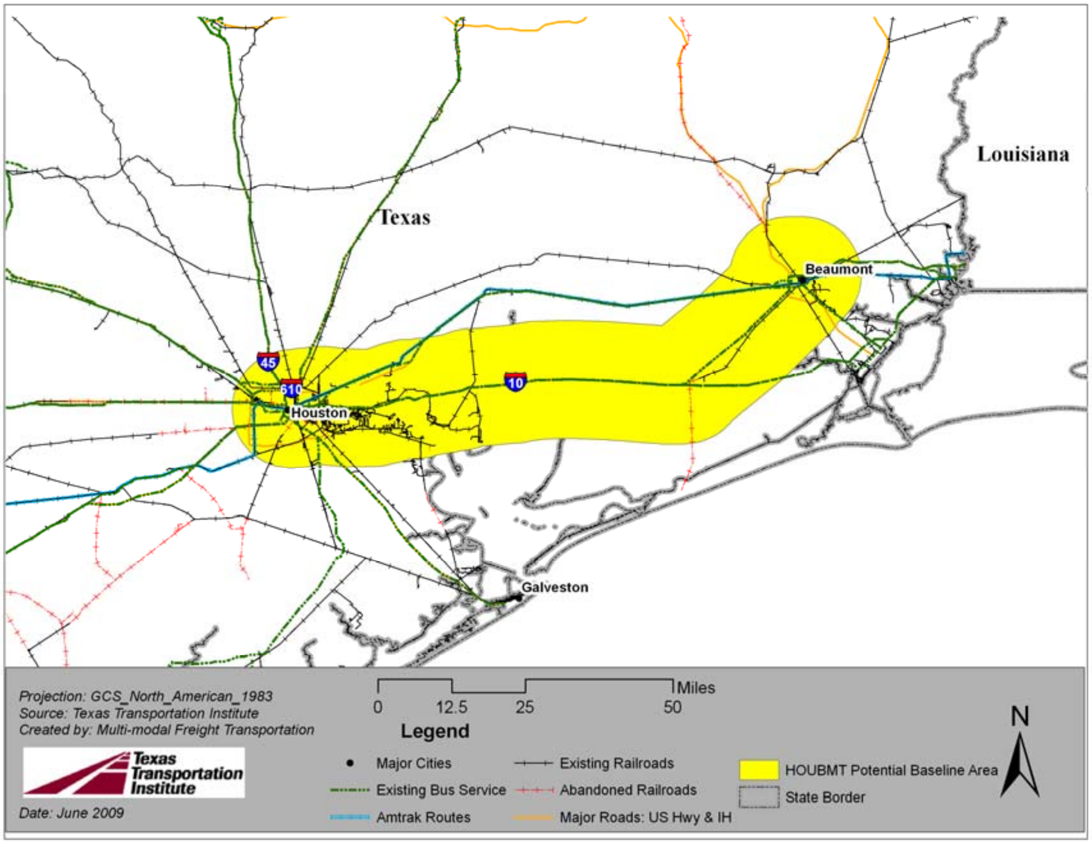
Corridor 11 – Houston to Austin

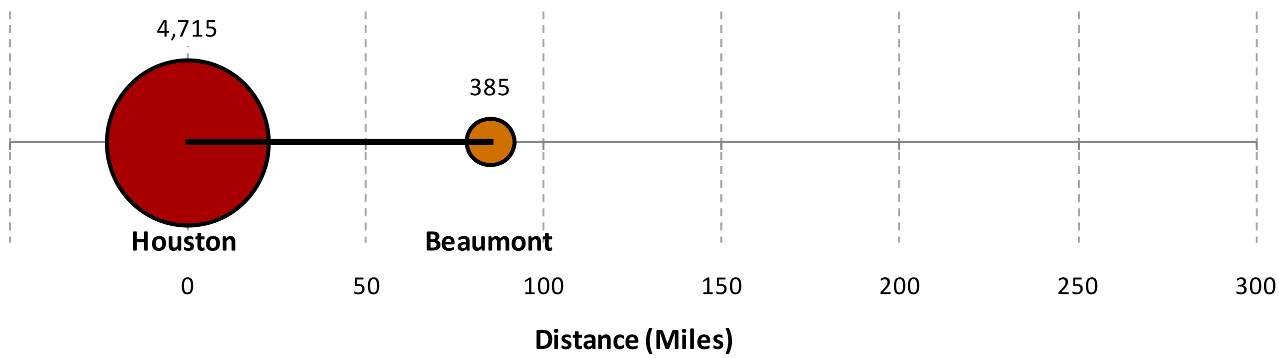




HOUAUS	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Houston 4,	715,400	8,400,100	78	-	-	-	-	-
Brenham 3	0,400	39,500	30	75	75	1:15	0:56	0:40
Austin 1	,249,800	2,658,500	113	90	165	2:45	2:03	1:30

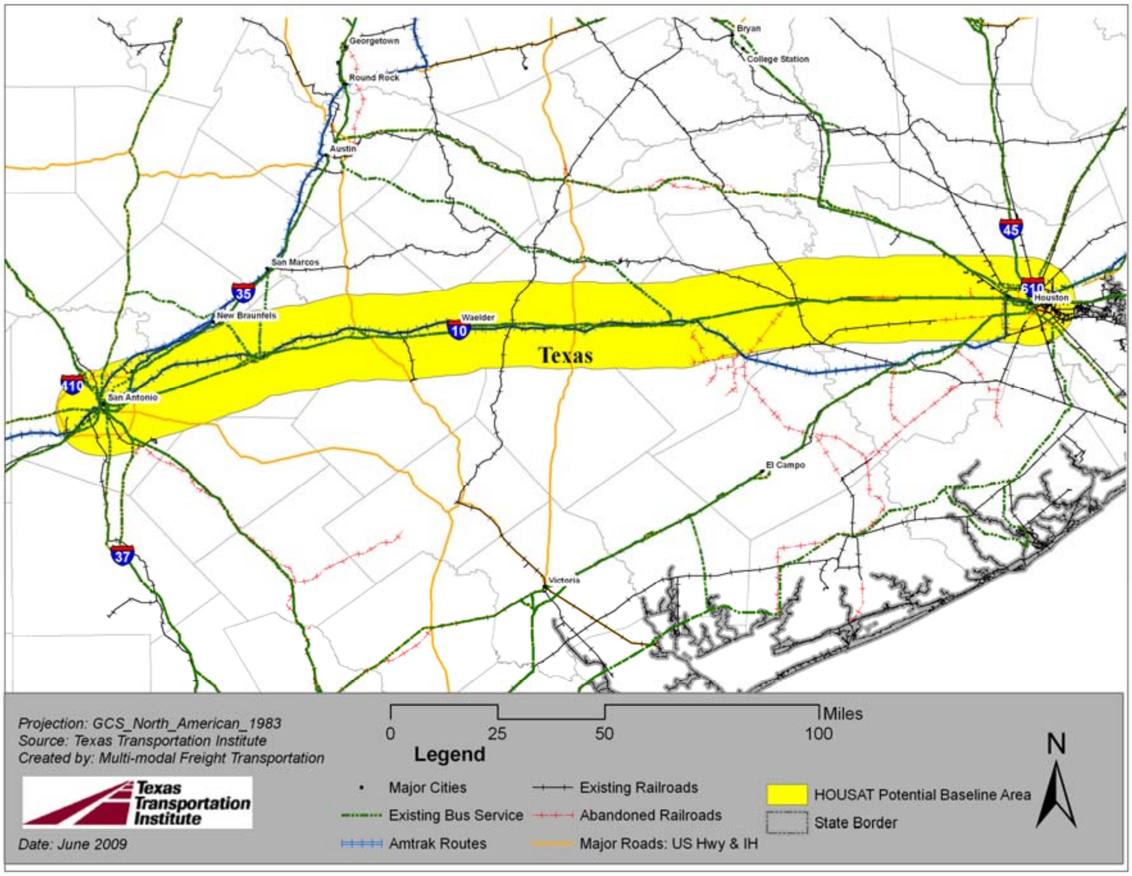
Corridor 12 – Houston to Beaumont

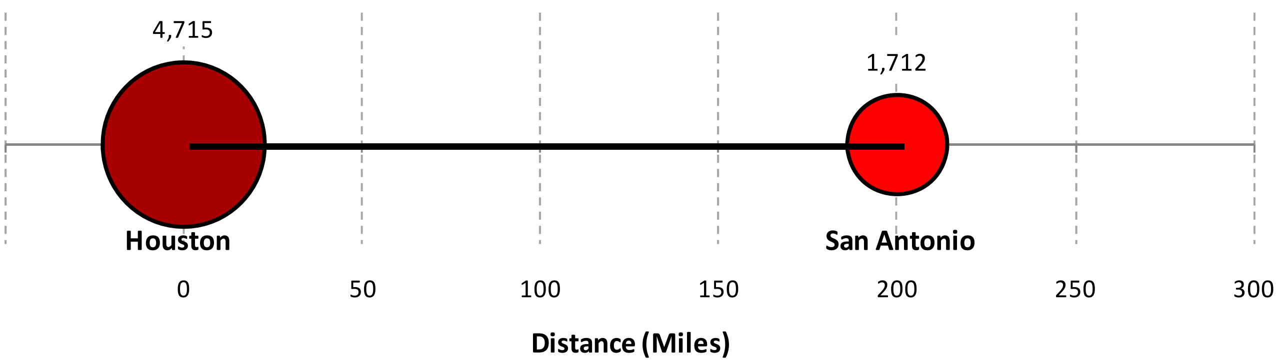




HOUBMT	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Houston 4,	715,400	8,400,100	78	-	-	-	-	-
Beaumont 38	5,100	455,500	18	85	85	1:25	1:04	0:46

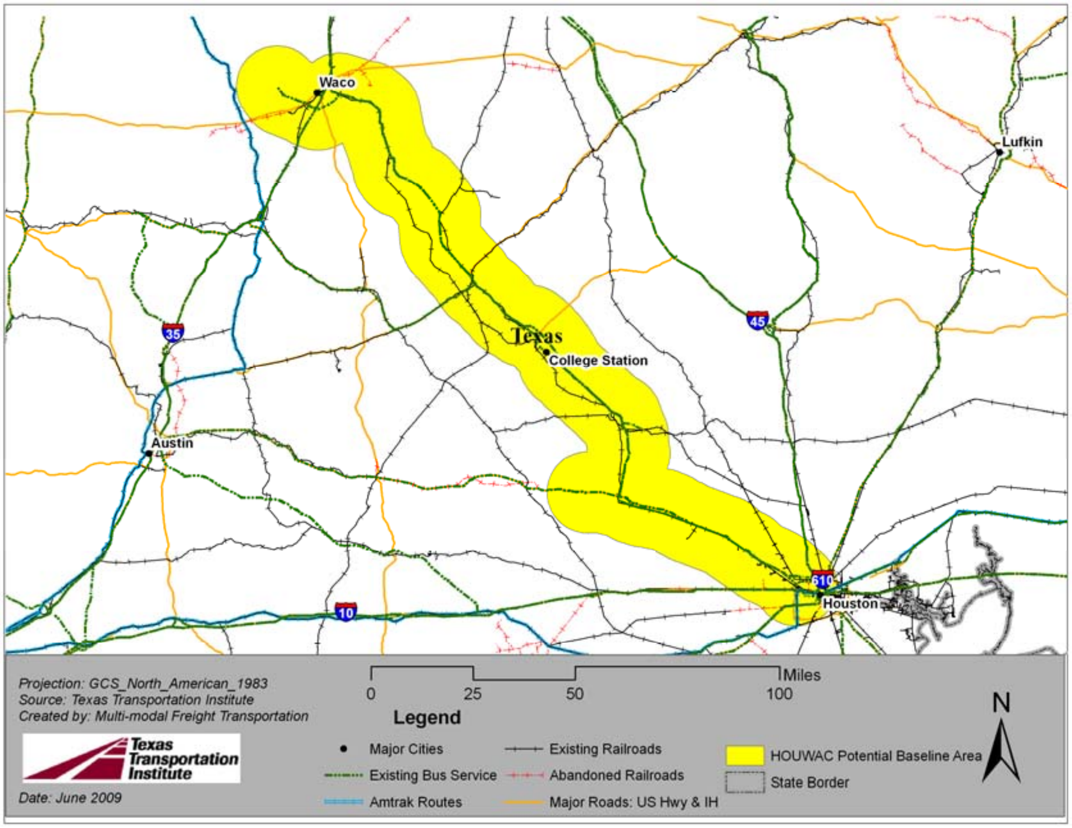
Corridor 14 – Houston to San Antonio

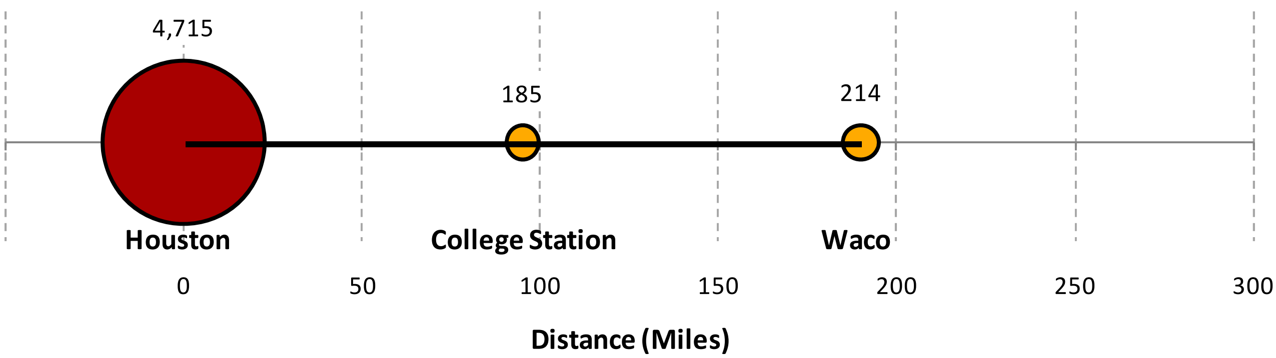




HOUSAT	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Houston 4,	715,400	8,400,100	78	-	-	-	-	-
San Antonio	1,711,700	2,512,000	47	200	200	3:20	2:30	1:49

Corridor 16 – Houston to Waco

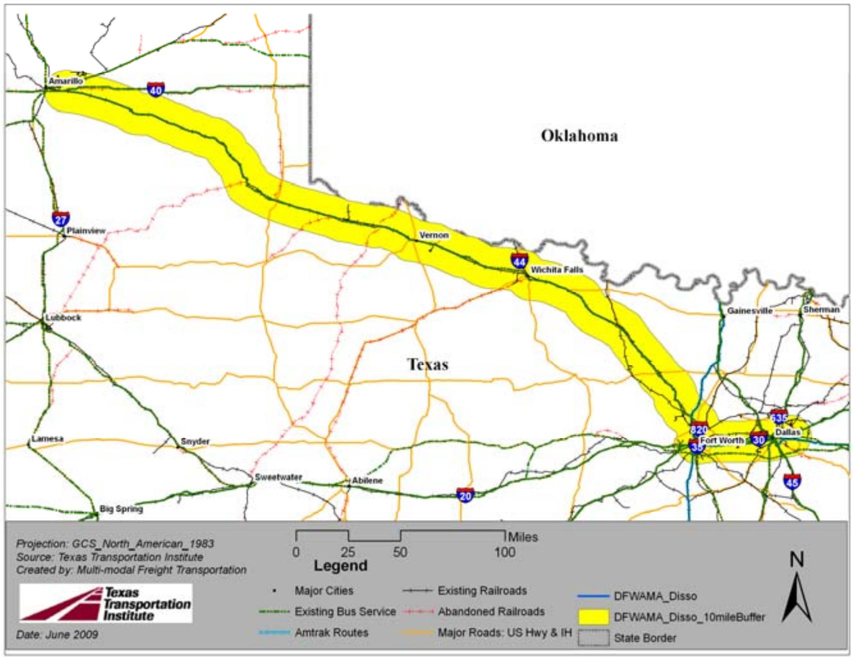


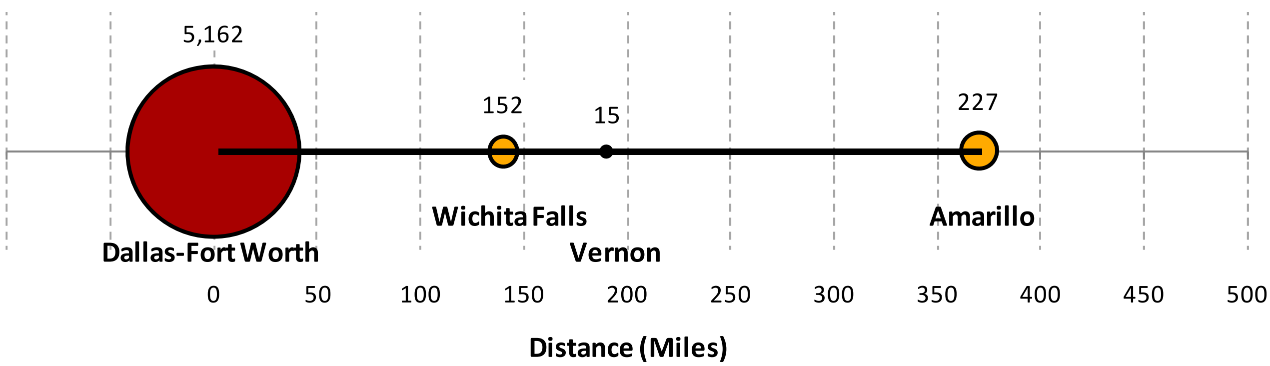


HOUWAC	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Houston 4,	715,400	8,400,100	78	-	-	-	-	-
College Station	184,900	267,700	45	95	95	1:35	1:11	0:51
Waco 2	13,500	285,500	34	95	190	3:10	2:22	1:43

Corridors Longer than 250 Miles but Less than 500 Miles in Length

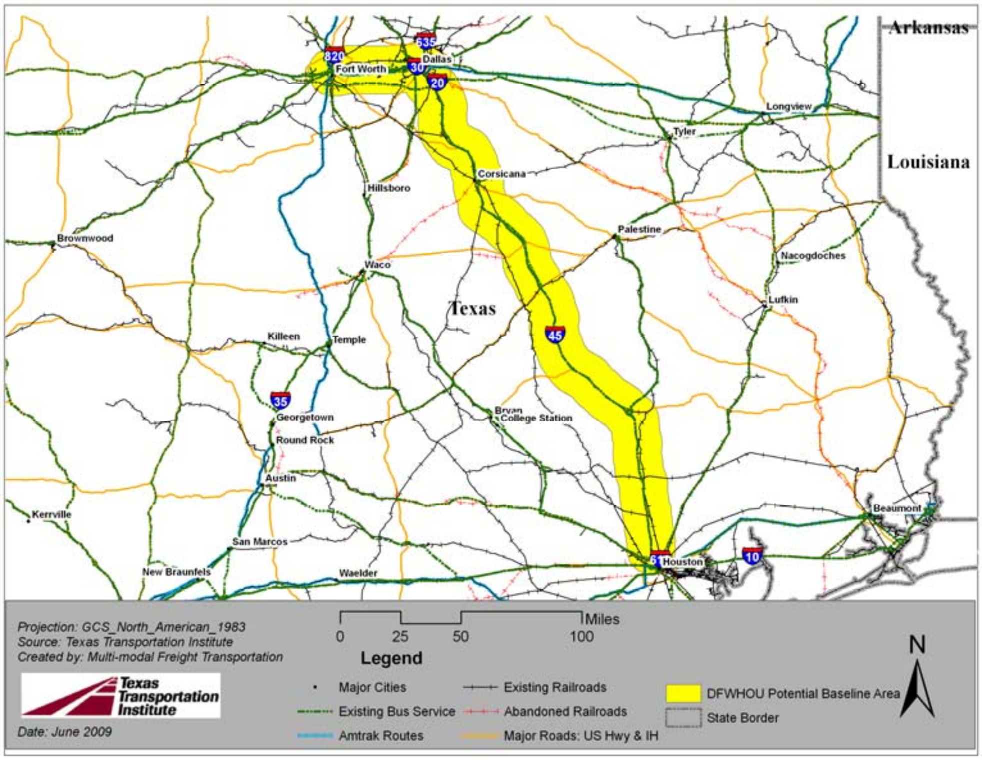
Corridor 3 – Dallas-Fort Worth to Amarillo via Wichita Falls

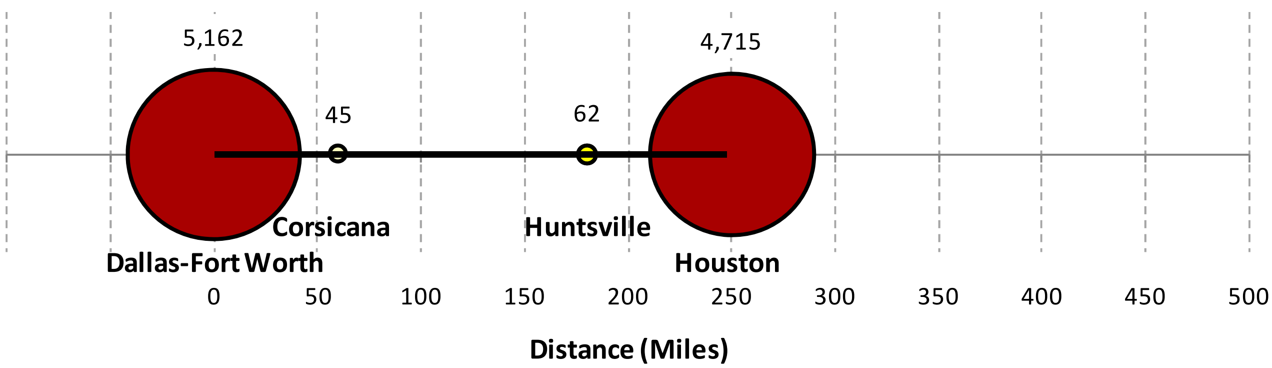




DFWAMA	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Dallas-Fort Worth	5,161,500	10,106,800	96	-	-	-	-	-
Wichita Falls	151,500	172,400	14	140	140	2:20	1:45	1:16
Vernon 1	4,700	16,500	12	50	190	3:10	2:22	1:43
Amarillo 2	26,500	330,700	46	180	370	6:10	4:37	3:21

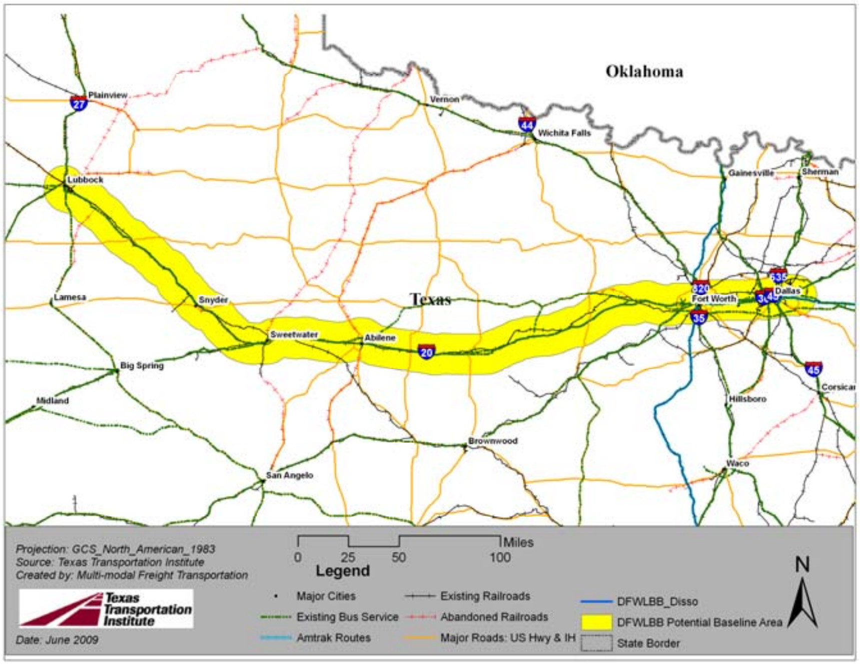
Corridor 4 – Dallas-Fort Worth to Houston

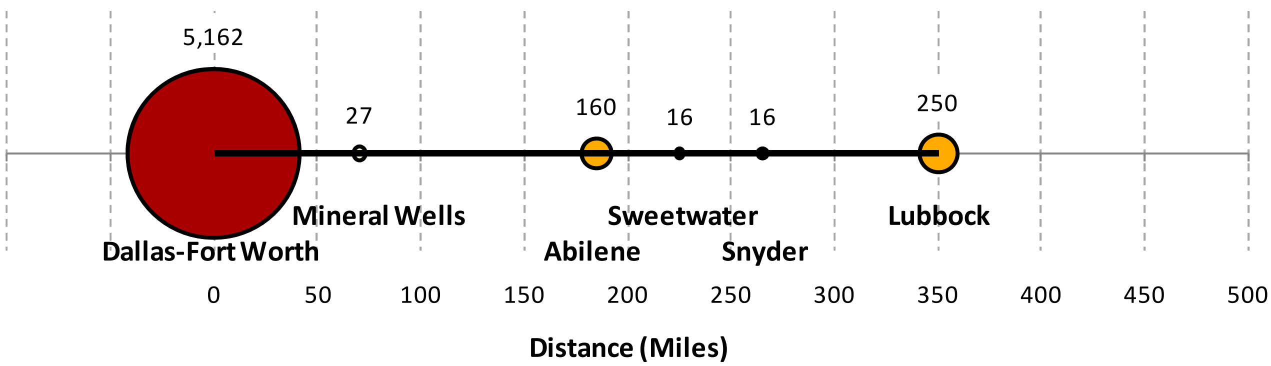




DFWHOU	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Dallas-Fort Worth	5,161,500	10,106,800	96	-	-	-	-	-
Corsicana 4	5,100	70,900	57	60	60	1:00	0:45	0:32
Huntsville 6	1,800	77,800	26	120	180	3:00	2:15	1:38
Houston 4,	715,400	8,400,100	78	70	250	4:10	3:07	2:16

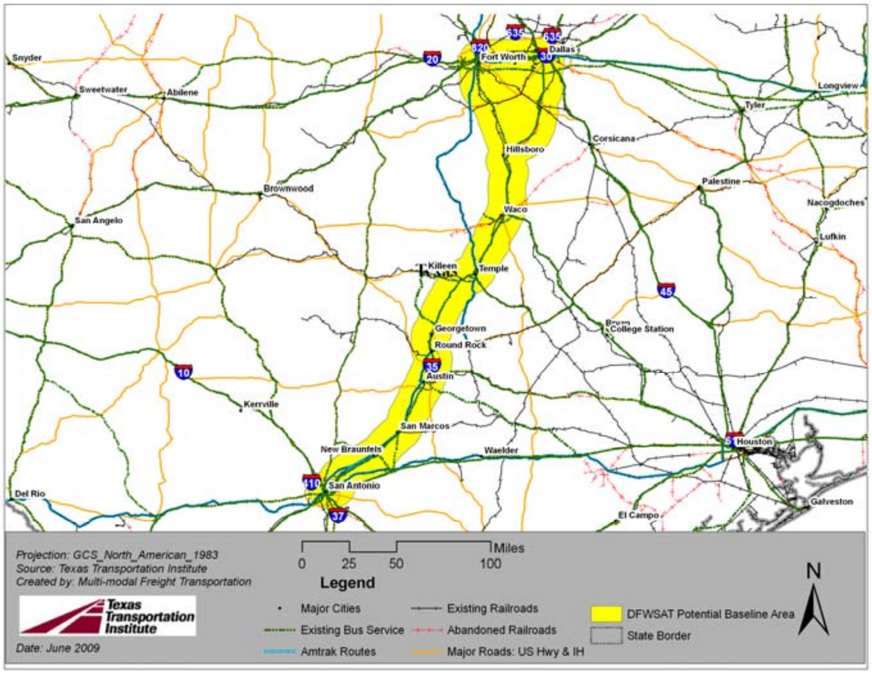
Corridor 5 – Dallas-Fort Worth to Lubbock via Abilene

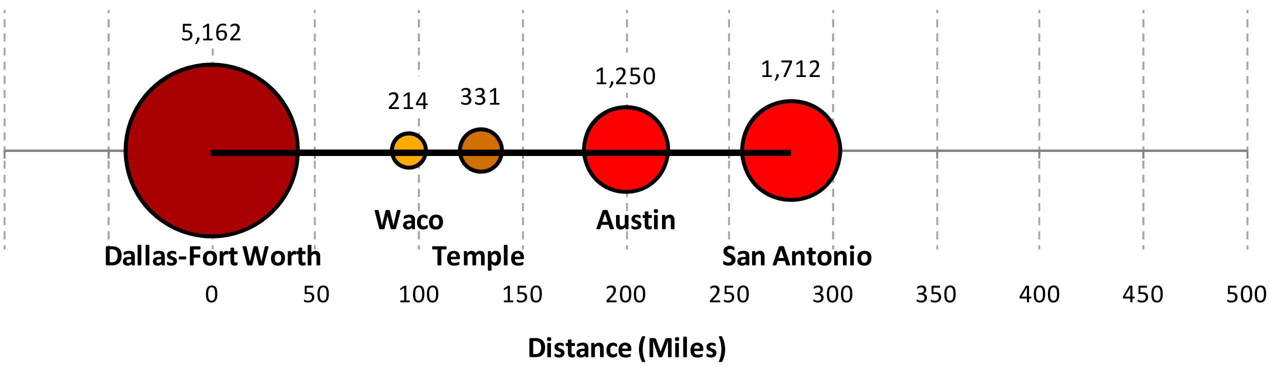




DFWLBB	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Dallas-Fort Worth	5,161,500	10,106,800	96	-	-	-	-	-
Mineral Wells	27,000	36,700	36	70	70	1:10	0:52	0:38
Abilene 1	60,200	181,600	13	115	185	3:05	2:18	1:40
Sweetwater 1	5,800	17,700	12	40	225	3:45	2:48	2:02
Snyder 1	6,400	17,500	7	40	265	4:25	3:18	2:24
Lubbock 24	9,700	300,300	20	85	350	5:50	4:22	3:10

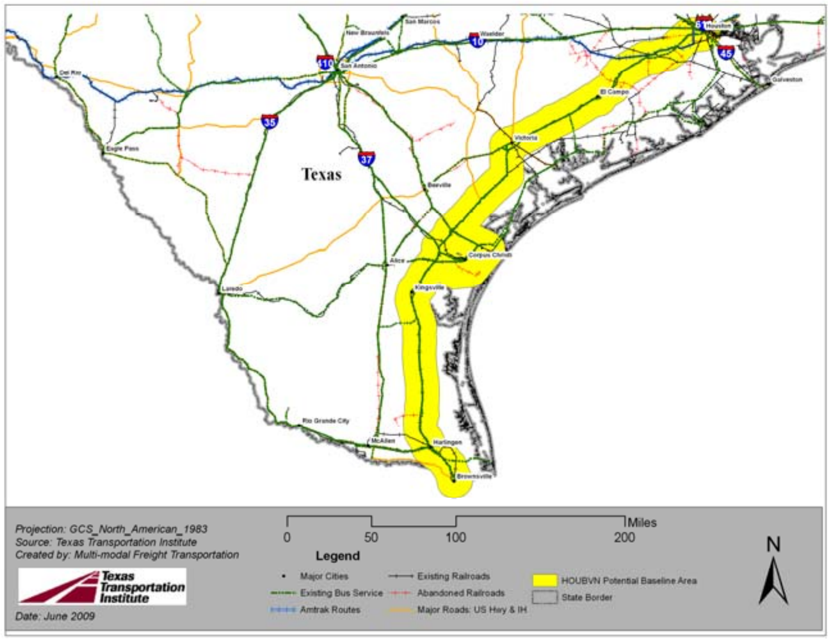
Corridor 7 – Dallas-Fort Worth to San Antonio

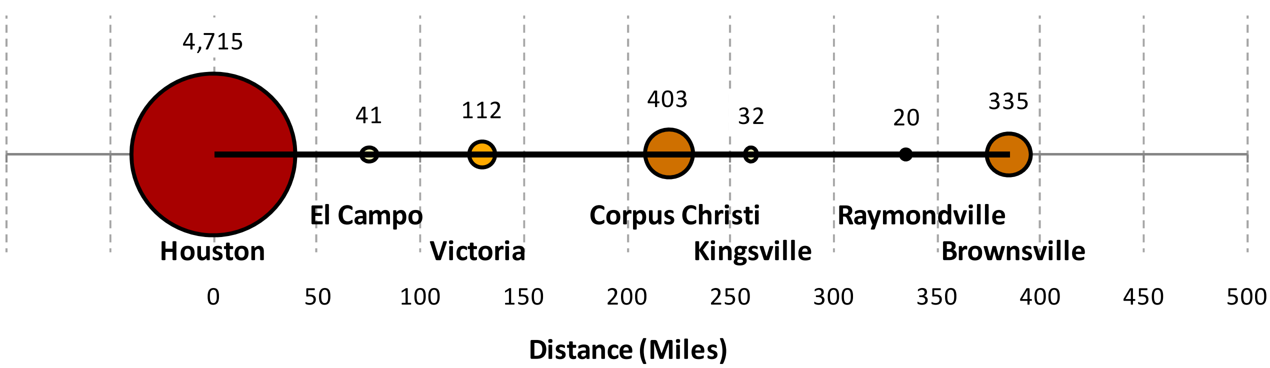




DFWSAT	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Dallas-Fort Worth	5,161,500	10,106,800	96	-	-	-	-	-
Waco 21	3,500	285,500	34	95	95	1:35	1:11	0:51
Temple 33	0,700	553,700	67	35	130	2:10	1:37	1:10
Austin 1	,249,800	2,658,500	113	70	200	3:20	2:30	1:49
San Antonio	1,711,700	2,512,000	47	80	280	4:40	3:30	2:32

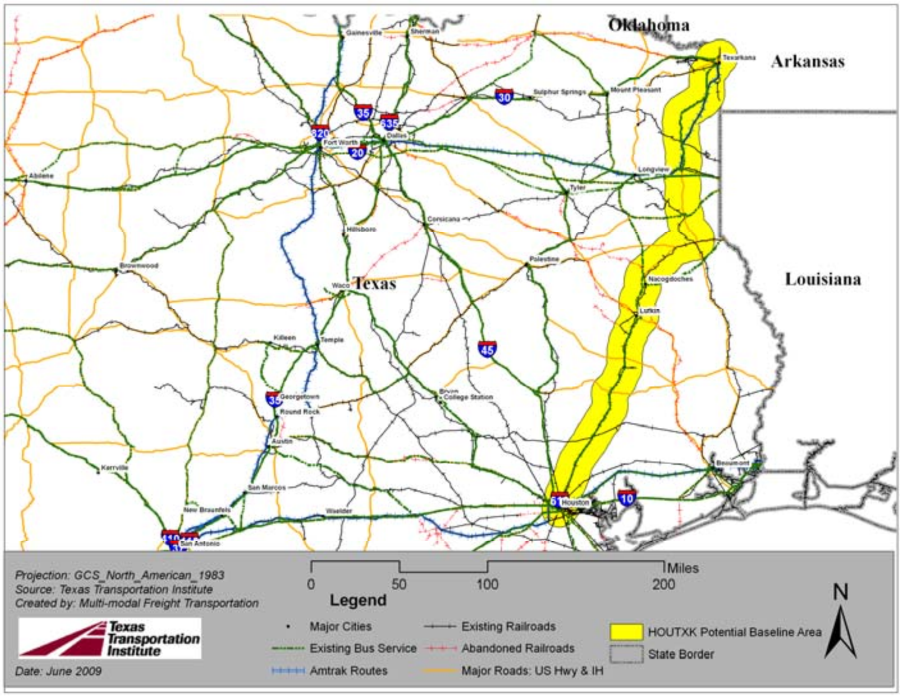
Corridor 13 – Houston to Brownsville

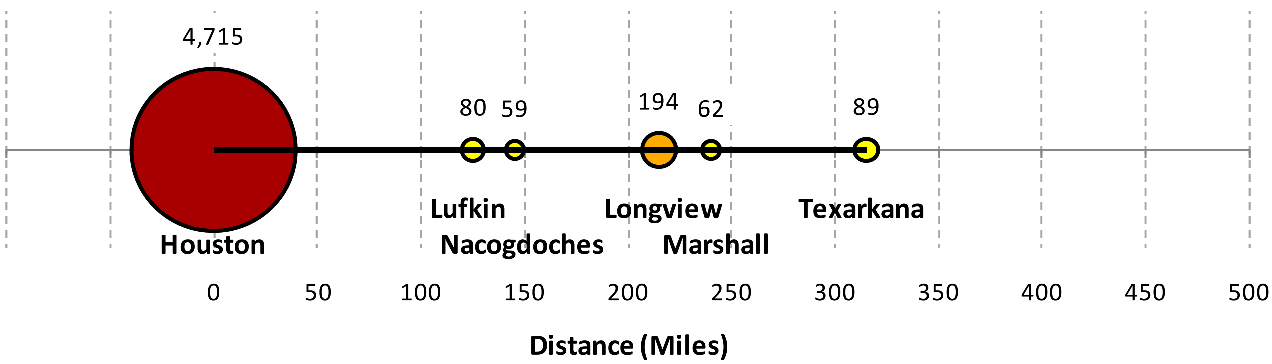




HOUBVN	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Houston 4,	715,400	8,400,100	78	-	-	-	-	-
El Campo	41,200	51,000	24	75	75	1:15	0:56	0:40
Victoria 11	1,700	153,800	38	55	130	2:10	1:37	1:10
Corpus Christi	403,300	606,100	50	90	220	3:40	2:45	2:00
Kingsville 3	2,000	47,400	48	40	260	4:20	3:15	2:21
Raymondville 2	0,100	30,500	52	75	335	5:35	4:11	3:02
Brownsville 3	35,200	675,700	102	50	385	6:25	4:48	3:30

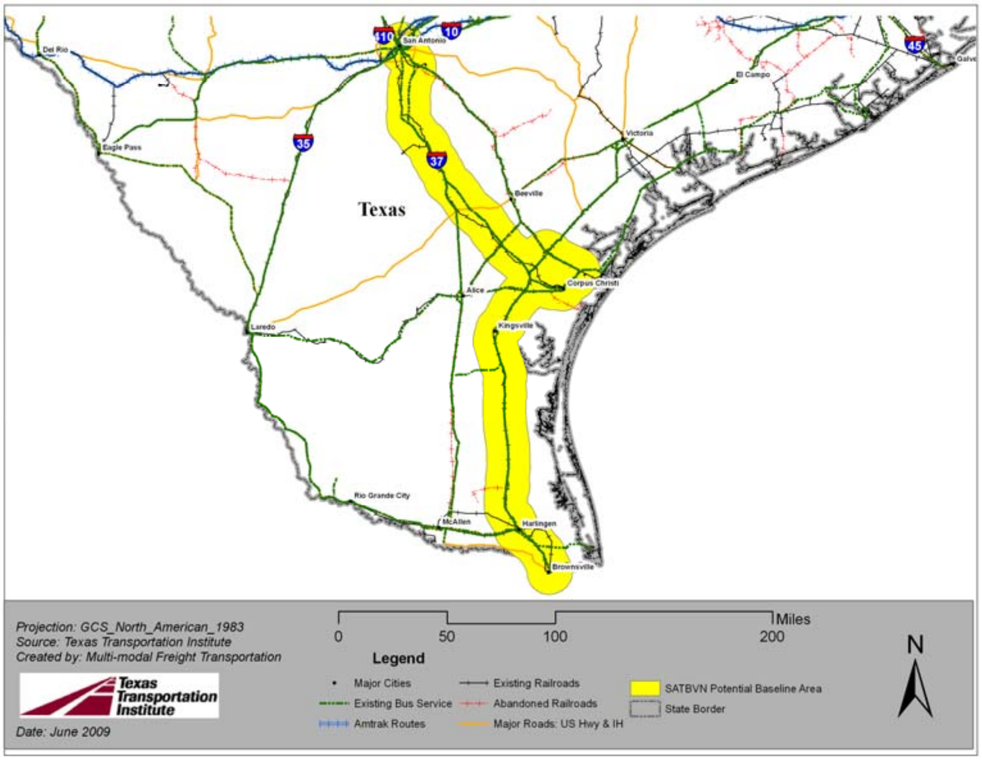
Corridor 15 – Houston to Texarkana

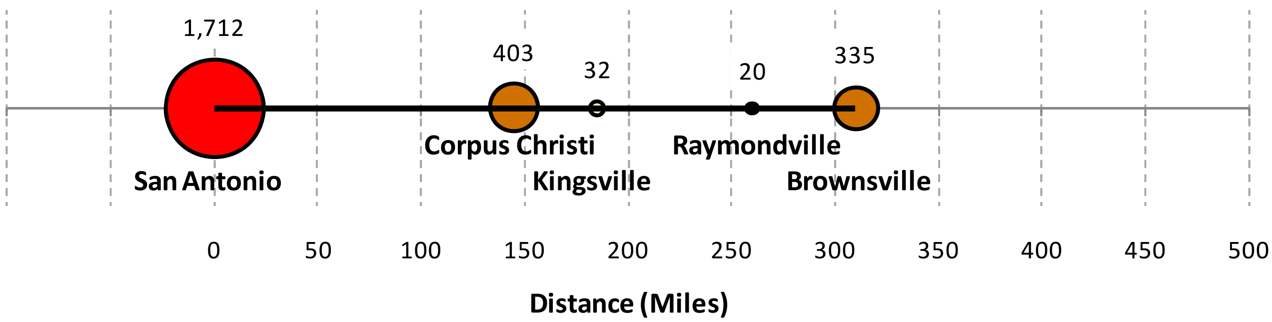




HOUTXK	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Houston 4,	715,400	8,400,100	78	-	-	-	-	-
Lufkin 8	0,100	111,200	39	125	125	2:05	1:33	1:08
Nacogdoches 5	9,200	75,800	28	20	145	2:25	1:48	1:19
Longview 19	4,000	249,800	29	70	215	3:35	2:41	1:57
Marshall 6	2,100	85,500	38	25	240	4:00	3:00	2:10
Texarkana 8	9,300	84,300	-6	75	315	5:15	3:56	2:51

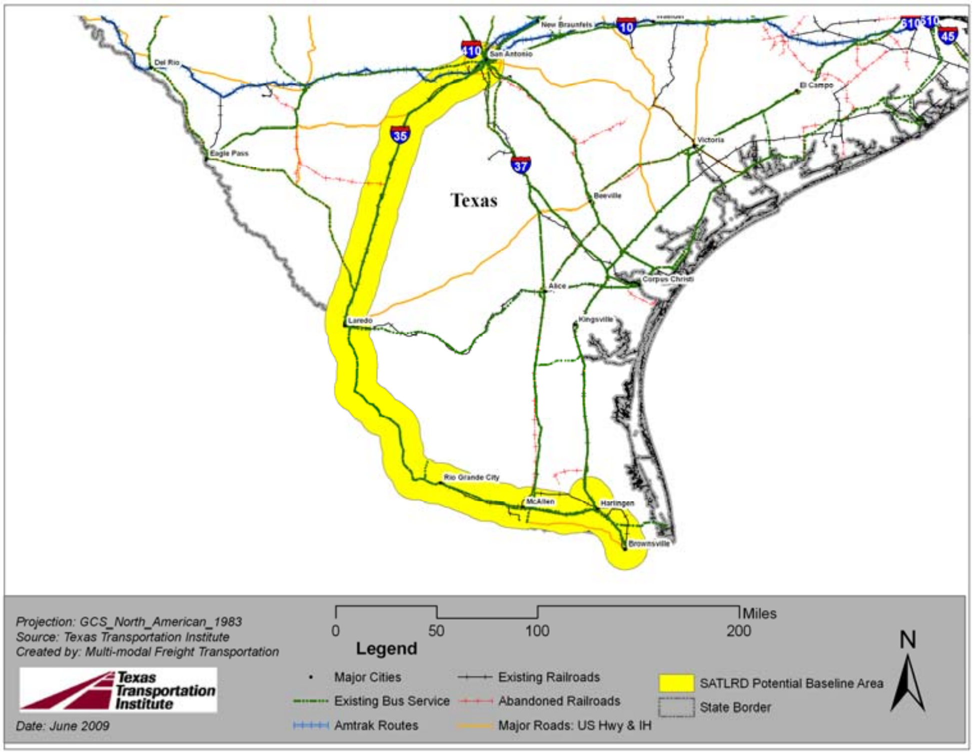
Corridor 17 – San Antonio to Brownsville via Corpus Christi

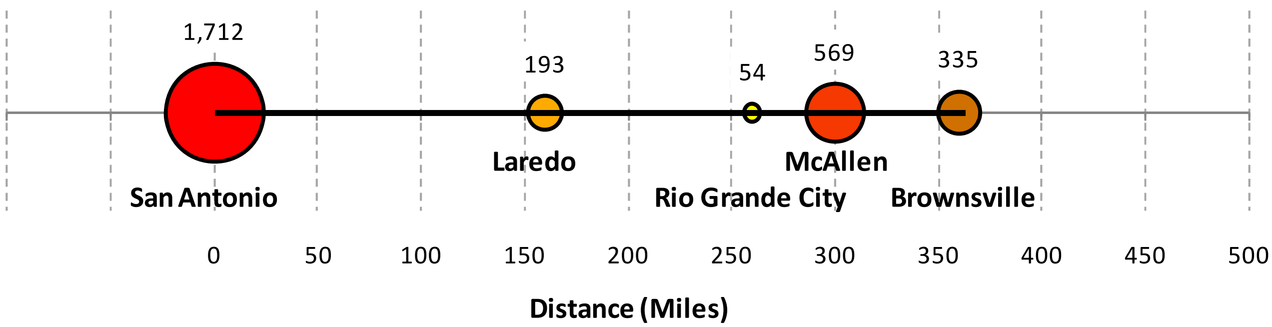




SATBVN	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
San Antonio	1,711,700	2,512,000	47	-	-	-	-	-
Corpus Christi	403,300	606,100	50	145	145	2:25	1:48	1:19
Kingsville 3	2,000	47,400	48	40	185	3:05	2:18	1:40
Raymondville 2	0,100	30,500	52	75	260	4:20	3:15	2:21
Brownsville 3	35,200	675,700	102	50	310	5:10	3:52	2:49

Corridor 19 – San Antonio to Brownsville via Laredo

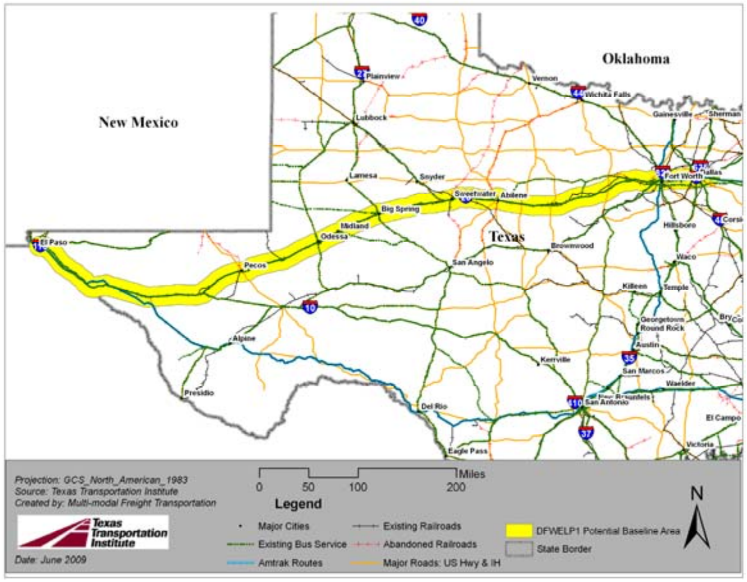


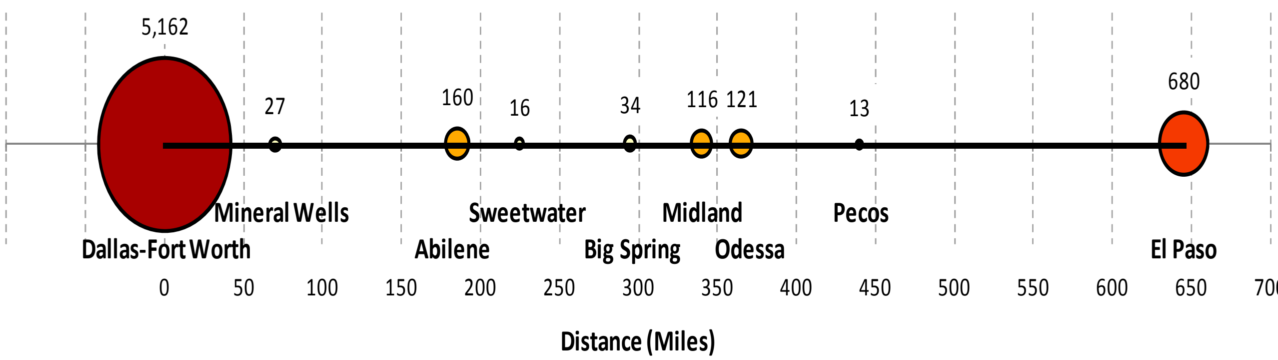


SATLRD	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
San Antonio	1,711,700	2,512,000	47	-	-	-	-	-
Laredo 1	93,100	542,600	181	160	160	2:40	2:00	1:27
Rio Grande City	53,600	112,700	110	100	260	4:20	3:15	2:21
McAllen 5	69,500	1,439,500	153	40	300	5:00	3:45	2:43
Brownsville 3	35,200	675,700	102	60	360	6:00	4:30	3:16

Corridors Greater than 500 Miles in Length

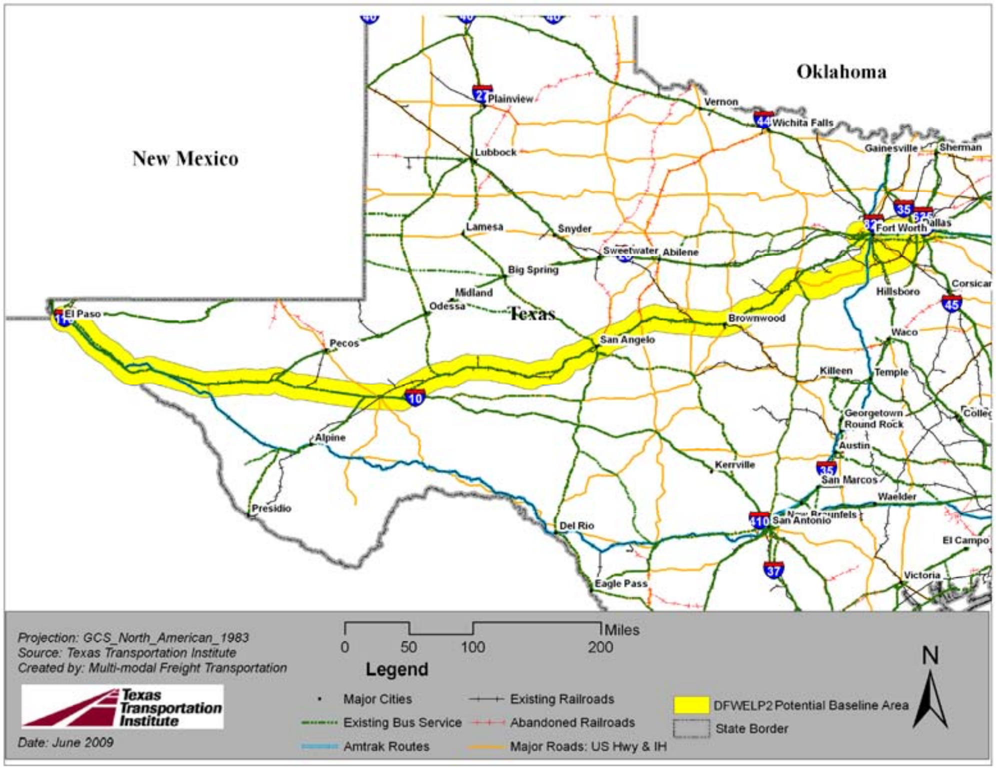
Corridor 2 – Dallas-Fort Worth to El Paso via Abilene

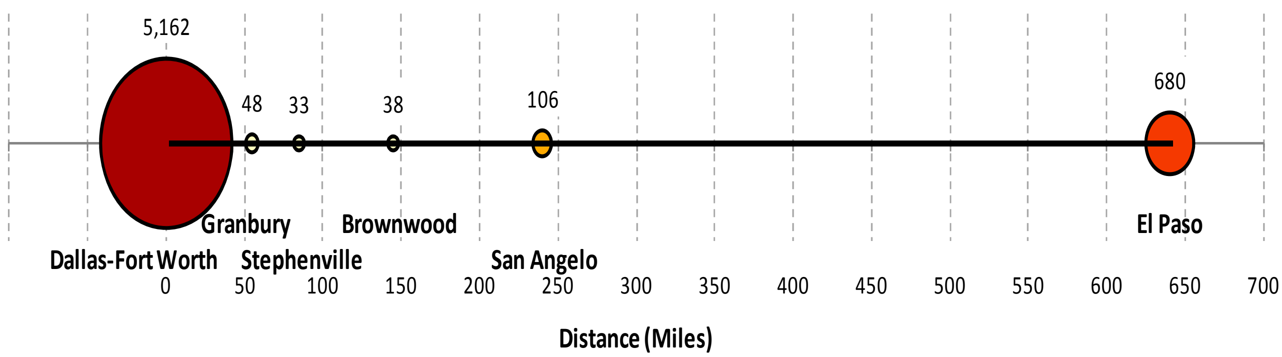




DFWELP1	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Dallas-Fort Worth	5,161,500	10,106,800	96	-	-	-	-	-
Mineral Wells	27,000	36,700	36	70	70	1:10	0:52	0:38
Abilene 1	60,200	181,600	13	115	185	3:05	2:18	1:40
Sweetwater 1	5,800	17,700	12	40	225	3:45	2:48	2:02
Big Spring	33,600	35,500	6	70	295	4:55	3:41	2:40
Midland 1	16,000	145,200	25	45	340	5:40	4:15	3:05
Odessa 1	21,100	163,100	35	25	365	6:05	4:33	3:19
Pecos 1	3,100	15,100	15	75	440	7:20	5:30	4:00
El Paso	679,600	1,153,100	70	205	645	10:45	8:03	5:51

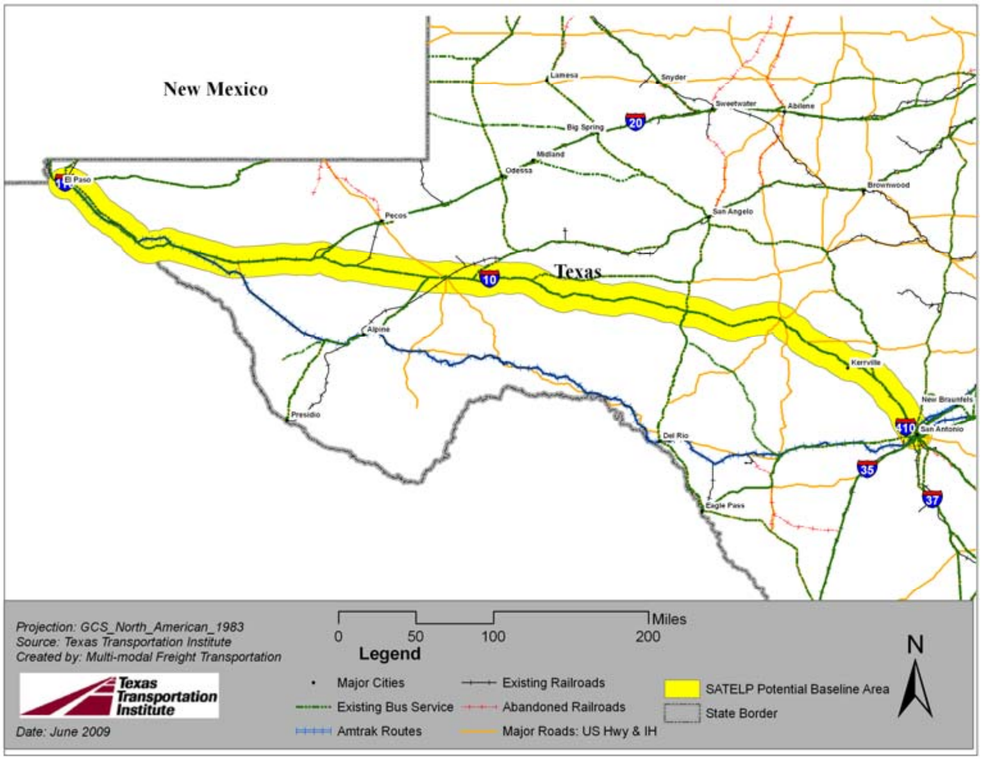
Corridor 9 – Dallas-Fort Worth to El Paso via San Angelo

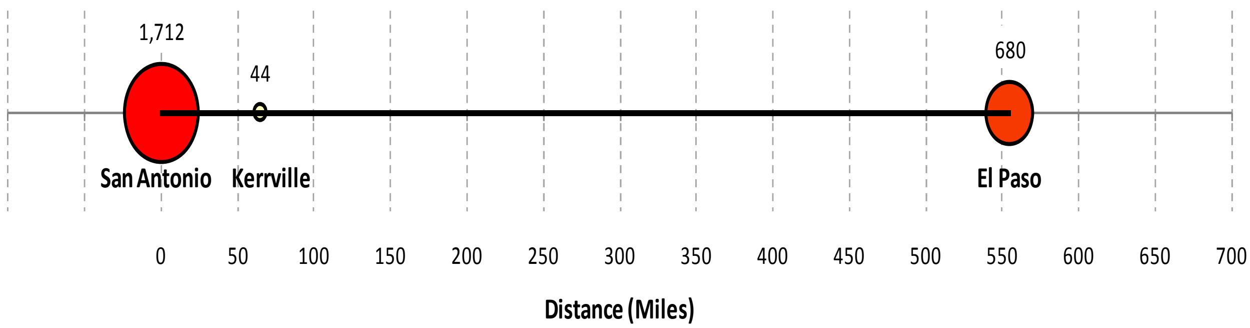




DFWELP2	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
Dallas-Fort Worth	5,161,500	10,106,800	96	-	-	-	-	-
Granbury 4	7,900	83,500	74	55	55	0:55	0:41	0:30
Stephenville 3	3,000	50,200	52	30	85	1:25	1:03	0:46
Brownwood 3	7,700	42,000	11	60	145	2:25	1:48	1:19
San Angelo	105,800	123,900	17	95	240	4:00	3:00	2:10
El Paso	679,600	1,153,100	70	400	640	10:40	8:00	5:49

Corridor 18 – San Antonio to El Paso





SATELP	Population			Distance (miles)		Travel Time (hours:minutes)		
CBSA	2000	2040	Total % Growth	Segment	Cumulative	60 mph	80 mph	110 mph
San Antonio	1,711,700	2,512,000	47	-	-	-	-	-
Kerrville 4	3,700	51,000	17	65	65	1:05	0:48	0:35
El Paso	679,600	1,153,100	70	490	555	9:15	6:56	5:02

APPENDIX G. INTERCITY TRANSIT TECHNOLOGIES AND METHODS FOR CREATING HIGH RIDERSHIP SYSTEMS

This chapter describes some of the transit technologies available for intercity transit service, both rail and bus, and summarizes some of the factors that have been shown to increase transit service in general and are likely to be particularly pertinent to longer-distance, intercity transit trips. The research team collected the information in this chapter during Task 1 of the project.

RAIL AND BUS TECHNOLOGIES AVAILABLE FOR INTERCITY TRANSIT SERVICE

Rail Technologies

There are several major types of rail rolling stock that can be used to serve intercity passenger markets. The first major category by which to classify passenger trains is by their source of locomotive power. Passenger trains can either be locomotive-hauled (one or more locomotives pulling unpowered passenger coaches, dining car, etc.) or self-powered passenger cars (no separate locomotive—engines are located on passenger cars that may pull additional passenger coaches). Further, locomotives can be classified by their power source (i.e., diesel-electric locomotive power or direct contact electric power from an overhead catenary or third-rail). The actual type of rolling stock chosen for any project is dependent on a variety of economic and operational factors. Some typical intercity passenger rail configurations or "consists" are described below.

Diesel-Electric Locomotive-Hauled Passenger Train

This is the type of train most typical for intercity long-distance passenger rail service and is also used in many commuter rail operations. One or more diesel-electric locomotives are joined to several unpowered passenger coaches or other specialty cars. Because this train configuration can operate on existing tracks used by freight trains without having to invest in or maintain a new overhead catenary power grid, this option is often the most inexpensive for starting new intercity passenger systems. These trains can also be operated in a push-pull mode when a cab-control car is added at the rear of the train.

Electric-Powered Locomotive Passenger Train

In several high-use passenger train corridors additional investment has been made to power trains by using electric power produced at power stations rather than producing electricity with diesel engines onboard the locomotive. Typically this power is transferred to an electric locomotive via an overhead catenary wire system that runs the length of the tracks. Because power is generated and distributed from outside the train itself, the train is lighter and can accelerate and decelerate more quickly—thereby improving train performance. This type of consist can also operate in push-pull mode with the use of a cab-control car. Most high-speed rail systems in Europe and around the world use electric power from overhead catenaries as the means for propelling their rolling stock.

Diesel-Multiple Unit (DMU) Vehicles.

DMU vehicles are classified as self-powered rail cars (SPRC). Each car has an onboard diesel engine that provides power to its own wheels but, unlike a locomotive, the car also has seats for passengers. Several DMUs can be linked together to provide additional seating for passengers, and most DMU vehicles are powerful enough to pull an additional one or two unpowered passenger coaches if ridership demands exceed the capacity of the powered vehicles. The smaller size and flexibility of the DMU and other SPRCs as well as their fuel efficiency has made them appealing for use in intercity service; however, most DMU vehicles produced worldwide do not meet Federal Railroad Administration (FRA) crashworthiness standards. This means that the vehicles are not allowed to operate over existing freight rail tracks at the same time as freight trains. Only recently have DMU vehicles meeting FRA crashworthiness standards been designed and placed into service for intercity travel in the U.S.

Several other emerging technologies such as magnetic levitation (Maglev) propulsion and tilt-train technology can be applied to improve train speed or performance in the future but have not been proven in intercity passenger service in the U.S. at this time. The technology chosen by any system will result from an analysis of the tradeoff between cost, performance, passenger demand, and transportation needs within a corridor.

Express Bus Technologies

There are three general types of bus technologies available for intercity service: transit buses, express bus/bus rapid transit, and intercity buses.

Transit Buses

The most common bus design for urban transit systems has front and center doors, low-back seating, and no restroom facilities or luggage compartments. These buses generally range from 30 to 40 feet in length and are usually able to accommodate one or two wheelchairs. Class A transit buses are equipped with more than 35 passenger seats, Class B buses contain 25 to 35 seats, and Class C buses contain less than 25 seats (*46, 47*). Articulated buses can be 54 to 60 feet long and can hold around 60 passengers. Rural transit systems may use urban-type transit buses, vans, or "body-on-chassis" minibuses, any of which may be manufactured or modified to be Americans with Disabilities Act (ADA)-accessible.

Express Bus/Bus Rapid Transit

Bus rapid transit employs a network of facilities and services that are intended to provide many of the benefits of rail transit (greater speed, travel time reliability) at a lower cost and/or greater flexibility. BRT systems often are designed to resemble rail transit systems, with stations (instead of roadside stops), distinctive vehicles, and frequent service. Transit Cooperative Research Program Project A-23 identified the following three general categories of bus rapid transit operating in North and South America, Europe, and Australia:

- BRT that operates entirely on exclusive or protected rights of way. This type of system most closely resembles rail rapid transit.
- BRT that operates within some combination of exclusive rights of way (ROW), median lanes, curbside bus lanes, and street lanes. This type of system most closely resembles light rail transit.
- BRT that operates mainly on regular street lanes with regular traffic, usually with some form of on-street priority. This type of system is similar to tram or streetcar service.

BRT systems often employ intelligent transportation systems including automatic vehicle location, passenger information systems including real-time arrival information at stations, and traffic signal priority. Many BRT systems lead to significantly increased ridership levels (compared to the traditional bus services they replaced). Past experience has shown that BRT has the greatest chance for success in urban areas with populations over a million that experience significant levels of congestion. The more "rail"-type aspects that a BRT system has (dedicated or prioritized ROW, attractive and easily accessible vehicles and stations, off-vehicle fare collection), the more likely it will be to attract high ridership levels (*48*).

Intercity Buses

Also called "over-the-road coaches," intercity buses tend to have one front door, high-backed seats, restroom facilities, and luggage compartments. They tend to be 40 feet long or more and hold about 40 passengers. Traditionally, these buses were not designed to accommodate wheelchairs, but legislation passed in 2000 requires that new vehicles purchased for intercity services be ADA-compliant (*49*). As a result, one of the barriers to integrating intercity transit service with urban and/or rural public transit is beginning to be addressed, as intercity fleets are replaced. For example, over half of Greyhound's buses, including all of the vehicles purchased in 2001 or later, are wheelchair-accessible (*50*). The Over-the-Road Bus Transportation Accessibility Act of 2007, passed into law on July 30, 2008, amended Title 49 to provide further clarification and enforcement of ADA standards for intercity transportation carriers (*51*). In an effort to attract more commuters and other "choice" riders to intercity bus service, many intercity transit providers have begun to purchase over-the-road coaches that emulate the look and feel of commuter rail coaches.

KEY FACTORS INFLUENCING TRANSIT RIDERSHIP

Widespread vehicle ownership, an extensive state and interstate highway system, and relatively inexpensive air travel have all contributed to a nationwide decline in the use of buses and passenger rail for intercity trips. However, rising fuel costs, traffic volumes, and travel delays (both on the road and in the air) may be starting to reverse the trends of recent decades (*52*). This section addresses some of the factors that have been shown to increase transit ridership in general and that also have the potential to influence mode choice for longer-distance trips.

External Factors Contributing to High Transit Ridership

The findings of Transit Cooperative Research Program Report 111 indicate that external factors influencing ridership may have a greater effect on ridership than system/service design factors, which can be directly affected by transit service providers (*53*). The following external factors were listed as the most important to consider.

Regional Growth

Increased population and economic growth within a region tend to increase transit ridership simply by expanding the potential ridership base. Increases in ridership are also associated with high populations or growing populations of senior citizens, college students, and recent immigrants. Growing tourism can also increase the number of transit riders.

Cost and Convenience of Other Modes

As other travel alternatives become more expensive, transit use tends to increase. As mentioned previously, the rising cost of oil is causing the two most popular intercity travel modes—personal vehicles and air travel—to become increasingly expensive. Transit use also tends to increase if the quality of service for other modes decreases due to increased congestion, increased travel times, or decreased convenience.

Public Policies

Transit use tends to increase within an area when public transportation is integrated with welfare-to-work efforts, education, and/or social service programs. Local policies such as air quality mandates and auto emission standards can also encourage transit ridership within that area, though there is little information about the effect of these policies on long-distance intercity trips.

Transit System Features Contributing to High Transit Ridership

Coordinated Services, Easy Connections

People intending to ride intercity bus or rail must be able and willing to travel from their origin point to an intercity transit station and from another intercity station to their final destination. Intermodal stations that provide connections between local and intercity transit services, as well as options for automobile travel (parking facilities, rental car services) maximize the feasibility of intercity bus/rail as a travel mode. Coordinated schedules (e.g., a local feeder bus schedule that coordinates with train departures from the station they both serve) minimize the time passengers must wait at the transit station between legs of their trip; reductions in out-of-vehicle wait times have been shown to have greater influence than actual travel times on passengers' decisions to ride transit (*53*).

Service Improvements

Transit providers that have restructured their routes or introduced specialized services to increase travel speed, service frequency, service hours, and/or capacity often see a rise in ridership as a result. Travel time reliability and on-time performance is another important factor in a rider's perception of service quality (*54*). Transit modes that have the advantage of a separate right of way, on-street priority, or other tools that allow them greater speed or reliability are likely to attract riders.

Reduced or Special Fares

Deep discount passes, outlet/internet sales of fare media, free transfers, and other means of reducing transit fares have been shown to increase ridership. Greyhound has introduced a frequent rider program similar to airline "frequent flyer" programs, with discounts and other benefits as rewards to riders for accruing travel miles.

Improved Image

Transit tends to suffer from the perception that it is the poor person's mode of travel, with the attendant assumptions that it is not a particularly safe, comfortable, or desirable travel option. In general, rail transit is viewed by riders as more "upscale" than bus transit. Many local and intercity bus operators have begun to purchase vehicles that have the look and feel of light rail or commuter rail coaches, as well as upgrading stations and stops with on-site ticketing and other amenities similar to those associated with rail transit. Measures that increase safety and security, such as safety features aboard vehicles and a security presence at transit stations, also promote a more positive image. Finally, customer service and attitude of the vehicle operator and/or other transit staff with whom the passenger interacts are important to maintaining a positive image of transit (*53*).

Improved Marketing and Information

Marketing of a transit service is a primary tool for communicating service improvements, cost savings, new services, and amenities to potential riders. Transit information services can also play a role in increasing transit ridership by educating potential riders on available options for their travel needs.