2.0 Economics, Demographics, Freight, and the Multimodal Transportation System – Conditions and Trends

2.1 Introduction

Texas is the second most populated state in the nation and contains the nation's largest highway network, has the largest interstate network, and has the second highest volume of traffic. Texas ports handle 19.1 percent of the nation's total domestic and foreign maritime cargo. Additionally, Texas has the largest freight rail network in the country carrying 8 percent of all freight moved by rail. There are 29 urban transit providers in Texas that account for 3 percent of the nation's urban transit ridership.[5] Finally, two of the nation's top 10 busiest commercial airports (Dallas-Fort Worth International Airport [DFW] [4] and George Bush Intercontinental Airport [IAH] [8]) are located in Texas.[6]

Population and interrelated economic activity drive demand for transportation facilities and services. This chapter identifies Texas' existing and projected demographic and economic conditions, the existing multi-modal transportation system and the potential effects of population and economic growth on that system. The future transportation needs of Texas are projected to be greater than in past years while future funding sources and levels are uncertain.

Environmental concerns related to transportation are becoming more prevalent and the planning process must evolve to address these concerns. These topics will be discussed in depth in Chapter 8.

What makes Texas transportation unique?

- ★ Texas is a large state that has a lot of roadway mileage. It takes 13 hours at the posted speed limits to cross the state at its widest point.
- ★ It has a large international boundary with Mexico with 27 border crossings that handle the most truck, rail, and personal vehicle crossings of any state.

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[5] Sources: U. S. Census Bureau, The 2010 Statistical Abstract of the United States, Tables 12, 1053, and 1054. Available at http://www.census.gov/compendia/statab/. Bureau of Transportation Statistics, State Transportation Statistics 2009, Tables 1-14, 3-24, 3-4, 4-4, 5-3, available at http://www.bts.gov/publications/state_transportation_statistics/state_transportation_statistics_2009/index.html

[6] Federal Aviation Administration 2008 passenger boarding statistics

- Its seaports are of national importance. Millions of gallons of petroleum products, manufactured goods, military deployments, and other freight are moved into and out of Texas, and between the global marketplace and the rest of the U.S.
- The vital routes of Interstate Highway 40 (I-40), I-30, I-20, and I-10 through Texas connect the western U.S. to the southern and eastern U.S.
- Texas is demographically diverse, with large expanses of rural areas, and distinct north, south, east, and western Texas regions.
- Texas is geographically diverse, with many ecological regions, from the western Chihuahuan deserts to the eastern forests as well as the central plains and mountains of El Paso and the Big Bend.
- Texas has several of the largest metropolitan urban areas in the U.S.—Houston-Galveston, Dallas-Fort Worth, Austin and San Antonio, the Lower Rio Grande Valley, and El Paso—as well as many large cities. Connectivity between these urban areas is a vital part of the economy.

2.2 Texas Economic, Population, and Employment Trends

2.2.1 The Texas Economy

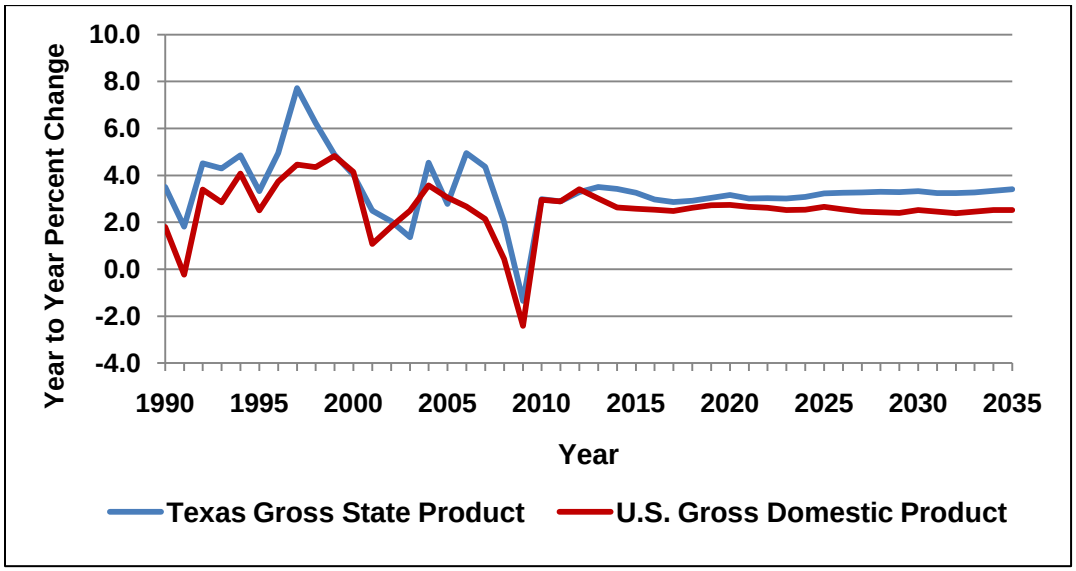
While there have been four recessions in the U.S. over the past 30 years (i.e., 1981–1982, 1990–1991, 2001, and 2007–2009) it is generally accepted that the most recent economic recession was the worst since the Great Depression of the 1920s and 1930s. The ongoing high levels of unemployment continue to affect transportation in two major ways: reduced levels of travel and reduced tax revenues. However, several Texas metropolitan areas are experiencing population growth because of net in-migration (international and from other states). While slowed by the current recession, the Texas economy has remained stronger than that of the U.S. as a whole.

The Texas economy has also grown faster, on average than the U.S. economy as a whole since 1990. Historical data on GDP and gross state product (GSP) show that the average increases per year between 1990 and 2007 were 2.89 percent for the U.S. GDP and 4.04 percent for Texas GSP.

Forecasts from the Texas Comptroller of Public Accounts predict that the U.S. and Texas economies will rebound from the current recession (in terms of GSP and GDP), and grow at 2.6 percent and 3.37 percent, respectively, on average, per year between

2010 and 2035 (Figure 2-1).[7] An efficient and well-maintained transportation system is vital to the state's ability to remain economically competitive at home and abroad.

Figure 2-1: Comparative Annual Economic Growth, 1990 to 2035



2.2.2 Texas Population Forecasts

Of the many forces driving and shaping growth in transportation demand, population is the largest. For the SLRTP, the recommended Texas population forecast scenario is the "0.5" scenario. Migration scenarios offered by the State Demographer are described below:

Scenario 0.0 (Zero Migration): This scenario assumes that the forecast net migration is zero resulting in growth only through natural increase (the excess or deficit of births relative to deaths).

Scenario 0.5 (One-Half 1990–2000 Migration): The SLRTP uses this scenario, which has been prepared as an approximate average of the zero (0.0) and 1990–2000 (1.0) scenarios. It assumes rates of net migration one-half of those of the 1990s.

Scenario 1.0 (1990–2000 Migration): The "1.0" scenario assumes that the net migration rates of the 1990s will characterize those occurring in the future of Texas. The 1990s was a period characterized by rapid growth.

[7] Texas Comptroller of Public Accounts and HIS Global Insight, Inc. Data are historical through 2007. Numbers are in 2000 dollars.

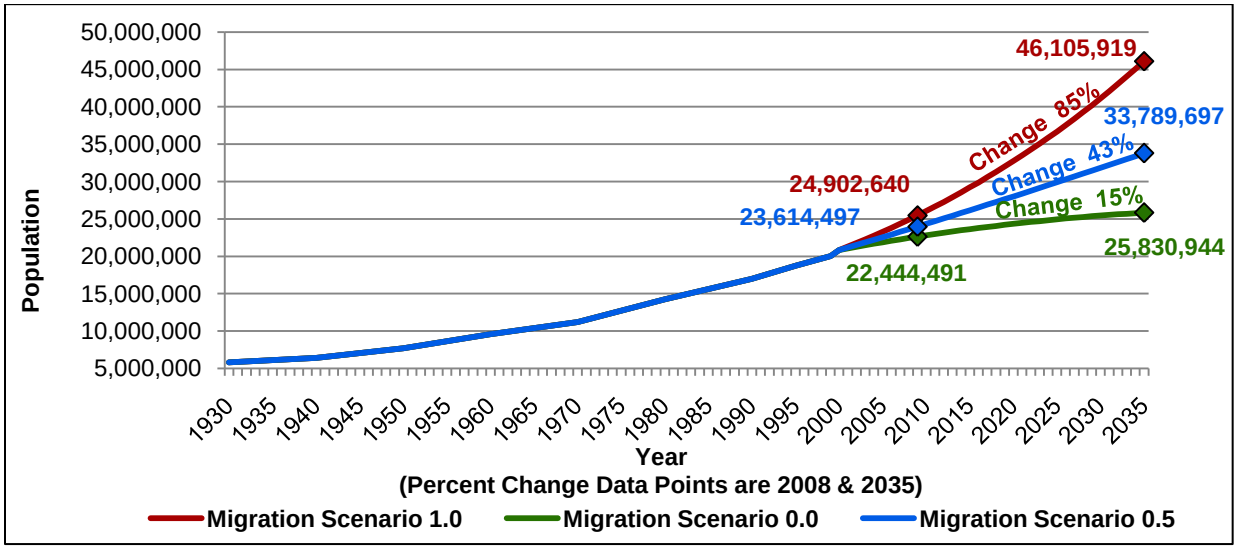
The Texas State Demographer suggests that the 0.5 scenario continues to be the most appropriate scenario for most counties for use in long-term planning. The 2008 and 2035 population projections for each scenario are compared in Table 2-1.

Table 2-1: Texas Population, 2008 and 2035 by Migration Scenario[8]

Scenario	2008 Population	2035 Population	Change	Percent
Scenario 0.0	22,444,491	25,830,944	3,386,453	15.1
Scenario 0.5	23,614,497	33,789,697	10,175,200	43.1
Scenario 1.0	24,902,640	46,105,919	21,203,279	85.1

Based on the "0.5" scenario the population of Texas increased by an estimated 6,627,987 persons (i.e., a 39.0 percent increase) since 1990.[9] From 2008, Texas' population is forecast to grow an additional 10,175,200 persons by 2035. Figure 2-2 shows Texas' population growth, a 43.1 percent increase over the estimated 2008 levels and a forecast average annual percent per year increase of 1.6 percent, or 376,859 persons per year. Figure 2-3 illustrates the geographic distribution of Texas' 2035 forecast population and percent change in population from 2008 to 2035 by county.

Figure 2-2: Texas Historical and Forecast Population Growth, 1930 to 2035[10]

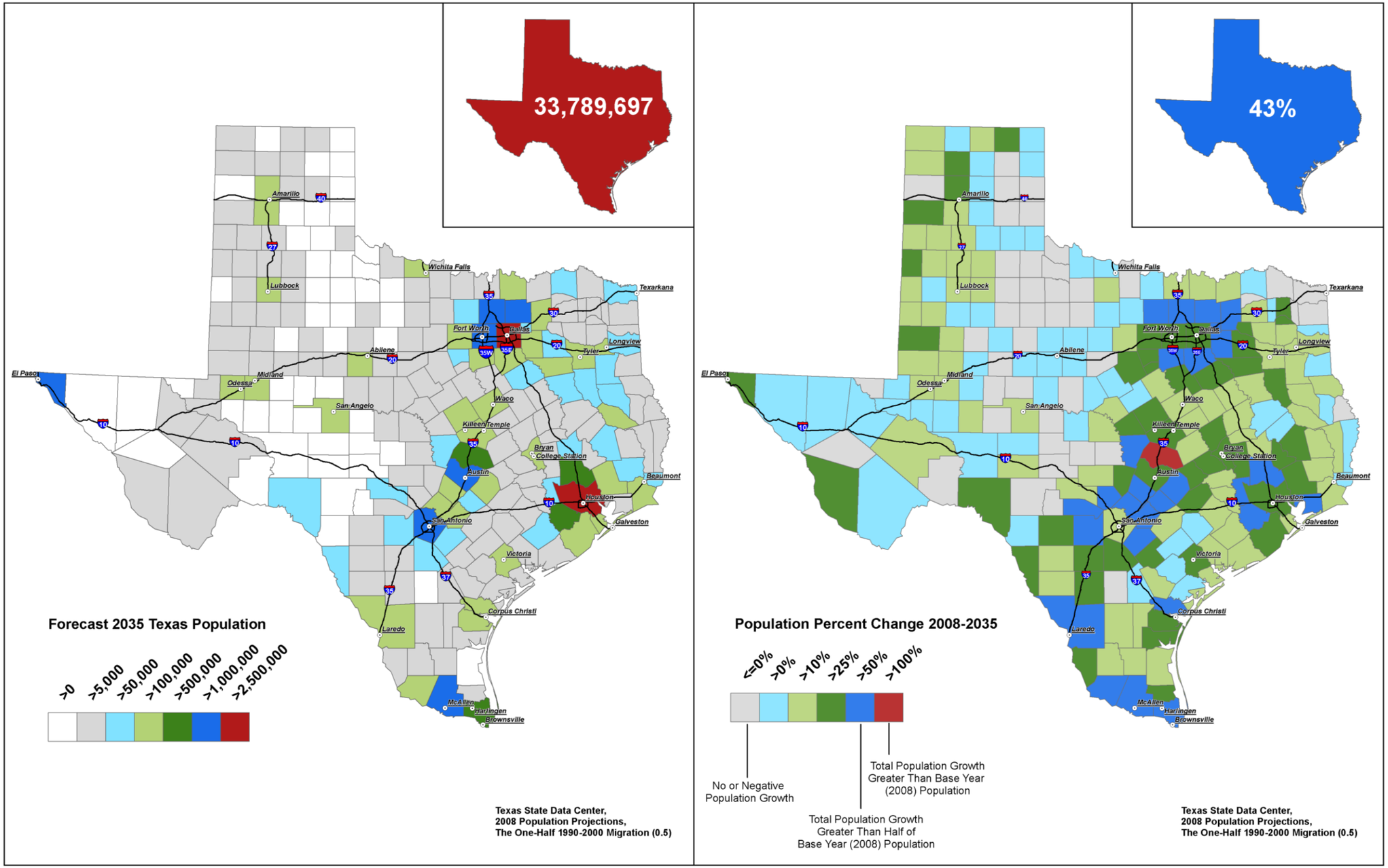


8 Texas State Data Center (TSDC), *2008 Population Projections*

9 Historical: U.S. Bureau of the Census. Texas Population of Counties by Decennial Census: 1900 to 1990. March 27, 1995. Available at http://www.census.gov/population/www/censusdata/cencounts/index.html

10 "Historical population data (1930–2007) is based on actual U.S. Bureau of the Census population decennial population counts and interim estimates. Population projections from 2008–2035 are based on the TSDC's *2008 Population Projections, The One-Half 1990–2000 Migration (0.5) Scenario* (which is the TSDC's recommended scenario).

Figure 2-3: 2035 Texas Population and Population Change 2008-2035



2.2.2.1 Geographic Distribution of Texas Population

In order to study the statewide geographic distribution of population and population growth and their impact to transportation, a classification scheme was developed at the county level for the SLRTP. Each county was assigned a type based on:

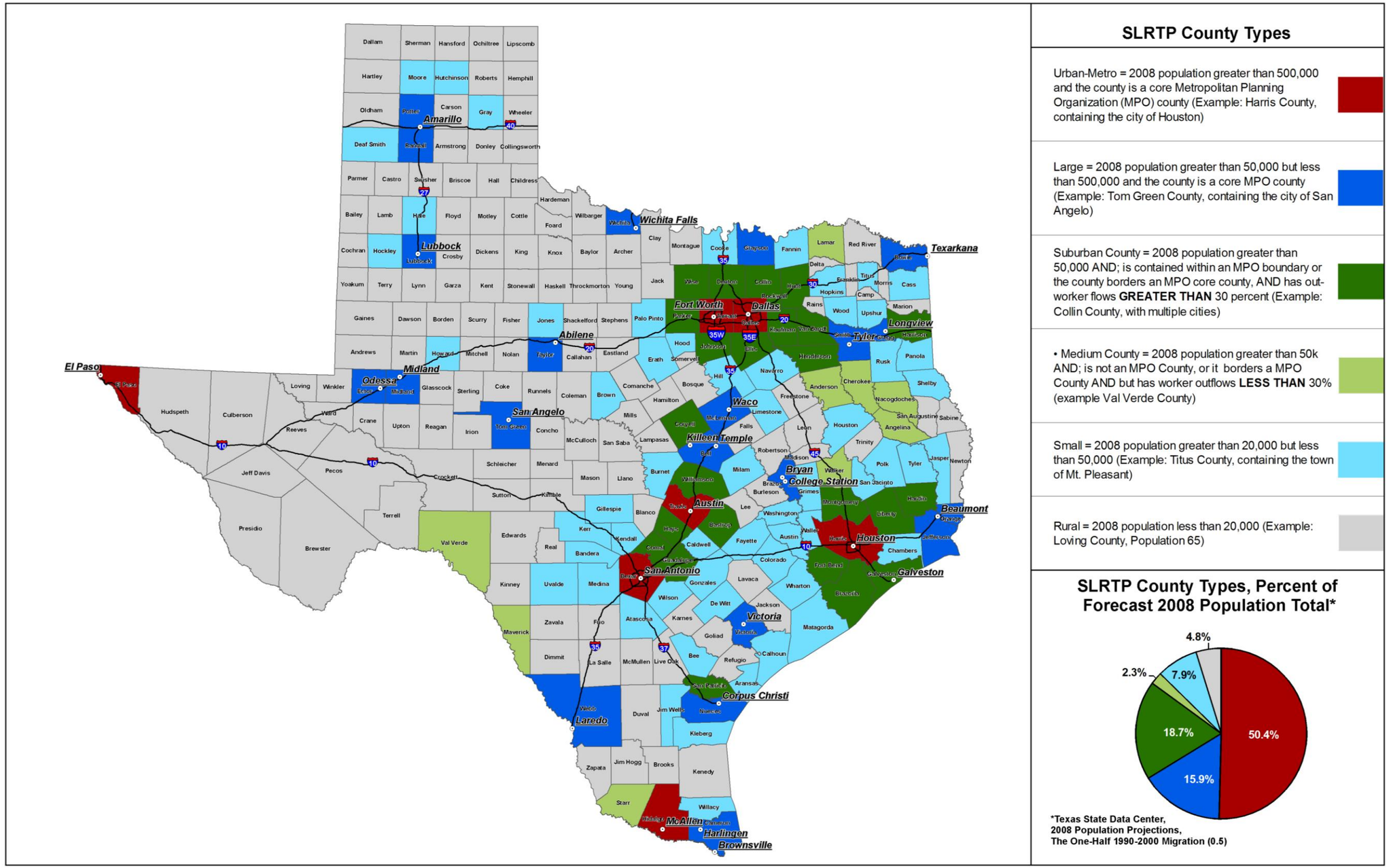
- Its estimated total county 2008 population,
- The population of the largest city within the county in 2008,
- Whether or not the county contained an urbanized area classified as an MPO,
- The proximity of the county to other counties with large populations or MPOs, and
- The commuting characteristics of the resident population.

The county types defined in the SLRTP are as follows:

- Urban-metro County = 2008 population greater than 500,000 and the county is a core MPO county (Example: Harris County, containing the city of Houston)
- Large County = 2008 population greater than 50,000 but less than 500,000 and the county is a core MPO county (Example: Tom Green County, containing the city of San Angelo)
- Suburban County = 2008 population greater than 50,000 AND; is contained within an MPO boundary or the county borders an MPO core county, AND has out-worker flows **GREATER THAN** 30 percent (Example: Collin County, with multiple cities)
- Medium County = 2008 population greater than 50k AND; is not an MPO County, or it borders a MPO County AND but has worker outflows **LESS THAN** 30 percent (example Val Verde County)
- Small County = 2008 population greater than 20,000 but less than 50,000 (Example: Titus County, containing the town of Mt. Pleasant)
- Rural County = 2008 population less than 20,000 (Example: Loving County, Population 65)

The county types were used to analyze both 2008 and 2035 population growth and other measures in a consistent manner. Each county type and county name is provided on Figure 2-4.

Figure 2-4: SLRTP County Types

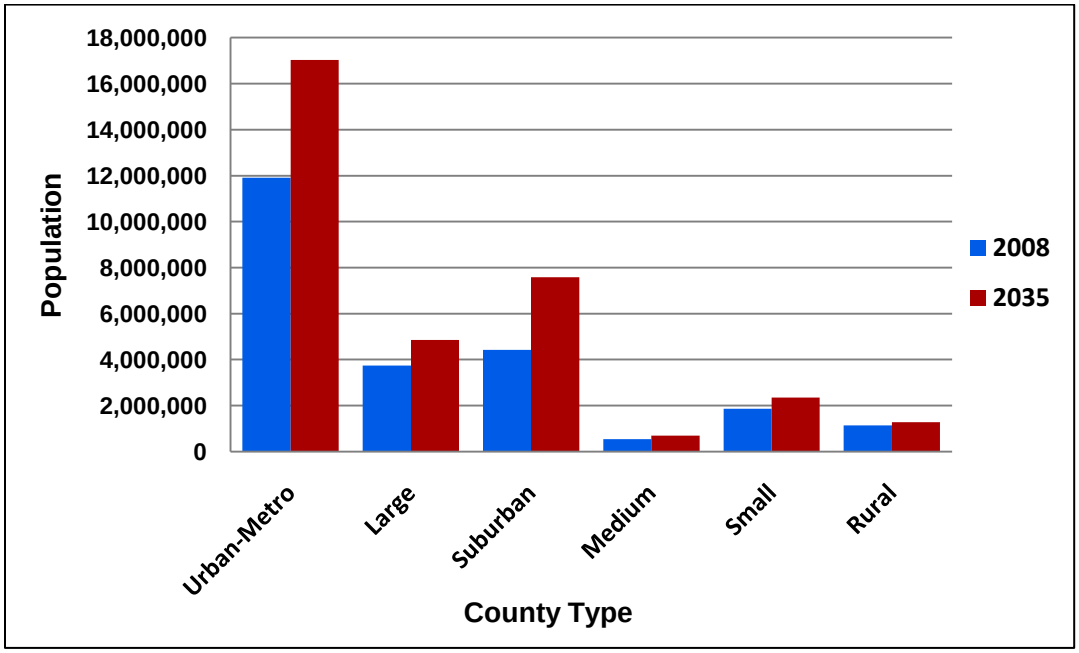


As shown in Table 2-2 and illustrated on Figure 2-5, the vast majority of population growth will occur in urban-metro, suburban, and large counties. Combined, these counties will account for 92 percent of the growth, over 9.3 million persons by 2035.

Table 2-2: 2000, 2008, and Forecast 2035 Population by County Type

County Type	2000	2008	2035	Growth 2008-2035	% Change 2008–2035
Urban-Metro	10,519,992	11,903,007	17,028,201	5,125,194	**43.1**
Large	3,412,833	3,747,564	4,852,359	1,104,795	**29.5**
Suburban	3,647,447	4,427,349	7,583,884	3,156,535	**71.3**
Medium	497,108	546,767	696,821	150,054	**27.4**
Small	1,701,214	1,857,473	2,356,424	498,951	**26.9**
Rural	1,073,226	1,132,337	1,272,008	139,671	**12.3**
Total	**20,851,820**	**23,614,497**	**33,789,697**	**10,175,200**	**43.1**

Figure 2-5: Texas 2008 and Forecast 2035 Population Trends by County Type



2.2.2.2 Texas Population by Age Group

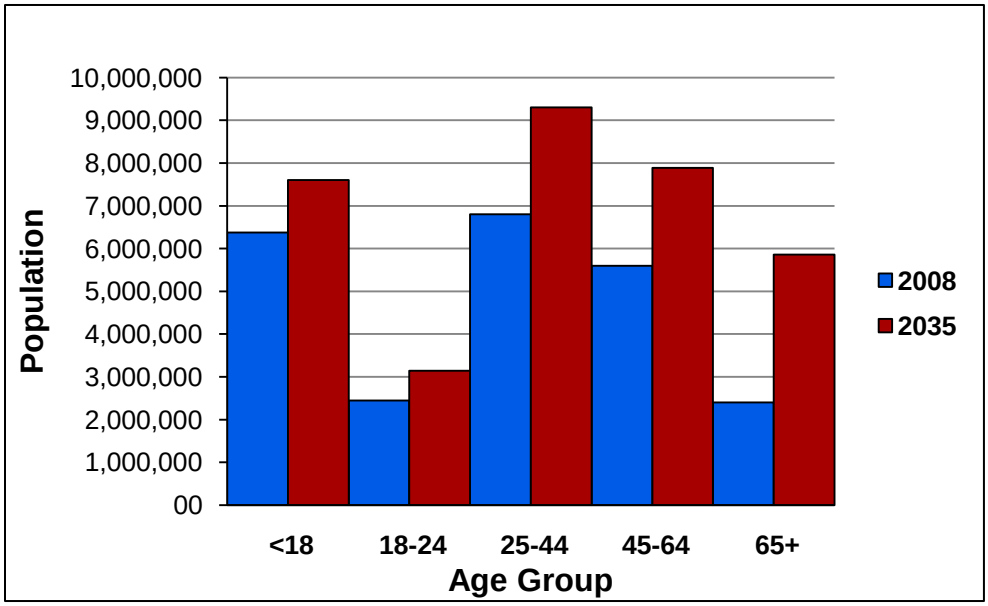
The overall population of the U.S. and Texas is aging, as the baby-boomer generation enters the 65+ age group. Table 2-3 and Figure 2-6 show the population forecast by age group for Texas. Between 2008 and 2035, Texas will add an additional 3.4 million persons in the 65+ age group, a 144 percent increase. Texas will go from having 10 percent of its population in this age group to over 17 percent. However, while the 65+ age group will be the fastest growing age group, the majority of Texas residents will remain in the younger age groups.

The increase in older Texans will have an impact on transportation needs, since this age group either is retired or demonstrates different work, shopping, leisure, and medical and special needs travel behavior.

Table 2-3: Texas 2008 and Forecast 2035 Population by Age Group

Age Group	2008	2035	% 2008	% 2035	Growth	% Change
<18	6,373,056	7,600,617	27.0	22.5	1,227,561	19.3
18–24	2,448,144	3,141,915	10.4	9.3	693,771	28.3
25–44	6,799,904	9,306,023	28.7	27.5	2,506,119	36.9
45–64	5,593,461	7,885,313	23.7	23.3	2,291,852	41.0
65+	2,399,932	5,855,829	10.2	17.4	3,455,897	144.0
Total	**23,614,497**	**33,789,697**	**100**	**100**	**10,175,200**	**43.1**

Figure 2-6: Texas 2008-2035 Population by Age Group



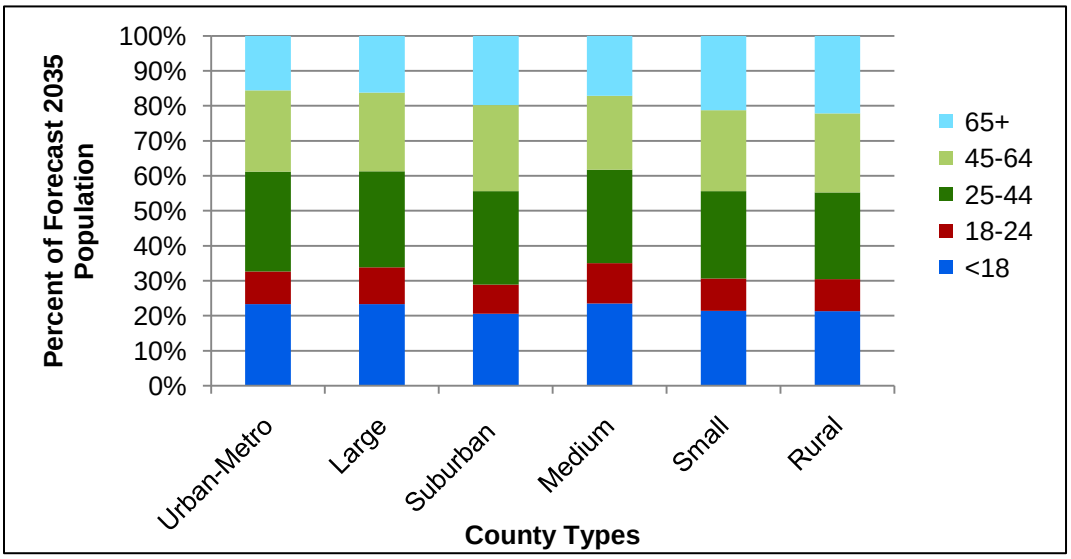
2.2.2.3 Population by Age Group and County Type

By 2035, the trend towards more elderly people living in Texas will be most significant in rural counties (22 percent age 65+), small counties (21 percent age 65+), and suburban counties (20 percent age 65+) (Table 2-4 and Figure 2-7).

Table 2-4: 2008 and Forecast 2035 Percent of Population by Age Group and County Type

County Type	<18	18–24	25–44	45–64	65+	Total
2008 Percent of Total Population						
Urban-Metro	28.0	10.0	30.7	22.7	8.6	**100**
Large	27.2	11.7	27.4	22.4	11.4	**100**
Suburban	26.1	9.9	28.3	26.5	9.2	**100**
Medium	26.5	12.8	27.1	21.8	11.8	**100**
Small	24.5	10.4	24.4	25.3	15.4	**100**
Rural	24.0	10.6	23.1	25.1	17.2	**100**
2035 Percent of Total Population						
Urban-Metro	23.3	9.4	28.5	23.2	15.6	**100**
Large	23.3	10.5	27.4	22.5	16.3	**100**
Suburban	20.6	8.3	26.7	24.6	19.8	**100**
Medium	23.5	11.5	26.7	21.2	17.1	**100**
Small	21.4	9.2	25.0	23.2	21.2	**100**
Rural	21.3	9.1	24.8	22.6	22.2	**100**

Figure 2-7: Forecast 2035 Population by Age Group and County Type

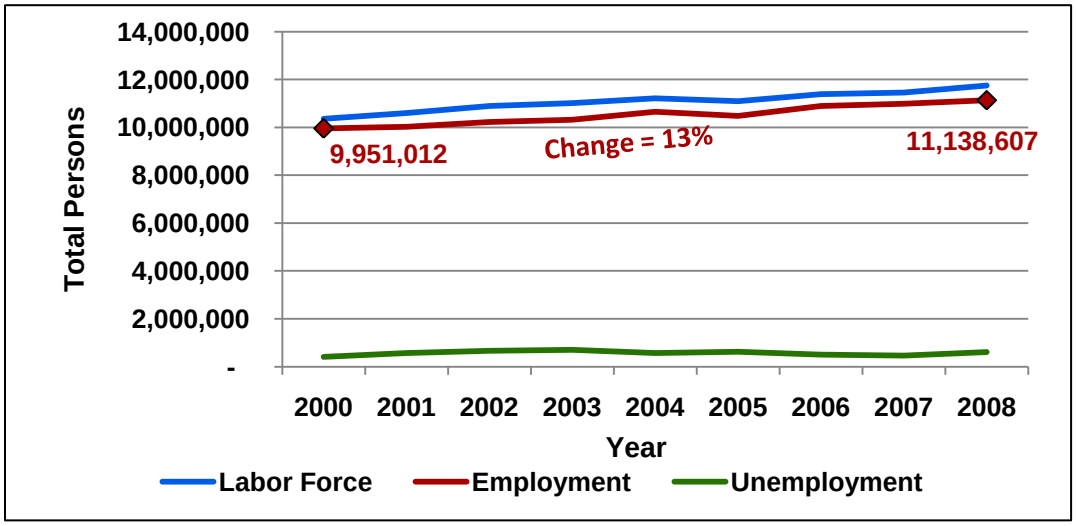


2.2.3 Texas Employment

Employment increase typically tracks with population increase, more specifically, with the labor force increase. Labor force is the proportion of the population that is eligible for work, typically measured as all eligible (e.g., nonincarcerated) population between the ages of 16 and 65 years old. Total employment is equal to labor force minus unemployed persons. Therefore, if the unemployment rate remains relatively stable and the proportion of the population eligible for work remains stable, then total employment typically tracks as a proportion of population. In 2008, the state's labor force was equal to 11,812,190 persons.

According to statistics published by the Texas Workforce Commission, there were 1,249,324 more persons working in 2008 (11,200,334) than in 2000 (9,951,010), representing a 13 percent change (Figure 2-8).

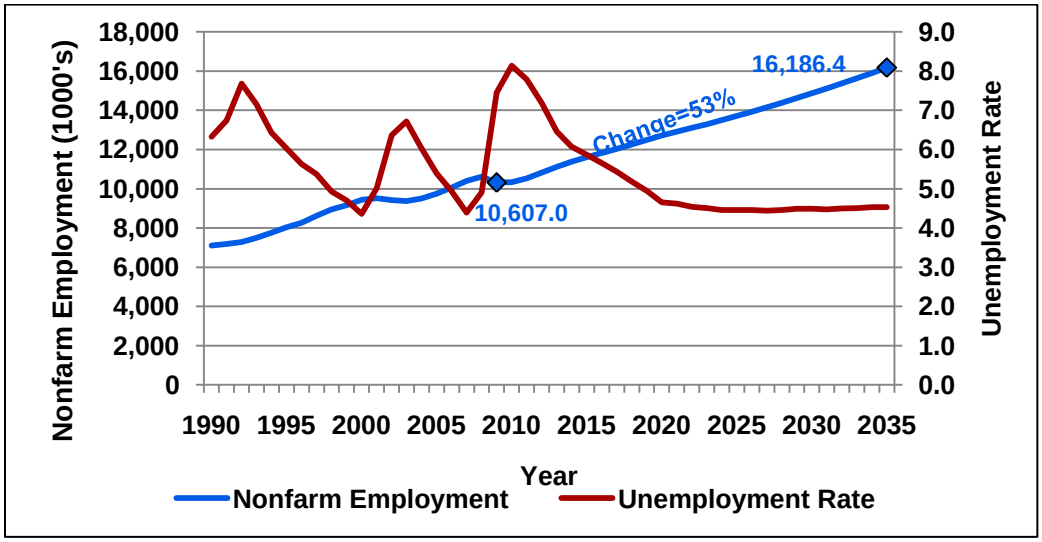
Figure 2-8: Labor Force, Employment, Unemployment 2000–2008[11]



Recent employment forecasts from the Texas Comptroller of Public Accounts estimate that by 2035 nonfarm employment will be 16,186,400 persons or an approximate 53 percent increase from 2008 nonfarm employment (Figure 2-9). Additionally, the unemployment rate in 2035 is forecast to be approximately 4.5 percent of the labor force.

[11] Historic Employment Data Source: Texas Workforce Commission, Tracer, Unemployment (LAUS), yearly October estimates, available at http://www.tracer2.com/cgi/dataanalysis/

Figure 2-9: Historic and Forecast Nonfarm Employment and Unemployment 1990–2035[12]



2.2.3.1 Worker Flows and Employment by County Type

The commute to work has a significant impact on the transportation system. Work trips constitute 9.6 percent[13] of all daily trips in Texas, and most of them occur during the same time of day. This commuter behavior creates most of the congestion during the peak periods.

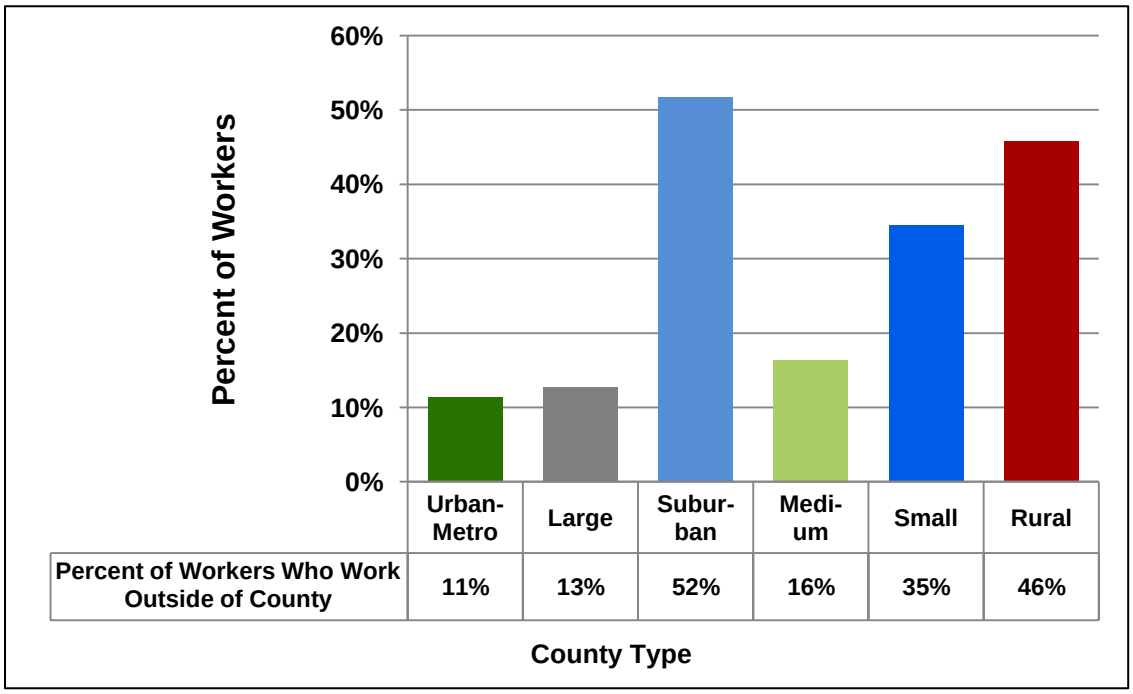
The U.S. Census Bureau conducts the American Community Survey (ACS) sample of U.S. households each year. The ACS is used to tabulate journey-to-work information. The ACS data are summarized and reported every year using the previous 3 years' collected data. According to the 2006–2008 ACS, 25 counties in Texas had greater than 50 percent of their residents work in an adjacent county. Most of these counties were adjacent to the large metropolitan regions of Dallas-Fort Worth, Austin, San Antonio, or Houston. This indicates that a significant proportion of workers are choosing to commute into core urban counties from surrounding counties rather than working in the county where they reside. This characteristic reflects the tradeoffs that people make between short commutes and access to affordable housing often found in more suburban or rural counties. It also reflects the dynamic nature of the job market with people changing jobs and thus commuter patterns on a regular basis. Transportation plays a role in these patterns, both in terms of supporting work-trip commutes and in the need to adapt to these new demands.

[12] Forecast employment data presented in this section is based on current economic analysis provided by the Texas Comptroller of Public Accounts provided by Gary Preuss. No data is available at this time for forecast conditions at the county level.

[13] National Household Travel Survey, 2009, available at http://nhts.ornl.gov/

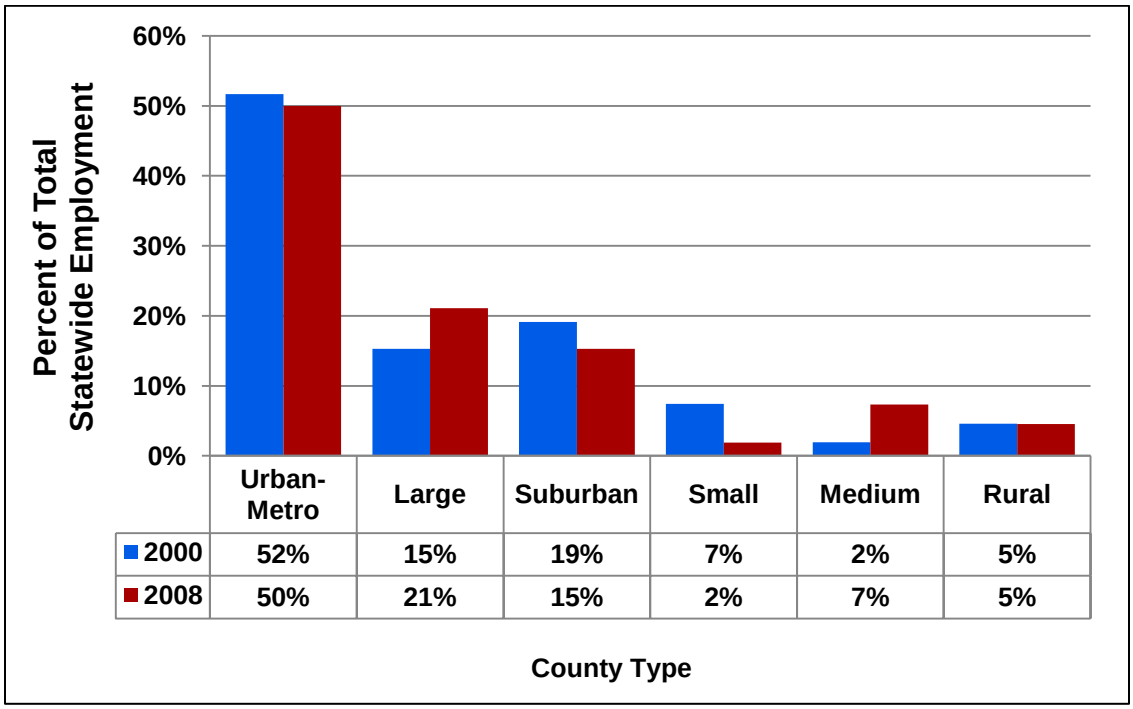
As illustrated on Figure 2-10, greater than 50 percent of workers living in suburban counties travel to work outside of their residence county, followed by rural counties (49 percent), small counties (35 percent), medium counties (16 percent), large counties (13 percent), and urban-metro counties (11 percent).

Figure 2-10: Percent of Workers Who Work Outside of County



Similar to population growth, employment as a percent of the state total is increasing for urban-metro, suburban, and large counties (from 84 percent in 2000 to 86 percent in 2008) (Figure 2-11).

Figure 2-11: Percent of Total Statewide Employment 2000–2008 by County Type



	Urban-Metro	Large	Suburban	Small	Medium	Rural
2000	52%	15%	19%	7%	2%	5%
2008	50%	21%	15%	2%	7%	5%

2.3 Texas Roadway Inventory

As part of the statewide planning process, an inventory of Texas roadways was completed. Roadways are measured by their length ("centerline" miles), and by the length and number of lanes they have ("lane miles"). Lane miles represent total capacity on the roadway system. Additionally, roadways are classified by TxDOT as either "on-system" or "off-system."

On-system roadways are on the designated state highway system, owned and maintained by TxDOT, and are typically funded with a combination of federal and state or state-only funds. These roadways include all interstate highways, U.S. highways (US), state highways (SH), farm-to-market roads (FM), and other state roads.

Off-system roadways are not part of the designated state highway system and are under the direct jurisdiction of the local government such as a county, city, other political subdivision of the state, or special district with authority to finance a highway improvement project.

For the SLRTP, centerline miles and lane miles in 2008 were measured from several sources. The Roadway Highway Inventory Network (RHiNO) Database is the main source of information.

For 2035, future centerline and lane miles are subject to implementation of plans, programming of projects, construction, and funding availability. Details of potential future roadways can be found in:

- MTPs – These plans are published by MPOs and are updated every 5 years.
- 2010 UTP – adopted in April 2010 by the Texas Transportation Commission,

Table 2-5 provides 1990 and 2008 total centerline miles and lane miles for on-system roadways. From 1990 to 2008, total on-system roadway centerline miles and lane miles in the state grew by 4.3 percent and 6.0 percent, respectively. In addition, 226,336 centerline miles of off-system roadways were added to the state as of 2008. Figure 2-12 shows the interstates U.S. highways, and state highways of Texas.

Figure 2-12: Texas Roadways

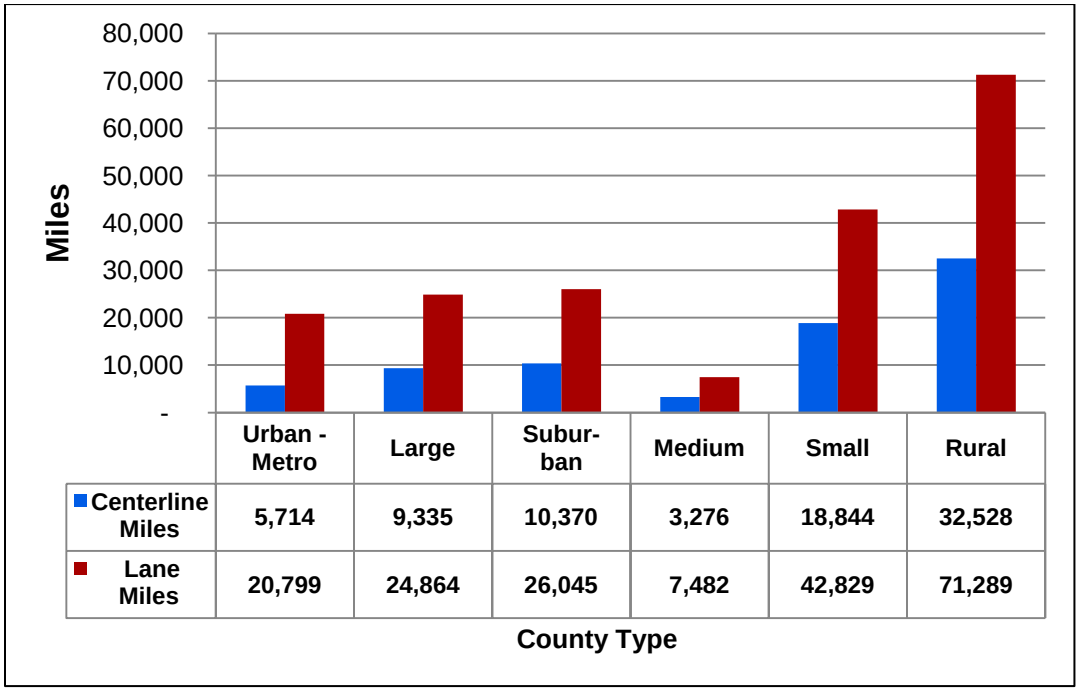
Table 2-5: Texas 1990 and 2008 Roadways, On-System Centerline and Lane Miles[14]

Mileage	1990	2008	Growth	% Change
Centerline Miles	76,730	80,067	3,337	4.3
Lane Miles	182,447	193,309	10,861	6.0

Note: Excludes Off-System Toll Roads

Figure 2-13 illustrates total 2008 centerline miles and lane miles by county type. Rural counties hold the most roadway mileage in Texas.

Figure 2-13: Texas 2008 Roadways, On-System Centerline Miles and Lane Miles by County Type[15]



Note: Excludes Off-System Toll Roads

Table 2-6 provides total centerline miles and lane miles for on-system roadways in 2008 by highway system. FM and other roads are the largest part of the highway system in the state in terms of both centerline miles and lane miles, followed by SH (which include highways and loops).

[14] Source: TxDOT RHiNO database

[15] Source: TxDOT RHiNO database

Table 2-6: Texas 2008 Roadways, On-System Centerline and Lane Miles by Highway System[16]

Highway System	Centerline Miles	% of On-System Roads	Lane Miles	% of On-System Roads
Interstates (I-)	3,233	4.0	15,155	7.8
U.S. Highways (US)	12,105	15.1	35,737	18.5
State Highways (SH), spurs, loops, business routes	16,346	20.4	42,384	21.9
Other (farm-to, ranch-to-market roads, recreational roads, etc.)	41,313	51.7	85,355	44.2
Frontage Roads	7,069	8.8	14,677	7.6
Total	**80,067**	**100.0**	**193,309**	**100.0**

Note: Excludes Off-System Toll Roads

2.4 Texas Vehicle Miles of Travel Forecast

2.4.1 Variability in Transportation Forecasts

When developing a plan as large as the SLRTP, it is important to underscore the fact that the future cannot be precisely predicted. Although the SLRTP uses one set of forecasts, it is important to discuss the variability that might be expected over the life of the plan.

The past is not always a good guide to the future. It is plausible that some nontraditional factors will exert unexpected influences on society over the 25-year life of this plan, resulting in different trends.

For the most part, travel demand does not vary greatly in the short term. While factors such as weather, maintenance/construction, incidents, major events, and school/public holidays will influence road traffic and transit ridership from hour-to-hour or day-to-day, any given Monday will likely be similar to the previous and following Mondays. Over the long term, however, other factors begin to influence travel demand. These factors are typically gradual.

- Population growth,
- Age distribution, i.e., an aging population,
- Employment trends, and
- Disposable income.

[16] Source: TxDOT RHiNO database

Other factors can be both gradual and at times more precipitous:

- Economic disruptions (and recovery),
- Addition or loss of transportation system capacity,
- Relocation of major employers, and
- Opening/closure of major traffic generating facilities.

Over an extended period of time, such as the 24-year period covered by this plan, these and other factors will combine to influence the frequency and extent of local and long distance travel behavior, the modal choice, and the economics of personal travel and freight transportation.

2.4.2 Alternative Futures for Texas Transportation

Economic conditions have historically driven personal and freight transportation choices. Technological advances have historically led to efficiencies in transportation, which led to changes in modal choice and travel behavior. Texas has moved among various modes, from horseback to steam trains, to diesel trains to personal automobiles, to urban rail and commuter rail. In a plan such as the SLRTP 2035, it is expected that this trend of change in response to economics and efficiency will continue.

Traditionally, increasing affluence has led to increasing levels of personal mobility through greater auto ownership. Increasing affluence has also allowed Texans to afford a greater choice in residential location and discretionary travel choice. With Texas' abundance of land and limited constraint on new development, suburbanization has increased the footprint of its metropolitan areas, commutes have lengthened, and traffic congestion has grown. Looking forward, it is plausible that the same trend will continue over the life of this plan.

Relatively inexpensive energy coupled with the "just in time delivery" concept has allowed for a boom over the past 20 years in freight transportation. A much wider diversity of products has been made available to the average Texan because of economical freight transportation and supply chain management. The development of efficient freight movement and technologies has also put a strain on the ability of state and local governments to meet the demands that freight transportation is placing upon the systems.

The following factors may affect future transportation choices in Texas:

Factor 1: Changing Energy Sources Will Influence Transportation

The past 100 years has seen the rise of the internal combustion engine and the widespread availability of relatively inexpensive petroleum. This assumption has been traditionally built into transportation planning. Various opinions suggest that global oil production will reach a peak, and subsequently enter a state of terminal decline, in the coming years or decades.[17] Regardless of the exact timing, petroleum-related fuel prices are expected to rise significantly, unless fuel efficiency improves and/or global demand for oil decreases by at least the same rate as the decline in production. Several possibilities exist that must be taken into account for the SLRTP 2035. Future travel patterns may be significantly different from historic trends, unless alternate sources of transportation energy are brought online, such as:

- Alternative energy sources for vehicles, whether they are electric, hybrid, or natural gas conversions, or even other sources, may change the economics of personal and freight transportation choices.
- Possible scarcity of gasoline and diesel, changing the economic factors that currently contribute to the growth in single-occupant vehicular travel.
- Rapidly changing technologies and patterns of gasoline usage, resulting in more efficient personal and freight transportation, may offset the effect on personal and freight transportation choices that would otherwise be precipitated by increases in gasoline costs.
- Alternative energy sources will affect the gasoline tax, a major source of revenue used by government to build transportation systems.

If energy costs for personal and freight transportation can remain stable by bringing alternative sources into common usage, then travel demand is expected to grow at a similar pace as it has over the past 20 years.

Another possible scenario for the SLRTP 2035 is that transportation energy costs will be unstable. This instability could be a pattern of relatively inexpensive gasoline and diesel cost, spiked periodically by increasingly frequent increases in gasoline and diesel cost. This instability, while causing significant disruptions in transportation economics and individual choices, would precipitate a move towards stabilizing energy costs, resulting in increased usage of alternative fuels and sources of energy for transportation.

[17] National Academies Press, Available at; http://www.nap.edu/catalog.php?record_id=11585

Factor 2: Climate Change Could Effect Transportation

Climate change may have several important implications for the Texas transportation system by the end of the century. While these are beyond the timeframe for this plan, it is nonetheless timely to consider possible impacts of climate change:[18]

- Sea-level rise and increased storm surge during hurricanes may increase the risk of major coastal impacts, including both temporary and permanent flooding at airports, roads, rail lines, and tunnels,
- Flooding from increasingly intense downpours may increase the risk of disruptions and delays in air, rail, and road transportation, and damage from erosion in some areas,
- The increase in extreme heat may limit some transportation operations and cause pavement and track damage. Decreased extreme cold could provide some benefit such as reduced snow and ice removal costs, and
- Increased intensity of strong hurricanes could lead to more evacuations, infrastructure damage and failure, and transportation interruptions.

U.S. States Department of Transportation (USDOT) has provided some guidance on possible steps to adapting to climate change.[19]

Factor 3: Urban Livability and Sustainability Goals Will Impact Transportation

Livability and sustainability are concepts that are likely to be central to future surface transportation legislation. While new federal legislation is not expected soon, it is appropriate to recognize how this may influence transportation planning over the life of this plan.[20] Some impacts could include an increased focus on transit and rail services, transit-oriented development, smaller personal vehicles, and human powered modes, e.g., bicycle/pedestrian.

In the past 20 years, Texans have moved toward more sustainable choices for transportation, a trend that is expected to continue. Changes in Texas included the following:

- A revival of downtown and inner-city residential development and infill of central metropolitan regions,

[18] http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts/
[19] http://climate.dot.gov/impacts-adaptations/planning.html
[20] http://fta.dot.gov/publications/publications_10935.html

- Development of three urban rail systems (in Dallas-Fort Worth, Houston and Austin), and support for the development of more rail and streetcar systems,
- An increasing desire for more bicycle and pedestrian opportunities for work, shopping, and recreational travel purposes.

Factor 4: Changing Personal Travel Behavior Will Change Transportation Demand

Personal choices to change how and when Texans choose to travel will affect how the transportation system is developed. While many of these changes are personal choices, transportation agencies can encourage alternative travel times and modes using Travel Demand Management (TDM). TDM provides an approach to better matching travel demand with available travel options. Some examples of TDM measures include:

- Dynamic and intelligent measures to increase vehicle occupancy, such as high-occupancy vehicle (HOV) lanes, car/van pooling, increased use of existing transit/paratransit, and addition of new transit services,
- Information and communications technologies with new workplace practices, including measures such as teleworking, telecommuting, and flextime,
- Measures such as allowing greater use of night time hours for truck deliveries, and changes in parking policies in both downtown and suburban areas,
- Parking policy changes could include reduced parking requirement standards for new developments, elimination of free parking spaces for employees in congested areas, introduction of on-street parking charges, and residential area parking policies. These measures may prove to be challenging in the short term for institutional, logistical, and societal reasons.

Factor 5: New Technology Could Bring New Patterns of Transportation to Texas

New technology can bring changes to how and when Texans choose to travel, and the economics of those decisions. Looking back 20 or 30 years, the advent of the internet and communications has changed the transportation landscape. Vehicles are now safer and more reliable. Changes in technology could bring changes in demand for transportation to Texas.

One example of a change in technology that is envisioned for intercity travel in the U.S. is high-speed rail service connecting large metropolitan areas. In April 2009, USDOT published its Vision of High-Speed Rail in America.[21] This includes several lines in

[21] Federal Rail Administration Vision of High-Speed Rail in America http://www.fra.dot.gov/downloads/Research/FinalFRA_HSR_Strat_Plan.pdf

Texas that if developed as high-speed rail facilities, could result in new options for travel between San Antonio, Dallas and points north, and between Houston and points east.

Another example of an advanced technology that could change transportation demand is ITS. Global Positioning Systems (GPS) navigation, instant routing services, dynamic traffic signal systems, and other advanced traffic management techniques could have a large impact on the need for new capacity.

2.4.3 Forecast Vehicle Miles of Travel Methodology

Demand for roads is typically measured in vehicle miles of travel (VMT). VMT is the total daily vehicles that use a road multiplied by the length of the roadway. One car travelling for 1 mile equals one vehicle mile of travel. Two cars travelling for 2 miles are four VMT, and so on.

Forecasts for 2035 VMT were developed by using the RHiNO trend line method for the rural areas and urban network models for urban areas. The RHiNO trend line method uses a historical series of traffic counts to create a trend line of traffic for each segment of roadway to 2028. The trend line method was extended from 2028 to 2035. Urban network models are used to forecast the number of trips, their destination, and route, and in some urban areas, the mode used to make the trip. The urban network models reflect the capacity improvements documented in the urban area long-range plans.

2.4.4 Forces Affecting VMT Growth in Texas

VMT are the basic measurement of traffic on roadways, which includes personal autos commercial trucks. The main driving forces behind the predicted increases in VMT include:

- Population growth – as population continues to increase, more people use the roadways.
- The need for delivery of goods – increasing population requires more goods to be transported, much of which is done by commercial trucks.
- The quantity of travel per person – as the urban and suburban areas expand, the average miles driven per day per person also increases. Expanding urban areas create more opportunities for work, home, and business locations across a larger urban area.
- Increasing imports and exports to Texas ports drive growth in transporting goods from maritime ports to Texas and the rest of the U.S.

- Increasing imports and exports to international border gateways has a similar effect.
- Increasing flows of passenger and freight travel across the east-west and north-south interstate and US routes through Texas.
- Expanding tourist and business opportunities in Texas increases nonresident vacation and business conference attendance.

2.4.5 VMT and Population Growth

Figure 2-14 shows that the average daily VMT is expected to grow faster than population by 2035. VMT is predicted to grow 72 percent, while population will grow by 43 percent over 2008 measured levels. While some of this faster growth in VMT is attributable to increased trip length and number of trips per person, much of the higher growth rate in VMT is because of truck and commercial vehicle travel.

Figure 2-14: VMT, Population, and Lane Miles, 1985–2035[22]

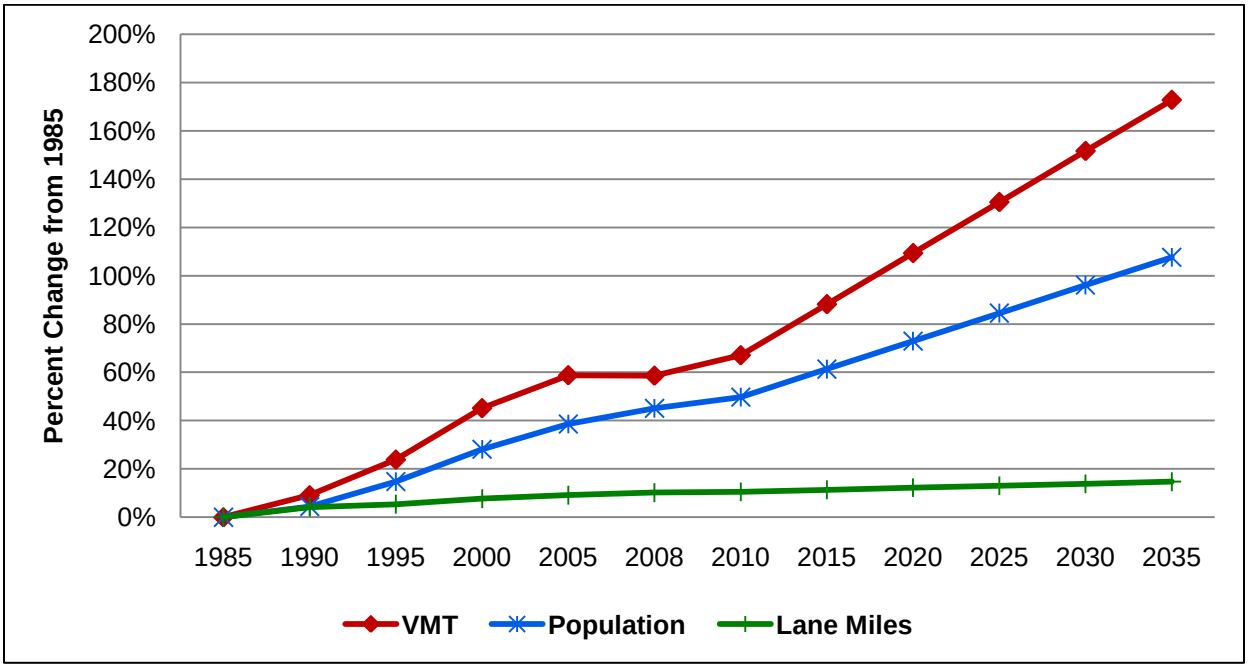


Table 2-7 and Figure 2-15 indicate the different growth rates between passenger autos and commercial trucks. While passenger auto VMT is expected to increase by

[22] Historical Lane Mileage and VMT, 1985, 1990, 1995, 2000, 2005 – Highway Performance Monitoring System (HPMS), USDOT; Historical population, 1985, 1990, 1995, 2000 – U.S. Census; Projected population, 2005 and 2035 –TSDC, 0.5 growth scenario; 2035 Projected VMT – TxDOT Roadway-Highway Inventory Network (RHiNO) and urban network travel demand model analysis; 2035 Projected Lane Mileage – TxDOT RHiNO, TxDOT UTP, urban network models as of May 2010; All projections interpolated for 2010, 2015, 2020, 2025, and 2030 for graphical presentation.

66 percent between 2008 levels and 2035, truck VMT is expected to grow by 123 percent. In addition to the faster growth rate in truck travel, the overall percentage of trucks as a proportion of total VMT is expected to increase from about 10.7 percent to about 13.9 percent. Much of the increase in truck travel is attributable to growth in population in Texas, but also to the efficiency of trucks over other modes for certain transport needs, and the growth in through-state and out-of-state freight transportation.

Table 2-7: Population, Auto VMT, Truck VMT, 2008–2035 On- and Off-System[23]

Summary	2008	2035	Growth	% Change
Population	23,614,497	33,789,697	10,175,200	43.1
Auto VMT	572,347,915	949,104,225	376,756,310	65.8
Truck VMT	68,617,389	152,998,839	84,381,450	123.0
Truck VMT (% of Total)	10.7	13.9	–	–
Total VMT (On/Off-System Breakout Below)	640,965,305	1,102,103,063	461,137,758	71.9
On-System VMT	**475,380,414**	**839,861,095**	**364,480,681**	**76.7**
Off-System VMT	**165,584,891**	**262,241,968**	**96,657,077**	**58.4**

Figure 2-15: Growth in Daily Auto and Truck VMT, 1985 to 2035[24]

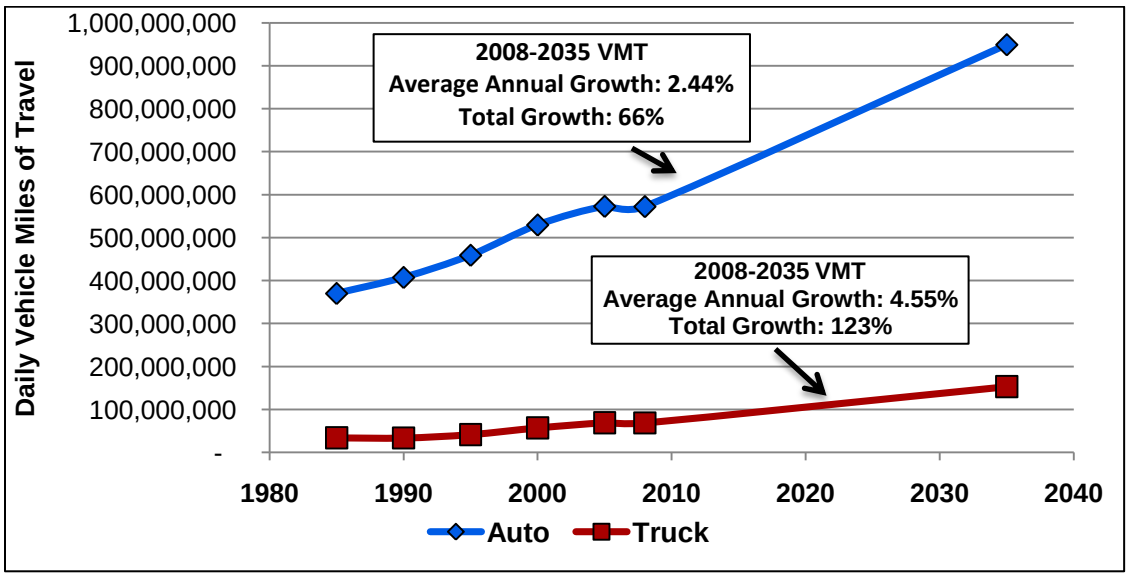
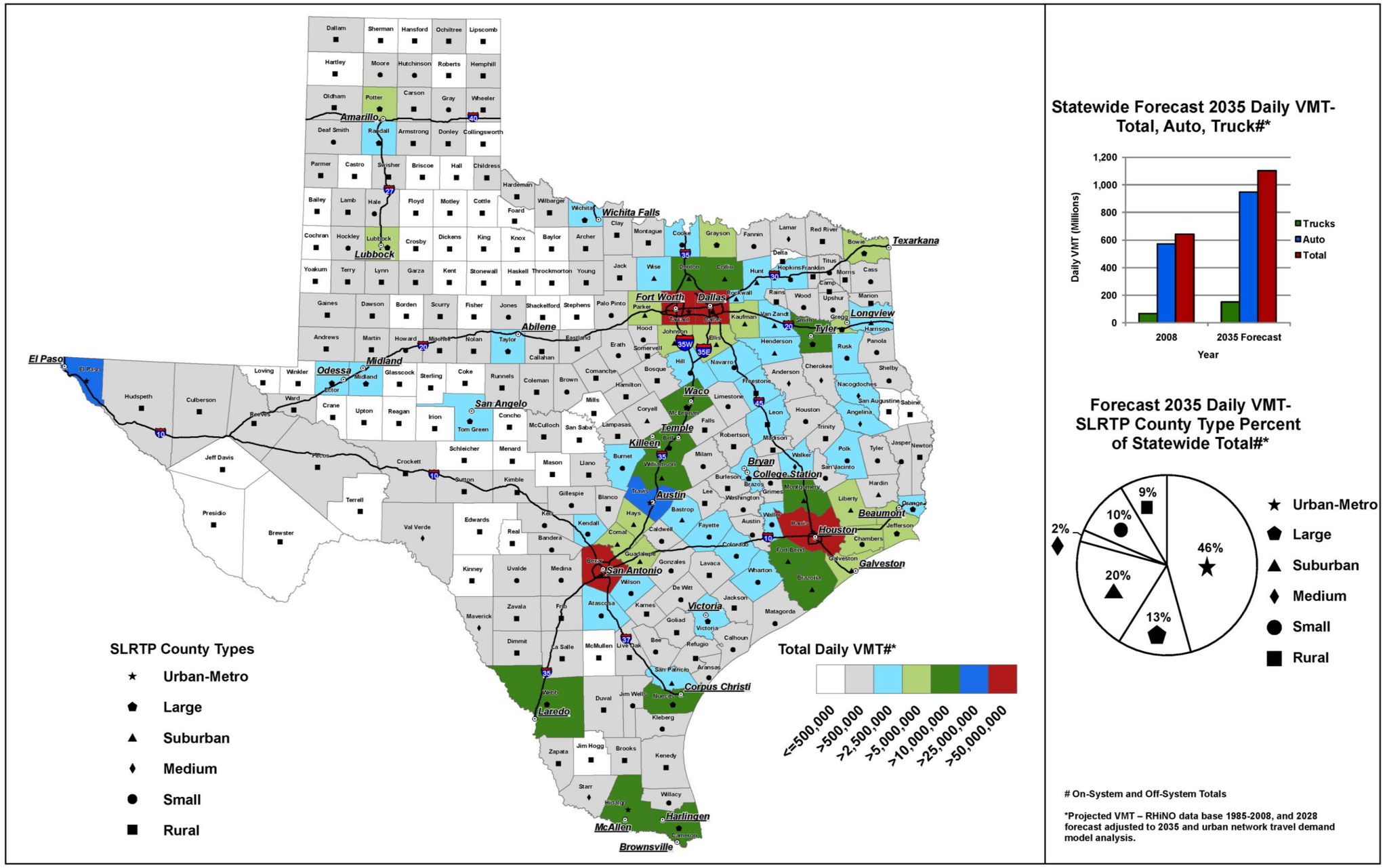


Figure 2-16 illustrates total daily VMT by county for 2035.

[23] Projected population, 2008 and 2035 –TSDC, 0.5 growth scenario; 2035 Projected VMT – RHiNO database 2028 forecast adjusted to 2035 and urban network travel demand model analysis.

[24] Projected VMT – RHiNO database 1985–2008, and 2028 forecast adjusted to 2035 and urban network travel demand model analysis.

Figure 2-16: Forecast 2035 VMT by County



2.4.6 The Geography of Texas Auto and Truck VMT Growth

Figure 2-17 shows the growth in VMT in the highest 20 counties in Texas ranked by total 2035 VMT. Harris County dominates the growth in auto and truck VMT. It is important to note that Dallas and Tarrant counties are considered one metropolitan area although they are shown separately on this chart. This chart shows the increase in VMT from 2008 to 2035. After the largest metropolitan counties, most of the remaining fastest growing counties are suburban to these core metropolitan counties. However, included in the top 20 counties are other individual large counties, such as El Paso and Nueces counties.

Figure 2-17: Daily Auto and Truck VMT Growth, 2008–2035, in Top 20 Counties[25]

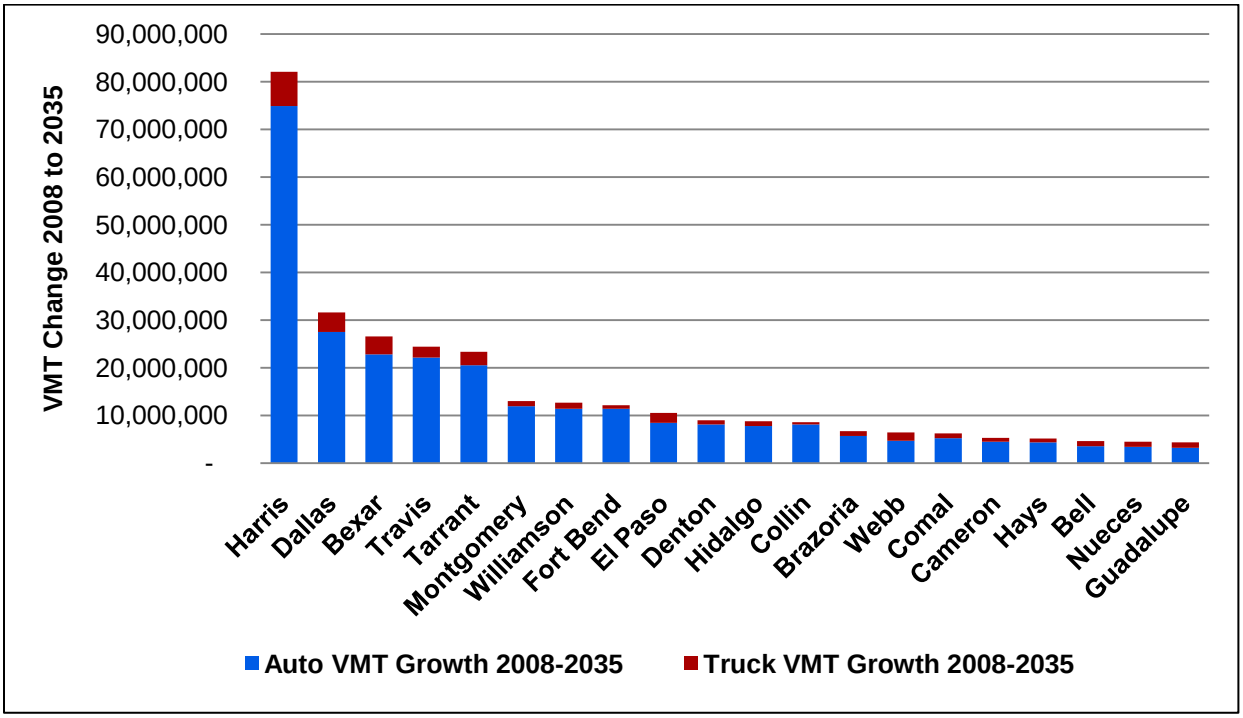


Table 2-8 shows the 2008 and 2035 auto, truck and total daily VMT and percent change by type of county type. Figure 2-18 illustrates VMT growth by county type. While much of the growth in both population and VMT by 2035 will occur in urban-metro counties, all areas will see a significant percent change in VMT. All county types (not all counties individually) will see a rise of more than 50 percent in VMT. This chart shows that in more urbanized regions of the state, VMT growth is more closely tied to population growth than in rural areas. In contrast, VMT will grow by over 60 percent in rural areas,

[25] Sources: Projected VMT – RHiNO database 2008 and 2028 forecast adjusted to 2035 and urban network travel demand model analysis.

while population increases by only 12 percent, indicating that growth in VMT in these counties is tied more closely to trucks and autos generated outside the county.

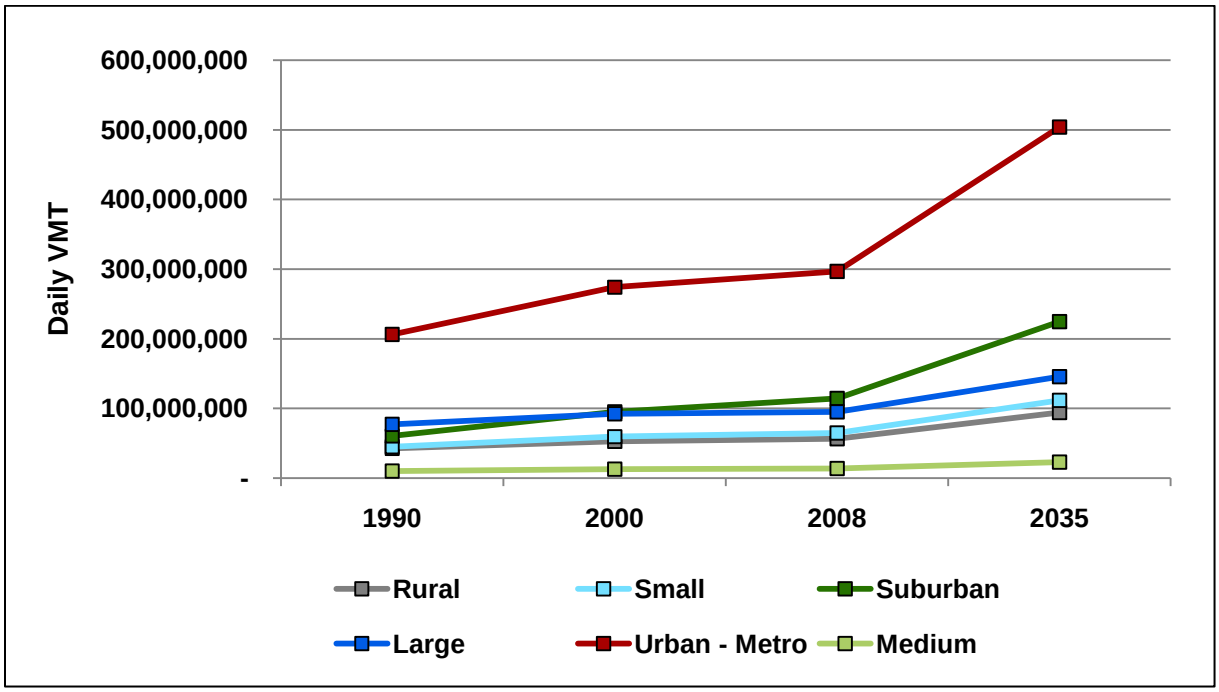
Table 2-8: Total Daily VMT by County Type On- and Off-System Roads, 2008–2035[26]

Summary	Urban – Metro	Large City	Suburban	Medium	Small	Rural	Total
	2008						
Auto VMT	278,677,645	84,167,975	101,502,596	11,500,162	53,575,684	42,923,853	572,347,915
Truck VMT	18,006,787	10,884,740	12,788,259	2,187,325	11,180,160	13,570,118	68,617,389
Total VMT	296,684,433	95,052,716	114,290,855	13,687,487	64,755,844	56,493,970	640,965,305
Population	11,903,007	3,747,564	4,427,349	546,767	1,857,473	1,132,337	**23,614,497**
-	**2035**						
Auto VMT	462,662,358	120,712,594	195,756,808	18,184,470	87,751,643	64,036,351	949,104,225
Truck VMT	41,193,896	24,760,372	28,706,167	4,698,803	23,758,544	29,881,057	152,998,839
Total VMT	503,856,254	145,472,965	224,462,975	22,883,273	111,510,188	93,917,408	1,102,103,063
Population	17,028,201	4,852,359	7,583,884	696,821	2,356,424	1,272,008	**33,789,697**
-	**% Change 2008–2035**						
Auto VMT	66.0	43.4	92.9	58.1	63.8	49.2	65.8
Truck VMT	128.8	127.5	124.5	114.8	112.5	120.2	123.0
Total VMT	69.8	53.0	96.4	67.2	72.2	66.2	71.9
Population	**43.1**	**29.5**	**71.3**	**27.4**	**26.9**	**12.3**	**43.1**

While high growth in truck travel is to be expected in counties where population is growing the fastest, it is important to note that truck travel in rural areas is also expected to grow significantly. This growth in truck VMT in rural counties is a result of the many miles of connecting roadways crossing these counties including in particular the interstate system.

[26] Sources: Projected VMT – RHiNO database 2008 and 2028 forecast adjusted to 2035 and urban network travel demand model analysis.

Figure 2-18: Daily VMT by County Type, 1990–2035[27]



While Table 2-8 shows the expected growth in VMT for each county type, Table 2-9 shows where the total growth is expected to occur. Urban-metro counties and adjacent suburban counties will account for 69 percent of the growth in VMT in Texas by 2035 (45 percent plus 24 percent, respectively).

Table 2-9: Percent of Total Daily VMT Growth by County Type, 2008–2035

County Type	% of Total Growth	% of Auto Growth	% of Truck Growth
Urban-Metro	45	49	27
Large	11	10	16
Suburban	24	25	19
Medium	2	2	3
Small	10	9	15
Rural	8	6	19
Total	**100**	**100**	**100**

[27] Sources: Projected VMT – RHiNO database 1990, 2000, 2008, and 2028 forecast adjusted to 2035 and urban network travel demand model analysis.

2.4.7 Forecast Traffic Congestion Levels (On-System Roads Only)

While it is important to inventory the Texas roadway system and total travel in the state, it is also important to measure the roadway traffic conditions expected by 2035. Congestion is a term heard often when discussing highway traffic conditions, and there are many definitions. The Texas Transportation Institute (TTI) has an ongoing monitoring study called the Urban Mobility Report (http://mobility.tamu.edu/) that uses consistent methods to measure congestion. The SLRTP uses one of TTI's methods.

Using the RHiNO database, a basic measure of congestion can be obtained by dividing the Average Daily Traffic (ADT) into the number of lanes on each segment, yielding an ADT per lane. Table 2-10 shows the thresholds of ADT per lane for each level of congestion.

Table 2-10: Daily Traffic Volume per Lane Congestion Calculation[28]

Facility and Congestion Level	Daily Traffic Volume per Lane
Freeway	
Uncongested	Under 15,000
Medium	15,001–17,500
Heavy	17,501–20,000
Severe	20,001–25,000
Extreme	Over 25,000
Arterial	
Uncongested	Under 5,500
Medium	5,501–7,000
Heavy	7,001–8,500
Severe	8,501–10,000
Extreme	Over 10,000

Clearly, there are many special situations on certain segments of roadway that cause traffic bottlenecks and delays. These special situations, including inclement weather conditions, are not represented by this basic measure.

A representative summary of the overall traffic conditions can be obtained by aggregating the VMT on roadways that fall into each congestion level. Table 2-11

[28] 2009 Urban Mobility Report, TTI.

shows daily VMT on the state roadway system for each level of congestion for 2008 and 2035.

Table 2-11: VMT by Congestion Level On-System Roads, 2008–2035[29]

	Freeway				Arterial			
	2008		2035		2008		2035	
Summary	**VMT**	**% of Total**	**VMT**	**% of Total**	**VMT**	**% of Total**	**VMT**	**% of Total**
Uncongested	97,929,466	**45.6**	130,610,584	**32.7**	186,138,452	**71.4**	227,722,248	**51.8**
Medium	22,404,813	**10.4**	33,261,069	**8.3**	25,706,170	**9.9**	52,087,778	**11.8**
Heavy	17,578,520	**8.2**	28,856,963	**7.2**	17,366,898	**6.7**	45,276,220	**10.3**
Severe	37,538,930	**17.5**	54,728,298	**13.7**	9,818,812	**3.8**	31,045,088	**7.1**
Extreme	39,288,495	**18.3**	152,565,588	**38.1**	21,609,858	**8.3**	83,707,262	**19.0**
% ≥ Heavy		**44.0**		**59.0**		**18.7**		**36.4**
Total	214,740,224		400,022,501		260,640,190		439,838,594	

Figure 2-19 and Figure 2-20 show the breakout by county type of VMT on the state roadway system in the heavy or greater level of congestion for 2008 and 2035. While 67 percent of freeway travel is currently occurring in heavy or worse congestion in urban-metro counties, this is expected to grow to over 80 percent of travel by 2035. Additionally, given current trends, the percentage of VMT operating at heavy or greater level of congestion on freeways and arterials in large, suburban, medium, and small county types is expected to increase by 2035.

[29] Projected VMT – RHiNO database 2008 and 2028 forecast adjusted to 2035 and urban network travel demand model analysis. 2009 Urban Mobility Report, TTI.

Figure 2-19: Percent of Freeway VMT at Heavy or Greater Congestion by County Type, On-System Roads[30]

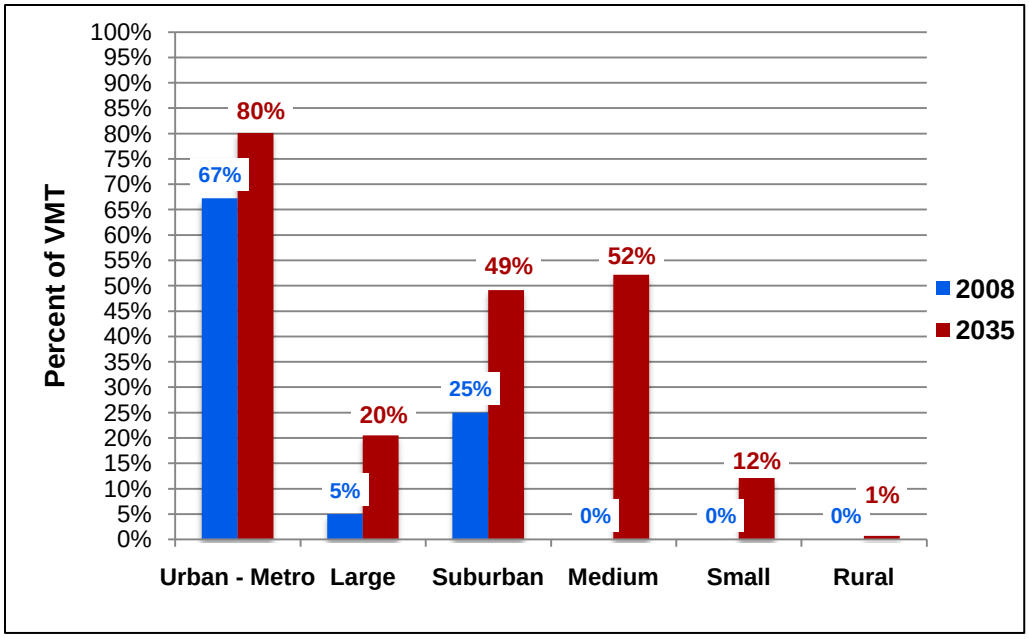
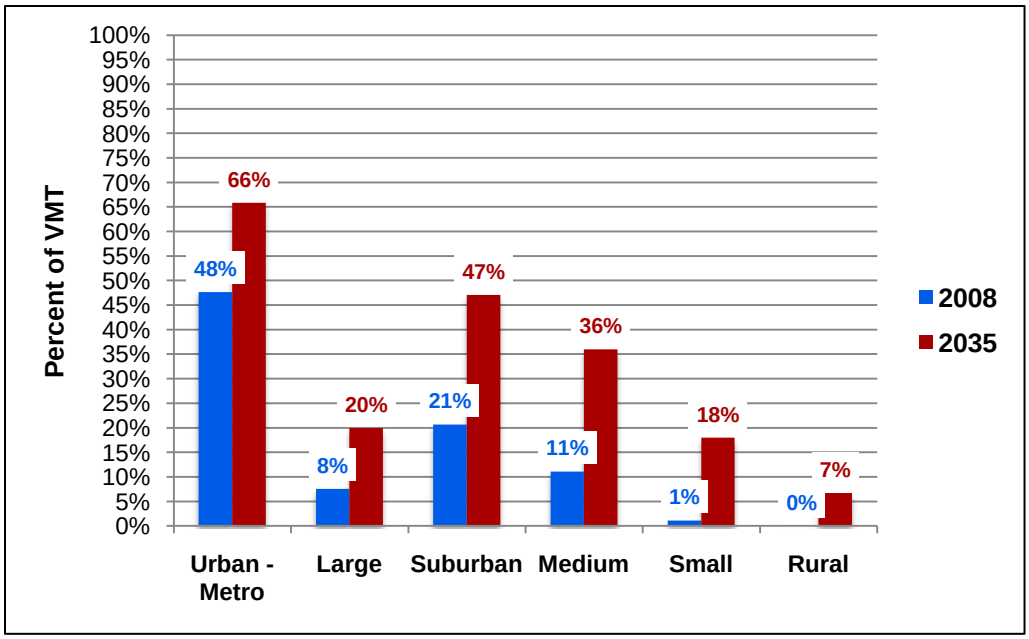


Figure 2-20: Percent of Arterial VMT at Heavy or Greater Congestion by County Type, On-System Roads[31]



[30] Ibid

[31] Ibid

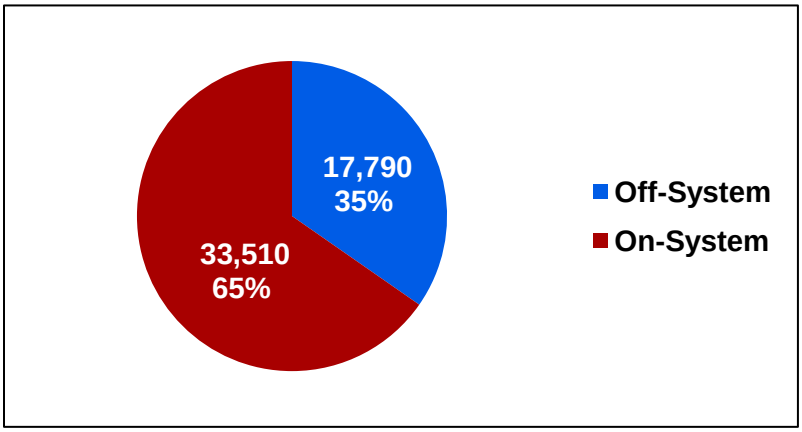
2.5 Texas Bridges

Figure 2-21 shows the number and distribution of Texas' 51,300 on- and off-system bridges in Texas.

On-system bridges are vehicular bridges that are located on the designated state highway system, owned and maintained by TxDOT, and typically funded with a combination of federal and state or state-only funds.

Off-system bridges are not part of the designated state highway system and are under the direct jurisdiction of the local government such as a county, city, other political subdivision of the state, or special district with authority to finance a highway improvement project.

Figure 2-21: Texas Bridge Classification 2010[32]



The correlation between the age of bridges and their need for special maintenance predicts the need for resources to support bridge replacement and rehabilitation. In addition, on-system Texas bridges built after 1900 can be classified by significant changes in the design criteria that governed their construction:

- Built before 1950—Bridges generally designed for less than the current state legal load.
- Built between 1950 and 1970—Bridges generally required to accommodate the minimum design load or higher recommended by the American Association of State Highway and Transportation Officials (AASHTO), but may be narrower than their approach roadways. A number of these bridges are too narrow to meet

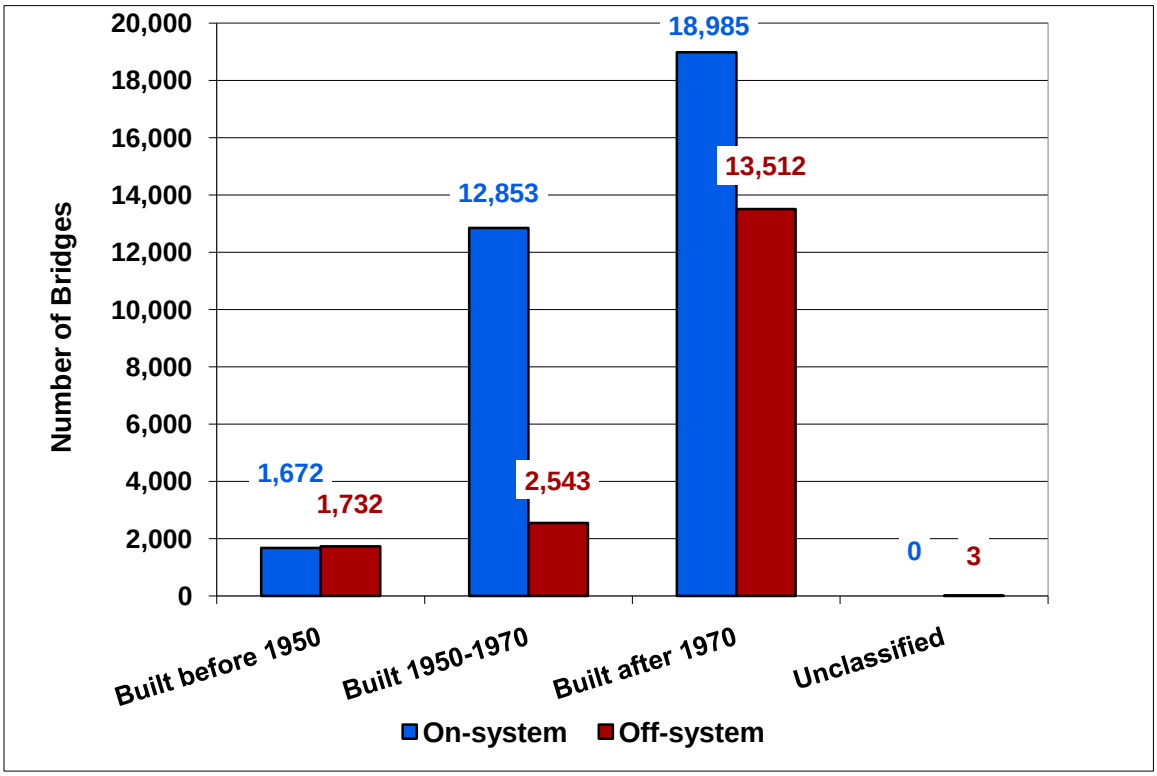
[32] TxDOT BRINSAP Database

current requirements. (Required bridge load capacity is described in detail in TxDOT's Bridge Inspection Manual.)

- ★ Built after 1970—Bridges generally required to accommodate the minimum design load or higher recommended by the AASHTO and must be at least as wide as their approach roadways.

Figure 2-22 shows the number of bridges constructed during the periods described above.

Figure 2-22: Time Period of Bridge Construction[33]



The federal criterion for bridge replacement is a sufficiency rating of 50 or below. A statistical analysis on the Bridge Inventory, Inspection and Appraisal Program (BRINSAP) database from 1997 through 2007 performed by the Center for Transportation Research for 2030 Committee Transportation Needs Report determined that on-system bridges typically reach this threshold at 55 years of age. Similar analysis for off-system bridges yields a value of 50 years of age. The values were developed to

[33] TxDOT BRINSAP Database

achieve a 10 percent probability that the age of replacement is less than the calculated value.[34]

Data from BRINSAP indicate that Texas will experience one of the first sizeable "bridge reconstruction cycles" during this plan period (2010–2035). Based on an estimated service life of 55 years for on-system bridges, more than 15,000 bridges constructed between 1955 and 1980 will be considered potential candidates for replacement during the needs analysis. One quarter of these bridges were constructed in just three urban districts: Dallas, San Antonio, and Fort Worth—in the wake of post-war economic growth, implementation of the interstate system, and freeway development in the larger cities. Many of the remaining on-system structures during this timeframe appear to be related to the addition of mileage to the farm-to-market system in districts such as Waco, San Angelo, and Yoakum.

For off-system bridges, over 5,000 of the 17,800 structures were also built between 1955 and 1985, especially by large municipalities, cities, counties and developers of new residential and commercial neighborhoods in the suburban areas. Over half of these bridges are located in the largest urban areas of the period: Houston, Dallas, Fort Worth, and San Antonio.

The distribution of the on-system bridges indicates the decade in which most of the interstate construction was accomplished (1960s) and the decade of major construction efforts in each of the large districts. The off-system bridges track with the amount of residential and commercial development to accommodate the rapid growth in the state since 1980.

The number of bridges does not provide an indication of the size of bridges. The size of the bridge deck, measured in square feet, is used to compare bridge sizes. Figure 2-23 and Figure 2-24 show the distribution of deck area by age for on- and off-system bridges.

For on-system bridges, spikes in the graph can be associated with bridge work with major freeway construction/reconstruction projects. The 1960s reflected major efforts on the first wave of urban freeways as well as interstate construction. The spike in 1989 includes the Downtown Y in San Antonio. The 1990s encompassed the reconstruction of North Central Expressway in Dallas. The spike in 2007 is associated with the opening of SH 45, Loop 1, and SH 130 in Central Texas.

[34] TxDOT 2030 Committee Texas Transportation Needs Report, 2009

For off-system bridges, the amount of deck area tracks with population gains and economic prosperity of the mid- to late 1980s and the first decade of this century. The economic downturns in 2002, 2003, and 2008 clearly track the reduction in new housing and commercial developments.

Figure 2-23: Distribution of Deck Area by Year Built for On-System Roadways[35]

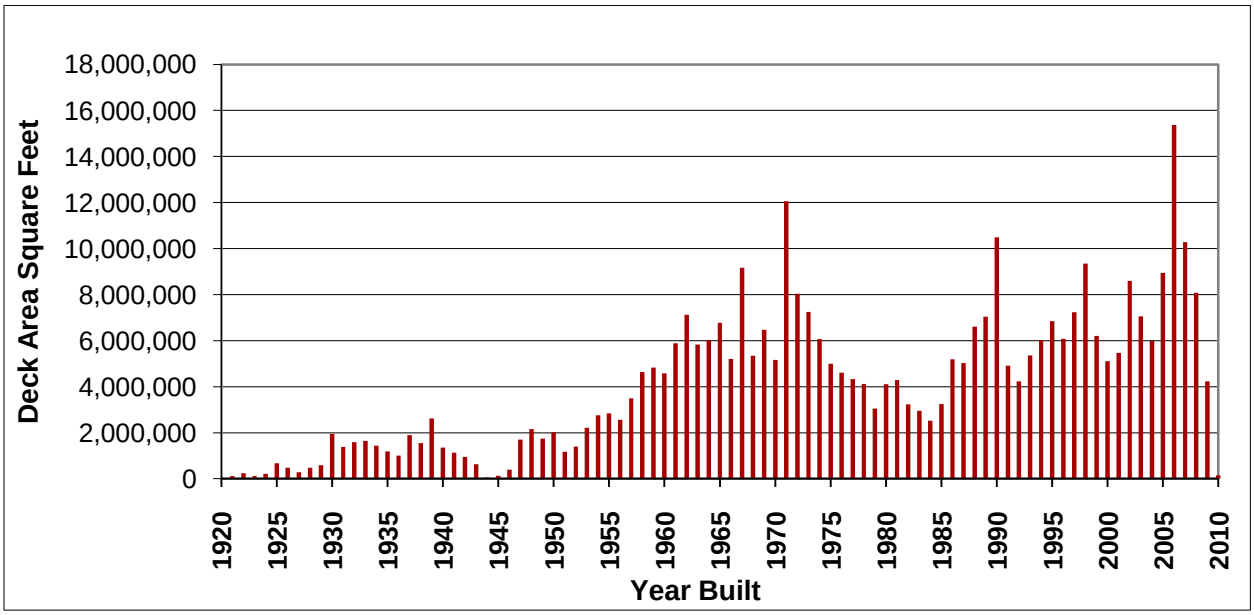
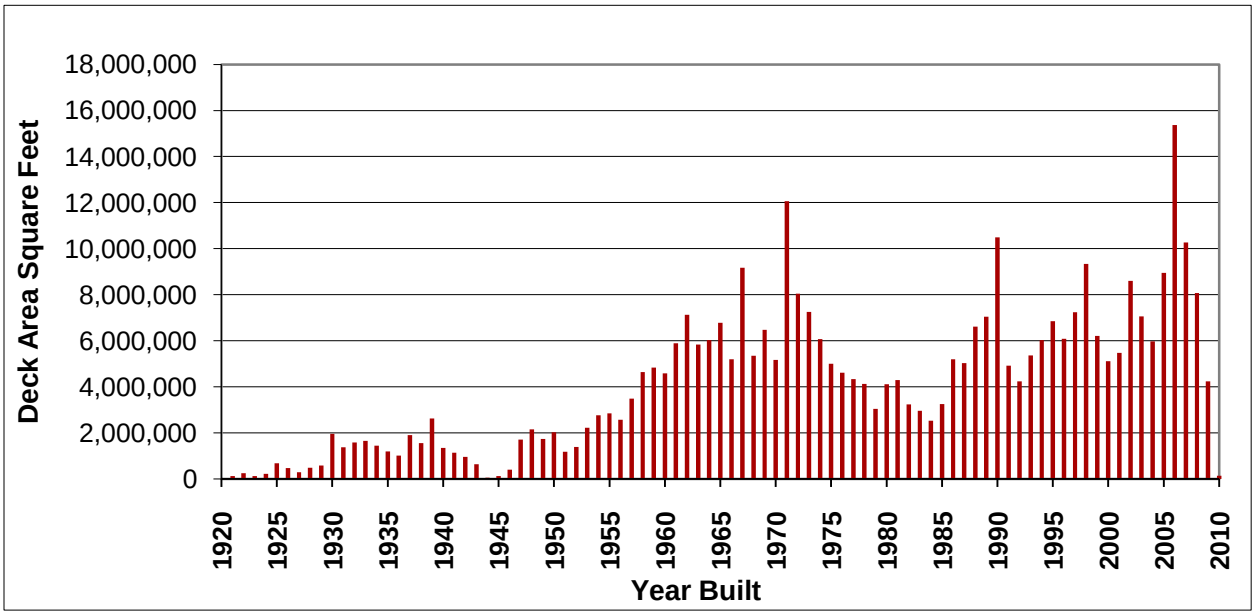


Figure 2-24: Distribution of Deck Area by Year Built for Off-System Roadways[36]



[35] TxDOT BRINSAP Database

[36] Ibid

Table 2-12 shows distribution of bridges by bridge length. The longest on-system bridge in Texas is the Sabine River/Toledo Bend Bridge on SH 21 at 13,196 feet. The longest off-system bridge in Texas is the Pharr/Reynosa Bridge over the Rio Grande at 15,770 feet.

Table 2-12: Bridges by Length[37]

Bridge Length	On-System Bridges			Off-System Bridges		
	Over Waterway	Not Over Waterway	Total*	Over Waterway	Not Over Waterway	Total*
<30 feet	5,707	4	5,711	3,098	4	3,102
30–100 feet	10,213	132	10,345	10,502	106	10,608
100–250 feet	6,068	3,376	9,444	2,759	202	2,961
250–400 feet	1,511	2,663	4,174	445	123	568
400–1,000 feet	1,429	1,142	2,571	286	108	394
1,000–2,500 feet	466	492	958	68	61	129
2,500 feet–1 mile	112	132	244	14	9	23
1–2 miles	30	24	54	3	0	3
≥ 2 miles	5	2	7	1	0	1
Totals	**25,541**	**7,967**	**33,508**	**17,176**	**613**	**17,789**

*Note: Totals differ from Figure 2-21 due to incomplete data records for a total of three bridges.

2.5.1 Texas Bridge Conditions

The standard definitions for condition of bridges are as follows:

- **Structurally Deficient:** A structurally deficient bridge is one with routine maintenance concerns that do not pose a safety risk or one that is frequently flooded. To remain open to traffic, structurally deficient bridges are often posted with reduced weight limits that restrict the gross weight of vehicles using the bridges.
- **Functionally Obsolete:** Classification as functionally obsolete means the bridge met current design standards when built, but over time has become obsolete due to an increase in traffic volume. Functionally obsolete bridges are those that do not have adequate lane widths, shoulder widths, or vertical clearance to serve current traffic demands or are occasionally flooded.
- **Substandard-for-Load-Only:** The term "substandard-for-load-only" is used by TxDOT to designate bridges in relatively good condition that do not have specific maintenance concerns, but do have a load-carrying capacity less than the state

[37] Ibid

legal limit for public roadways. Substandard-for-load-only bridges are posted with reduced weight limits. These bridges are not classified as structurally deficient or functionally obsolete under Federal Highway Administration (FHWA) definitions.

Table 2-13 shows the condition of Texas bridges as of March 2010.

Table 2-13: Condition of Texas Bridges, March 2010[38]

Rating	Bridges	Percent
On-System (33,510 bridges)		
Substandard for Load Only	93	0.28
Structurally Deficient	328	0.98
Functionally Obsolete	3,514	10.49
Off-System (17,790 bridges)		
Substandard for Load Only	1,085	6.10
Structurally Deficient	1,281	7.20
Functionally Obsolete	3,979	22.37

Figure 2-26 and Figure 2-27, provide a comparison of bridges in each of the four TxDOT regions (Figure 2-25) and show the distribution of functionally obsolete and structurally deficient bridges.

[38] Ibid

Figure 2-25: TxDOT Regions and Districts

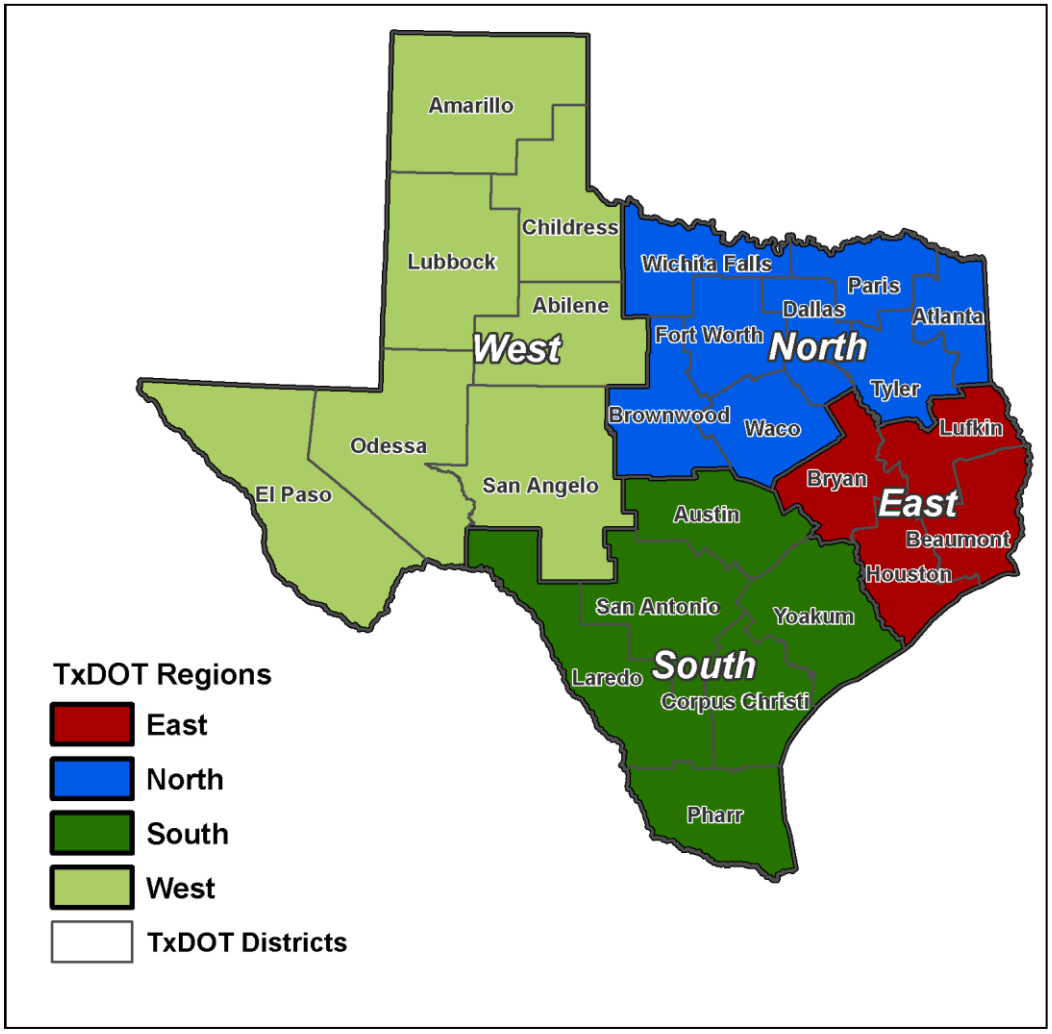


Figure 2-26: Functionally Obsolete Bridges by Region, March 2010[39]

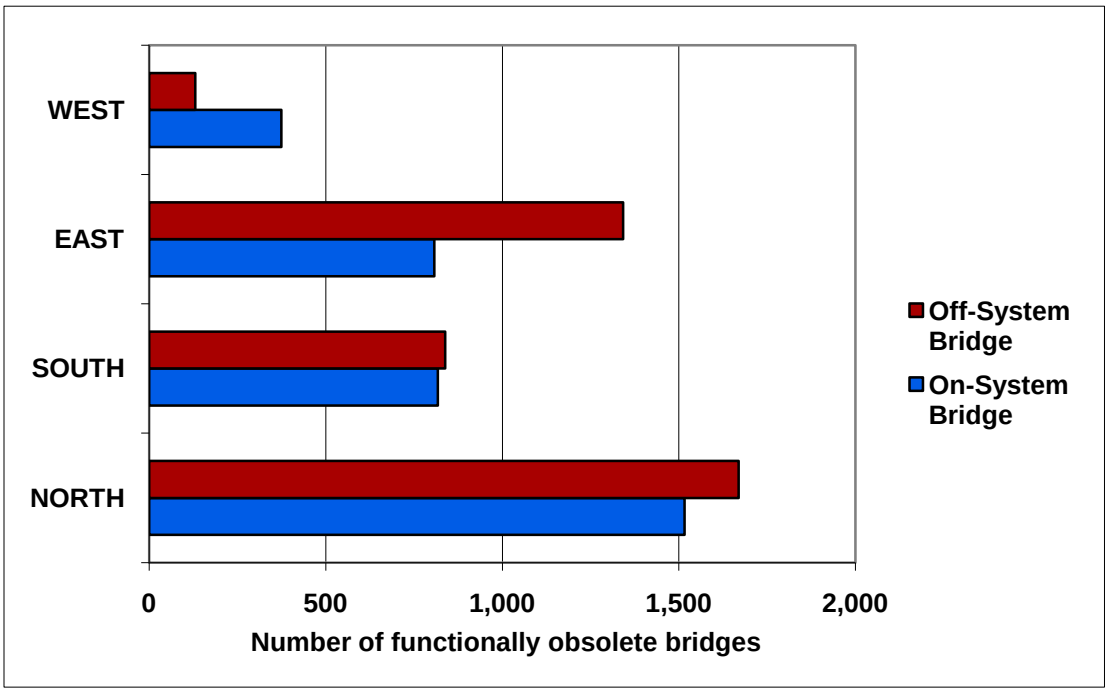
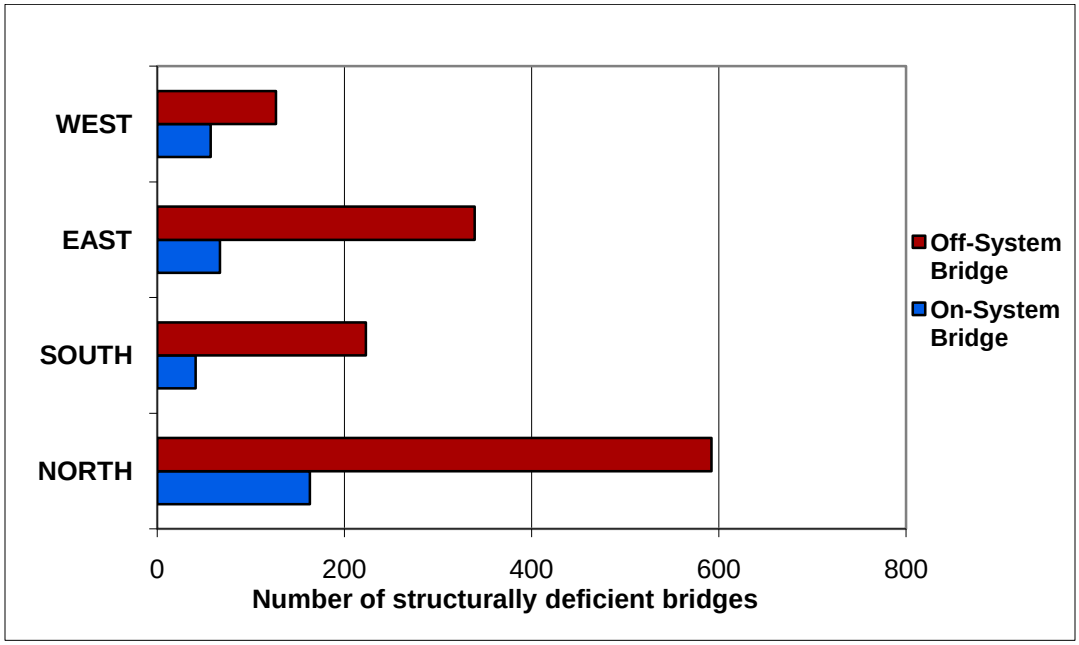


Figure 2-27: Structurally Deficient Bridges by Region, March 2010[40]



[39] Ibid

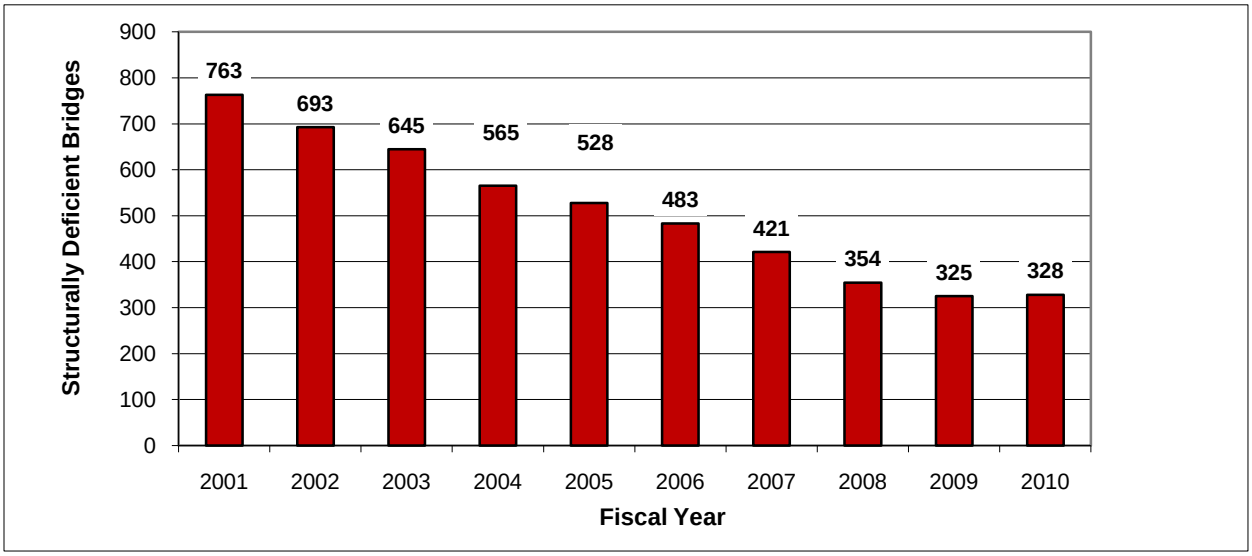
[40] TxDOT BRINSAP Database

The Texas Transportation Commission established the goal of achieving 80 percent of the bridges rated in good or better condition by September 2011.[41] Bridges are considered in "good or better" condition if they are not structurally deficient, functionally obsolete or substandard-for-load-only. Figure 2-28 summarizes the progress towards achieving this goal.

Table 2-14: On- and Off-System Bridge Ratings by Year[42]

Fiscal Year	Good or Better (%)
2001	70
2002	71
2003	75
2004	76
2005	76
2006	77
2007	78
2008	78
2009	79
2010	80
Goal 2011	**80**

Figure 2-28: Reduction in On-System Structurally-Deficient Bridges by Year, 2001–2010[43]



[41] Transportation Commission Minute Order 108608, August 30, 2001

[42] TxDOT Bridge Facts, 2001-2009

[43] Transportation Commission Minute Order 108608, August 30, 2001

TxDOT expended $3.9 billion over the last nine fiscal years to achieve the progress in replacing bridges. Figure 2-29 and Figure 2-30 show the value of construction contracts to replace or rehabilitate existing bridges and contracts to build new bridges over this time period.

Figure 2-29: Value of Rehab/Replace Bridge Contracts, 2001–2009[44]

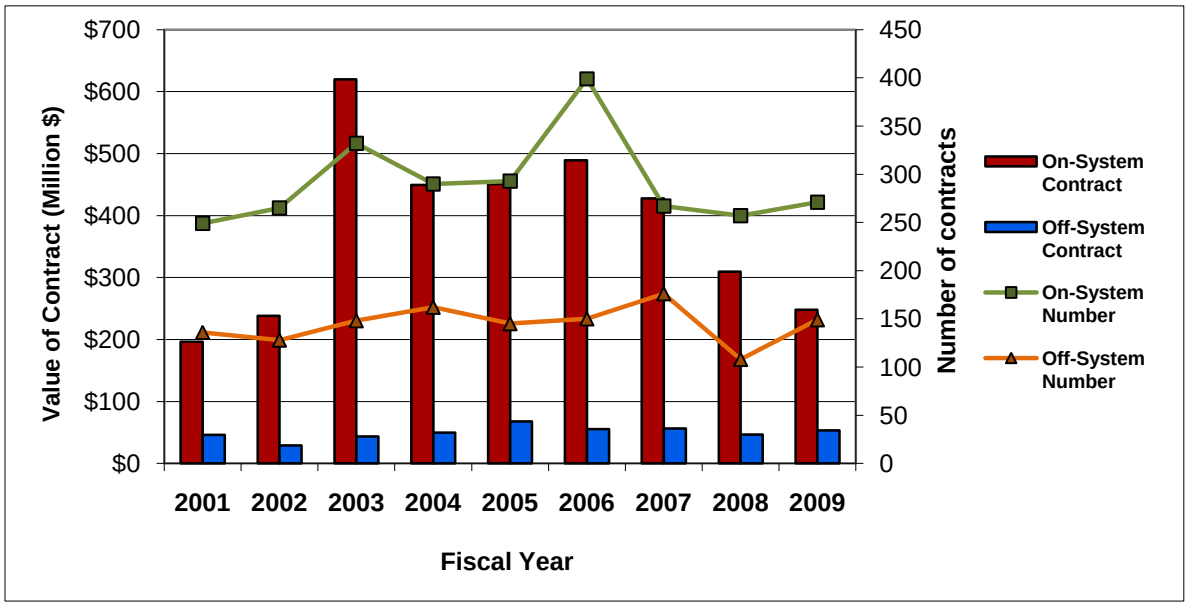
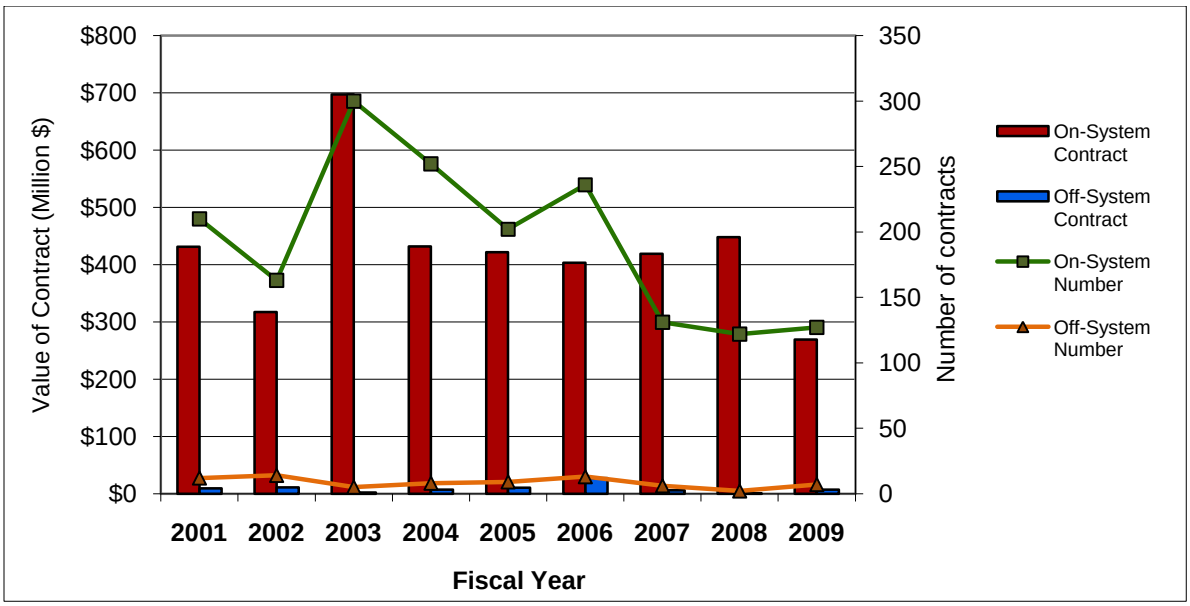


Figure 2-30: Value of New Location Bridge Contracts, 2001–2009[45]



[44] TxDOT Bridge Facts, 2001–2009

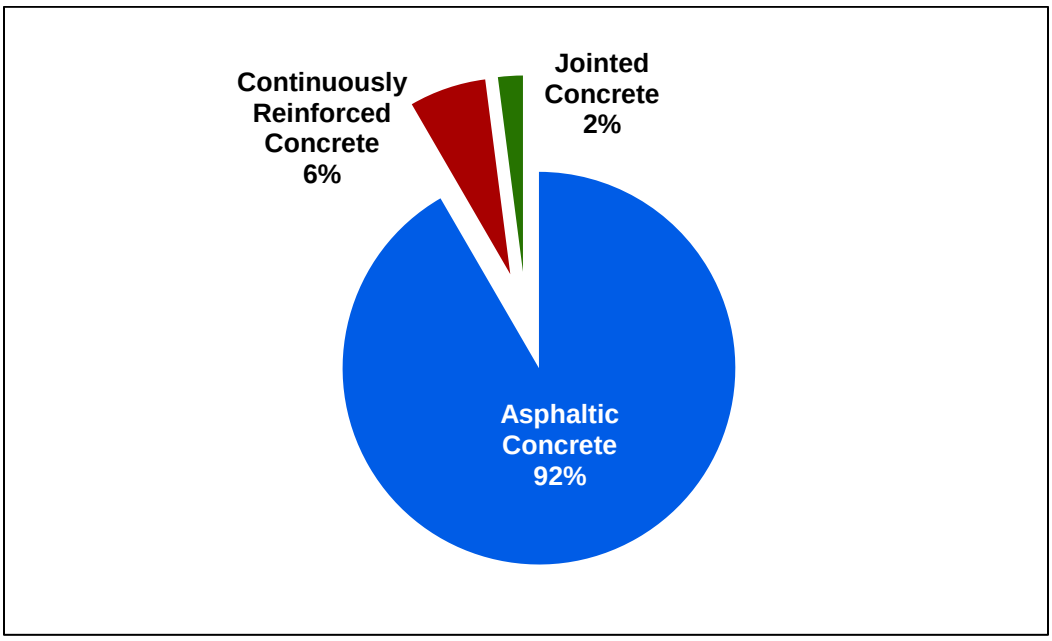
[45] TxDOT Bridge Facts, 2001–2009

2.6 Texas Pavements

2.6.1 Texas Pavement Types

For Routine Maintenance/Preventative/Rehabilitative Maintenance (RM/PRM) planning purposes, TxDOT groups pavements into three general categories. Figure 2-31 shows the general distribution of each pavement type within the TxDOT system.

Figure 2-31: Pavement Types[46]



- ★ Asphaltic concrete pavement (ACP) is by far the most common type of pavement on the TxDOT system. This category also includes the sealed flexible base sections found on most farm-to-market roads.
- ★ Continuously reinforced concrete pavement (CRCP) is primarily found on high volume roadways and uses steel reinforcement to manage concrete cracking in a controlled manner.
- ★ As the name implies, joints are constructed at regular intervals, creating jointed concrete pavement (JCP) slabs. Reinforcing steel use varies widely in JCP.

2.6.2 Texas Pavement Conditions

Pavement conditions on existing Texas roadways are affected by a number of variables such as age, traffic volume, number and size of heavy trucks, weather, strength and

[46] TxDOT Construction Division, 2010

stability of underlying soils, stormwater and internal drainage, and the type/quality of the initial pavement construction. RM/PRM must be systematically performed to counter the combined impacts of these variables.

The process for planning, budgeting, and scheduling pavement RM/PRM generally includes development and maintenance of a pavement inventory, regular measurement of the existing pavement conditions, and identification and prioritization of RM/PRM needs.

Several terms have specific meanings when used in discussions about pavement conditions.

- ★ Distress rating – A numerical value used to quantify the extent of pavement distress for a particular roadway section. The distress rating is one of the two key measurements used to define overall pavement conditions.
- ★ Ride quality measurement – A directly measured numerical value used to quantify the smoothness or roughness of pavements. It is the second key measurement used to quantify overall pavement conditions.
- ★ Pavement distress – A general term used to describe pavement that has deteriorated from any combination of variable factors. Descriptive terms such as "rutting," "cracking," "potholes," "patched areas," and "punchouts" all refer to pavement distress.
- ★ Ride quality – This term is used to describe the smoothness of pavement surfaces.
- ★ Pavement condition – A composite numerical value calculated from pavement distress ratings and ride quality measurements taken for a specific section of roadway. TxDOT annually calculates new pavement condition scores – in roughly half-mile sections – for the entire roadway system not under construction.

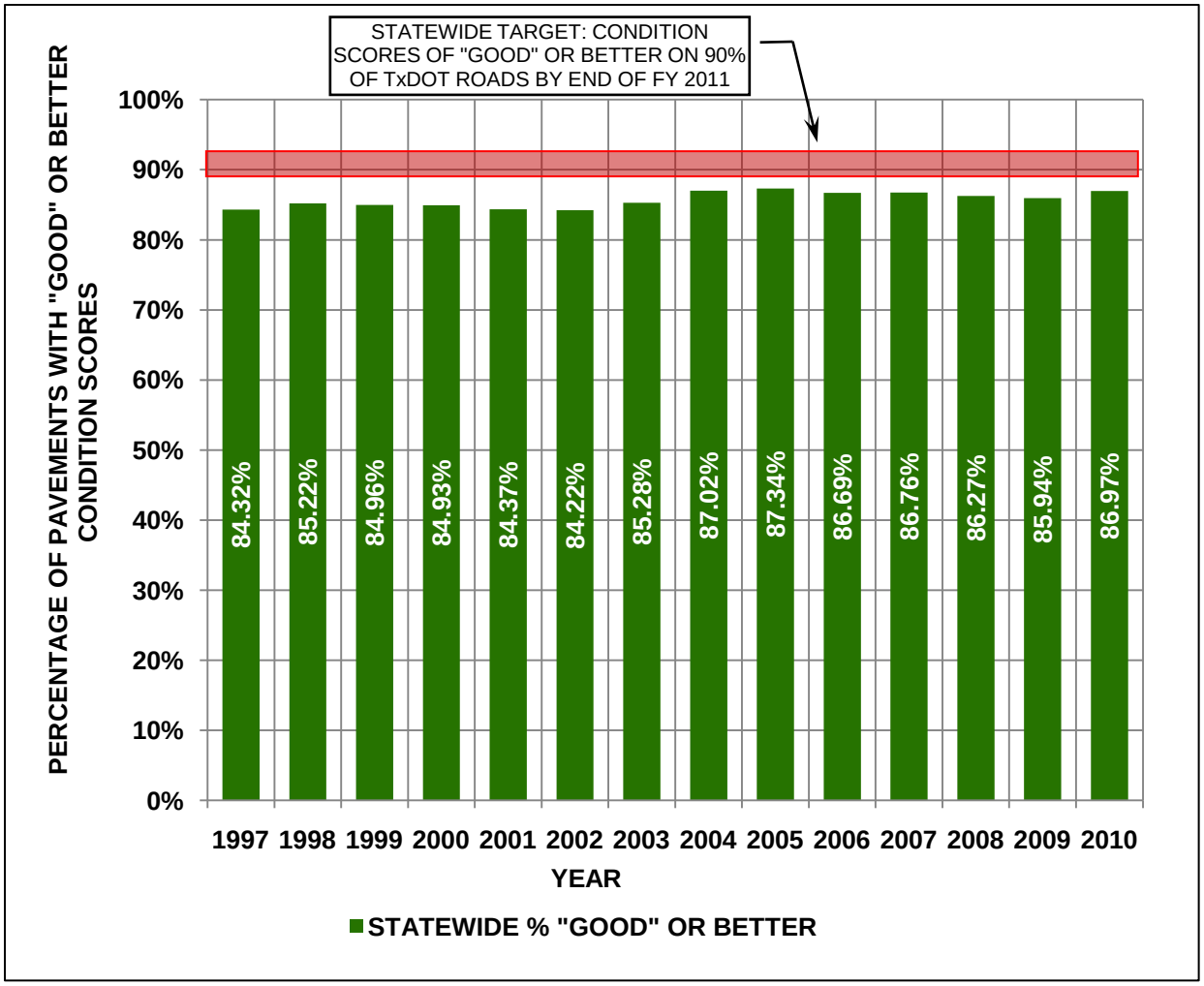
TxDOT's Pavement Management Information System (PMIS) is a statewide program that annually collects on-site measurements of pavement distress ratings, ride quality measurements, and composite pavement condition scores to show trends and overall RM/PRM needs for the TxDOT system.

A general snapshot of the pavement conditions is also generated to meet a specific Departmental goal. In August 2001, the Texas Transportation Commission set a statewide goal to have 90 percent of Texas pavements in "good" or better condition

within 10 years.[47] "Good" condition is defined as a composite pavement condition score of 70 or higher for a particular section of roadway. The pavement condition scores collected within PMIS will need to be at least 70 for roughly 90 percent of the roadway sections to meet this goal.

Although pavement condition scores improved slightly from 2003 to 2005, scores are again declining. The goal of 90 percent of the pavement in "Good" or better condition has not been met. Figure 2-32 provides a summary of the overall pavement condition scores since 1997.

Figure 2-32: Percentage of Roads with Good or Better Condition, Fiscal Year 1997–2010[48]



[47] Transportation Commission Minute Order 108608, August 30, 2001

[48] TxDOT Construction Division, 2010

As demand increases, particularly truck traffic, the wear and tear on Texas' highways increases. Added to this increasing need for maintenance is severely limited funding to repair roads. A significant difference exists between TxDOT's projected PRM funding for 2010–2035 and the pavement maintenance funding needs recently identified by the Center for Transportation Research. A clear portrayal of the cumulative effect of the PRM funding deficit is presented on Figure 2-33, which shows the dramatic decline in PMIS pavement condition scores predicted by the Center for Transportation Research (CTR) pavement deterioration model under TxDOT's current projected PRM funding levels through 2035. This figure shows that although TxDOT is close to meeting its goal of 90 percent of pavements rated as good or better, current trends in funding lead to a rapid decline in overall average statewide pavement rating. This decline, given current funding trends, will cause Texas' pavement scores to average less than 10 percent good or better by 2035.

Figure 2-33: Projected Percentage of Lane Miles in Good or Better Condition

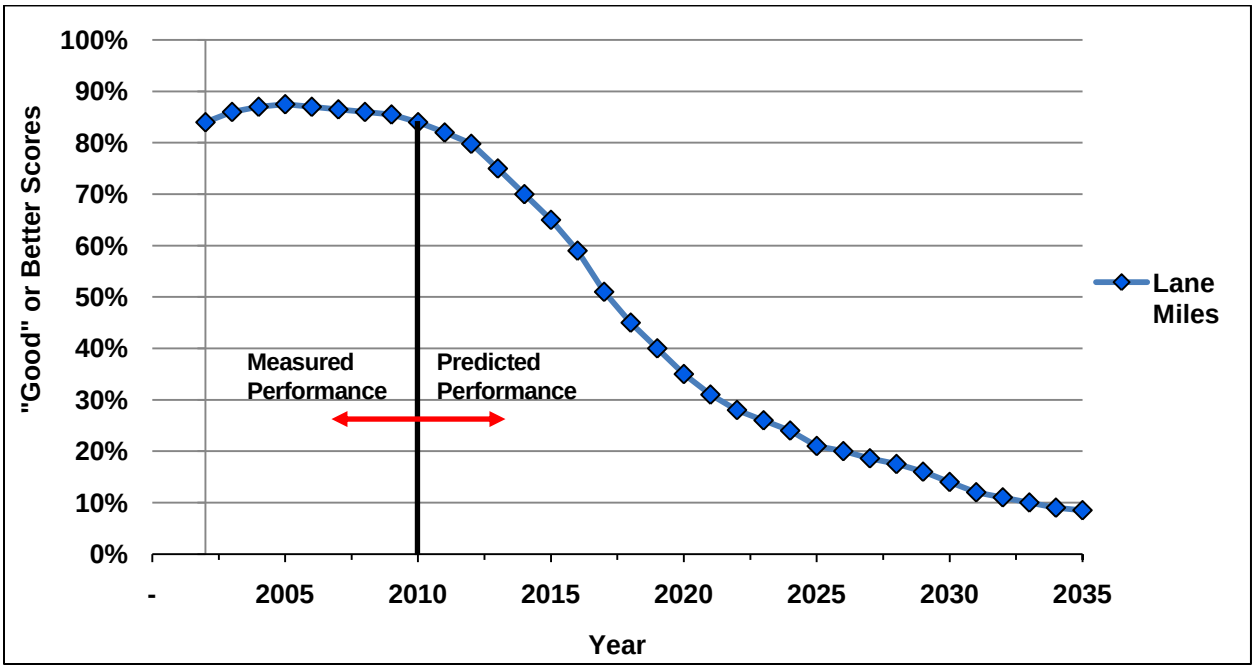
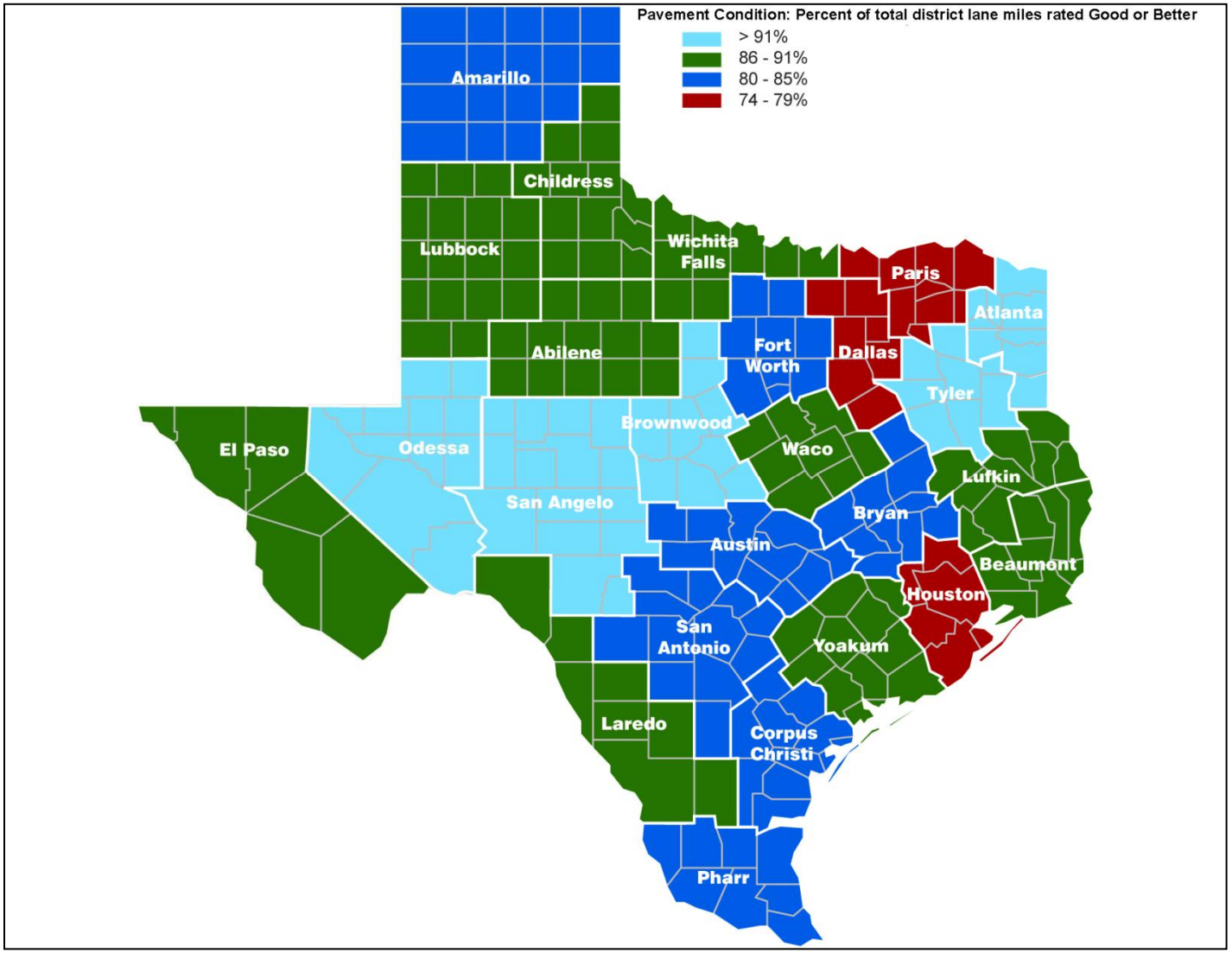


Figure 2-34 illustrates pavement conditions by TxDOT district.

Figure 2-34: Percent of Total District Lane Miles Rated Good or Better



2.7 Intelligent Transportation Systems

Since the early 1990s, ITS has been an important part of the Texas transportation system. USDOT defines ITS as "the integration of advanced communications technologies into the transportation infrastructure and in vehicles."

ITS provides users with up-to-date information on incidents, weather conditions, and congestion while improving the overall movement of vehicles through the monitoring of traffic conditions at a centralized traffic management center (TMC). In addition, ITS improves the flow of information to emergency responders, media outlets, and traffic information providers—resulting in a safer and more efficient transportation system. ITS can be a cost-effective tool to reduce congestion and improve air quality.

ITS technologies can cover a wide range of travel modes including transit and freight. Advanced Public Transportation Systems (APTS) incorporate the latest technology into transit systems to move passengers and vehicles efficiently. The freight industry and businesses with large commercial fleets rely on ITS information for routing, dispatching, and managing fleet operations.

2.7.1 Intelligent Transportation Systems Technologies and Operations

A variety of ITS technologies has been implemented over the last 20 years in Texas. While roadway applications of ITS typically focus on state highways maintained by TxDOT, other agencies such as cities, counties, toll roads, and transit authorities have also implemented ITS into their overall systems.

The following are examples of ITS equipment currently deployed in Texas:

Traffic Management Centers (TMCs) are central hubs where highway, transit, incident, and weather information unite. The largest TMCs include DalTrans & TransVision in the Dallas-Fort Worth area, San Antonio's TransGuide, and Houston's TranStar. Several city agencies have also implemented smaller scale TMCs that focus on monitoring traffic signal timings throughout the city. An example is the City of Dallas' TMC, where staff can detect signal malfunctions and change traffic signal timings directly from the TMC.[49]

Some TMCs house multiple agencies. At Houston's TranStar, officials from Harris County, the City of Houston, Houston Metro, and TxDOT partner together to serve the

[49] City of Dallas, http://www.dallascityhall.com/pwt/traffic_management_center.html, May 25, 2010

mobility needs of the area. This cross-agency coordination has served the Houston area well especially during hurricane evacuation and response.[50]

Dynamic Message Signs (DMS) are large signs with electronic messaging that convey travel time, AMBER Alerts, weather, incident information, and safety messages to drivers. While the great majority of DMS are located along freeways, cities like Dallas have begun implementing DMS on arterial roadways in order to give drivers alternate options when congestion occurs.[51]

Closed-Circuit Television (CCTV) cameras monitor traffic conditions and incidents by providing real-time video to the TMC that the general public can access through websites. This allows the TMC to apply the necessary measures to warn the user of the impending condition and notify the appropriate emergency personnel. Cameras also give cities the ability to detect malfunctions at signalized intersections. CCTV cameras in Houston have been especially helpful before, during, and after hurricane evacuations.

Lane Control Signals (LCS) are mounted above the travel lane and give advance warning to drivers of a lane closure due to incidents or construction.

Radar Detection uses electromagnetic waves to determine vehicular volumes, speed, classification, and travel times between points. This data can be used for establishing traffic patterns and calculating travel times between points. Dallas/Fort Worth and El Paso implement nearly 80 percent of the radar detection devices in Texas.

Loop Detection provides similar information as radar detection except that it uses magnetic induction loops in the pavement to track vehicle information. The majority of loop detection on freeways is found in the Austin-San Antonio area.

Highway Advisory Radio (HAR) broadcast important roadway information to drivers. Typically, a large sign with flashers will indicate which station the driver can access. For example, a driver in the Austin area can tune into 5:30 AM to hear about lane closures 24 hours a day.[52] Similarly, drivers can also tune into a specific radio station as they approach a major airport to obtain flight information.

Ramp Metering uses timed signalization at entrance ramps to provide an even distribution of vehicles merging onto congested highways. Houston is currently the only

[50] Houston TranStar, http://www.houstontranstar.org, 2008 Annual Report, May 25, 2010
[51] City of Dallas, http://www.dallascityhall.com/pwt/dynamic_message_signs.html, May 25, 2010
[52] Texas Department of Transportation, http://www.dot.state.tx.us/aus/newsrel/laneclos.htm, May 25, 2010

city implementing ramp metering on its highways in order to control freeway congestion during peak hours.

Automatic Vehicle Identification (AVI) uses transponder tags to determine traffic flow characteristics and are used primarily by Houston TranStar to measure travel times and speeds.

Roadway Weather Information Systems such as flood warning systems and weather sensors warn drivers of adverse weather conditions. Information on wind, rainfall, hurricane, ice, and snow conditions can allow drivers and emergency officials to take the appropriate precautions during a weather event.

Advanced Traffic Signal Systems consist of equipment that can monitor traffic flows and can communicate to both the TMC and adjacent signal systems in order to maximize signal timing efficiency and reduce delays.

Traffic Signal Priority (TSP) enables transit vehicles to obtain an early or extended green light at traffic signals in order to allow improved service between stations. Dallas Area Rapid Transit (DART) has been implementing and testing TSP at several intersections in Dallas.[53]

Automatic Vehicle Location (AVL) uses GPS to monitor exact locations of transit vehicles and accurately calculate travel times. An example is VIA in San Antonio, which began implementing AVL in 2002 to manage their bus fleet better.[54] Most of the large transit agencies in Texas utilize AVL. In addition, freight companies utilize AVL to determine the location and movement of goods throughout Texas.

Automatic Passenger Counters (APC) are currently used on several DART and Capital Metro (Austin) vehicles. All of Houston Metro's transit vehicles use APC.[55] Passenger counts assist transit agencies in determining bus and rail schedules based on demand.

Electronic Toll Collection (ETC) allows drivers to use transponder tags to pay tolls. This reduces the need for cash systems that can delay traffic. Examples include EZ-tags in Houston, TollTags in Dallas, and TxTAGs, which can be used on any toll road statewide.

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[53] ITS-Texas, http://www.itstexas.org/meetings/2009meetingoverview.stm, May 25, 2010

[54] VIA, http://www.viainfo.net/Organization/History.aspx, May 25, 2010

[55] Boyle, Daniel, Passenger Counting Systems: A Synthesis of Transit Practice, Transit Cooperative Research Program (TCRP): Synthesis 77, 2008, pp. 71–72

The majority of ITS communications in Texas are based on wired networks—usually copper or fiber-optic cables that run underground through special conduits. The cost to construct and relocate these lines can be high. Additionally, underground cabling of fiber optic cable can be difficult to deploy in rural areas due to the long distances required and the ratio of construction cost to the overall users of the technology.

The use of wireless communication technology is being implemented as an alternative to traditional wiring. Wireless technology uses radio bands, which can be licensed or unlicensed. Although unlicensed bands can be used by everyone and are easier to implement, they can be susceptible to interference. TxDOT, city departments, and emergency personnel use both types of radio bands depending on the nature of communication. Wireless ITS devices use both unlicensed and licensed bands.

TxDOT maintains an inventory of ITS equipment throughout the state. Table 2-15 summarizes the current statewide ITS operations by District and gives a general idea of whether a District's ITS deployment is in its initial or advanced stages. All but three TxDOT Districts utilize some form of ITS equipment with urban areas commanding the largest percentage of operations. Where applicable, the TMC name is given.

Table 2-15: Summary of Statewide ITS Operations by TxDOT District

District (TMC Name)	DMS	CCTV	CCTV Wireless	LCS	Radar Detection	Loops	HAR	Ramp Meter	AVI Site	Flood Warning	Weather Sensor
Abilene	4										
Amarillo (PEGASIS)	13	16					1				1
Atlanta	3	5	1								2
Austin (Austin Roads)	44	91	23	261	12	1884	4				
Beaumont	19										
Brownwood	3		4								
Bryan	3	6	2								
Childress											
Corpus Christi	22	26	1								
Dallas (DalTrans)	62	285	14		287						
El Paso (TransVista)	61	113		169	256		13				
Ft Worth (TransVision)	74	162	14	56	182					2	
Houston (TranStar)	186	548	24		73		13	87	160		39
Laredo (STRATIS)	16	33	5	44	12	64					

Table 2-15: Summary of Statewide ITS Operations by TxDOT District

District (TMC Name)	DMS	CCTV	CCTV Wireless	LCS	Radar Detection	Loops	HAR	Ramp Meter	AVI Site	Flood Warning	Weather Sensor
Lubbock (TransView)	3	16			4					3	3
Lufkin											
Odessa	4	3									
Paris	4										
Pharr	13	1									
San Angelo											
San Antonio (TransGuide)	178	179	1	247	98	1,200				17	
Tyler (NETRIS)	2	3					1				
Waco	6	2	2								
Wichita Falls (Texoma Vision)	4		9			16				1	2
Yoakum	4		7		11						
Totals	**728**	**1,489**	**107**	**777**	**935**	**3,164**	**32**	**87**	**160**	**23**	**47**

2.7.2 Intelligent Transportation Systems and Congestion

As the Texas population increases, congestion and travel delays are expected to increase, placing significant economic and safety demands on the existing transportation system. ITS will allow agencies to innovatively use technology to reduce congestion and increase mobility at a lower cost than the traditional method of constructing new roadways.

The TTI has produced National Congestion Tables over the last 12 years that reflect the cost to the public from traffic delays and congestion. These measures are part of an ongoing, long-term effort by TTI to track congestion and mobility. Table 2-16 summarizes the congestion costs in Texas' urban areas and the savings that have been achieved in 2007 with operational and ITS treatments.

Table 2-16: Annual Congestion Cost and Savings by Urban Area (2007)[56]

Urban Area	Congestion Costs/Consumption			Operational Treatment Savings		
	Travel Delay (1,000 Hours)	Excess Fuel Consumed (1,000 Gallons)	Congestion Cost ($ Million)	Operational Treatment*	Delay Savings (1,000 Hours)	Cost Savings ($ Million)
Dallas/Fort Worth/ Arlington	140,744	96,477	2,849	r, i, s, a, h	11,186	221.8
Houston	123,915	88,239	2,482	r, i, s, a, h	15,201	300.8
San Antonio	31,026	21,973	621	i, s, a	1,386	27.8
Austin	22,777	15,578	471	i, s, a	1,209	25.1
El Paso	7,185	4,691	147	i, s, a	515	10.3
Laredo	1,806	1,005	37	i, s, a	36	0.8
Corpus Christi	1,629	970	32	s, a	23	0.5
Beaumont	1,425	866	28	s, a	13	0.2
Brownsville	841	486	17	s, a	18	0.4
Totals	**331,348**	**230,285**	**6,684**	**-**	**29,587**	**587.7**

*r: freeway ramp metering; i: freeway incident management; s: arterial street signal coordination; a: arterial street access management; h: high-occupancy vehicle lanes

2.7.2.1 Intelligent Transportation Systems Current Challenges and Future

Since TMCs and ITS systems are not uniform across all districts, one of the key challenges for TxDOT is statewide communication. The Traffic Operations Division is working to implement updated software that will allow TMCs across the state to communicate with each other. This update presents its own challenges such as:

- ★ A mixture of old and new technology;
- ★ District institutional and control boundaries; and
- ★ Operational agreements.

The ultimate goal is to send information back and forth from a centralized statewide system so that the public can receive information about the whole state via one website.

Another challenge is funding. Federal funding from the FHWA was a key incentive to initiate the early ITS projects. These dedicated federal funds have been discontinued

[56] Texas Transportation Institute Urban Mobility Report, 2009

now that ITS is considered an integral part of major highway construction projects. Consequently, Districts have had to incorporate equipment maintenance as a component of the traditional maintenance budget and to fund additions to ITS systems under the traditional traffic-funding category.[57]

2.7.3 Expanded Use of Existing Technologies

Depending on funding, the following is a sampling of potential applications that Texas could see in the future.

Enhance Traffic Management. Moving ITS components beyond freeways and implementing them on arterials will further enhance the system-wide operations of the transportation system. This will require efficient coordination between local and state governments. The Dallas area is one of several cities nationwide that is pioneering the concept of Integrated Corridor Management (ICM).[58] With ICM, multiple entities and modes can work together as a system rather than independently allowing travelers to have a central source of information to determine route and mode choice.

Continued dissemination of travel time and incident information via dynamic message signs, electronic devices, and websites could reduce congestion by providing road users with alternate choices. TxDOT is also evaluating the implementation of a "5-1-1 system" where travelers can dial 5-1-1 for up-to-date traffic information.

Increase use of Integrated Signal Systems. Continued improvements to existing signal systems through the monitoring of vehicular flows, efficient signal timing, and communication between multiple signalized intersections can significantly improve traffic flow within congested areas. This will require ongoing coordination between counties, cities, and TxDOT.

ITS at Texas Border Facilities. Increased usage of ITS technologies such as cameras, wait-time displays, ETC, and vehicle sensors can help improve the flow of trade and tourism between Mexico and Texas. This in turn will improve homeland security and cross-border data collection. Commercial vehicles that travel back and forth across the border will benefit from decreased delay times as these ITS technologies are implemented.

[57] Discussion with TxDOT, March 17, 2010.

[58] USDOT website, http://www.its.dot.gov/icms/pioneer_dallas.htm, June 14, 2010

Freight Applications. Integrating ITS with commercial vehicles will improve general permitting processes and allow agencies to better track hazardous materials and oversized vehicles.

Transit ITS. As rail and Bus Rapid Transit (BRT) options become commonplace throughout Texas cities, ITS technologies such as AVL and travel-time displays can be used to assist passengers with planning trips. Combining transit and roadway management will be vital to efficient multimodal operations.

Congestion Pricing. On heavily congested highways that include an optional express lane, technologies like ETC can be used to apply congestion pricing (varying the toll rate based on congestion to influence traveling patterns).

Wireless Technology. Wireless connections allow ITS equipment to be implemented on a wider scale with less cost. This will allow important information to be transmitted quickly to travelers, as well as giving traffic management officials a broad range of information.

Emergency Management. ITS has emerged as a valuable resource during large-scale hurricane evacuations and dealing with congestion as a result of catastrophic events. Expanded use of ITS in these regions will allow the state to continue its commitment to improve responses to both weather and homeland security events.

2.7.4 New Technologies in Development

The following is a sample list of newer ITS technologies that have been in development.

In-Vehicle Technologies. Traditionally, many ITS technologies have focused outside of the passenger's vehicle. The next generation of ITS components will include the use of "in-vehicle" technologies. These "smart" technologies will allow vehicles to detect obstructions and other out-of-sight vehicles, improving the safety of drivers on the roadway and reducing collisions.

Floating Vehicle Data. Data such as speed and traffic information can be collected using wireless or GPS devices within vehicles.

Occupancy Detection. For HOV applications, emerging technologies that can detect the number of passengers in a vehicle will assist law enforcement in the verification process.

Intelligent Speed Assistance (ISA). These technologies advise a driver or vehicle to adapt their speed based on local speed limits and road conditions.

Road to Vehicle Communications. In-ground sensors using radio frequency identification (RFID) will assist drivers to safely adjust to roadway conditions.

As Texas grows, ITS will provide a key tool to achieve the state's goals to "provide safe, effective, and efficient movement of people and goods."[59] ITS will provide an important resource to obtain operations data that can be used to determine the overall transportation system's performance. These performance measures will allow agencies to objectively make decisions on how to fund and deliver ITS applications throughout the state.

2.8 Public Transportation in Texas

2.8.1 Urban Transit in Texas

As of 2010, urban transit in Texas includes fixed-route and demand-response bus systems, trolley systems, and urban rail systems. Urban transit systems in Texas consist predominantly of fixed-route bus service. Urban rail systems exist in the cities of Austin, Dallas, and Houston, and trolley/streetcar systems exist in Dallas and Galveston. Subsequent sections discuss these urban transit systems for each of the seven Metropolitan Transit Authorities (MTA), one coordinated county transit authority, and 30 urban transit agencies, providing ridership and fleet data for each.

In general, the majority of urban transit system usage within Texas occurs within the eight MTAs. Figure 2-35 shows the statewide transit ridership for fiscal 2008 for MTAs, urbanized, nonurbanized (rural), elderly and disabled, and Job Access Reverse Commute (JARC) systems. The seven MTAs and one coordinated county transit authority in Texas accounted for 92 percent of urban transit ridership, while the 30 urbanized areas only accounted for 6 percent. However, this disparity is expected, as the MTAs are the largest and most densely urbanized areas.

[59] TxDOT website, http://www.dot.state.tx.us/about_us/mission.htm, May 27, 2010

[59] Schrank, David, and Lomax, Tim, 2009 Urban Mobility Report, Texas Transportation Institute, July 2009.

Figure 2-35: 2008 Public Transit System Ridership[60]

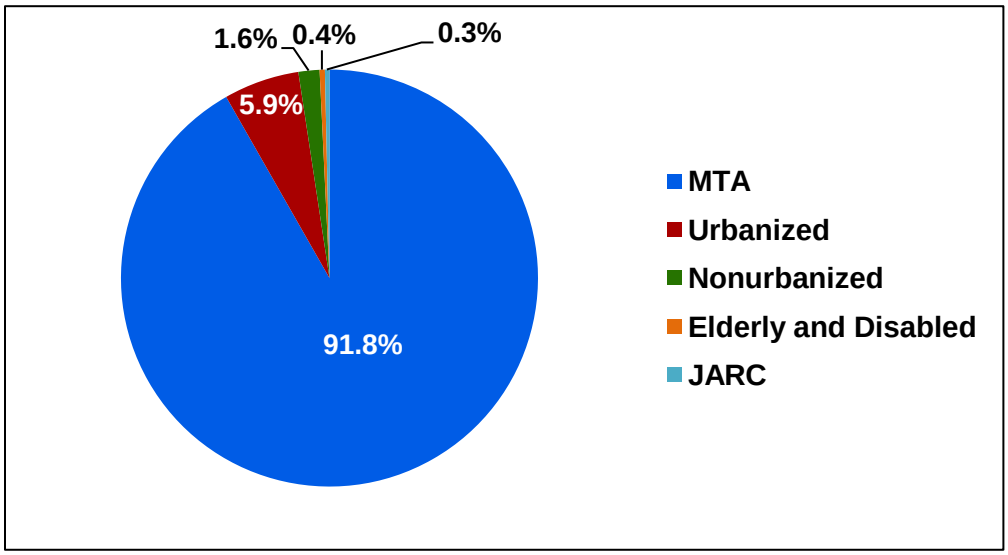
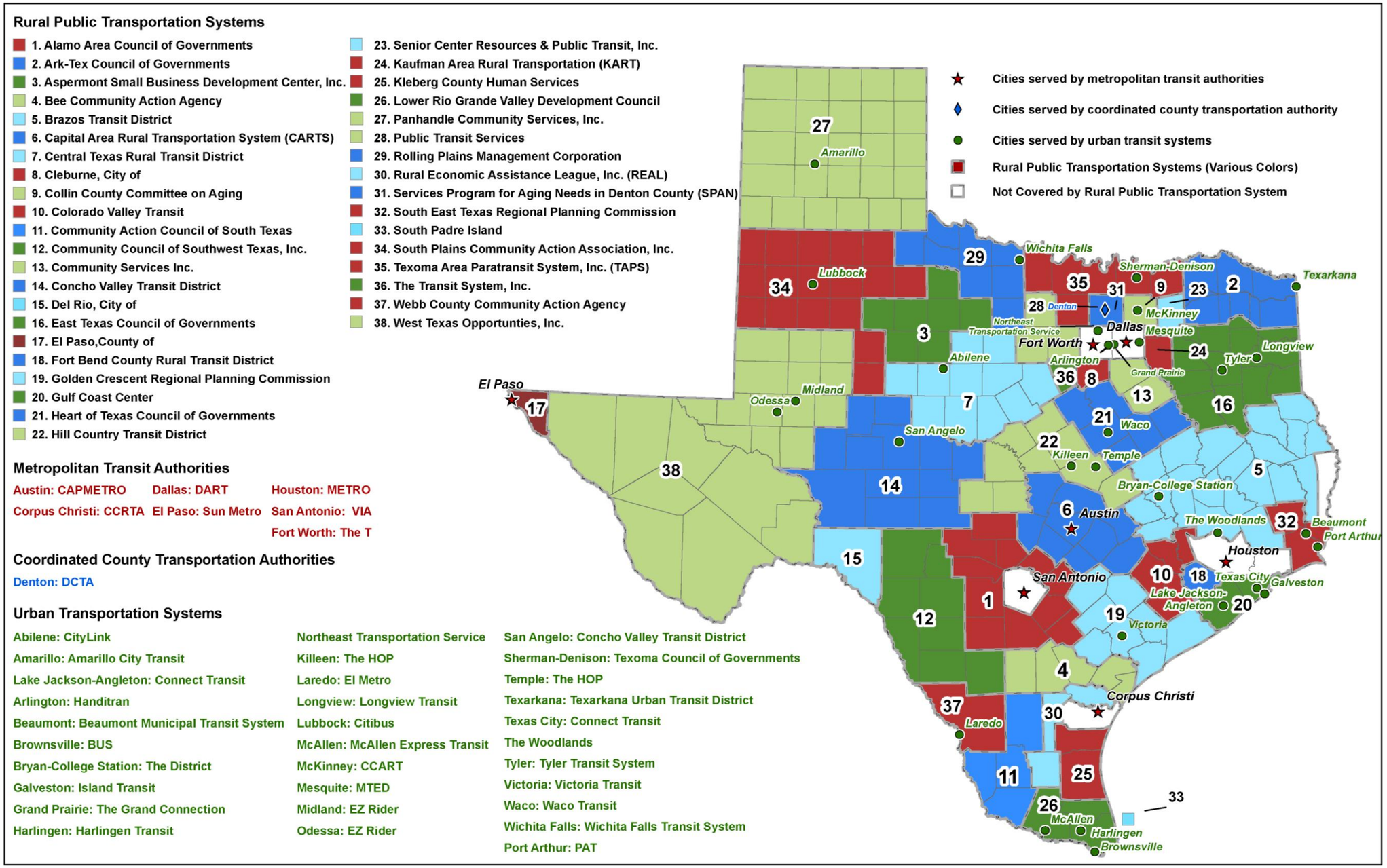


Figure 3-36 shows the geographic coverage of public transportation systems in Texas.

[60] TxDOT, 2008 Texas Transit Statistics

Figure 2-36: Public Transportation Systems in Texas (Cities and Counties Served by Public Transportation Systems)



Within Texas as a whole, urban transit system ridership is increasing. As shown in Table 2-17, between 2002 and 2008, transit ridership within the MTAs increased by 10.2 percent, while ridership within the urbanized areas increased 10.1 percent. An "Unlinked Passenger Trip" is a count of each passenger entering a public transportation vehicle. It does not represent a single passenger trip as some passengers may need to change busses to get to their final destination.

Table 2-17: Summary of Unlinked Passenger Trips and Bus Fleet Vehicles for 2002 and 2008[61]

Transit Area	2002	2008	2002 to 2008	
			Growth	% Change
Unlinked Passenger Trips				
MTA	252,550,674	278,397,166	25,846,492	10.2
Urbanized Area	268,991,402	296,181,091	27,189,689	10.1
Summary of Bus Fleet Vehicles				
MTA	4,912	4,449	-463	-9.4
Urbanized Area	5,491	5,193	-298	-5.4

While urban transit ridership increased as a whole between 2002 and 2008, bus fleet size actually decreased among MTA's and urban transit systems by 9.4 and 5.4 percent, respectively.

While some of this reduction is a result of the introduction of urban rail in cities such as Dallas and Houston, much of the bus fleet reduction is likely a result of efficiency reductions in order to lessen the impact of budget shortfalls due to the recession. The largest increases were in Denton, Longview, and McAllen with increases of 360 percent, 175 percent, and 63 percent, respectively, while the largest reductions were in Texas City, Fort Worth, and Victoria, with reductions of 52 percent, 37 percent, and 31 percent, respectively.

2.8.2 MTA Bus Systems

The following sections describe existing bus service in each of the MTAs: Austin, Corpus Christi, Dallas, Denton, El Paso, Fort Worth, Houston, and San Antonio. For each MTA system area, the service area is described, and recent fleet size and ridership trends are discussed.

[61] TxDOT 2002–2005 Texas Transit Statistics; TxDOT 2008 Texas Transit Statistics

Austin Bus System: The Capital Metropolitan Transportation Authority (CapMetro or CMTA), serves a 500-square-mile area with approximately 3,300 stops throughout the capital area through local, limited and flyer, feeder, crosstown, special event, University of Texas Shuttle (UT) shuttle, express fixed bus routes, and vanpools.

The CapMetro bus fleet contained a total of 665 buses in 2008, an 11.3 percent reduction in fleet from fiscal year (FY) 2002. The FY 2008 ridership was approximately 35 million passenger trips, representing a 2.7 percent increase in ridership over FY 2002 ridership levels. Average weekday bus ridership in FY 2008 was 140,000 one-way trips.

A system map can be found at http://www.capmetro.org/riding/

Corpus Christi Bus System: The Corpus Christi Regional Transportation Authority (RTA) covers 838 square miles. The RTA provides fixed route service, tourist, commuter, charter, public event, and van/car pool services. Additionally, the RTA offers paratransit bus service called the B-Line, which provides public transportation for people whose disabilities prevent them from using fixed route bus services.

In 2008, the RTA's bus fleet contained 121 buses, a 1 percent reduction from FY 2002. The FY 2008 ridership was approximately 5.5 million passenger trips, representing a 3.6 percent decrease in ridership over FY 2002 ridership levels. Average weekday bus ridership in FY 2008 was 18,331 trips.

A system map can be found at http://ccrta.org/rider-info/system-map/

Dallas Bus System: The Dallas area is served by DART, providing fixed-route and demand-response bus services to the City of Dallas, as well as Addison, Carrollton, Cockrell Hill, Farmers Branch, Garland, Glenn Heights, Highland Park, Irving, Plano, Richardson, Rowlett, and University Park. As of 2010, the DART bus system operates approximately 130 bus routes covering 13 cities and 700 square miles. Additionally, DART provides paratransit services for the disabled.

The DART bus fleet had 1,025 buses in 2008, a 3.8 percent reduction from FY 2002. The FY 2008 ridership was approximately 67.0 million passenger trips, representing a 15.8 percent increase in ridership over FY 2002 ridership levels. Average weekday bus ridership in FY 2008 was 152,700 trips.

A system map can be found at http://www.dart.org/

Denton Bus System: The Denton County Transportation Authority (DCTA) provides several bus services to the general public in the Greater Lewisville and Denton area. These services include fixed route service in Denton, Highland Village, and Lewisville, campus shuttles to the University of North Texas and North Central Texas College, and a regional commuter service into downtown Dallas. Additionally, DCTA offers demand response/paratransit service in Denton, Lewisville, Highland Village, and Corinth.

The DCTA bus fleet contained 69 buses in 2008, a 360 percent increase from FY 2002. The FY 2008 ridership was approximately 1.9 million passenger trips, representing a 521 percent increase in ridership over FY 2002 ridership levels.

A system map can be found at http://www.dcta.net/commuterexpress.asp

El Paso Bus System: The El Paso area is served by Sun Metro, which offers fixed-route and paratransit bus service within El Paso County and throughout the City of Sunland Park, New Mexico. Sun Metro has 63 fixed bus routes running within this service area. Job Express, another service of Sun Metro, provides support to individuals transitioning from welfare to work through job training, education, employment, and childcare destinations.

Sun Metro had 251 buses in 2008, a 16.2 percent increase from FY 2002. The FY 2008 ridership was approximately 12.5 million passenger trips, representing an 8.4 percent decrease in ridership over FY 2002 ridership levels.

A system map can be found at http://www.elpasotexas.gov/sunmetro/

Fort Worth Bus System: The Fort Worth T, generally called The T provides local bus service, express bus service, and rider request service within Fort Worth and Richland Hills. The T has 37 fixed bus routes running within this service area. In addition, the T's Mobility Impaired Transportation Service offers door-to-door transportation within Fort Worth, Richland Hills, and Blue Mound.

The Fort Worth T bus fleet contained 200 buses in 2008, a 37.1 percent decrease from FY 2002. The FY 2008 ridership was approximately 8.4 million passenger trips, representing a 37.7 percent increase in ridership over FY 2002 ridership levels.

A system map can be found at http://www.the-t.com/

Houston Bus System: The Houston area is served by the Metropolitan Transit Authority of Harris County, referred to as METRO. METRO provides local, express, and Texas Medical Center circulator services, as well as paratransit services. Communities

that are part of the METRO service area include the Cities of Houston, Bellaire, Bunker Hill Village, El Lago, Hedwig Village, Hilshire Village, Humble, Hunters Creek, Katy, Missouri City, Piney Point, Southside Place, Spring Valley, Taylor Lake Village, and West University Place. Major portions of unincorporated Harris County are also included.

METRO has 102 fixed bus routes running within this service area. METRO had 1,423 buses in 2008, a 16.6 percent decrease in fleet from FY 2002. The FY 2008 ridership was approximately 102.1 million passenger trips, representing a 6.1 percent increase in ridership over FY 2002 ridership levels.

A system map can be found at http://www.ridemetro.org/SchedulesMaps/

San Antonio Bus System: The San Antonio area is served by VIA Metropolitan Transit, commonly referred to as VIA. VIA's service area is 1,226 square miles, which is 98 percent of Bexar County. The service area is made up of the unincorporated parts of Bexar County and the following municipalities: Alamo Heights, Leon Valley, Balcones Heights, Olmos Park, Castle Hills, San Antonio, China Grove, Shavano Park, Converse, St. Hedwig, Elmendorf, Terrell Hills, Kirby, and Von Ormy. Also included in VIA's service area is the Bexar County portion of Cibolo.

VIA provides local and express bus service, paratransit service for riders with disabilities, vanpool service for commuters, and special event park-and-ride service. VIA has 6,994 bus stops along 90 bus lines, which are divided into five service categories: frequent, metro, express, skip, and streetcar.

The VIA bus fleet had 695 buses in 2008, a 3.2 percent decrease from FY 2002. The FY 2008 ridership was approximately 46.2 million passenger trips, representing an 18.2 percent increase in ridership over FY 2002 ridership levels.

A system map can be found at http://www.viainfo.net/

2.8.3 Other Urban Bus Systems

As of 2010, there are 30 urban bus systems operating in Texas. Cities with urban bus systems (see Figure 2-36) have service areas located in cities or geographic areas with urbanized area populations that range from 48,767 to 523,144 as listed in the 2000 census. These urban area transit districts can be classified into three population groups:

- Small urban areas with populations between 50,000 and 100,000,
- Medium urban areas with population from 100,000 to 215,000, and

- Larger urban areas with population greater than 215,000.

2.8.3.1 Small Urban Area Transit

The Texarkana Urban Transit District serves 48,767 people (Census 2000) in its urbanized area, which includes both Texas and Arkansas. Texarkana's bus transit agency (the T-Line) provides fixed route and Americans with Disabilities Act of 1990, as Amended (ADA)-compliant curb-to-curb bus service throughout the greater Texarkana area within both Texas and Arkansas. From 2002 to 2008, ridership on the T-Line system increased by approximately 70.5 percent, from 167,306 to 285,200 unlinked passenger trips per year. However, during this same period, the number of buses in the fleet (8) did not change. This suggests that Texarkana was successful in promoting service within its area and increasing efficiency within its existing operations.

Other small urban area transit districts with populations less than 100,000 that experienced an increase in ridership are Temple, Victoria, Wichita Falls, Galveston, San Angelo, and Longview. Small urban area transit districts that experienced a decrease in ridership greater than 25 percent include Sherman-Denison and Texas City.

2.8.3.2 Medium Urban Area Transit

The Midland-Odessa Urban Transit District serves an urbanized population of 210,616 people (Census 2000). The area's bus transit agency (EZ Rider) provides fixed route and ADA-compliant curb-to-curb bus service within the urbanized areas of both Midland and Odessa. The urban bus system started reporting data in 2004 and serviced 479,727 unlinked passenger trips in 2008. The first year this transit agency did report unlinked passenger trips was 2004 with 232,867 (TxDOT 2002–2005 Transit Statistics). The percent increase for unlinked passenger trips increased by 106 percent from 2004 to 2008. The number of buses decreased from 38 buses in 2004 to 23 buses in 2008, meaning the newly formed transit agency in 2004 became more efficient providing ridership with fewer buses.

Other medium urban area transit districts that experienced increases in excess of 90 percent in ridership include Mesquite and Bryan-College Station. Medium urban area transit districts that experienced decreases in ridership greater than 20 percent include Beaumont, Lubbock, and Harlingen.

2.8.3.3 Large Urban Area Transit

McAllen is served by multiple transit companies, including McAllen Express (ME) Transit as the City of McAllen's Public Transportation System and Valley Transit Company, offering intercity service within the Rio Grande Valley and Mexico. These

services provide international, national, fixed route, and paratransit bus services for a population of 523,144 (Census 2000). McAllen is host to the only major bus terminal along the U.S.-Mexico border to house American and Mexican bus lines as well as the City's primary bus station for the urban bus system. McAllen Express increased its unlinked passenger trips by 10.9 percent from 2002 to 2008. The number of buses in its fleet also increased by 62.5 percent from 16 buses in 2002 to 26 buses in 2008. The urban area of McAllen includes more than one community experiencing increases in population, and therefore, the transit district is increasing its fleet size to meet the increased public transit demands.

Other large urban areas that also experienced increases in ridership include Arlington and North Richland Hills (NETS). None of the larger urban area transit districts experienced decreases in ridership.

2.8.4 Urban and Commuter Rail Systems

Note: Detailed Information regarding urban and commuter rail systems can be found in the Texas Rail Plan available at http://www.txdot.gov/public_involvement/rail_plan/trp.htm.

Within Texas, urban and/or commuter rail systems currently exist within the Dallas-Fort Worth metroplex area (DART, the Trinity Railway Express [TRE], and McKinney Avenue Transit Authority [MATA]), Houston (MetroRail), and Austin (Capital MetroRail). In addition, the Cities of Dallas, Fort Worth, and Austin have initiated studies for the planning and design or expansion of urban streetcar systems to complement regional rail. The City of Galveston operates a small streetcar system covering a service area of approximately 6 miles on the island. Two cars previously operated on the system, with each car designed to look like vintage electric trolleys. The cars are powered by diesel-electric engines. The Galveston trolley service is currently suspended due to extensive damage suffered during Hurricane Ike in 2008, including damage to the trolleys, tracks, and maintenance facilities. Each existing rail transit system is described in more detail below.

2.8.4.1 The Dallas-Fort Worth Urban and Commuter Rail System

The 48-mile DART Rail system provides service to work, shopping, and entertainment destinations in Dallas, Garland, Plano, and Richardson. Thirty-nine stations currently exist along three routes, with all stations served by additional connecting bus routes. DART Rail routes vary from dedicated elevated route segments to at-grade and underground routes. Power to the rail system is supplied by an overhead electrification system. The DART rail fleet contains 115 rail vehicles. The FY 2008 ridership was

approximately 19.4 million passenger trips. Average weekday ridership in FY 2008 was 65,800 passengers, making it the eighth highest in the United States.

DART and the T jointly operate the TRE, containing 35 miles of commuter rail transit linking downtown Dallas and Fort Worth with stops in the mid-cities and at DFW Airport. The TRE system offers frequent departures from Union Station in downtown Dallas to the Intermodal Transportation Center (ITC) in Fort Worth. The TRE system currently serves 10 stations along the Dallas-Fort Worth route, with bus connections to the DFW Airport and consists of diesel-powered locomotives pulling one or two-level passenger cars. The TRE also operates self-powered diesel railcars. The TRE fleet contains 6 locomotives, 13 rail diesel cars, 11 bi-level coaches, and 10 bi-level cab cars. The FY 2008 ridership was approximately 2.7 million passenger trips. Average weekday ridership in FY 2008 was 9,800 passengers.

The MATA operates a 5.2-mile trolley route (M-Line) from the north side of Downtown Dallas along McKinney Avenue through the Uptown neighborhood. The MATA system consists of four vintage electric powered streetcars, all built between 1909 and 1925. The FY 2008 ridership was approximately 291,106 passenger trips, a 16 percent increase over FY 2007 levels.

2.8.4.2 The Houston MetroRail System

The Houston MetroRail system serves downtown Houston, Midtown, the Museum and Hospital Districts, and Reliant Stadium. As of 2010, the Red Line route consisted of approximately 7.5 miles of light rail transit. MetroRail has 18 light rail vehicles. Each 96-foot-long, double-articulated vehicle has four low platform doors per side and has a capacity of 72 seated and approximately 169 standing passengers, or a total capacity of around 241 per car. The average daily weekday ridership in FY 2008 was 39,500 passengers.

2.8.4.3 The Austin Capital MetroRail Commuter Rail System

The Capital MetroRail Red Line commuter rail system opened March 22, 2010, and provides a downtown Austin to Leander route. Nine stations exist along the 32-mile route.

The startup rail system fleet consists of six railcar vehicles. The vehicles have a capacity of 200 passengers, 108 seated and 92 standing. The system operates on shared-use track with local freight rail and is currently operating during rush hour periods only, Monday through Friday.

2.8.5 Rural Transit Systems

Rural transit systems provide the general public with both fixed-route and demand-response services. In Texas, rural transit systems are generally regional systems serving multiple counties, although some systems serve only one county or even sections of a county. Several rural transit systems provide service and connections to larger nearby metropolitan areas through established fixed route service with transfer points.

In general, fixed route service is normally the most cost-effective service available, as it provides dependability in moving riders between desired destinations. In rural areas, fixed route service may be available between larger communities within the service area, as well as servicing major destinations within a single community. Some rural areas also have fixed route service in local tourist areas, such as South Padre Island. In rural areas, fixed route service normally operates during daylight hours with limited to no service available at night. The service is designed for safe and efficient use of the traveling public. ADA accessible fixed-route bus service in rural communities has been successful at transporting persons with disabilities. This is due, in part, to the support of the communities' leadership and promotion of the service.

Rural transit agencies also provide demand-response transit services. This type of bus service is useful to meet the needs of lower density rural areas of Texas. Most demand-response trips tend to be taken by the elderly, lower income, and rural residents who require transportation assistance getting to medical appointments, employment, shopping, and other services. In many rural areas, demand-response service is also available during evening hours to serve customers' needs after established fixed-route service ends.

Figure 2-36 shows the 38 rural public transportation systems in Texas. All rural counties, except Newton County in southeast Texas, are serviced by a rural transportation system. Table 2-8 provides a summary of the total ridership and fleet size for all rural areas in Texas for calendar years 2002 and 2008 Based on 2002 and 2008 data, service ridership showed a 9.5 percent increase among all rural transit providers, from 4,516,606 riders to 4,947,317 riders. During this same period, total fleet size among all providers stayed ahead of ridership, increasing from 1,151 vehicles to 1,315 vehicles, a 14.25 percent increase.

Table 2-18: Summary of Unlinked Passenger Trips and Bus Fleet Vehicles for 2002 and 2008[62]

Summary	Unlinked Passenger Trips		% Change	Total Fleet Size		% Change
	2002	2008		2002	2008	
Total Rural Ridership and Fleet Size	4,516,606	4,947,317	9.50	1,151	1,315	14.25
Average for Reporting System*	115,810	126,854	9.50	29	34	17.24

*Average is based on 39 rural transit providers (two agencies merged after 2008).

2.8.6 Planned Transit System Improvements

Planning efforts for future transit improvements varies based on the size of the system. The MTA agencies generally have long-range planning studies available to guide expansion of service. Due to their smaller size and limited funding, urban and rural transit agencies do not generally conduct the same level of long-range forecasting and planning. Future services for the smaller agencies are almost exclusively a function of the amount of local, state, and federal funding provided to the agency.

While the majority of the population growth will be in the larger communities, counties with less than 50,000 population are projected to grow by over 625,000 people by 2035. The growth in population over 65 years of age for Texas as a whole is 144 percent (or nearly 3.5 million) which will lead to a higher percentage of the population within this age bracket for all county types.

2.8.6.1 Factors that Impact Future Transit Usage

The major factors that are anticipated to influence future transit usage and forecasts include system expansions, changes in demographics, transit-oriented development (TOD), roadway congestion, and economic conditions.

Factor 1: Demographics

One of the more significant influences on forecasted ridership is changing demographics, including total population, elderly population, and income level (Table 2-19). In general, increases in total population result in increases in transit ridership. Even where the percentage of transit ridership is static over time, an increase in the

[62] TxDOT 2002 – 2005 Texas Transit Statistics; TxDOT 2008 Texas Transit Statistics

pool of potential users (i.e., total population) will result in an overall increase in ridership. Moreover, elderly individuals (i.e., persons 65 years of age and older) have historically had a higher rate of transit ridership than any other age group. Therefore, increases in total population and/or increases in elderly populations will likely result in increased transit ridership as well.

Table 2-19: Population Change for Urban-Metropolitan Statistical Areas[63]

Metropolitan Statistical Area (MSA)	Total Pop (2005)	Total Pop (2035)	% Pop Change	Elderly Pop (2005)	Elderly Pop (2035)	% Elderly Change
Dallas-Fort Worth-Arlington	5,670,067	9,360,983	65.1	451,294	1,573,933	248.8
Houston-Sugar Land-Baytown	5,120,772	7,894,728	54.2	410,278	1,323,879	222.7
San Antonio-New Braunfels	1,833,766	2,448,170	33.5	198,199	465,305	134.8
Austin-Round Rock-San Marcos	1,405,087	2,466,185	75.5	104,260	470,647	351.4
El Paso	740,723	1,098,856	48.3	72,813	166,229	128.3
McAllen-Edinburg-Mission	657,116	1,308,819	99.2	60,715	165,377	172.4
Corpus Christi	430,831	587,030	36.3	49,267	97,365	97.6
Lubbock	261,945	296,760	13.3	28,943	50,799	75.5
Amarillo	240,465	320,247	33.2	28,527	58,150	103.8
Laredo	226,862	490,418	116.2	16,510	50,697	207.1
Brownsville-Harlingen	374,446	631,964	68.8	41,516	90,223	117.3
Waco	221,426	277,042	25.1	27,570	44,512	61.5
Bryan-College Station	195,410	263,456	34.8	16,565	39,800	140.3
Beaumont-Port Arthur	395,695	447,290	13.0	51,623	85,024	64.7
Odessa	126,645	158,776	25.4	14,155	26,698	88.6
Abilene	165,587	181,803	9.8	21,349	34,310	60.7
San Angelo	109,281	124,278	13.7	14,714	23,917	62.5
Victoria	117,996	150,201	27.3	14,856	27,246	83.4
Longview	200,411	242,056	20.8	28,224	48,225	70.9
Sherman-Denison	114,163	131,687	15.3	16,969	28,760	69.5

As shown in Table 2-19, all 20 MSAs are forecast to experience growth in both total population and elderly population, which suggests a corresponding increase in future urban transit system ridership. However, growth rates vary widely between the various

[63] Texas State Data Center. *2008 Population Projections, The One-Half 1990–2000 Migration (0.5) Scenario.* February 2009. Available at http://txsdc.utsa.edu/tpepp/2008projections/

MSAs, from a low of 9.8 percent total population growth in the Abilene MSA to a high of 351.4 percent elderly population growth in the Austin-Round Rock-San Marcos MSA.

Among the 20 MSAs analyzed, the overall highest growth rates in total population between 2005 and 2035 are forecast to occur in the Laredo, McAllen-Edinburg-Mission, Austin-Round Rock-San Marcos, Brownsville-Harlingen, and Dallas-Fort Worth-Arlington MSAs, with growth rates of 65 to 116 percent. Meanwhile, the highest growth rates in elderly population during this same time period are forecast to occur in the Austin-Round Rock-San Marcos, Dallas-Fort Worth-Arlington, Houston-Sugar Land-Baytown, Laredo, and McAllen-Edinburg-Mission MSAs, with growth rates in excess of 150 percent. Comparing the two lists reveals that four of the five MSAs are contained in both lists. Therefore, based on demographic changes between 2005 and 2035, a higher than average growth in transit ridership can be expected in the Laredo, McAllen-Edinburg-Mission, Austin-Round Rock-San Marcos, and Dallas-Fort Worth-Arlington MSAs.

Factor 2: System Expansion

System expansion is the most robust tool that transit agencies possess that can be used to increase ridership. By expanding the existing system, the transit agency provides a transit alternative to an area without service, resulting in increased ridership from people residing in that area as well as people traveling to destinations within the new service area.

System expansions vary in type and intensity depending upon the size and type of existing service. Some expansions consist of the addition of local bus routes or new express routes, while other expansions in the larger systems may include light rail, commuter rail, and/or streetcar lines.

Factor 3: Land Use

Public transportation systems typically have higher ridership in areas of more intense land use density. The land use patterns in the larger Texas cities are transitioning to increase residential density along new transportation corridors, such as the DART light rail lines, or to bring more residential units to downtown areas, such as in Austin. Increases in density bring the need for more transit and pedestrian-friendly streetscapes. In suburban counties, mixed-use developments, or TODs, are being planned around new (or planned) rail stations.

TODs are mixed-use residential and commercial centers designed to maximize transit and nonmotorized transportation access. TODs typically have a centrally located train station, metro station, tram stop, or bus stop surrounded by relatively high-density

development. The land use density transitions to progressively lower-density development as the distance from the transit core increases.

TODs are being established in urban areas adjacent to public transportation facilities throughout Texas, especially within the largest MSAs, such as Dallas, Fort Worth, Houston, San Antonio, and Austin. By providing a compact, mixed-use development within an urban environment accessible by transit, TODs provide opportunities for people to move into urban neighborhoods, alleviate the need for and expense of personal vehicles, and avoid ever-increasing congestion. Urban planners and real estate experts expect TODs to continue gaining in popularity in the future due in part to some cities giving incentives that include, but are not limited to, the following:

- Allowing a mix of land uses,
- Allowing an increase in floor area ratios (FAR). FAR is the ratio of the total floor area of buildings on a certain location to the size of the land of that location,
- Allowing an increase in total development density,
- Allowing a reduction in required parking spaces per square foot of development,
- Providing streamlined permitting, and
- Providing tax incentives.

Therefore, as developers continue to build TODs around existing and proposed transit stops, transit ridership should continue to increase concurrently.

Factor 4: Economic Conditions

An overarching factor that influences all of the factors mentioned is economic conditions. The condition of the economy greatly influences whether transit agencies undertake system expansions, whether developers build more TODs, whether people decide to ride public transit versus using personal vehicles, and whether the entities responsible for building and expanding roadways throughout the state have the money to do so in order to attempt to relieve congestion.

The United States as a whole, is currently in the midst of a major economic recession. Most economists believe that while we are slowly emerging from the recession, we are not likely to return to prerecession levels of prosperity any time soon. Therefore, transit system expansions and TODs will likely continue to be deferred, while roadway expansions projects are also deferred due to lack of funds. This delay in roadway expansion coupled with continued population growth within the urbanized areas will likely increase congestion. As a result, transit ridership should continue to grow;

however, transit ridership will likely grow at a slow rate until the economy rebounds and transit agencies are able to program future expansions.

Another economic factor that influences transit ridership levels is the price of gasoline. As gasoline prices rise in Texas, more people across the state reduce the use of their cars and turn to public transportation to commute to work, to go to school, to travel to shopping centers, and to attend medical appointments. Record high gas prices of $4 per gallon during the summer of 2008 contributed to a significant increase in transit ridership for many of the transit systems in Texas. According to the American Public Transportation Association historical ridership data, the percentage increase in total public transit ridership levels during the summer of 2008 over summer 2007 levels were 4.8 percent in Fort Worth, 8.6 percent in Dallas, 17.2 percent in Austin, and 17.3 percent in Denton. The Dallas-Fort Worth Trinity Railway Express commuter rail system experienced an 18.8 percent increase in transit ridership during this period. Many smaller metropolitan and rural transit agencies experienced increased transit ridership during this same period with an increase of 7.3 percent in Corpus Christi and 11.0 percent within the rural Bryan, Texas, based Brazos Transit District. Of the large transit agencies, only the Houston (–6.9 percent) and Galveston (–10.8 percent) area experienced decreased transit ridership during this period. However, these areas were significantly impacted by Hurricane Ike during early September 2008. Prior to Hurricane Ike's landfall, Houston METRO experienced similar public transit ridership increases with a 9.6 percent increase from July 2008 over July 2007 levels.

By the summer of 2009, gasoline prices had fallen approximately 36 percent from their 2008 summer peak. Most transit agencies within Texas experienced decreased ridership levels during this period including Dallas (–12.3 percent), Austin (−11.3 percent), San Antonio (–10.9 percent), Houston (–7.1 percent), and El Paso (–4.5 percent).[64]

2.8.7 Transit Ridership Forecasts

The latest public transportation statistics were published by TxDOT in 2009 and reported information for 2008. Transit ridership increased substantially for some transit agencies due to the spike in gasoline prices. The straight-line forecast discussed below is based on total trips within the state of Texas for each type of system and may not reflect the trends in each community. Ridership forecasts by system are shown in Table 2-20.

[64] American Public Transportation Association (APTA) website, http://www.apta.com/mediacenter/pressreleases/2008/Pages/081208_ridership_surges.aspx, accessed June 8, 2010.

Table 2-20: Annual Transit Ridership Forecasts[65]

System	2002	2008	Ridership Growth (Unlinked Passenger Trips) 2002–2008	% Change 2002–2008	Projected Ridership (Unlinked Passenger Trips) 2035
Rural	4,516,606	4,947,317	430,711	9.5	6,885,517
Urban	16,206,693	17,783,925	1,577,232	9.7	24,881,469
MTA	252,857,636	278,397,166	25,539,530	10.1	393,325,052
Total	273,580,935	301,128,408	27,547,473		425,092,037

Rural: Between 2002 and 2008, the rural transit systems had a 9.5 percent growth in unlinked passenger trips. Using the growth from 2002 to 2008, the number of trips could increase from just over 4,947,000 in 2008 to over 6,885,000 in 2035.

Urban: Between 2002 and 2008, the statewide unlinked passenger trips grew by 9.7 percent or over 1,577,000 trips. This number includes 1,173,000 in 2008 on four new systems that went into operation after 2002. Using the growth from 2002 to 2008, the number of trips could increase from just over 17,783,000 in 2008 to over 24,881,000 in 2035.

MTA: Between 2002 and 2008, the statewide unlinked passenger trips grew by 10,1 percent or over 25,339,530 trips. Using the growth from 2002 to 2008, the number of trips could increase from just over 278,397,000 in 2008 to over 425,092,000 in 2035.

2.8.7.1 Bus and Urban and Commuter Rail System Expansions

Note: Detailed Information regarding urban and commuter rail system expansions can be found in the Texas Rail Plan available at:

http://www.txdot.gov/public_involvement/rail_plan/trp.htm

While all of the MTAs in Texas have long-term transit system expansion plans, the current state of the economy is forcing many of the agencies to defer expansion plans, replace high dollar expansion alternatives with more modest alternatives, or simply cancel expansion plans until the economy recovers. For example, DART recently announced that because of continuing shortfalls in sales tax revenues, all proposed rail expansion projects that are not currently under construction are being put on hold indefinitely. This decision applies to all rail expansion projects proposed over the next

[65] TxDOT 2008 Texas Transit Statistics and straight-line forecasts based on 2002 to 2008 growth

20 years. This move is being made as a result of the continued recession and is a move that many of the transit agencies in Texas are being forced to make, despite ongoing efforts to provide transit alternatives to a broader group of people.

Overall, long-term system expansion will continue statewide; however, most transit agencies are currently deferring major system expansions and focusing instead on less costly, more efficient alternatives that incrementally increase ridership. Some of these alternatives include implementing ITS to improve operational efficiency, encouraging additional TODs around existing stations, and considering BRT, streetcar, and commuter rail alternatives instead of the more costly light rail alternative. Additionally, the current administration in Washington, D.C., is proposing a change to the criteria used to select projects under the New Starts and Small Starts programs in order to consider sustainability and livability benefits for urban rail and BRT projects. Many agencies are focusing future expansion efforts toward using modern streetcars, including Dallas, Fort Worth, Houston, San Antonio, and Austin.

2.8.7.2 Planned Transit for Central Texas

Bus: Capital Metro has proposed 11 fleet and route expansion projects for the 2010 and 2011 fiscal years to meet population growth trends in their service area (TxDOT, Austin District – FY 2008–2011 STIP). The 11 fleet and route expansion projects include the following:

- ★ Purchasing 7 buses for rapid transit services,
- ★ Replacing 149 buses,
- ★ Purchasing 49 sedans for paratransit service, and
- ★ Replacing 47 paratransit vans.

Capital Metro is also proposing to expand nonfixed routes for ADA paratransit service, contract a third party to provide additional rural public transit, and provide job access reverse commutes for the 2010 and 2011 fiscal years. These proposed projects are to be funded with both non-federal and federal funds.

As part of its All Systems Go Long-Range Transportation Plan, Capital Metro has proposed expansion of enhanced/BRT bus service. The BRT bus service (MetroRapid) will consist of hybrid buses operating on 10 to 15 minute headways with limited stops, offering up to 20 percent faster service within defined corridors. This service is expected to offer high-tech features, such as traffic signal priority systems and continuously updated bus arrival information. Initial service will include two routes along heavily traveled Burnet Road, Lamar Boulevard, and Congress Avenue. Capital Metro has

secured funding for the initial system and is completing designs of stations and the traffic signal priority system.

Commuter Rail: Capital MetroRail is currently considering expansion of its commuter rail system. The expansion would include:

- A new 28-mile Green Line route connecting downtown Austin with East Austin, Manor and Elgin, using existing Capital Metro-owned tracks,
- Up to five additional trains operating on 20-minute peak period headways along the new route that would serve eight stations, and
- Projected ridership between 7,000 to 12,000 daily riders along the new route in 2030 assuming an all-day, weekday, bidirectional service.

Modern Street Car: The City of Austin has proposed a downtown modern streetcar circulator system. The system would:

- Have estimated daily ridership of approximately 13,100 passenger trips in 2030 for the downtown circulator system,
- Have approximately 19,100 weekday riders along a future extension from Downtown to Austin-Bergstrom International Airport,
- Link to the existing Capital MetroRail Red Line and proposed Lone Star Rail District (LSTAR) commuter rail route,
- Connect key activity centers within the Austin metropolitan area including the downtown area, the Capital Complex, the University of Texas, and the Mueller Redevelopment area, and
- Provide a future connection to the Long Center and Zilker Park.

The City of Round Rock is considering an 18.3-mile commuter rail connection from the cities of Round Rock, Georgetown, and Pflugerville, called the RR/GT/PF Rail Link. The proposed alignment has the connecting branch starting from the Capital Metropolitan Transit Authority Red Line just north of Howard Lane and running along the SH 45 rights-of-way and the now-abandoned Missouri/Kansas/Texas corridor. Three stations are planned for Round Rock, with one station planned for Georgetown and one for Pflugerville.

The Lone Star Rail District (LSTAR): is a proposed passenger rail line that would consist of express service from Downtown Austin to Downtown San Antonio, with stops in San Marcos and New Braunfels. LSTAR would also provide local service between

Georgetown and San Antonio with stops at 16 proposed stations. The rail line would run in the Union Pacific corridor that parallels I-35. It is anticipated that completion and federal approval of the engineering and environmental studies and receipt of a notice-to-proceed allowing the Lone Star Rail to begin final design and construction will occur in 2011.

2.8.7.3 Planned Transit for Corpus Christi

Bus: RTA has proposed seven fleet expansion projects for the 2010 and 2011 fiscal years to meet population growth trends in their service area (TxDOT, Corpus Christi District – FY 2008–2011 STIP). The seven fleet expansion projects include the following:

- Purchasing paratransit vehicles,
- Purchasing service vehicles, vans and support vehicles, and
- Repowering existing fleet to extend useful life.

2.8.7.4 Planned Transit for the Dallas-Fort Worth-Arlington MSA

Bus: DART is planning to reinforce key radial express bus corridors currently not served by rail and improve cross-town express bus services. By doing this, it will allow passengers to be connected from cross-town express bus routes to radial rail corridors and key transit facilities. Future DART bus projects include the following:

- 4 Express bus projects,
- 9 Enhanced bus projects along Loop 12, and
- 2 BRT corridor projects (Northwest Highway and Ferguson Road).

According to the Fort Worth Transportation Authority's 2005 Strategic Plan, The T's projected future plans, which are divided into future year segments 1 to 3 years, 4 to 10 years, and 11 to 25 years starting in 2005 include:

1 to 3 years

- Research the feasibility of BRT systems,
- Identify potential corridors, and
- Coordinate with partner agencies to manage lanes for BRT and HOV.

4 to 10 years

- Acquire BRT funding,
- Complete design and construction,
- Begin circulator service for Downtown and Uptown areas, and
- Manage bus priority signaling.

11 to 25 years

- Establish high-capacity circulator services for Downtown and Uptown areas and
- Coordinate with TxDOT to construct freeway bus-only ramps.

The T has proposed fleet replacement funding for the 2010–2011 fiscal years to meet population growth trends in their service area, but do not give the exact number or specification of replacement vehicles (TxDOT, Dallas-Fort Worth District – FY 2008–2011 STIP). The proposed projects are to be funded with both local share and federal monies.

DCTA has proposed two fleet replacement projects for the 2010 and 2011 fiscal years to meet population growth trends in their service area (TxDOT, Dallas-Fort Worth District – FY 2008–2011 STIP). The two fleet replacement projects include the following:

- Replacing eighteen 30-foot vehicles, and
- Replacing six vans.

Urban and Commuter Rail: DART, TRE and MATA have all announced expansions or upgrades of their rail systems. In addition, Fort Worth's The T is planning commuter rail service from Fort Worth to DFW. In addition, the DCTA is planning rail service linking Downtown Denton with the DART light rail transit (LRT) Green Line route in Carrollton.

DART's *2030 Transit System Plan* details the following information regarding the LRT expansion:

- By 2018, LRT mileage will increase to 93 miles,
- By 2030, the LRT is projected to carry 160,000 riders a day,
- By 2030 an additional 17 miles will be added to the LRT system for a system-wide total of 110 miles,

- The expansion will include 29 additional stations in southeast Dallas, Rowlett, Farmers Branch/Carrollton, Love Field, Irving, and DFW, and
- Will expand commuter rail service along the 26-mile Cotton Belt corridor from the Red Line in Plano, Texas, to DFW.

DART is also conducting the Downtown Dallas Transit Study (D2) that seeks to identify a preferred route for a second LRT alignment through the Central Business District (CBD). The additional transit route would support the planned expansion of the regional LRT and commuter rail system and would be vital to sustaining DART's ridership growth, mobility, and continued quality of service. The study will also address expansion of the MATA trolley service to include modern streetcar service expansion into Downtown Dallas.

DART and The T jointly operate the TRE commuter rail system. Proposed improvements to the TRE system include the construction of a full double-track corridor between Union Station in Downtown Dallas, and the ITC in Fort Worth. Construction has begun on the east side of the corridor (Dallas County) and is planned for the west side of the corridor (Tarrant County). The upgrades will allow for shorter service headways across the entire corridor.

DART also supports MATA, the 5.2-mile historic trolley line (M-Line) linking Dallas' uptown and downtown neighborhoods. MATA is planning a realignment and extension that will cover the south end of the M-Line along Olive Street to a planned connection with the LRT at the St. Paul Station within the Downtown Dallas CBD.

The T is planning commuter rail currently scheduled to begin service in 2013 that will consist of:

- Commuter rail service within a proposed 35-mile corridor from southwest Fort Worth, through downtown Fort Worth, and then northeast to link with the DFW Terminal A-B area,
- Connections to the TRE at the Intermodal Transfer Center in Downtown Fort Worth,
- Connections to the DART Cotton Belt Corridor and future Orange Line at DFW, and
- Projected daily ridership of approximately 15,000 to 16,000 trips per day by 2030.

The City of Fort Worth is studying the feasibility of a modern streetcar system in downtown Fort Worth. The system would connect downtown and the TRE to adjacent mixed-use districts. In April 2010, the city voted to conduct a detailed streetcar study to

examine such issues as alignments, funding, ridership, and projected economic benefits.

DCTA is currently constructing a regional rail line linking downtown Denton with Carrollton. The new service (the A-Train) will include:

- A 21-mile regional rail line between downtown Denton and Carrollton, roughly paralleling I-35E,
- Five rail stations in Denton, Highland Village, and Lewisville,
- Projected ridership of about 5,600 riders per day by 2030, and
- Total DART/DCTA system-wide transit usage to increase by about 17,300 unlinked trips daily.

2.8.7.5 Planned Transit for the El Paso Area

Bus: According to the El Paso MPO, 2007 – TransBorder 2035 Metropolitan Transportation Plan, Sun Metro has proposed to create a BRT system by 2015. The BRT system would include ITS, signal prioritization, diamond-striped lanes, and transit terminal interfaces. Sun Metro plans to create the BRT system incrementally, starting with an arterial corridor and four extension corridors. The BRT projects will include, but are not limited to, the following urban corridors within the city limits of El Paso: International/Downtown Corridor, Alameda Corridor, Mesa Corridor, Montana Corridor, and Dyer Corridor. Specific proposed BRT projects include:

- The International/Downtown Corridor will connect the downtown international bridges to the Oregon Street Transit Mall and on to the University of Texas at El Paso by 2015. This BRT corridor will be the core line for the expansion of other BRT corridors.
- The Alameda Corridor is scheduled to be the first expansion of the BRT system and will extend from the Oregon Street Mall to R.E. Thomason General Hospital and on to the Texas Tech School of Medicine complex by 2015.
- The Mesa BRT Corridor is scheduled for construction by 2015 and will connect Baltimore Avenue to Crossroads (Doniphan Drive).
- The Montana BRT Corridor is scheduled to be implemented by 2025 and would connect the Central Business District to George Dieter Drive.
- The Dyer BRT Corridor is planned to be implemented by 2025 and would connect US 54 to Sun Valley Drive.

Sun Metro's other transit projects that are planned for the 2010 and 2011 fiscal years include:

- expanding ADA paratransit services, and
- constructing station stops and terminals.

2.8.7.6 Planned Transit for Houston and Harris County

Bus: The 2025 METRO Solutions Plan proposes to increase the existing bus service by 50 percent, which equates to 44 new routes or 1,038 miles in new routes for their local bus service. Other amenities that would support the increase in bus service include nine new transit centers, upgrading existing transit centers, bus service on major streets, longer hours of operation on major routes, and improved regional access to all activity centers. The 2025 Plan also proposes new signature express service with major crosstown routes. The proposed express routes will provide more frequent service with fewer stops, distinguishable vehicles and upgraded passenger shelters, and connections to regional activity and employment centers. Also planned by METRO are nine new park and ride lots with over 250 miles of two-way park and ride service.

METRO has budgeted for five regionally significant transit projects for the 2010–2011 fiscal years to meet population growth trends in their service area (TxDOT, Houston District – FY 2008–2011 STIP).

The regionally significant transit projects include the following:

- Bus acquisition for express bus service,
- Curb cut/intersection improvements,
- 250 bus maintenance facility, and
- Bus pads/bus lane program.

As part of its long-range METRO Solutions plan, Houston METRO is developing approximately 47 miles of BRT within the Greater Houston metropolitan area. The first line, called the Bellaire Quickline signature bus service, currently operates on a 9-mile West Houston to Texas Medical Center Transit Center Station route. The Quickline features ultra-quiet hybrid buses, limited stops, automated announcements, and eight state-of-the-art bus stations complete with digital "next bus" signage to provide commuters with real-time information. Additional BRT service is planned to begin operation in 2010 or 2011 along additional commuter routes from the west and northwest suburban areas of Houston.

Urban and Commuter Rail: The 2025 METRO Solutions Plan forecast includes $2 billion of transit system investments as contained within the METRO Solutions Phase 2 Implementation Plan. Key rail components of the Implementation Plan include:

- Expansion of five new rail lines,
- Construction of 56 light rail stations within the Greater Houston area,
- Purchase of 96-foot-long, double-articulated vehicles with a capacity of 72 seated and approximately 169 standing passengers, or a total capacity of 241 per car,
- Future connection opportunities for citizens and visitors to/from major activity centers throughout the metropolitan area and additional commuting opportunities for area residents,
- Increased ridership of approximately 15,000 to 30,000 trips per day by 2030,
- Approximately 30 miles of additional LRT,
- Service to the North Houston, East End, Southeast, Uptown, and University Corridors,
- Approximately 28 miles of commuter rail transit,
- Ten new transit intermodal facilities serving light rail, commuter rail, bus, and auto modes, and
- The University Corridor LRT project will consist of an 11.3-mile, double-track LRT line with 19 stations extending from the Hillcroft Transit Center on the west to the Eastwood Transit Center on the east, with the majority of the line located within the inner city I-610 Loop of the City of Houston. The line will include 32 light rail vehicles, and a projected total ridership of approximately 49,200 unlinked trips per day by 2030.

Potential commuter rail lines currently being considered include:

- US 90A, from the Fannin South Station to Missouri City,
- Westpark, from the Hillcroft Transit Center to FulShear,
- US 290, from Downtown to Cypress, and
- Within the Houston to Galveston corridor.

2.8.7.7 Planned Transit for the San Antonio Area

Bus: VIA is currently in the process of creating a Long Range Comprehensive Transportation Plan for Bexar County to year 2035. This comprehensive study labeled as SmartWaySA will identify and prioritize high capacity transit corridors for a range of transit alternatives and supporting activities.

VIA has budgeted for several transit projects for the 2010 and 2011 fiscal years to meet population growth trends in their service area (TxDOT, San Antonio District – FY 2008–2011 STIP).

The transit projects include the following:

- Constructing bus stations,
- Constructing and improving park and ride lots,
- Constructing passenger centers,
- Implementing job access/reverse commuting services,
- Improving paratransit services,
- Contracting third parties for transportation services,
- Implementing super stops,
- Improving traffic signal priorities for bus service,
- Replacement large and small buses,
- Purchasing expansion buses, and
- Improving elderly and disabled program.

The proposed projects are to be funded with both local share and federal monies.

The City of San Antonio is currently planning for the implementation of BRT services from the proposed Westside Multimodal Transit Center near downtown San Antonio to the proposed South Texas Medical Center Transit Center. The service, called VIA Primo, would operate along Fredericksburg Road and Medical Drive and would connect major employment centers in the medical center area, Balcones Heights, Deco District, and the downtown CBD. The proposed BRT route would be approximately 20 miles in length and will serve the two transit centers, eight stations along the corridor, and local stops in the CBD and medical center area. Service may also extend to The University of Texas at San Antonio's main campus in far North San Antonio.

According to VIA, the proposed VIA Primo system would utilize diesel-electric hybrid vehicles, and may incorporate such ITS features as automated scheduling/dispatch systems, signal priority systems, and real-time passenger service information. VIA is currently conducting environmental assessments along the proposed route with service expected to begin in 2012.

2.8.8 Planning for Rural Transit Systems

Rural transit systems provide services to areas not served by urban and metropolitan systems, providing services for special needs passengers as well as transportation for the general public. While the majority of the population growth will be in the larger communities, counties with less than 50,000 population are projected to grow by over 625,000 people by 2035. The growth in population over 65 years of age for Texas as a whole is 144 percent (or nearly 3.5 million) which will lead to a higher percentage of the population within this age bracket for most counties.

Future demand for rural transit services is generally function of the size of the elderly population, income levels and participation in special needs programs. As the Texas population ages and as people continue to move to fringe areas around larger cities, the future need for rural transit will also increase. In contrast, future services are highly dependent upon the amount of local, state, and federal funding provided to the agency.

Expansion activities for these rural transit systems are often a combination of additional vehicles and technology upgrades to improve the efficiency of the fleet, such as the implementation of a comprehensive ITS program to improve dispatching and scheduling. Transportation needs are often linked to the need for medical care and other social services only available in larger urban areas. In general, however, expansion activities for these small urban and rural transit systems may include of the implementation of a comprehensive ITS program to augment additional bus service routes.

2.8.9 Texas Intercity Bus Service

Within Texas and nationwide, the largest intercity bus systems are Greyhound Lines and the Trailways system. Greyhound had its beginnings in Minnesota in the 1920s, and through numerous mergers and acquisitions, evolved into the present nationwide system. The Trailways system formed in 1936 consisted of various companies working together to form a nationwide system. However, the company underwent reorganization in 1987 with the result that only smaller Trailways companies currently exist with many of these companies providing charter services only. The largest regional intercity bus services in Texas are Kerrville Bus Company and Valley Transit Company. Kerrville Bus Company provides service to most of Texas extending into parts of western Louisiana

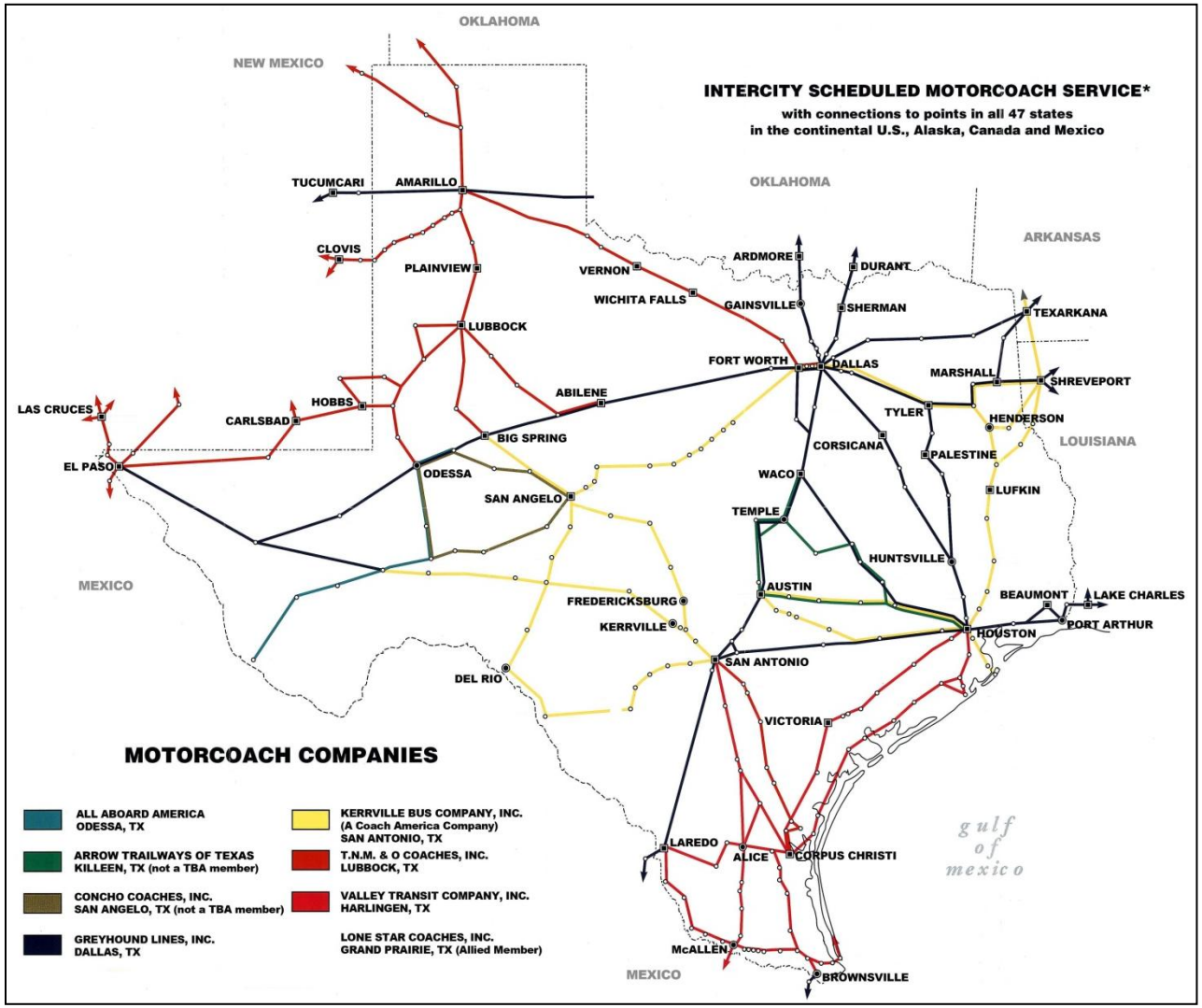
and Arkansas. Valley Transit has more than 60 vehicles in its coach fleet with a service area that extends from Houston and San Antonio in the north, southward through all of South Texas and the Rio Grande Valley into Northern Mexico. In addition, several other smaller companies provide intercity and coach charter service within Texas. Table 2-21 lists existing intercity transit providers in Texas along with service area, fleet information, and type of service and Figure 2-37.

Table 2-21: Summary of Intercity Bus Providers[66]

Intercity Bus Providers	Service Area	Fleet Information	Charter (Y/N)	Fixed Routes
All Aboard America	Midland/Odessa to Presidio, Texas	Motor-coaches	Y	Y
Arrow Trailways of Texas	Dallas, Houston, San Angelo, Austin, and San Antonio, and Nationwide	Motor-coaches, mini-coaches, and vans	Y	Y
Concho Coaches, Inc.	San Angelo and Midland/Odessa, Texas	Motor-coaches	Y	N
Greyhound Lines, Inc.	Nationwide and Statewide	1,250 buses	Y	Y
Sun Travel Trailways	Lake Charles Louisiana, and Beaumont, Texas	Nine 55-passenger motor-coaches and two 29-passenger mid-sized coaches	Y	N
Gotta Go Trailways	Dallas, Fort Worth, and Abilene, Texas	Motor-coaches	Y	N
Eagle Trailways of Texas	Dallas, Fort Worth, Houston, San Antonio, and Austin, Texas	Motor-coaches with 36 to 56 passengers	Y	N
Kerrville Bus Company, Inc.	Texas, Arkansas, Louisiana	Motor-coaches with 55 passengers	Y	Y
Sierra Trailways of Texas	College Station/Bryan, Freeport, Galveston, Houston, Sugar Land, Alvin, Pearland, and League City, Texas	Motor-coaches with 44 to 55 passengers	Y	N
Lone Star Trailways	East Texas and Shreveport, Louisiana	10 motor-coaches	Y	N
T.N.M. & O. Coaches, Inc.	Same as Greyhound	Operated by Greyhound	Y	Y
Valley Transit Company, Inc.	Mission, Harlingen, Brownsville, Roma, South Padre Island, San Antonio, and Houston, Texas, northern Mexico	Vans with 10 to 14 passengers, motor-coaches with 33 to 57 passengers	Y	Y
Central Texas Trails	Central Texas and Nationwide charter service	10 motor-coaches with 29 to 57 passengers	Y	N
Sun Set Stages, Inc.	Del Rio, Texas, and Nationwide	Motor-coaches	Y	N
Lone Star Coaches, Inc.	Local and nationwide charter service; serving the greater northeast Texas area; based in Grand Prairie, Texas	Motor-coaches with 48 to 57 passengers	Y	N

[66] URS, 2010; from bus provider's websites

Figure 2-37: Intercity Bus Routes[67]



[67] Texas Bus Association, Inc., Intercity Bus Routes as of 2007

2.8.10 Intercity Passenger Rail

Note: Detailed Information regarding intercity passenger rail in Texas can be found in the Texas Rail Plan available at:

http://www.txdot.gov/public_involvement/rail_plan/trp.htm

Intercity passenger rail service in Texas is provided by Amtrak. Amtrak is a common name for the National Railroad Passenger Corporation, which is a corporation owned by the U.S. government and several railroad companies that contributed equipment when the corporation was chartered in 1971. Amtrak routes in Texas include:

- The Texas Eagle: Chicago to San Antonio, via St. Louis, Little Rock, Texarkana, Dallas, Fort Worth, and Austin,
- The Sunset Limited: New Orleans to Los Angeles, via Houston, San Antonio, Alpine, and El Paso, and
- The Heartland Flyer: Daily round trip between Oklahoma City, Oklahoma and Fort Worth, Texas.

Additionally, Amtrak's partnership with Greyhound serves other areas of the state by providing bus connections where possible. Table 2-22 shows annual ridership for each route for 2008 and 2009.

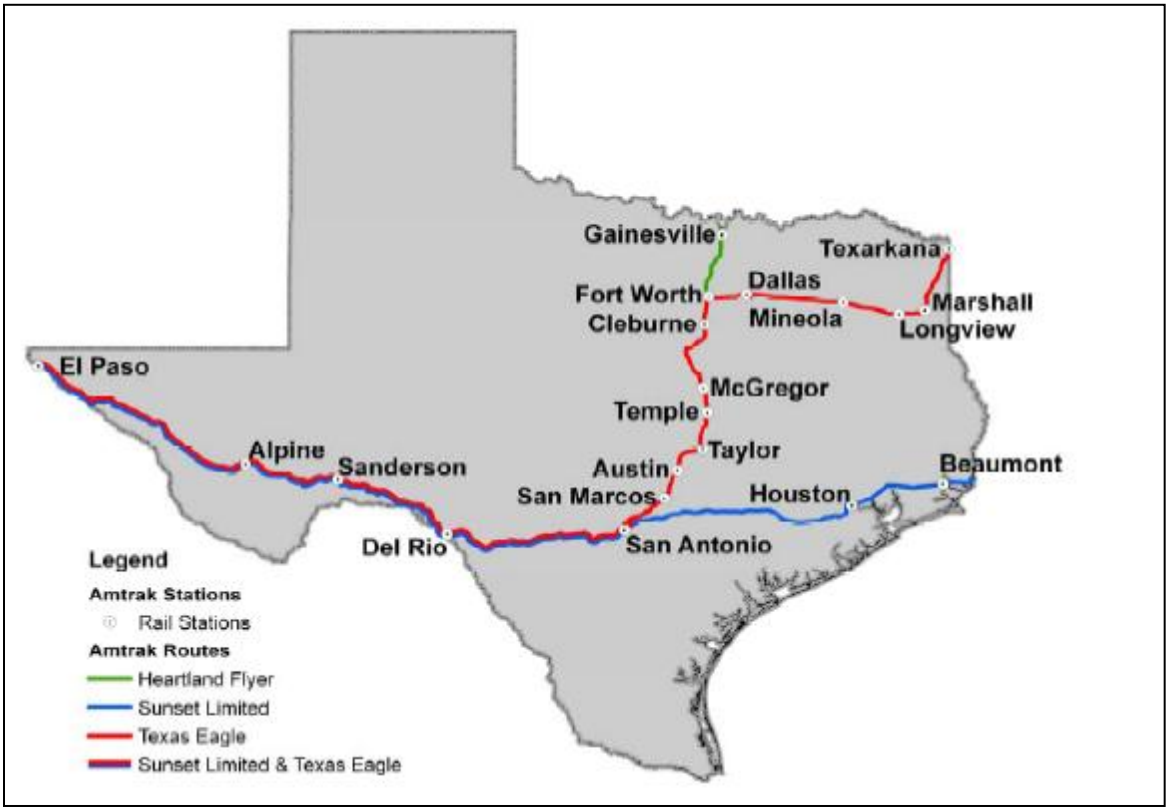
Table 2-22: Amtrak Ridership 2008–2009[68]

Amtrak Line	2008 Ridership	2009 Ridership	% Change in Ridership
Texas Eagle Chicago-Dallas-San Antonio	251,518	260,467	3.6
Sunset Limited New Orleans-San Antonio-Los Angeles	71,719	78,775	9.8
Heartland Flyer Oklahoma City-Fort Worth	80,892	73,564	-9.1

The Texas Eagle and the Sunset Limited lines both experienced increases in ridership over this period of time; however, the Heartland Flyer experienced a drop in ridership. While the purpose for Amtrak ridership is primarily recreational, this upward trend in ridership for the Texas Eagle and the Sunset Limited shows an interest in intercity passenger rail transportation in Texas. Figure 2-38 illustrates these Amtrak routes.

[68] USDOT, Federal Highway Administration (FRA), National Rail Plan, 2009

Figure 2-38: Current Amtrak Routes



2.8.11 High-Speed Rail Planning in Texas

Note: Detailed Information regarding high-speed rail (HSR) in Texas can be found in the Texas Rail Plan available at http://www.txdot.gov/public_involvement/rail_plan/trp.htm

The Federal Railroad Administration (FRA) of the USDOT released a strategic planning document in April 2009 outlining the administration's vision for HSR development in the U.S. The report listed national strategic transportation goals for HSR investment.

The report's **Strategic Transportation Goals**[69] state that transportation investment strategy must address several strategic goals in the coming years:

- ★ **Ensure safe and efficient transportation choices**. Promote the safest possible movement of goods and people, and optimize the use of existing and new transportation infrastructure.
- ★ **Build a foundation for economic competitiveness.** Lay the groundwork for near-term and ongoing economic growth by facilitating efficient movement of

[69] FRA, *Vision for High-Speed Rail in America*, 2009, page 1

people and goods, while renewing critical domestic manufacturing and supply industries.

- ★ **Promote energy efficiency and environmental quality.** Reinforce efforts to foster energy independence and renewable energy, and reduce pollutants and greenhouse gas emissions.
- ★ **Support interconnected, livable communities.** Improve quality of life in local communities by promoting affordable, convenient and sustainable housing, energy and transportation options.

As support, the plan asserts, "each transportation mode plays a critical role in intercity passenger transportation, but the comparative advantage of each varies by market factor…" and provides the following table (Table 2-23) as support.

Table 2-23: FRA, Potential Modal Comparative Advantage by Market

Intercity Distance Mile			
Population Density	**0–100**	**100–600**	**600–3,000**
Light	1) Auto	1) Auto 2) Conventional Rail	1) Auto 2) Air
Moderate	1) Auto 2) Commuter Rail	1) High Speed Rail 2) Auto	1) Auto 2) Air
High	1) Commuter Rail 2) Auto	1) High Speed Rail 2) Air	1) Air

In Texas, the large metropolitan regions all fall within the population densities and 100 to 600 mile intercity distance range needed for HSR to have a comparative market advantage.

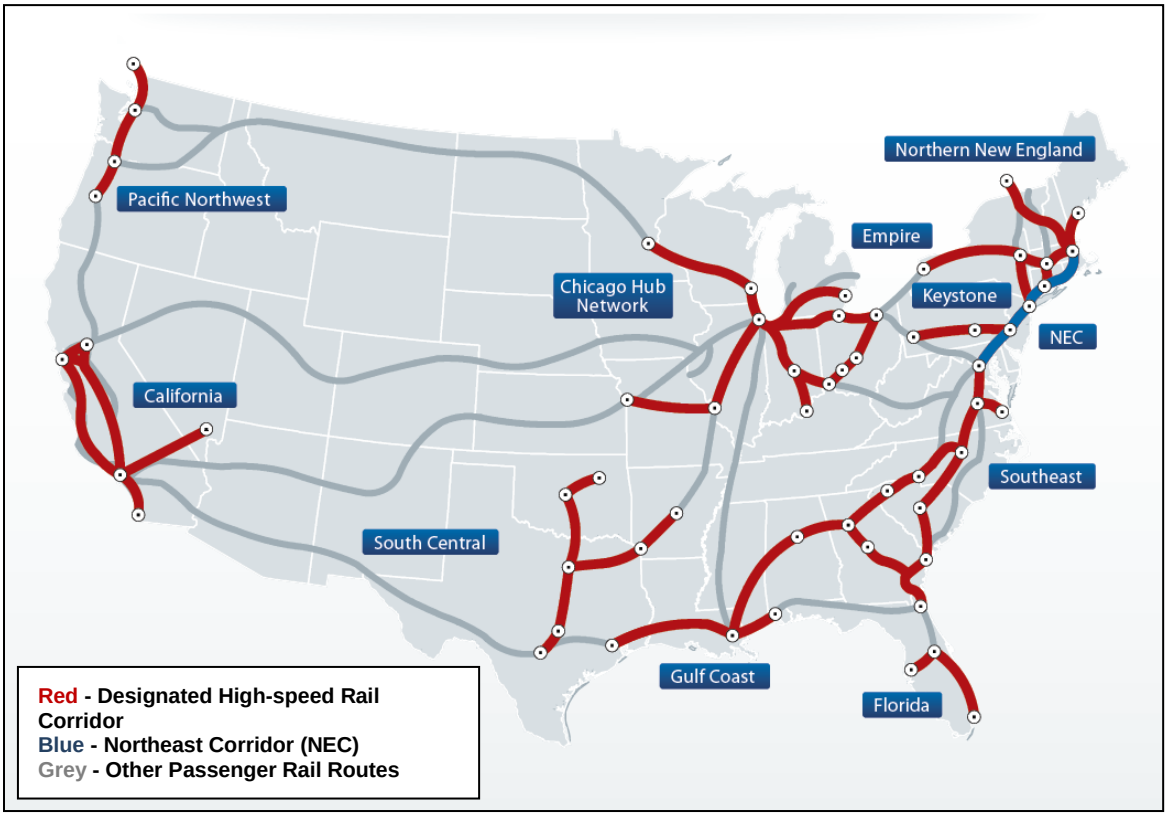
One of the distinguishing arguments for HSR is its ability to move people at high speeds from major cities and attractors, thus reducing a person's travel-time. Another benefit is the reduction in traffic congestion on the key roadways across the State. A final benefit that is certain to help Texans is the opportunity to move people who have limited transportation options.

Since the approval of the American Recovery and Reinvestment Act (ARRA) by Congress on February 13, 2009,[70] the momentum for HSR projects throughout the United States has increased considerably. HSR has been under study throughout the U.S. in various iterations either with intrastate or interstate programs for decades. This

[70] http://www.recovery.gov/About/Pages/The_Act.aspx

new funding mechanism provided states and regions with the ability to move forward with projects that either were currently under study or had been previously studied. After a nationwide competitive process, ARRA awarded over $8 billion to HSR projects throughout the U.S. The proposed FRA National High Speed Rail Map is shown on Figure 2-39.

Figure 2-39: High Speed Rail Map from the Federal Railroad Administration[71]



While Texas did not have a high-speed rail project ready for the 2009 ARRA application process, the Fort Worth area was awarded $4 million for improvements to Amtrak's Texas Eagle,[72] which operates between Fort Worth and Austin. This award is for final design and construction of signal timing improvements, which will improve the operating speed and on-time performance of this important rail arterial. As of 2010, TxDOT has prepared and submitted planning fund applications for three HSR corridors:

- ★ **Austin to Houston:** This corridor would incorporate five intermediate cities; Bryan/College Station, Giddings, Brenham, and Hempstead;

[71] FRA, *Vision for High-Speed Rail in America*, 2009, page 6

[72] http://www.whitehouse.gov/sites/default/files/rss_viewer/hsr_awards_summary_public.pdf

- **Dallas/Fort Worth to Houston:** This corridor would parallel I-45. Intermediate cities connected by this corridor would include Waco, Bryan/College Station, Corsicana, Conroe, and Huntsville;
- **Oklahoma City to South Texas:** This would be an 850-mile corridor from Oklahoma City to South Texas includes the cities of Dallas/Fort Worth, Waco, Austin, San Antonio, Laredo, Corpus Christi, and Brownsville.

2.9 Texas Bicycle and Pedestrian Plans

Bicycle and pedestrian travel modes are becoming increasingly important parts of the Texas transportation system. They provide positive benefits both for users and for the community as a whole. Bicyclists and pedestrians experience increased levels of physical fitness, greater mobility (especially for nondrivers), financial savings, and enjoyment. Every trip taken by bicycle or on foot immediately benefits communities by decreasing traffic and air pollution. Many planning elements that are designed to increase the livability of communities, such as traffic calming, improved crossing signals, and decreased sprawl, also benefit the bicycle and pedestrian modes by making them safer, more practical, and more pleasant.

Unlike other transportation modes, bicycle and pedestrian movements provide more than a means to get from one place to another for errands and work. Bike and pedestrian travel modes also provide the community with recreational activities. Most improvements that are made to bicycle and pedestrian facilities therefore serve the work commute, other trip purposes, and recreation functions. The pedestrian mode is also unique in that travel by every mode includes a pedestrian component, even if it is only a walk from a parking place into a building.

Recreational motoring, in terms of travel as well as destinations, has for nearly 100 years been recognized in Texas as a significant economic generator for great personal and community benefit. Highway infrastructure investment has effectively supported the multiple purposes of commuting, business travel, commercial transportation and recreational motoring. A similar relationship exists between both transportation and recreational bicycling and pedestrian activities. For example, recreational cycling can help generate the motivation and skill to begin bicycle commuting, and vice versa. Also, charity fundraising challenges depending on cyclists, runners and walkers will benefit greatly if those persons have daily venues through which they can condition and train themselves for these events. It is critical that bicycle and pedestrian accommodations be considered and TxDOT is committed to proactively plan, design and construct for bicyclists and pedestrians on appropriate facilities.

Bicycle and pedestrian modes are appropriate for many "short trips" of 3 miles or less that are currently made 72 percent of the time by motor vehicles.[73] Of all driving trips, 43 percent are 3 miles or less, or a 20-minute bike ride[73]. Of all driving trips, 20 percent are 1 mile or less, or a 20-minute walk[73]. If half of these short motor vehicle trips were replaced with bicycling and pedestrian trips in congested urban areas, significant reduction in motor vehicle traffic in the 15 to 20 percent range could be realized. Bicycle and pedestrian modes are also appropriate for destinations involving longer distances. Bicyclists frequently commute for distances greater than five and even 10 miles. A 1997 University of Washington analysis of bicycle commuting practices of 2374 voluntary survey respondents from across the country reported an average bicycle commute distance of 7.2 miles.[74] Persons of average but not exceptional physical fitness can easily cover these distances, even up to and beyond the 12-mile average motor vehicle commute distance. Investment in infrastructure, education and encouragement for bicycling in communities such as Seattle, WA; Portland, OR; Minneapolis, MN and Copenhagen, Denmark has resulted in significant increases in the number of bicyclists and increase in trip distances for transportation purposes. Copenhagen currently has 36 percent bicycle commuters[75] with a goal of 50 percent for 2015.[76] Public transportation systems, especially those with bicycle accommodations, facilitate even greater pedestrian and bicycle commuting distances.

What can be safely assumed is that most all trips involve some type of pedestrian component. This may be as little as the walk from a parking place or bus stop to a final destination, or as much as the selection of walking as a primary commuting mode. Walking is also a common recreational activity. It can also be assumed that Texas bicycle transportation needs involve a range of different bicyclists. The most experienced adult riders may need bicycle facilities that support rapid travel on arterial streets with direct access to a work destination. At the other end of the spectrum, bicycle-riding children may need access to destinations such as schools using residential streets with low traffic volumes.

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[73] National Household Travel Survey, Federal Highway Administration Office of Policy, 2009 (summary of "Mode Share" and "Short Trips" compiled into on-line report by League of American Bicyclists and America Bikes, Washington, D.C., 2010); Available at http://www.bikeleague.org/resources/reports/pdfs/nhts09.pdf

[74] *A Survey of North American Bicycle Commuters*, William E, Noritz, Ph.D., University of Washington, Seattle, WA, 1997. http://www.bicyclinglife.com/library/moritz1.htm

[75] *Livable Copenhagen: The Design of a Bicycle City*, Center for Public Space Research, Copenhagen, Denmark and University of Washington, Seattle, WA, 2009. http://www.sightline.org/research/sprawl/res_pubs/Livable_Copenhagen_reduced.pdf

[76] *Copenhagen: City of Cyclists; Bicycle Account 2008*, Traffic Department, City of Copenhagen, Denmark, 2008. http://www.kk.dk/sitecore/content/Subsites/CityOfCopenhagen/SubsiteFrontpage/CitizenInformation/CityAndTraffic/CityOfCyclists/~/media/F9FC02F424F84FFEAFC5428085F4AF05.ashx

The State of Texas has recognized that bicycle and pedestrian modes have a place in its transportation system and has committed to their expansion and improvement. TxDOT has adopted the AASHTO Guide for the Development of Bicycle Facilities as official design criteria for bicycle facilities. The state has also taken advantage of new sources of funding such as transportation enhancement funds for bicycle and pedestrian facilities available in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, the Transportation Equity Act for the 21st Century (TEA-21, and the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU).

Additionally, the 25 MPOs in Texas address cyclist and pedestrian needs in their respective MTPs. Several Texas MPOs have extensive bicycle and pedestrian networks that they promote in stand-alone plans. The need for facilities is difficult to forecast, but based on a review of the MPOs' MTPs, basic goals indentified include:

- ★ Improve access to the downtown, including municipal, cultural and shopping locations
- ★ Improve access to local recreational opportunities
- ★ Provide for safe crossing of major highways
- ★ Provide access to key inter-modal transit centers
- ★ Improve bicycle and motor vehicle operator education
- ★ Promote opportunities for bicycling in the City

2.9.1 Regional Bicycle and Pedestrian Plans

Bicycle and pedestrian travel are an increasingly important part of the Texas transportation system. Between 1990 and 2007 Texas experienced a 38 percent increase in commuters who bicycled to work. Similarly, between 2000 and 2007 people walking to work increased by 9 percent. In 2010, Texas had seven of the top 50 cities in terms of percentage of commuters who bicycled or walked to work.[77]

MPOs are federally mandated and federally funded transportation policy-making organizations in the United States that are made up of representatives from local government and governmental transportation authorities. Each MPO is tasked with providing a continuing, cooperative, and comprehensive planning process for federally funded transportation projects and programs in its respective region. Of the 25 MPOS,

[77] Alliance for Biking and Walking. *Bicycling and Walking in the United States 2010 Benchmarking Report.* Available at http://www.peoplepoweredmovement.org/site/

all include a bicycle/pedestrian section in their MTPs. Moreover, there are additional stand-alone plans in regions that establish a system of bicycle and pedestrian routes Table 2-24.

Table 2-24: MPO Bicycle and Pedestrian Plans

MPO	Location	Included in MTP	Additional Studies/Plans
Abilene MPO	Abilene, Texas	Yes	2006 Sidewalk Master Plan 2004 Abilene Comprehensive Plan (based on The City of Abilene's Multi-use Bicycle & Pedestrian Trail Plan)
Amarillo MPO	Amarillo, Texas	Yes	2003 Amarillo Hike and Bike Plan
CAMPO	Austin, Texas	Yes	2030 Regional Bicycle Map 2030 Campo Mobility Plan 2006 City of Austin Bicycle & Pedestrian Plans
SETRPC	Beaumont, Texas	Yes	
Brownsville MPO	Brownsville, Texas	Yes	2004 Bicycle Pedestrian Plan
BCSMPO	Bryan-College Station, Texas	Yes	
CRP	Corpus Christi, Texas	Yes	2004 Bicycle & Pedestrian Plan
El Paso	El Paso, Texas	Yes	Stand Alone Plan
HSB MPO	Harlingen, Texas	Yes	Stand Alone Plan
H-GAC	Houston-Galveston, Texas	Yes	2007 Regional Bikeway Plan 2004 Pedestrian and Bicycle Special Districts Study Standing Bike/Ped Advisory Sub-Committee Bayou Greenway Initiative
HMPO	Hidalgo, Texas	Yes	Non-Motorized Bicycle Plan in MTP 2007 Multi-Modal Study
K-T MPO	Belton, Texas	Yes	
Laredo	Laredo, Texas	Yes	
Longview MPO	Longview, Texas	Yes	
Lubbock	Lubbock, Texas	Yes	Comprehensive Bicycle Plan
MOTOR	Odessa, Texas	Yes	
NCTCOG	Dallas-Fort Worth	Yes	Bicycle and Pedestrian Advisory Committees
San Angelo MPO	San Angelo, Texas	Yes	2008 Bicycle and Pedestrian Plan
SABC MPO	San Antonio, Texas	Yes	City of San Antonio Bicycle Plan Regional Bicycle Travel Patterns Study
SD-MPO	Sherman, Texas	Yes	
Texarkana MPO	Texarkana, Texas	Yes	2009 Bicycle and Pedestrian Master Plan
Tyler MPO	Tyler, Texas	Yes	2009 Regional Trail Plan
Victoria	Victoria, Texas	Yes	
WUTS	Waco	Yes	
WFS MPO	Wichita Falls, Texas	Yes	

Source: Association of Texas Metropolitan Planning Organization, http://www.texasmpos.org/

The Abilene MPO used the Abilene City Council's Multi-Use Bicycle & Pedestrian Trail Plan as a foundation for the pedestrian mobility studies in the 2004 Abilene Comprehensive Plan. The Plan set guidelines for "paths, lanes and routes" shared by bicyclists, pedestrians and motorists. The MPO also encouraged use by facility accessibility (i.e., bicycle parking, shower/lockers and theft reduction measures) and suggested funding opportunities, such as, Transportation Enhancement Funds, Safe Routes to School Program, National Park Service, Texas Park and Wildlife – Recreational Trails Program and other private or nonprofit funding for projects.[78]

The City of Amarillo approved a "Hike and Bike Master Plan" in July of 2003. The Amarillo Hike and Bike Master Plan established a system of bicycle and pedestrian routes in and around the city. Implementation of bicycle facilities included plans to stripe 86 miles of cycling lanes. The plan outlined a schedule for linking neighborhoods south to the Rock Island Rail Trail and provides connections to selected schools.[79]

In 2010, civic and business leaders in the Houston Region came together with Harris County, the City of Houston and H-GAC (the Houston-Galveston Area Council) to develop a comprehensive hike and bike master trail plan that develops miles of land along Harris County's 10 major bayous, creating a system of linear parks. These 10 bayous all flow from west to east into Galveston Bay after meandering through multiple neighborhoods all over the region. This *Bayou Greenway Initiative* for the Houston Region includes almost 250 miles of new or upgraded hike and bike trails, miles of canoe/paddle trails and more than 50 new parks that also serve as retention basins and wetlands that improve the quality of the region's groundwater and flood runoff. The *Bayou Greenway Initiative* will also serve as the trunk line for an even larger network of trails and linear parks that will provide park and trail access to almost every community within Houston and Harris County and provide connectivity between communities, businesses and retail establishments. The initiative will create an alternative transportation source for urban residents and visitors alike.

As a result of the large number of cyclists and pedestrians in Austin, the Capital Area Metropolitan Planning Organization (CAMPO), through cooperative relationships with the City of Austin and other stakeholder groups, has developed a comprehensive planning program to manage its well-established and highly integrated network of bicycle-pedestrian facilities.

[78] Abilene Metropolitan Area Metropolitan Transportation Plan 2010–2035; http://www.abilenempo.org/

[79] Amarillo Metropolitan Transportation Plan 2010–203; http://www.amarillompo.com/

Due to the growing number of commuters and travelers, it is no doubt that MPOs and city councils around the state are focusing on bicycle and pedestrian transportation modes in order to achieve a balanced multimodal transportation system.

One of the greatest challenges facing the bicycle and pedestrian field has been the lack of documentation on usage and demand. However, effective methods for counting bicyclists and pedestrians continue to be developed and refined and are now being tested in Texas to improve the volume and quality of bicycle and pedestrian modal data. Without accurate and consistent demand and usage figures, it is difficult to measure the positive benefits of investments in these modes, especially when compared to the other transportation modes such as the private automobile. The 2002 National Survey of Pedestrian and Bicyclist Attitudes and Behaviors (U.S. Department of Transportation 2003) found only 0.9 percent of all trips in the United States were taken by bicycle, so bicycle counts on a route can vary by a large percentage, with only a small change in numbers. This lack of quantifiable methodologies for the nonmotorized modes is a likely reason the modes are often under-funded and an afterthought in policy decision-making.

2.9.2 Texas Regional Trails

The most extensive and well-documented system of bicycle and walking facilities in the State of Texas is maintained by the Texas Parks and Wildlife Department (TPWD). While these facilities are mostly recreational in nature, some multi-purpose trails may have utility in supporting nonrecreational trips. The statewide nature of this network and the available connections to other bicycle and pedestrian facilities warrants consideration as part of the Texas Transportation System.

2.9.2.1 Texas Parks and Wildlife Trails

The FHWA provides funding for the Texas Recreational Trails Program from a portion of federal gas taxes paid on fuel used in nonhighway recreational vehicles. While TPWD administers the program, proposed expenditures must be listed in TxDOT's STIP. Funds can be spent on both motorized and nonmotorized recreational trail projects such as:

- Construction of new recreational trails
- Improvement of existing trails
- Development of trailheads or trailside facilities, and
- Acquisition of trail corridors.

Texas was the first state in the nation to create birding and wildlife viewing trails, an idea that resulted in similar projects throughout North America. These trails provide economic incentives for landowners and communities to conserve habitats while providing recreational opportunities for the traveling public. The wildlife trails of Texas promote sustainable economic development and build public support for conservation of wildlife and habitats.

TPWD promotes four main (eight total) birding and wildlife trails in Texas:

- Great Texas Coastal Birding Trails (Upper Texas Coast, Central Texas Coast, and Lower Texas Coast)
- Heart of Texas Wildlife Trails (East and West)
- Panhandle Plains Wildlife Trail
- Prairies and Pineywoods Wildlife Trail (East and West)

For general information on TPWD's Trail programs, visit http://beta-www.tpwd.state.tx.us/.

2.9.2.2 The Texas Heritage Trails Program

A combination of historic preservation and tourism, this economic development initiative encourages communities to partner to promote Texas' historic and cultural resources. These successful local preservation efforts, combined with statewide marketing of the areas as heritage regions, increase visitation to cultural and historic sites and bring more dollars to Texas communities, especially rural ones.

The Texas Heritage Trails Program (THTP) is based around 10 scenic driving trails created in 1968 by Gov. John Connally and the Texas Highway Department as a marketing tool. The trails were established in conjunction with the HemisFair, an international exposition that commemorated the 250th anniversary of the founding of San Antonio.

In 1997, the Texas Historical Commission (THC) was charged by the State Legislature to create a statewide heritage tourism program. The THC based its program on the original driving trails, creating 10 heritage regions, but included all the surrounding counties: Texas Brazos Trail Region, Forest Trail Region, Forts Trail Region, Hill Country Trail Region, Lakes Trail Region, Independence Trail Region, Mountain Trail Region, Pecos Trail Region, Plains Trail Region, and Tropical Trail Region (Figure 2-40).

Several of these regions including the Mountain Region and Forts Trail Region are promoting cycling and/or sponsoring pilot cycling programs. In particular, the Mountain Trail Region is promoting cycle-friendly accommodations and events. Information regarding cycling in this region can be found at:

http://www.texasmountaintrail.com/index.aspx?page=7

And information regarding cycling in the Forts Trail Region can be found at:

http://www.texasfortstrail.com/index.aspx?page=1416

Figure 2-40: Texas Heritage Trails Program Regions

For general information on THC's Trails program visit http://www.thc.state.tx.us/heritagetourism/htprogram.shtml.

2.9.2.3 Texas Bicycle Tourism Trails Act

The Texas Bicycle Tourism Trails Act took effect September 1, 2005. The act created Section 201.9025 of the Texas Transportation Code to facilitate development of an on-road and off-road statewide network of bicycle trails that 'reflect the geography, scenery, history, and cultural diversity of this state' and may include multiuse trails to accommodate pedestrians and equestrians. This infrastructure can serve local bicycle and pedestrian transportation network needs.

2.10 Texas International Border Transportation

Texas' 1254-mile border with Mexico creates a vital and unique economic, trade, and transportation region. Border entry points are both urban and rural between Texas and Mexico; and some regions have multiple entry points. The crossings handle vehicular, commercial, and pedestrian traffic. They are owned by the U.S. government, the State of Texas, local governmental entities, and private companies. The crossings are:

- El Paso, Texas – Ciudad Juárez, Chihuahua
- Fabens, Texas – Práxedis G. Guerrero, Chihuahua
- Fort Hancock, Texas – El Porvenir, Chihuahua
- Presidio, Texas – Ojinaga, Chihuahua
- Del Rio, Texas – Ciudad Acuña, Coahuila
- Eagle Pass, Texas – Piedras Negras, Coahuila
- Laredo, Texas – Nuevo Laredo, Tamaulipas
- Falcon Heights, Texas – Presa Falcón, Tamaulipas
- Roma, Texas – Ciudad Miguel Alemán, Tamaulipas
- Rio Grande City, Texas – Ciudad Camargo, Tamaulipas
- Hidalgo, Texas – Reynosa, Tamaulipas
- Progreso, Texas – Nuevo Progreso, Tamaulipas
- Los Indios, Texas – Lucio Blanco, Tamaulipas
- Brownsville, Texas – Matamoros, Tamaulipas

There are 27 vehicular border crossings between Texas and Mexico (Table 2-25). They are owned by the U.S. government, the State of Texas, local governmental entities, and private companies. Each bridge is unique allowing passage to a mix of private automobiles, commercial traffic, hazardous materials, and pedestrians. Each operates independently and has different hours. There is one additional bridge, the Donna International bridge located in Hidalgo County, not listed in Table 2-25, which is set to be open in 2010.

Table 2-25: Location and Ownership of International Bridges on Texas-Mexico Border

City	County	Bridge Name	Ownership
El Paso	El Paso	Ysleta-Zaragoza Bridge	City of El Paso
	El Paso	Good Neighbor Bridge	City of El Paso
	El Paso	Paso del Norte Bridge	City of El Paso
	El Paso	Bridge of the Americas (BOTA)	U.S. International Water and Boundary Commission
Fabens	El Paso	Fabens-Caseta Bridge	U.S. International Water and Boundary Commission
Fort Hancock	Hudspeth	Fort Hancock-El Provenir	U.S. International Water and Boundary Commission
Presidio	Presidio	Presidio Bridge	State of Texas
Del Rio	Val Verde	Del Río-Cuidad Acuña International Bridge	City of Del Rio
	Val Verde	Lake Amistad Dam	US and Mexico
Eagle Pass	Maverick	Camino Real International	City of Eagle Pass
	Maverick	Eagle Pass Bridge I	City of Eagle Pass
Laredo	Webb	Juárez-Lincoln Bridge	City of Laredo
	Webb	Gateway to the Americas Bridge	City of Laredo
	Webb	World Trade Bridge	City of Laredo
	Webb	Laredo-Colombia Solidarity Bridge	City of Laredo
Falcon Heights	Zapata	Lake Falcon	US and Mexico
Roma	Starr	Roma-Ciudad Miguel Alemán Bridge	Starr County
Rio Grande City	Starr	Starr-Camargo Bridge	Private
Los Ebanos	Hidalgo	Los Ebanos*	Private
Mission	Hidalgo	Anzalduas International Bridge	City of McAllen, Mission, Hidalgo, Granjeno
Hidalgo	Hidalgo	McAllen-Hidalgo-Reynosa Bridge	City of McAllen
Pharr	Hidalgo	Pharr-Reynosa International Bridge	City of Pharr
Progresso	Hidalgo	Progreso-Nuevo Progreso	Private
Los Indios	Cameron	Free Trade Bridge at Los Indios	Cameron County, City of San Benito, and City of Harlingen
Brownsville	Cameron	B&M Bridge at Brownsville	Private
	Cameron	Veterans International Bridge at Los Tomates	Cameron County and City of Brownsville
	Cameron	Gateway International Bridge	Cameron County

*Los Ebanos is a ferry

Table 2-26 and Figure 2-41 show total border crossings in 1995, 2000, and 2009. As shown in the table and figure, border crossings decreased in 2009 relative to 2000.

Table 2-26: Texas-Mexico Personal Vehicle, Truck, and Pedestrian Crossings, 1995–2000–2009[80]

Year	Vehicles	Buses	Pedestrians	Trucks	Trains
1995	40,632,864	82,776	15,293,043	1,892,545	8,268
2000	50,367,666	105,217	19,910,809	3,113,277	5,812
2009	35,585,141	102,111	18,847,287	2,854,881	6,406

Figure 2-41: Texas-Mexico Personal Vehicle, Truck, and Pedestrian Crossings, 1995–2000–2009[81]

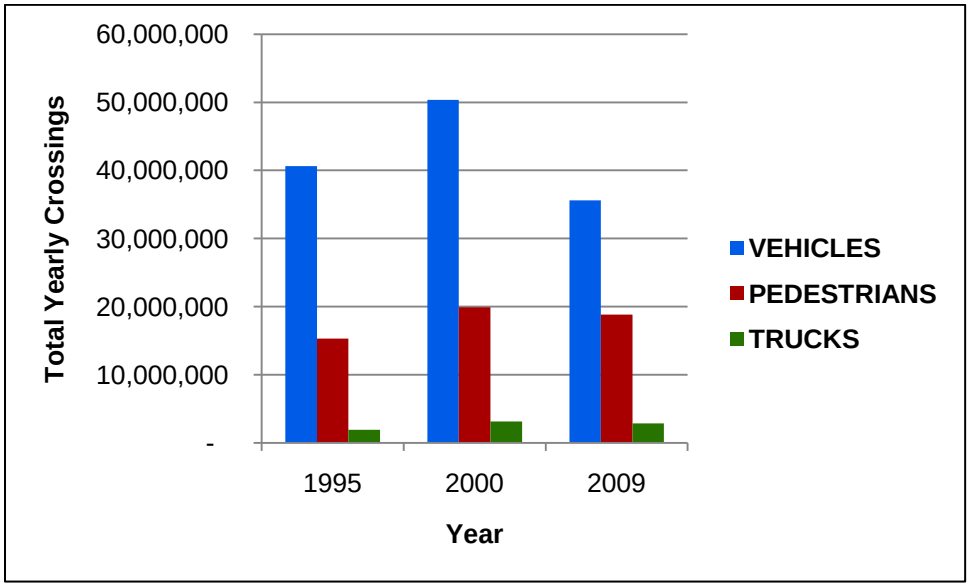


Figure 2-42 and Figure 2-43 show total border crossing in 1995, 2000, and 2009 for personal vehicles and trucks, respectively, by port region. As shown in the table and figure, border crossings decreased in 2009 relative to 2000.

[80] Bureau of Transportation Statistics

[81] Bureau of Transportation Statistics

Figure 2-42: Personal Vehicle Border Crossings by Port, 1995–2000–2009[82]

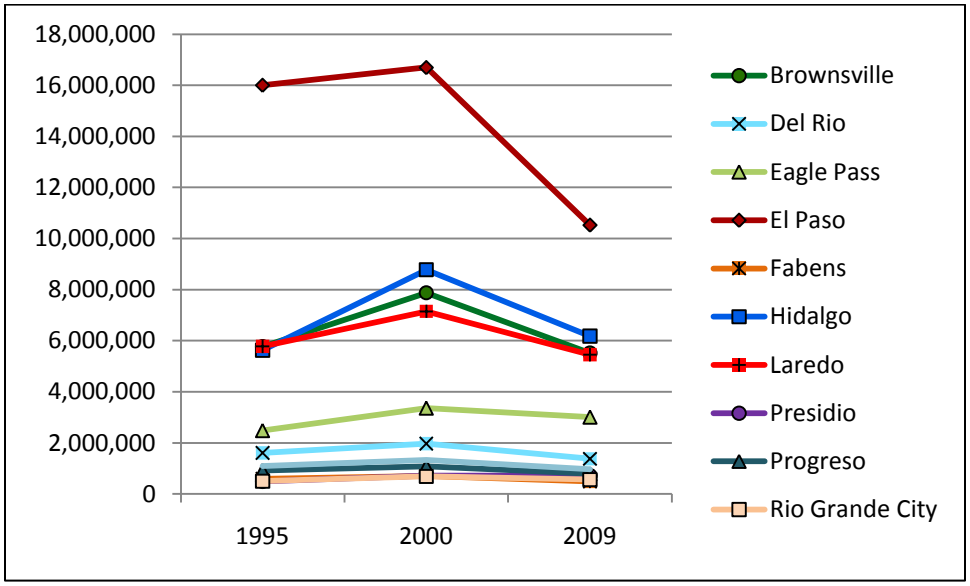
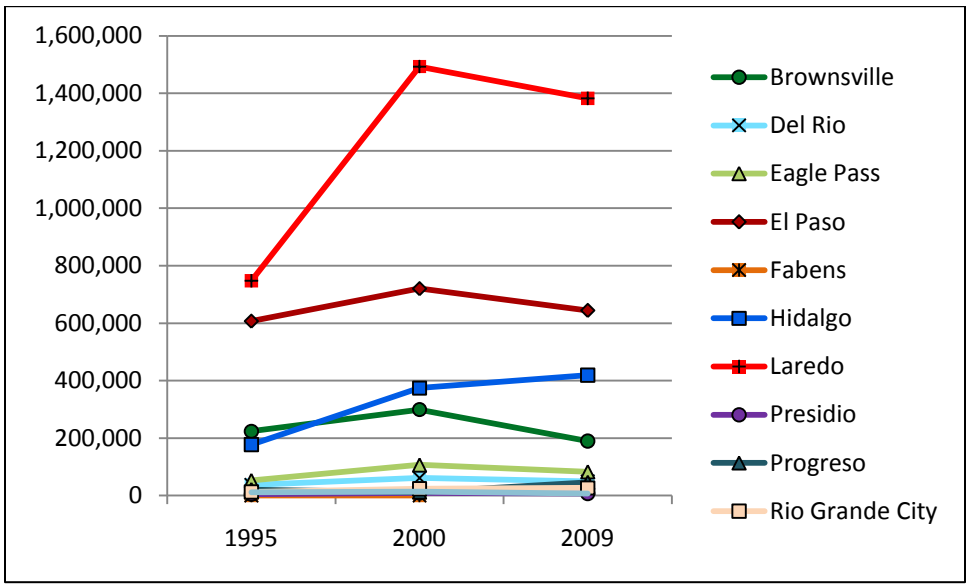


Figure 2-43: Truck Border Crossings by Port, 1995–2000–2009[83]



Future border crossings are difficult to predict and will vary based on economic, social, and political conditions.

[82] U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Border Crossing/Entry Data. Latest Available Data: December 2009 as of 6/1/2010

[83] Ibid

2.11 Texas Aviation

Note: Detailed Information regarding the aviation system in Texas can be found in the Texas Airport System Plan (TASP) available at http://www.dot.state.tx.us/business/aviation/system_plan.htm

Texas is home to one of the most robust and active state airport systems in the nation. The state has 292 existing airports spanning in size from large hub commercial airports in heavily populated metropolitan areas to very small general aviation airports located in remote areas of the state. Due to the vast size of the state, the diverse activities of Texas businesses and residents, and the ever-present need to move people and goods efficiently, airports are critical to the state's economy.

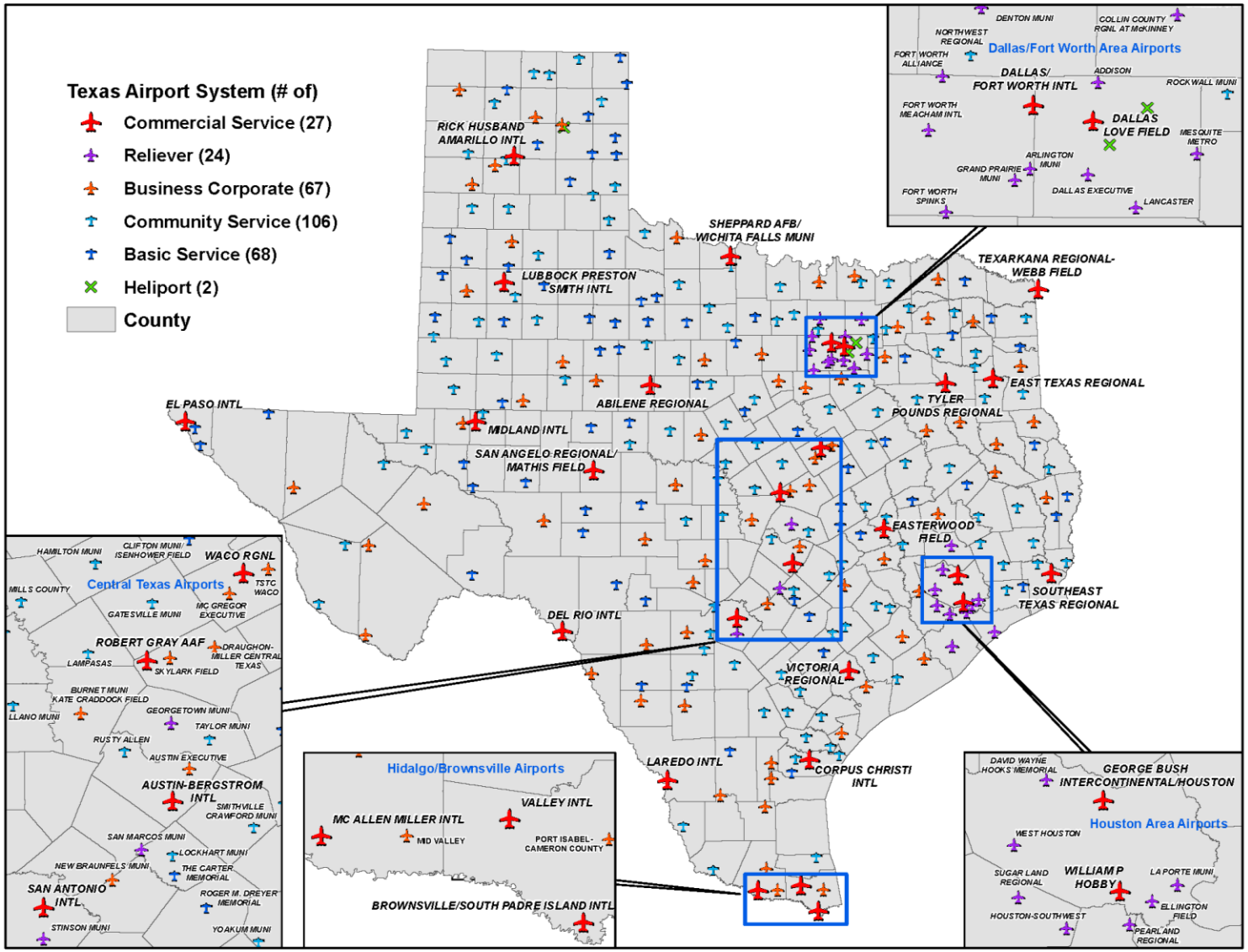
The importance of aviation to Texas is highlighted by the fact that three of the world's largest commercial airlines (American, Continental, and Southwest) maintain headquarters in the state and conduct major operations from Texas airports. These airlines have certainly contributed to the growth of air transportation within the state and, in fact, throughout the world. The growing demand for air transportation in turn, has led to the continued development of the Texas' commercial and general aviation (GA) airports.

While commercial aviation may be the most visible part of the Texas airport system, it is important to note that general aviation airports account for more than 90 percent of the state's airports. There are 27 existing commercial service airports and 265 general aviation airports in Texas. As expected, there are large clusters of airports close to population centers in Dallas-Fort Worth and Houston. While airports of all types are generally well dispersed throughout the state, there are notably fewer airports in West Texas given the lower population densities in that region.

As noted above, the state's airports differ widely in size and function. For instance, American Airlines and Continental Airlines operate some of the world's largest hubs at DFW and IAH, respectively. These airports handle millions of passengers and thousands of cargo tons each year via multiple terminals and runways. On the other hand, the primary function of many general aviation airports in Texas is to increase system capacity by providing air access to widely dispersed economic activity centers of the state and relieving air traffic congestion in and around major metropolitan areas.

Figure-44 shows airports in Texas.

Figure 2-44: Texas Airports



2.11.1 Methodology Forecast - Activity Levels: Commercial Aviation and General Aviation

In reporting forecasts for Texas aviation activity, a variety of sources were consulted. These sources included the 2010 TASP, the Federal Aviation Administration (FAA) Terminal Area Forecast (TAF)[84] FY 2009–2030, the FAA Aerospace Forecast – FY 2009–2025, and commercial airport master plans.

The forecasts contained in the TASP are themselves sourced to the two FAA forecasts, although in the case of the Terminal Area Forecast, TASP utilized the 2008 version of the report, which was the latest available at the time.

The commercial airport master plans contain independent forecasts and were used to verify FAA forecast levels. While differences between the forecasts are expected due to varying dates of production and differing methodologies, the FAA and master plan forecasts were compared in terms of order of magnitude as well as overall growth trends. For commercial airports, the forecasts go out to 2030, which is very close to the 2035 forecasts required for this report. For purposes of this study, activity estimates to 2035 were extrapolated from the existing forecast data using the average annual growth rates for each airport between 2010 and 2030. For GA airports forecasts are reported as presented in the TASP.

2.11.2 Commercial Aviation in Texas

The 27 commercial airports in Texas offer scheduled service by major, national, or regional airlines. Each of these airports offers flights to domestic points in the United States. Several Texas airports also have flights to international destinations, some of which are operated by foreign airlines. Table 2-27 lists the locations and names of Texas' commercial airports.

The runway lengths of the 27 commercial airports exceed 5,000 feet and, in the case of airports handling wide body aircraft, can exceed 12,000 feet. The Texas commercial airports also have full parallel taxiways and high intensity runway lighting. These airports are all capable of handling heavy transport aircraft.

The commercial aviation airports are typically owned and operated by the municipalities or the airport authorities of their respective communities. As the owners, these municipalities and airport authorities are responsible for developing and maintaining the facilities, roadways, equipment, and other infrastructure on the airport property.

[84] FAA, Terminal Area Forecasts FY 2009–2030, Available at FAA Terminal Area Forecast 2009, Available at http://www.faa.gov/data_research/aviation/taf_reports/

Table 2-27: List of Commercial Airports in Texas

Associated City	Airport Name
Abilene	Abilene Regional
Amarillo	Rick Husband Amarillo International
Austin	Austin-Bergstrom International
Beaumont-Port Arthur	Southeast Texas Regional
Brownsville	Brownsville/South Padre Island International
College Station	Easterwood Field
Corpus Christi	Corpus Christi International
Dallas	Dallas Love Field
Dallas-Fort Worth	Dallas-Fort Worth International
Del Rio	Del Rio International
El Paso	El Paso International
Harlingen	Valley International
Houston	William P. Hobby
Houston	George Bush Intercontinental/Houston
Killeen	Robert Gray Army Air Field
Laredo	Laredo International
Longview	East Texas Regional
Lubbock	Lubbock Preston Smith International
McAllen	McAllen Miller International
Midland	Midland International
San Angelo	San Angelo Regional/Mathis Field
San Antonio	San Antonio International
Texarkana	Texarkana Regional
Tyler	Tyler Pounds Regional
Victoria	Victoria Regional
Waco	Waco Regional
Wichita Falls	Sheppard Air Force Base (AFB)/Wichita Falls Municipal

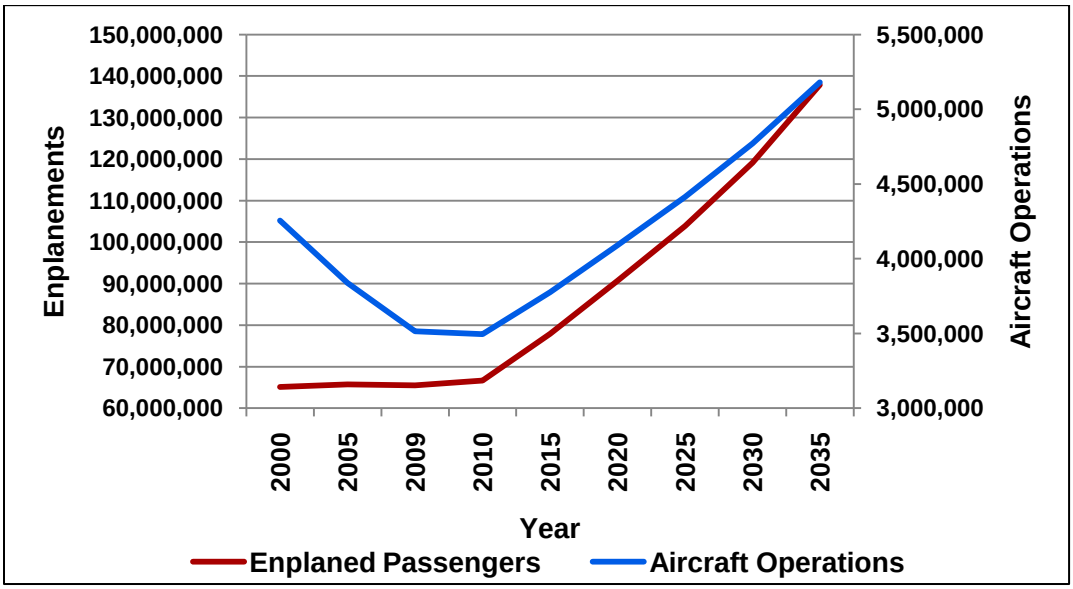
2.11.2.1 Historical and Forecast Activity Levels at Commercial Aviation Airports

Table 2-28 and Figure 2-45 present historic trends and forecasts of aircraft operations and enplanements for commercial airports in Texas and are described below.

Table 2-28: Commercial Airports Historic and Forecast Aircraft Operations and Enplanements[85]

Year	Aircraft Operations	Enplaned Passengers
2000	4,256,364	65,146,667
2005	3,838,117	65,749,646
2009	3,514,974	65,476,384
2010	3,494,706	66,643,944
2015	3,775,722	77,892,456
2020	4,090,693	90,676,709
2025	4,413,526	103,856,306
2030	4,772,312	119,183,428
2035	5,180,910	137,898,637
Total Growth 2000–2035	**924,546**	**72,751,970**
% Change	**21.7**	**111.7**
Compound Annual Growth Rate 2000–2035	**0.6%**	**3.2%**

Figure 2-45: Commercial Airports Historic and Forecast Aircraft Operations and Enplanements – Trends[86]



85 FAA, Terminal Area Forecasts FY 2009–2030, Available at FAA Terminal Area Forecast 2009, Available at http://www.faa.gov/data_research/aviation/taf_reports/; 2035 forecasts are the average annual growth rate between 2010 and 2030 extrapolated to 2035

86 FAA, Terminal Area Forecasts FY 2009–2030, Available at FAA Terminal Area Forecast 2009, Available at http://www.faa.gov/data_research/aviation/taf_reports/; 2035 forecasts are the average annual growth rate between 2010 and 2030 extrapolated to 2035

Aircraft operations at commercial airports have been on a noticeable decline over the past 10 years. Operations peaked at 4.1 million operations in 2000 and by 2009 had fallen below 3.4 million equating to an 18 percent drop.

There are many reasons for the decline in commercial aircraft operations. In 2000, business travel across the entire airline industry was at an all time high. As the economy faltered after 2000, it was somewhat natural for a slowdown in travel and, in turn aircraft operations, to occur. Then, the events of 9/11 led to even further cuts in aviation activity. In the years after 9/11, many airlines downsized their fleets and cut capacity to match lower travel demand. Several airlines also implemented strategies whereby fewer small aircraft were utilized in favor of larger aircraft with more seating capacity. These strategies led to reductions in aircraft operations as more seats could be flown with fewer operations. Finally, the onset of the global recession in 2008 led airlines to reduce capacity further by removing aircraft from their fleets. It is important to note, that the operational trends experienced by Texas' commercial airports over the past 10 years are not unique to Texas. These types of trends have been felt by airports across the United States and are explained by economic events and airline strategies.

Interestingly, while aircraft operations at Texas commercial airports have been falling since 2000, passenger enplanements have exceeded the levels of 2000 and experienced a new peak in 2007. In 2000, Texas commercial airport enplanements reached 65 million then fell back to 57 million in 2002 and 2003. By 2007, growth in enplanements reached 71 million passengers before again declining to 65 million in 2009.

As with aircraft operations, the changes in Texas commercial airport passenger enplanements can largely be explained by economic events and airline strategies. In terms of enplanements, the effects of the high business travel environment of 2000, the events of 9/11 and the beginning of recession in 2008 are all apparent in the historical Texas airport data. However, primarily because of the presence of the American Airlines hub at DFW and the Continental Airlines hub at IAH, enplanements increased significantly at Texas commercial airports. As airline strategies changed to match market demand, more passengers flowed through hub airports including DFW and IAH. Again, these passengers likely flew into and out of the hubs on larger aircraft with higher seat capacity. Thus, it is logical that at Texas' commercial airports over the past 10 years, aircraft operations have fallen significantly even while passenger enplanements have peaked in recent years.

The forecast of aircraft operations at Texas commercial airports shows a net increase of 1.7 million operations to 5.2 million between 2010 and 2035. This equates to total

growth of over 48 percent with an average annual growth rate of 1.6 percent during the forecast period.

This forecast growth compares to an 18 percent decline in aircraft operations from 2000 to 2009. Of course, these past 10 years include some of the most extraordinary (and negative) events in commercial aviation history including the events of 9/11, record high fuel prices, and the global recession starting in 2008. With events such as these, the airline industry has retrenched and in doing so has generally cut capacity.

These capacity cuts have occurred disproportionately with smaller aircraft where the cost of fuel is spread out over a much smaller passenger base than with larger aircraft. The net effect has been negative aircraft operations growth at most airports worldwide. In this context, Texas airports were not unique and the declines in operations at the state's commercial airports should not be seen as evidence of problems at the local level.

Looking forward, the growth outlook through 2035 shows a return to more normal patterns where the business cycle turns the corner in 2010 and airline operations show modest year-over-year growth. During the forecast period, all Texas commercial airports show gains in aircraft operations. Notably, the two largest Texas airports, DFW and IAH, will account for approximately 40 percent of total growth in aircraft operations among commercial airports from 2010 to 2035.

The forecast of enplaned passengers at Texas commercial airports shows a net increase of 71.3 million enplanements from 2010 to 2035 to 137.9 million. This equates to a doubling of enplanements with an average annual growth rate of 3.0 percent during the forecast period.

2.11.3 General Aviation in Texas

The 265 GA airports in Texas do not offer scheduled air services and can function in a variety of ways including Reliever, GA Business/Corporate, GA Community Service, and GA Basic Service. A summary of the numbers of general aviation airports and their locations in the state are shown in Table 2-29.

The runway lengths of the Reliever and the GA Business/Corporate airports are typically in excess of 5,000 feet with the ability to handle business jet aircraft. The GA Community Service airports have runways lengths of at least 4,000 feet while the GA Basic service runways are typically at least 3,200 feet long. GA Community Service airports must be able to handle light twin-engine aircraft, turboprops, and light business jets. GA Basic Service airports are designed to accommodate light twin-engine aircraft

as well as single piston airplanes. All GA level airports must have medium intensity runway lighting.

Table 2-29: General Aviation Airports in Texas[87]

Airport Service Level/Role	Number of Airports in Texas Airport System Plan
Reliever	24
Business/Corporate	67
Community Service	106
Basic Service	68
Total	**265**

2.11.3.1 Historical and Forecast Activity Levels General Aviation Airports

Table 2-30 and Figure 2-46 present historic trends and forecasts of aircraft operations for GA airports in Texas and are described below.

Table 2-30: General Aviation Airports Historic and Forecast Aircraft Operations[88]

Year	Single-Engine Aircraft	Other Aircraft#	Total
2000	3,949,824	1,083,901	5,033,725
2001	3,802,511	1,031,891	4,834,401
2002	3,895,825	1,067,651	4,963,477
2003	3,807,044	1,055,045	4,862,090
2004	3,635,305	1,090,172	4,725,477
2005	3,421,881	1,060,637	4,482,518
2006	3,436,412	1,097,223	4,533,635
2007	3,378,869	1,117,436	4,496,305
2008*	-	-	-
2009*	-	-	-
2010	3,240,039	1,184,393	4,424,432
2015	3,225,744	1,327,560	4,553,304
2020	3,316,682	1,477,947	4,794,629
2025	3,452,594	1,631,873	5,084,467
Total Growth 2000–2025	**(497,231)**	**547,973**	**50,742**
% Change 2000–2025	**-12.6**	**50.6**	**1.0**

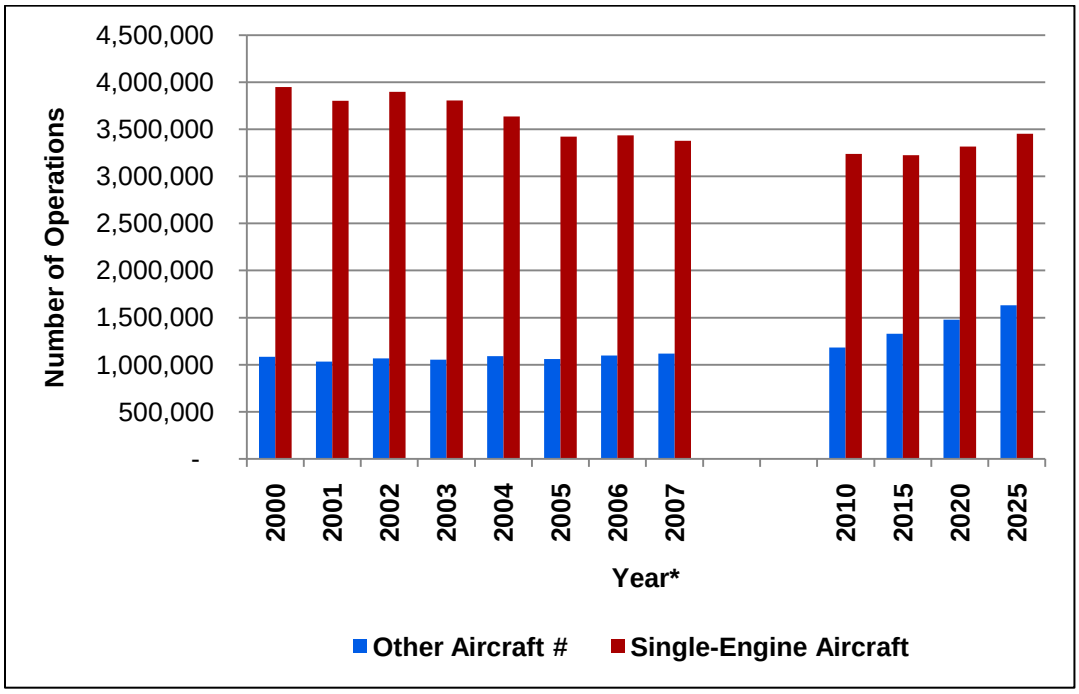
* TASP only includes forecasts to 2025 and excludes 2008 and 2009

Includes: multi-engine, turboprop, turbojet, and rotary aircraft

[87] TxDOT, 2010 TASP, Available at http://www.dot.state.tx.us/business/aviation/system_plan.htm

[88] TxDOT, 2010 TASP, Available at http://www.dot.state.tx.us/business/aviation/system_plan.htm

Figure 2-46: General Aviation Airports Historic and Forecast Aircraft Operations – Trends[89]



* TASP only includes forecasts to 2025 and excludes 2008 and 2009

\# Includes: multi-engine, turboprop, turbojet, and rotary aircraft

The forecast of Texas GA aircraft operations shows a net decrease of 50,742 from 2000 to 2025. This equates to total growth of over 1 percent. However, this decrease is due to declines in single-engine aircraft. For other types of aircraft (which include multi-engine, turboprop, turbojet, and rotary aircraft) operations are forecasted to increase by 547,973 from 2000 to 2025 for an increase of over 50 percent.

2.12 Texas Freight Demand

The movement of freight to, from, and within the state is integral to Texas' economy. This movement brings food and goods to the state's population, as well as supporting the movement of raw materials (for example crude oil) and refined materials (for example gasoline) to the nation and world. As shown in Table 2-31 and Figure 2-47, according to FHWA's Freight Analysis Framework[2] database (FAF[2]), in 2008[90] the total amount of freight shipped to, from, and within Texas was greater than 2.389 billion tons with a combined value of greater than $1.742 trillion. By 2035, the total tons and value

[89] Ibid

[90] Note: The historic base year for FAF[2] is 2002. Freight data for 2008 presented in this section is an estimate prepared by FHWA. The methodology for this estimate can be found at: http://ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2provisional_2008/rpt/chap2.htm#23

of goods shipped by freight is expected to increase by approximately 82 percent and 166 percent, respectively. It should be noted that each mode presented in Table 2-29 represents the mode used prior to the good arriving at a destination and not all legs of the movement.

Table 2-31: Texas Freight Summary by Mode, 2008–2035[91]

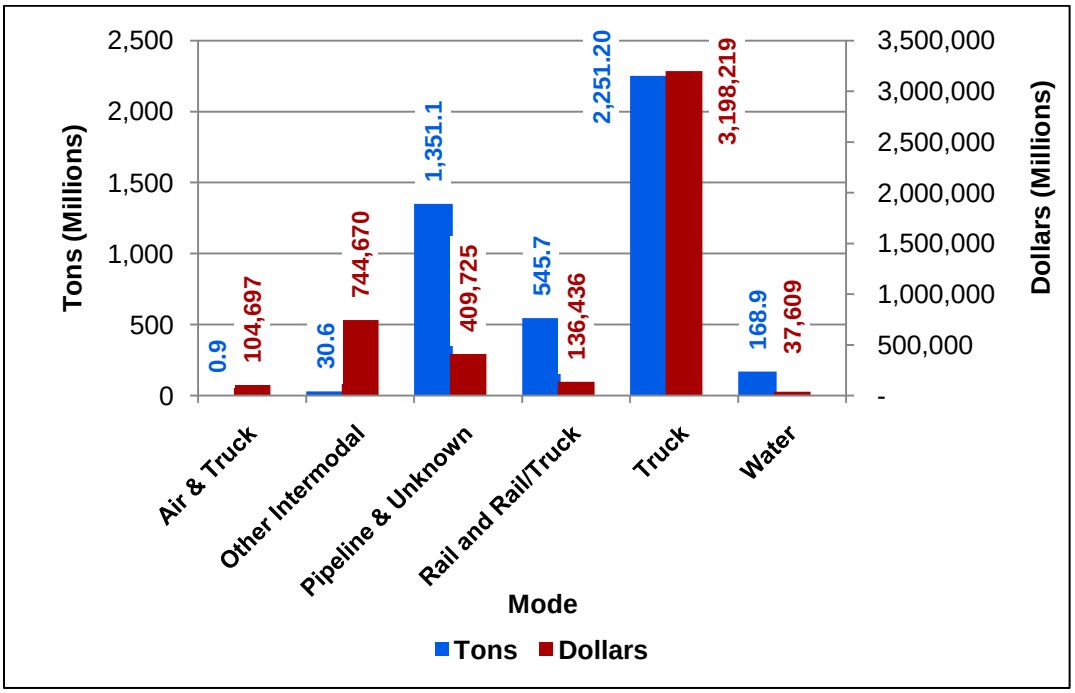
Mode	2008#	% of Total	2035	% of Total	% Change
Tons (millions)					
Air, Air & Truck	0.8	0.03	0.9	0.02	**12.50**
Other Intermodal	11.2	0.47	30.6	0.70	**173.21**
Pipeline & Unknown*	796.2	33.31	1,351.1	31.08	**69.69**
Rail and Rail/Truck	307.7	12.88	545.7	12.55	**77.35**
Truck	1,177.3	49.27	2,251.20	51.77	**91.22**
Water	96.5	4.04	168.9	3.88	**75.03**
Total	**2,389.7**	**100.00**	**4,348.4**	**100.00**	**81.96**
Dollars# (millions)					
Air, Air & Truck	73,102	4.19	104,697	2.25	**43.22**
Other Intermodal	85,816	4.93	744,670	16.07	**767.75**
Pipeline & Unknown*	318,339	18.26	409,725	8.86	**28.71**
Rail and Rail/Truck	96,605	5.54	136,436	2.95	**41.23**
Truck	1,157,575	66.43	3,198,219	69.06	**176.29**
Water	11,197	0.63	37,609	0.81	**235.88**
Total	**1,742,634**	**100.00**	**4,631,356**	**100.00**	**165.77**

*FHWA, regarding Pipeline and Unknown Shipments: "Pipeline and unknown shipments are combined because data on region-to-region flows by pipeline are statistically uncertain."

#2002 Dollars (based on the earliest reported FAF^2 year, which is 2002)

[91] FAF^2 Commodity Origin-Destination Data: 2002–2035; Available at http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_com.htm; and Provisional Annual Commodity Origin-Destination Data – 2008 available at http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_pro.htm

Figure 2-47: Forecast 2035 - Texas Freight by Mode, Tons and Dollars[92]



2.12.1 Texas Forecast Truck Freight Demand

Trucks will play an increasingly dominant role in the movement of freight to, from, and within Texas. As shown in Table 2-32, according to statistics published as part of the FHWA's FAF[2], it is expected that from 2008 to 2035 the value of goods shipped by truck within, from, and to the state will grow by 176 percent. By 2035 the weight of all freight originating in the state shipped by trucks will increase to 49 percent and similarly the weight of all freight destined to the state shipped by trucks will increase to 36 percent. By value in 2035, trucks are expected to handle 80, 63, and 63 percent of goods moved within, from, and to Texas, respectively. This equates to approximately 2.251 billion tons of goods with a combined value of more than $3.198 trillion.

[92] FAF[2] Commodity Origin-Destination Data: 2002–2035; Available at http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_com.htm; and Provisional Annual Commodity Origin-Destination Data – 2008 available at http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_pro.htm

Table 2-32: Truck Tons/Dollars Within, From, To State, 2008–2035[93]

Year	Summary (Millions)	Within State	From State	To State	Total
Tons (millions)					
2008	Trucks Alone	843	167	168	1,177
	All Other Modes*	613	243	356	1,212
	Total	**1,456**	**410**	**524**	**2,390**
	Trucks Alone % of Total	**58**	**41**	**32**	**49**
2035	Trucks Alone	1,538	361	352	2,251
	All Other Modes*	1,104	378	615	2,097
	Total	**2,641**	**740**	**967**	**4,348**
	Trucks Alone % of Total	**58**	**49**	**36**	**52**
Dollars (millions)					
2008	Trucks Alone	562,946	254,504	340,126	1,157,575
	All Other Modes*	194,820	190,900	199,339	585,060
	Total	**757,766**	**445,404**	**539,465**	**1,742,635**
	Trucks Alone % of Total	**74**	**57**	**63**	**66**
2035	Trucks Alone	1,275,690	1,092,220	830,309	3,198,219
	All Other Modes*	314,491	638,104	480,542	1,433,137
	Total	**1,590,181**	**1,730,324**	**1,310,851**	**4,631,356**
	Trucks Alone % of Total	**80**	**63**	**63**	**69**
Trucks % Change 2008–2035 Tons		**82**	**117**	**110**	**91**
Trucks % Change 2008–2035 Dollars		**127**	**329**	**144**	**176**

*Note: Includes Multi-Modal Truck Movements

#2002 Dollars (based on the earliest reported FAF[2] year, which is 2002)

As shown in Table 2-33, in 2035 trucks will remain a vital component in the shipment of most goods. Similarly to 2008, in terms of gross tonnage, by 2035 trucks are expected to carry the majority for most commodities with the exception of raw materials and chemical/petroleum commodities. Additionally, in terms of dollars, in 2035 trucks are expected to carry the majority for all commodities except for raw materials.

[93] FAF[2] Commodity Origin-Destination Data: 2002–2035; Available at http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_com.htm; and Provisional Annual Commodity Origin-Destination Data – 2008 available at http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_pro.htm

Table 2-33: Truck Tons/Dollars by Commodity, 2035[94]

Commodity Group	Tons (Millions)				Dollars (Millions)[#]			
	Trucks	All Other Modes*	Total	Trucks % of Total	Trucks	All Other Modes*	Total	Trucks % of Total
Raw Materials	384	1,251	**1,635**	**23**	50,977	223,035	**274,012**	**19**
Chemicals/ Petroleum	385	586	**971**	**40**	394,134	224,004	**618,139**	**64**
Building Materials	247	43	**289**	**85**	99,728	19,925	**119,653**	**83**
Food	247	116	**363**	**68**	160,397	18,454	**178,851**	**90**
Miscellaneous Mixed	359	10	**369**	**97**	527,027	120,448	**647,475**	**81**
Agriculture	96	8	**104**	**93**	45,472	2,950	**48,422**	**94**
Wood	71	14	**86**	**83**	102,961	11,814	**114,776**	**90**
Machinery	332	24	**356**	**93**	1,648,427	751,751	**2,400,178**	**69**
Other/ Unclassified Cargo	96	13	**110**	**88**	77,140	29,980	**107,120**	**72**
Textiles	34	33	**66**	**51**	91,954	30,775	**122,730**	**75**
Total	**2,251**	**2,097**	**4,348**	**52**	**3,198,219**	**1,433,137**	**4,631,356**	**69**

[#]2002 Dollars (based on the earliest reported FAF[2] year, which is 2002)

2.13 The Texas Freight Rail System

Note: Detailed Information regarding the freight rail system in Texas can be found in the Draft Texas Rail Plan available at http://www.txdot.gov/public_involvement/rail_plan/trp.htm

According to the Association of American Railroads (AAR), 44 railroads operate more 10,743 miles of track in Texas.[95] These railroads employ more than 17,000 people in the state, and in 2008,[96] 384.4 million tons of freight originated, terminated, or passed through Texas.

[94] FAF[2] Commodity Origin-Destination Data: 2002–2035; Available at http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_com.htm; and Provisional Annual Commodity Origin-Destination Data – 2008 available at http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_pro.htm

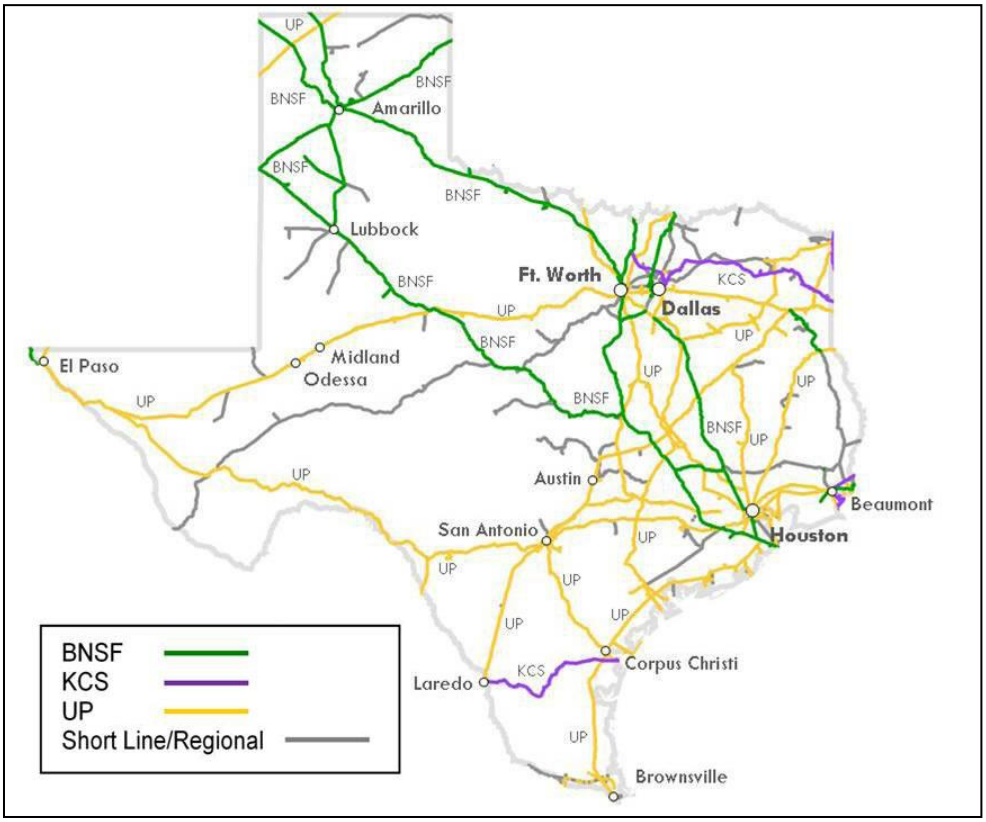
[95] "Freight Railroads in Texas: 2008," Association of American Railroads, 2008. Available at http://www.aar.org/~/media/AAR/InCongress_RailroadsStates/Texas.ashx

[96] Note: The historic base year for FAF[2] is 2002. Freight data for 2008 presented in this section is an estimate prepared by FHWA. The methodology for this estimate can be found at: http://ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2provisional_2008/rpt/chap2.htm#23

Three Class I railroads,[97] the BNSF, Kansas City Southern (KCF), and Union Pacific (UPRR) account for the majority of rail miles in the state. Additionally there are 2 regional railroads, Texas Northeastern Railroad and Texas Pacifico, and 39 local, switching, and terminal railroads in Texas.

Figure 2-48 illustrates the railroad mileage and locations within Texas.

Figure 2-48: The Texas Freight Rail Network



Short lines often serve a single customer or a small set of customers and haul a very limited set of commodities. Farm products and aggregate are among the most popular commodities moved by short line railroads. Current estimates suggest that as much as 90 percent of all short line moves involve an interchange with a Class I railroad.

The freight rail system is used predominantly to haul low-value, high-volume commodities over long distances. Energy products, aggregates, and chemicals are popular rail commodities, partly due to their high-volume/low-value in combination with

[97] Class I Railroad – A railroad with 2008 operating revenues of at least $401.4 million. Regional Railroad – A non-Class I line-haul railroad operating 350 or more miles of road and/or with revenues of at least $40 million. Local Railroad – A railroad which is neither a Class I nor a Regional Railroad and is engaged primarily in line-haul service. Switching & Terminal Railroad – A non-Class I railroad engaged primarily in switching and/or terminal services for other railroads. Railroads operating are as of December 31, 2008. Some mileage figures may be estimated.

delivery schedules that do not require precise delivery schedules. Additionally, intermodal freight rail is popular among shippers of bulk, nonperishable consumer goods. Containerized goods imported from the Asia-Pacific region pass through ports on the West Coast of the U.S., are placed on trains and moved eastward. These containers are often then placed on trucks for movement to deconsolidation facilities, where individual shipments are separated and reloaded into trucks for delivery to retail outlets throughout the state.

The Railroad Division within TxDOT maintains responsibility to inspect the network for safety compliance. According to the Rail Division's website, its responsibilities are:

> "…to improve highway-rail grade crossings by partnering with railroads to install and maintain crossing signals and gates, improve crossing surfaces on state highways and consolidate crossings where possible. The division has the authority to implement rail improvements by entering into public-private partnership agreements to provide investments in freight rail relocation projects, rail facility improvements, rail line consolidations or new passenger rail developments. The division participates in the state rail safety participation program in conjunction with the Federal Railroad Administration. State rail safety inspectors coordinate investigative activities with federal authorities in the areas of hazardous materials, motive power and equipment, operating practices, signal and train control and track structures."

2.13.1 Freight Rail Issues

The Texas Rail Plan indicates that between 1953 and 2005 Texas lost approximately 39 percent of its total track miles.[98] The plan highlights these critical issues:[99]

- **Freight Bottlenecks** – Rail operational bottlenecks, such as Tower 55 in Fort Worth, are hindering efficient movement of freight and passenger trains resulting in heavy congestion that slows commerce.
- **Grade Crossings** – Safety at rail grade crossings is major concern for the Houston greater area and several crossings have been identified as being "hot spots" for auto-train collisions. Conflicts between trains and trucks at grade crossing on the railroad mainlines are creating further reductions in mobility of trucks that serve the Port of Brownsville. The ports of Texas City and Lavaca also have significant grade crossing issues.

[98] "Draft Texas Rail Plan" TxDOT, 2010. Available at http://www.txdot.gov/public_involvement/rail_plan/trp.htm

[99] "Draft Texas Rail Plan" TxDOT, 2010, Pages 3-43,3-60, and 3-61, Available at http://www.txdot.gov/public_involvement/rail_plan/trp.htm

- **Rail Yard Capacity** – Increasing amounts of freight are straining capacity at rail yards in many parts of the state. For instance, over 95 percent of all freight trains moving in the Houston region must stop to pick up or drop off cars. Yard capacity is also a concern at the Union Pacific railroad interchange yard at the Port of Beaumont.
- **Border Rail Operational Issues** – Limited rail infrastructure and community impacts at border crossings have contributed to delays in crossing trains between the U.S. and Mexico.
- **Sidings** – Longer and heavier trains also are being used by the railroads to maximize existing capacity and improve efficiency. For example, the BNSF prefers that all their international intermodal shipments be handled in 40-foot well cars and all their inter-modal trains are 8,000 feet in length.

2.13.2 Freight Rail Usage Trends in Texas

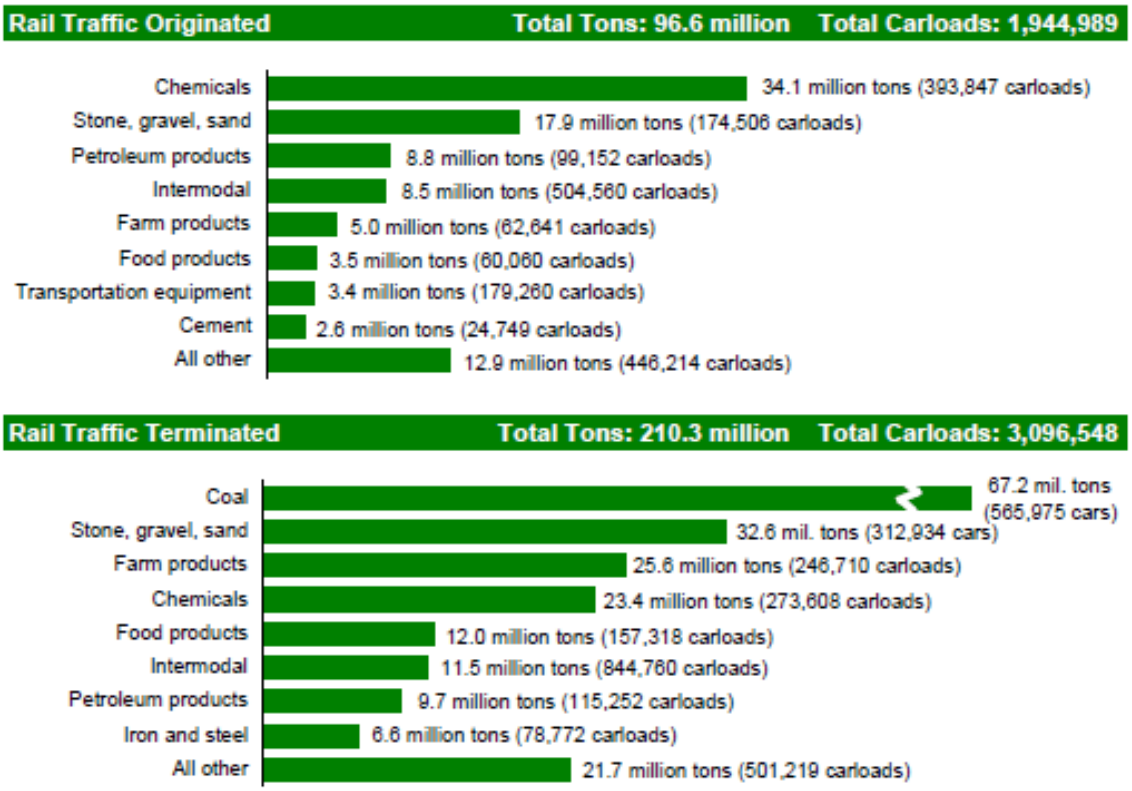
The 2007 Commodity Flow Survey (CFS) conducted by the U.S. Census Bureau shows increases in key indicators regarding the use of freight rail within the state since the 2002 CFS. According to the CFS the overall value of goods shipped by rail from the State more than doubled during the 5-year span to more than $76 billion. During the same period, the weight of goods increased by 5 percent to 153 million tons, and the average length of haul via railroad decreased by 5 percent, as well, to 724 miles. Rail handles 11.4 percent of the weight and 6.5 percent of the value of goods originating in Texas. These figures do not include shipments where rail was one component of an intermodal move. With the inclusion of intermodal movements (truck and rail, rail and water), the total weight of goods shipped by rail originating in Texas climbs to 185 million tons.[100]

These figures differ somewhat from those compiled by the AAR for 2008. According to the AAR, a total of 384.4 million tons of freight originated, terminated, or passed through Texas. Of this total, 96.6 million tons of goods originated in Texas, while another 210 million tons terminated in the state. Because these datasets originate from different sources, it is not recommended that they be compared directly to assess yearly changes from 2007 to 2008.

The AAR also offers statistics regarding the commodities moved by rail. Figure 2-49 shows these data.

[100] U.S. Census, Commodity Flow Survey, 2007, Texas, Available at: http://www.bts.gov/publications/commodity_flow_survey/2007/states/texas/index.html

Figure 2-49: 2008 Rail Movement Commodity Summary[101]



According to data compiled by the Texas Center for Border Economic and Enterprise Development (Table 2-34), rail border crossings into Texas from Mexico and out of Texas into Mexico decreased significantly from 2008 to 2009. These figures, which are illustrated in the tables below, reflect the effects of the global economic downturn.

Table 2-34: Annual Rail Crossings, 2008–2009[102]

Gateway	Northbound		North-bound Total	Southbound		South-bound Total
	2008	2009		2008	2009	
Brownsville	80,147	36,134	116,281	72,609	40,981	113,590
Eagle Pass	137,693	145,527	283,220	131,773	144,284	276,057
El Paso	168,361	102,240	270,601	-	-	-
Laredo	257,875	202,862	460,737	263,048	200,720	463,768
Total	644,076	486,763	1,130,839	467,430	385,985	853,415

101 "Freight Railroads in Texas: 2008," Association of American Railroads, 2008. Available at http://www.aar.org/~/media/AAR/InCongress_RailroadsStates/Texas.ashx

102 Texas Center for Border Economic and Enterprise Development, Border Trade Data, Rail Crossings, Available at http://texascenter.tamiu.edu/texcen_services/rail_crossings.asp?framepg=datarail

2.13.3 Texas Forecast Freight Rail Demand

As shown in Table 2-35, according to statistics published as part of the FHWA's FAF[2], it is expected that from 2008 to 2035 the value of goods shipped by rail within, from, and to the state will grow by 77 percent. By value in 2035, rail is expected to decrease from 2008 and handle only 1, 3, and 6 percent of the value of goods moved within, from, and to Texas, respectively. This equates to approximately 546 million tons of goods with a combined value of more than $136 billion (as shown in Table 2-35).

Table 2-35: Rail and Rail/Truck Tons/Dollars Within, From, To State, 2008–2035[103]

Year	Summary (Millions)	Within State	From State	To State	Total
Tons (Millions)					
2008	Rail and Rail/Truck	113	59	136	308
	All Other Modes*	1,342	351	388	2,082
	Total	**1,456**	**410**	**524**	**2,390**
	Rail and Rail/Truck % of Total	**8**	**14**	**26**	**13**
2035	Rail and Rail/Truck	194	86	266	546
	All Other Modes*	2,448	653	702	3,803
	Total	2,641	740	967	4,348
	Rail and Rail/Truck % of Total	**7**	**12**	**27**	**13**
Dollars (Millions)*					
2008	Rail and Rail/Truck	18,597	39,751	38,257	96,605
	All Other Modes*	739,169	405,653	501,208	1,646,029
	Total	**757,766**	**445,404**	**539,465**	**1,742,635**
	Rail and Rail/Truck % of Total	**2**	**9**	**7**	**6**
2035	Rail and Rail/Truck	17,947	44,152	74,337	136,436
	All Other Modes*	1,572,234	1,686,171	1,236,514	4,494,920
	Total	1,590,181	1,730,324	1,310,851	4,631,356
	Rail and Rail/Truck % of Total	**1**	**3**	**6**	**3**
Rail and Rail/Truck % Change Tons		**71**	**47**	**96**	**77**
Rail and Rail/Truck % Change Dollars		**–3**	**11**	**94**	**41**

*2002 Dollars (based on the earliest reported FAF[2] year, which is 2002)

As shown in Table 2-36, rail, in comparison to all other modes, will continue to play a lesser role in the shipment of most goods in terms of both tonnage and value.

[103] FAF[2] Commodity Origin-Destination Data: 2002–2035; Available at http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_com.htm; and Provisional Annual Commodity Origin-Destination Data – 2008 available at http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_pro.htm

Table 2-36: Rail and Rail/Truck Tons/Dollars by Commodity 2035[104]

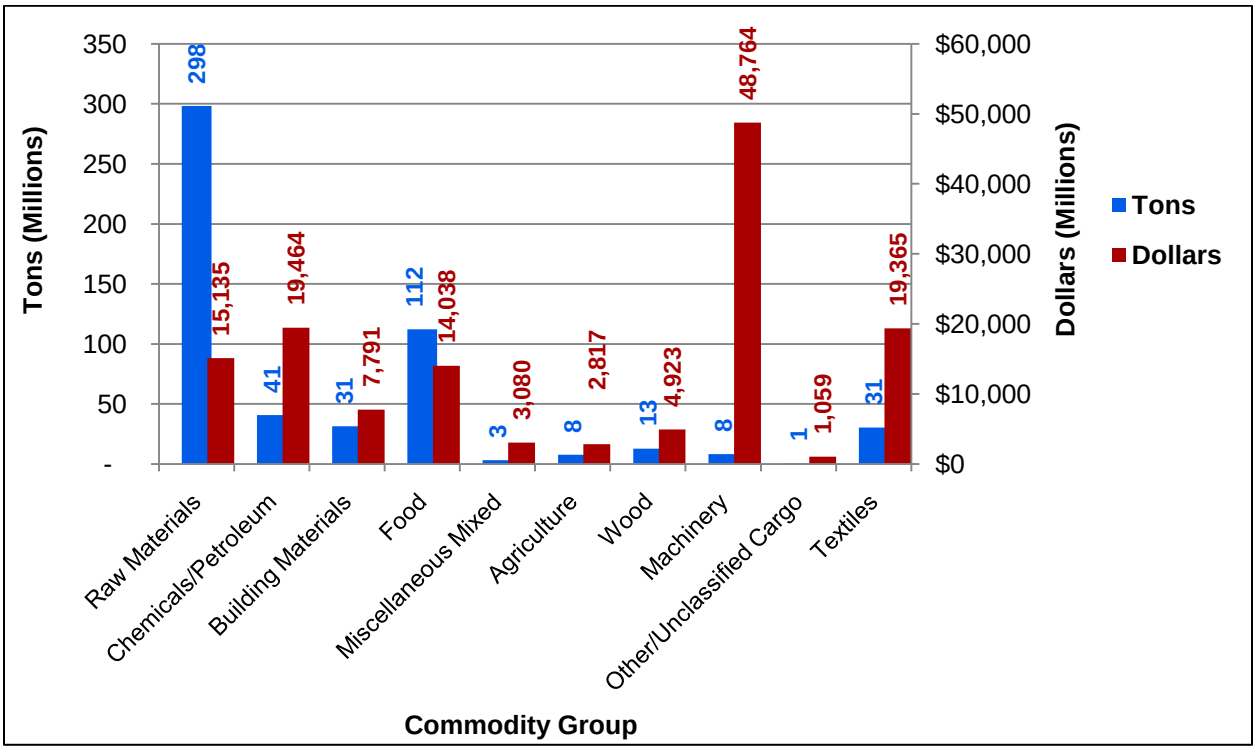
Commodity Group	Tons (Millions)				Dollars (Millions)*			
	Rail	All Other Modes	Total	Rail % of Commodity	Rail	All Other Modes	Total	Rail % of Commodity
Raw Materials	298	1,336	**1,635**	**18**	15,135	258,878	**274,012**	**6**
Chemicals/ Petroleum	41	930	**971**	**4**	19,464	598,675	**618,139**	**3**
Building Materials	31	258	**289**	**11**	7,791	111,862	**119,653**	**7**
Food	112	251	**363**	**31**	14,038	164,813	**178,851**	**8**
Miscellaneous Mixed	3	366	**369**	**1**	3,080	644,395	**647,475**	**<1**
Agriculture	8	96	**104**	**7**	2,817	45,605	**48,422**	**6**
Wood	13	73	**86**	**15**	4,923	109,852	**114,776**	**4**
Machinery	8	348	**356**	**2**	48,764	2,351,414	**2,400,178**	**2**
Other/ Unclassified Cargo	<1	109	**110**	**<1**	1,059	106,061	**107,120**	**1**
Textiles	31	36	**66**	**46**	19,365	103,365	**122,730**	**16**
Total	**546**	**3,803**	**4,348**	**13**	**136,436**	**4,494,920**	**4,631,356**	**3**

*2002 Dollars (based on the earliest reported FAF[2] year, which is 2002)

Figure 2-50 illustrates 2035 expected rail commodity shipments by tons and dollars. It is expected that for 2035 the value of goods per ton shipped by rail will decrease for most commodities with the exception of agriculture good, miscellaneous mixed goods, and machinery.

[104] FAF[2] Commodity Origin-Destination Data: 2002–2035; Available at http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_com.htm; and Provisional Annual Commodity Origin-Destination Data – 2008 available at http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_pro.htm

Figure 2-50: Rail and Rail/Truck Shipments by Commodity, 2035[105]



2.14 Texas Ports and Waterways

The ports and waterway system is an important component of the State of Texas' transportation system. The state has 270 miles of deep draft channels along with 12 deep draft public ports. There are also 750 miles of shallow draft channels and over 14 shallow draft public ports. Counting public and private facilities, Texas has more than 970 wharves, piers, and docks handling waterborne freight. In 2008, over 470 million tons of commodities moved through these channels. Employing over 1 million Texans, the ports contribute over $135 billion annually to the economy and generate approximately $5 billion in local and state tax revenues.[106] TxDOT recently estimated that Texas waterways are expected to move over 766 million tons by 2030 an increase of 293 million tons over 2008.[107]

Detailed statistics are collected for each of the deep draft ports. Data collected includes tonnage, vessel sailings, containers (measured in 20-foot Equivalent Unit [TEUs]),

[105] FAF[2] Commodity Origin-Destination Data: 2002–2035; Available at http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_com.htm; and Provisional Annual Commodity Origin-Destination Data – 2008 available at http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_pro.htm

[106] TxDOT, Texas Ports 2010 – 2011 Capital Program, http://www.dot.state.tx.us/travel/marine.htm

[107] Texas Ports 2009–2010 Capital Program, Texas Department of Transportation, p.2. The data cited in the report was from 2006 and does not reflect the recent recession which will have an impact on future forecasts.

commodities, imports, and exports. A TEU (or more commonly a shipping container) is equivalent to an 8-foot by 8-foot by 20-foot intermodal container and is used as a basic unit to measure the volume of containerized cargo. The data is collected by the port, U.S. Customs, Department of Commerce, the U.S. Army Corps of Engineers (USACE) Navigation Data Center, and various private data sources. These statistics have been historically used to forecast traffic changes through the ports. In addition, many ports have commissioned economic impact studies for their port and these often contain projections.

During the last decade, the national transportation system has experienced bottlenecks, congestion, and capacity problems resulting in delay and higher shipping costs. As the U.S. global outsourcing to Asia grew, the West Coast ports became dominant. However, in recent years, shippers have shifted and spread out deliveries to other ports and Texas ports have been the beneficiaries of some of this shift. Cargo through the Panama Canal from the Pacific has also grown over the last several years.

2.14.1 Ports Inventory

Texas has more than 1,000 port facilities on 1,000 miles of channel maintained by the Corps of Engineers. Of these, 21 ports can be considered major and are listed in Table 2-37 and ports, waterways, and channels are illustrated on Figure 2-51.

Table 2-37: Listing of Texas Ports, 2008

Common Name	Official Name	Deep/Barge/ Fishing	2006 Tonnage	Org. Type
1. Port of Anahuac	Chambers-Liberty Counties Navigation District	Barge	Anahuac: None Double Bayou: 36,000 Trinity River: None	Nav. Dist.
2. Aransas/Rockport/ Fulton/Cove	Aransas County Navigation District No. 1	Fishing	N/A	Nav. Dist.
3. Port of Bay City	Port of Bay City Authority	Barge	494,000	Nav. Dist.
4. Port of Beaumont	Port of Beaumont Navigation District of Jefferson County	Deep	79,486,000	Nav. Dist.
5. Port of Brownsville	Brownsville Navigation District	Deep	5,309,000	Nav. Dist.
6. Cedar Bayou	Cedar Bayou Navigation District	Barge	1,054,000	Nav. Dist.
7. Port of Corpus Christi	Port of Corpus Christi Authority of Nueces County, Texas	Deep	77,557,000	Nav. Dist.
8. Port Freeport	Port Freeport	Deep	32,147,000	Nav. Dist.
9. Port of Galveston	Board of Trustees of the Galveston Wharves	Deep	9,357,000	Municipal Utility
10. Port of Harlingen	Port of Harlingen Authority	Barge	349,000	Nav. Dist.
11. Port of Houston	Port of Houston Authority	Deep	222,147,000	Nav. Dist.
12. Port of Orange	Orange County Navigation and Port District	Deep	718,000	Nav. Dist.
13. Port of Palacios	Matagorda County Navigation District No. 1	Fishing	N/A	Nav. Dist.
14. Port of Port Arthur	Port of Port Arthur Navigation District	Deep	28,403,000	Nav. Dist.
15. Port of Port Isabel	Port Isabel-San Benito Navigation District	Deep	1,000	Nav. Dist.
16. Port of Port Lavaca	Calhoun Port Authority	Deep	10,808,000	Nav. Dist.
17. Port Mansfield	Willacy County Navigation District	Fishing	N/A	Nav. Dist.
18. Port of Sabine Pass	Sabine Pass Port Authority	Deep/Fishing	902,000	??
19. Port of Texas City	Texas City Terminal Railway Company	Deep	48,875,000	Private
20. Port of Victoria	Victoria County Navigation District	Barge	3,556,000	Nav. Dist.
21. Port of West Calhoun	West Side Calhoun County Navigation District	Barge	Included in Victoria	Nav. Dist.

Figure 2-51: Ports, Waterways, and Navigation Channels along the Texas Gulf Coast

As shown in Table 2-38 and Table 2-39, in 2009, the Port of Houston ranked second in the nation in terms of tonnage and seventh in the nation in terms of TEUs.

Table 2-38: Texas Ports Tonnage Shipped 2008[108]

U.S. Rank	Port Name	Domestic	Foreign Imports	Foreign Exports	Foreign Total	Total
2	Houston, Texas	65,808,295	92,018,956	54,380,670	146,399,626	212,207,921
5	Corpus Christi, Texas	21,430,962	43,373,738	11,981,473	55,355,211	76,786,173
7	Beaumont, Texas	22,687,915	41,167,853	5,627,771	46,795,624	69,483,539
13	Texas City, Texas	13,895,595	33,926,630	4,783,805	38,710,435	52,606,030
25	Port Arthur, Texas	10,004,521	14,834,711	6,913,510	21,748,221	31,752,742
26	Freeport, Texas	4,135,091	22,971,011	2,736,193	25,707,204	29,842,295
52	Matagorda-Port Lavaca-Port Comfort, Texas	1,873,129	6,953,796	1,490,689	8,444,485	10,317,614
54	Galveston, Texas	4,199,979	1,825,635	3,755,754	5,581,389	9,781,368
76	Brownsville, Texas	1,843,662	3,541,172	284,611	3,825,783	5,669,445
94	Victoria, Texas	2,861,933	0	0	0	2,861,933
136	Sabine Pass, Texas	1,214,023	290	0	290	1,214,313

Table 2-39: Top 20 U.S. Container Ports[109]

2005–2009 (in TEUs)						
Ranking	Ports	2005	2006	2007	2008	2009
1	Los Angeles	4,867,073	5,743,400	5,740,261	5,670,897	5,028,998
2	Long Beach	4,395,942	4,798,617	4,994,949	4,611,671	3,765,560
3	New York	3,390,308	3,678,247	3,935,262	3,992,258	3,587,740
4	Savannah	1,482,728	1,609,131	2,041,521	2,115,986	1,914,751
5	Oakland	1,372,231	1,414,782	1,451,326	1,394,684	1,398,420
6	Norfolk	1,318,831	1,424,993	1,573,273	1,591,566	1,375,632
7	Houston	1,231,186	1,295,366	1,415,657	1,370,759	1,256,049

[108] U.S. Army Corps of Engineers, Navigation Data Center, 2008 Waterborne Commerce of the United States (WCUS) Waterways and Harbors, Available at: http://www.ndc.iwr.usace.army.mil/publications.htm

[109] Journal of Commerce PIERS — Port Import/Export Reporting Service. Note: Ranking based on 2009 reported TEU counts.

Table 2-39: Top 20 U.S. Container Ports[109]

2005–2009 (in TEUs)						
Ranking	**Ports**	**2005**	**2006**	**2007**	**2008**	**2009**
8	Seattle	1,339,641	1,222,596	1,289,364	1,082,573	1,072,838
9	Charleston, SC	1,511,935	1,517,311	1,408,434	1,330,919	954,836
10	Tacoma	1,154,350	1,095,896	1,150,590	1,129,301	873,708
11	Miami	770,839	748,130	684,793	669,199	625,716
12	Port Everglades	580,179	639,481	691,645	680,536	543,387
13	Baltimore	380,574	409,526	427,902	435,135	405,552
14	New Orleans	174,072	177,487	254,782	239,792	229,869
15	San Juan	213,570	241,993	208,265	222,739	222.033
16	Jacksonville	144,635	153,009	151,110	158,119	197,656
17	Wilmington, NC	127,269	127,269	150,147	147,443	187,955
18	Philadelphia	158,706	176,901	196,827	218,618	180,091
19	Wilmington, DE	161,645	170,453	185,231	182,833	162,757
20	Gulfport	150,205	162,551	171,835	172,607	158,636
Top 20 U.S. Ports – Total		**24,925,919**	**26,807,139**	**28,123,174**	**27,417,635**	**23,920,373**
All U.S. Ports – Total		***26,444,652***	***28,555,590***	***29,306,922***	***28,532,629***	***28,532,629***

2.14.2 Cruise Ships

The Port of Galveston is the main cruise ship terminal in Texas. With the opening of the Bayport terminal in 2007, the Port of Houston added additional infrastructure to attract cruise ships to the Texas Gulf Coast. The cruise industry associations as well as the ports have passenger and sailing statistics, which can be used for forecasting. This industry has already modified its outlook and forecasts to account for the recession and its lingering impacts. Included in the forecast considerations will be ships currently under construction and planned for deployment in the U.S. market.

2.14.3 Military Traffic and Texas Ports

Texas ports have become a critical component in sustaining military operations. In terms of tonnage shipped, the Port of Beaumont is the largest military port in the U.S. and second largest in the world.[110] Significant infrastructure investments have been made in recent years and some are ongoing to improve the channel and the inland infrastructure connections to the port. Forecasting this element presents some

[110] Port of Beaumont

challenges since the military does not release shipment information and need will depend on the U.S. military presence or involvement on foreign soil.

2.14.4 Potential Effects of the Panama Canal Expansion

The opening of the expanded Panama Canal will allow larger, deeper draft vessels to access the Gulf of Mexico via the Caribbean Sea from the Pacific Ocean, which may affect Texas ports. The Panama Canal expansion project, started in 2007, is building locks on both sides of the 50-mile canal, digging a new channel linking the locks and deepening the waterway connecting the Pacific Ocean with the Caribbean Sea. As of 2010, ships loading fewer than five thousand 20-foot boxes use the canal. The expansion will accommodate vessels carrying about 12,600 containers and may generate cargo growth of about 5 percent a year.

Houston does not have a deep enough draft to handle some of these ships, but the port is pursuing funding and developing plans to deepen its draft.[111] Some analysts have predicted that about 20 percent of cargo ships now serving West Coast ports could divert to Houston once the Panama Canal is widened to handle a new breed of container vessel known as post-Panamax ships.

Once completed, the Panama Canal will have significant impacts on shipping routes, port development, and cargo distribution to the U.S. More ships are expected to shift to east and gulf coast ports from the congested west coast ports. Container trade is expected to be the single largest gainer. Houston already has 73 percent of the container market in the Gulf of Mexico, and 94 percent of the container market in Texas. About 14 percent of container traffic handled by the Port of Houston comes through the Panama Canal, a percentage that port officials say could grow to about 25 percent by 2020.[112] A 2006 TxDOT study said the impact of the Panama Canal expansion "will be felt most heavily on and around the Port of Houston, the state's largest container port and a key trading partner for goods shipped via the Panama Canal."[113]

Historically, dry and liquid bulk cargo have generated most of the Panama Canal's revenues. Bulk cargo includes dry goods, such as grains (corn, soy, and wheat, among others), minerals, fertilizers, coal, and liquid goods, such as chemical products, propane gas, crude oil, and oil derivatives. Recently, containerized cargo has replaced dry bulk cargo as the Panama Canal's main income generator, moving it to second place. Texas

[111] Port of Houston Authority, June, July 2010 Magazine

[112] "Houston eyes Asia trade as Panama Canal expands," Reuters on-line article, December 14, 2009, http://www.reuters.com/article/idUSN1016913920091214.

[113] Effects of the Panama Canal Expansion on Texas Ports and Highway Corridors," Cambridge Systematics, October 2006, www.camsys.com/pubs/freight_Panama%20Canal_ExecSum.pdf

ports handle much of the bulk goods entering the U.S., as well as most of the containerized cargo that does not flow through the west coast ports. The growth in Panama Canal usage over the past few years has been almost entirely driven by increased U.S. imports from China passing through the canal en route to ports on the U.S. east and Gulf coasts. However, it is increasingly recognized in both the United States and China that this imbalance in trade is unsustainable, so some of the more optimistic growth estimates should probably be trimmed back. The Panama Canal forecasts its growth at about 3 percent annually, doubling its tonnage between 2005 and 2025.[114] Approximately 70 percent of the canal's $100 billion containerized cargo is either destined to or coming from the United States. As the result of congestion at west coast ports and other inland bottlenecks, shippers have moved their shipments to alternative ports. This has resulted in the Panama Canal gaining significant market share, now handling over 40 percent of container traffic headed to the east coast.[115]

One of the most significant shifts resulting from the Panama Canal expansion is the introduction of even larger ships into the Gulf and east coast shipping lanes. The new generation of containerships, including many of the post-Panamax ships that will be attracted to the expanded Panama Canal, typically require channel depths of at least 50 feet, particularly for fully loaded vessels. Few Texas ports currently have the ability to handle ships of that depth. Although at 45 feet, the Port of Houston will have one of the deeper channels among Gulf Coast ports, it will still lag behind several of its major east coast competitors. The Port of Houston is spending about $1.2 billion to expand its Bayport Container Terminal to enable it to handle about 1.4 million containers per year.[116] The port is buying giant cranes capable of unloading post-Panamax cargo ships, which can carry up to 12,600 containers, almost three times the current number.[117] The Port predicts that its container volume will increase 11 percent a year for the next 5 years as a result of the larger, more efficient ships coming through the Panama Canal.[118] Since many Gulf and east coast ports do not have deep enough drafts for the post–Panamax ships, it will be necessary to build transshipment facilities to break up the cargoes from the larger ships to smaller ships that can be accommodated. One such scenario is an initial stop in a Mexican port that does have sufficient draft and then on to Houston, which is the closest major port.

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[114] "Proposal for the expansion of the Panama Canal," Panama Canal Authority, April 24, 2006 http://www.pancanal.com/eng/plan/

[115] "The Implications of Panama Canal Expansion to U.S. Ports and Coastal Navigation Economic Analysis," U.S. Army Corps of Engineers White Paper, December 2008. http://www.iwr.usace.army.mil/docs/iwrreports/WhitePaperPanamaCanal.pdf

[116] Ibid, Cambridge Systematics Study

[117] Port of Houston Authority, June, July 2010 Newsletter

[118] "The Gulf Coast's Rising Tide," Inbound Logistics, January 2009. Quote attributed to Jeff Moseley, president and CEO of the Greater Houston Partnership http://www.inboundlogistics.com/articles/features/0109_feature07.shtml

2.14.5 The Gulf Intracoastal Waterway

The primary shallow draft waterway in Texas is the Gulf Intracoastal Waterway (GIWW) (Figure 2-52), which stretches from Brownsville, on the Mexican border to the Louisiana state line at the Sabine River. There are two navigation locks on the Texas reach of the GIWW. The entire GIWW is a 1,300-mile-long man-made canal that runs along the Gulf of Mexico coastline from Texas' southernmost tip at Brownsville to St. Marks, Florida. The Texas portion of the waterway is 423 miles long. The GIWW is the nation's third busiest waterway with the Texas portion handling more than 58 percent of its traffic. The GIWW requires regular dredging to maintain the waterway at optimum levels and allow navigation without grounding for fully loaded commercial vessels. TxDOT, as the non-federal sponsor, works cooperatively with the USACE to plan, maintain, research, and improve the waterway.

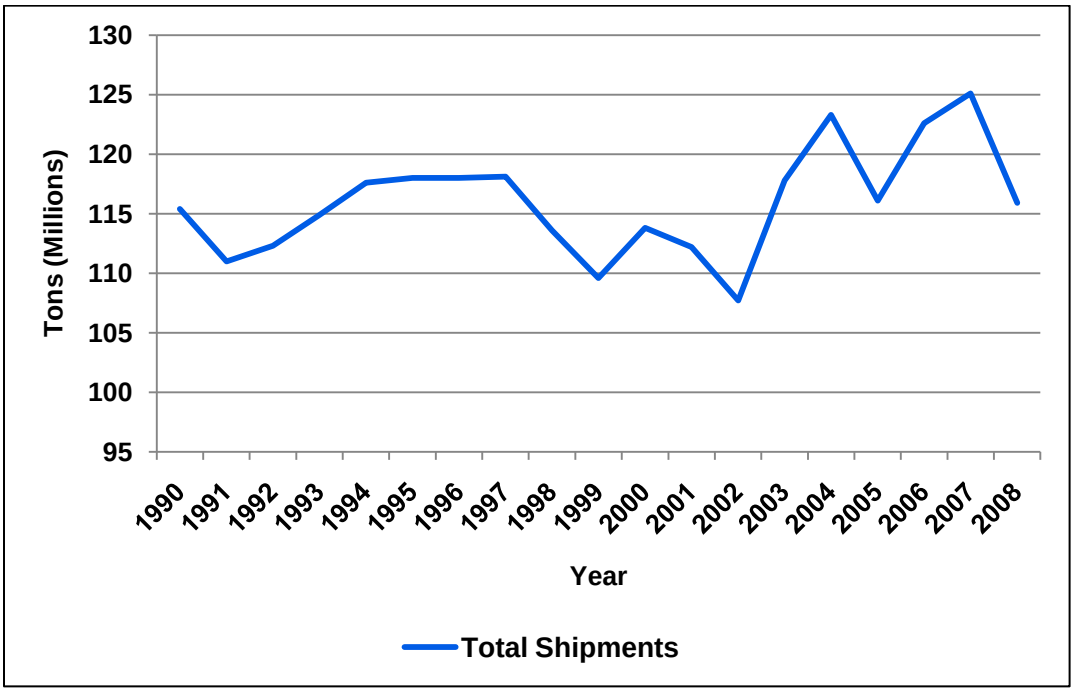
Table 2-40 and Figure 2-52 show shipping traffic along the GIWW from 1990 to 2008.

Table 2-40: Gulf Coast Intracoastal Waterway, Shipments by Type of Traffic and Commodity[119]

Summary	1990	2000	2008	% of 2008	% Change 1990–2008
	Type of Traffic (Millions of Tons)				
Coastwise	0.7	0.8	0.2	0.2	–71.4
Internal	114.6	113	115.7	99.8	1.0
Total	**115.3**	**113.8**	**115.9**	**100.0**	**0.5**
Summary	Commodity (Millions of Tons)				
Coal	9.2	5.9	6.9	6.0	–25.0
Petroleum & Petroleum Products	62.4	53.3	59.4	51.3	–4.8
Chemical & Related Products	22.9	25.4	20.2	17.4	–11.8
Crude Materials	14.4	20.4	20.8	17.9	44.4
Primary Manufacturing Goods	3	4.4	5.6	4.8	86.7
Food & Farm Products	2.2	2.1	1	0.9	–54.5
All Manufacturing Equipment	0.4	1.3	1.1	0.9	175.0
Other	0.8	1	0.9	0.8	12.5
Total	**115.3**	**113.8**	**115.9**	**100.0**	**0.5**

[119] USACE; 2008 Waterborne Commerce of the United States (WCUS) Waterways and Harbors on the: Part 5 – National Summaries of Domestic and Foreign Waterborne Commerce, Table 3-13 and Table 3-14

Figure 2-52: Gulf Coast Intracoastal Waterway, Total Shipments 1990–2008[120]



As shown in Table 2-40, from 1990 to 2008 internal shipments along the GIWW have remained steady with relatively small growth (1 percent). However, when viewed by commodities shipped there is much more variability with manufacturing equipment showing the greatest growth at 175 percent (although it should be noted that the overall tons of this commodity is small).

2.14.6 The Maritime Administration America's Marine Highway Program[121]

In April 2010, the USDOT Maritime Administration (MARAD) recently announced America's Marine Highway program to help identify rivers and coastal routes that could carry cargo efficiently, bypassing congested roads around busy ports and reducing greenhouse gases. Speaking to transportation professionals at the 7th Annual North American Marine Highways and Logistics Conference in Baltimore, MD, Transportation Secretary Ray LaHood said, "For too long, we've overlooked the economic and environmental benefits that our waterways and domestic seaports offer as a means of moving freight in this country. Moving goods on the water has many advantages: It

[120] USACE; 2008 Waterborne Commerce of the United States (WCUS) Waterways and Harbors on the: Part 5 – National Summaries of Domestic and Foreign Waterborne Commerce, Table 3-13

[121] Most of the information for this section comes from the MARAD site http://www.marad.dot.gov/ships_shipping_landing_page/mhi_home/mhi_home.htm

reduces air pollution. It can help reduce gridlock by getting trucks off our busy surface corridors."

The Marine Highway initiative stems from a 2007 law requiring the Secretary of Transportation to establish a short sea transportation program and designate short sea transportation projects to mitigate surface congestion. Under the new regulation, regional transportation officials will be able to apply to have specific transportation corridors—and even individual projects—designated by the USDOT as a marine highway if they meet certain criteria. Once designated, these projects will receive preferential treatment for any future federal assistance from the department or MARAD.

In 2010, Secretary LaHood announced $58 million in grants for projects to support the start-up or expansion of Marine Highways services, awarded through the Department's Transportation Investment Generating Economic Recovery (TIGER) grants program. Congress has also set aside an additional $7 million in grants, which MARAD awarded in August 2010. The Port of Brownsville was selected as part of the Cross Gulf Container Expansion. This project will expand existing container-on-barge operations by increasing the frequency and capacity of the service between Brownsville, and Port Manatee, Florida, across the Gulf of Mexico (Figure 2-53).[122]

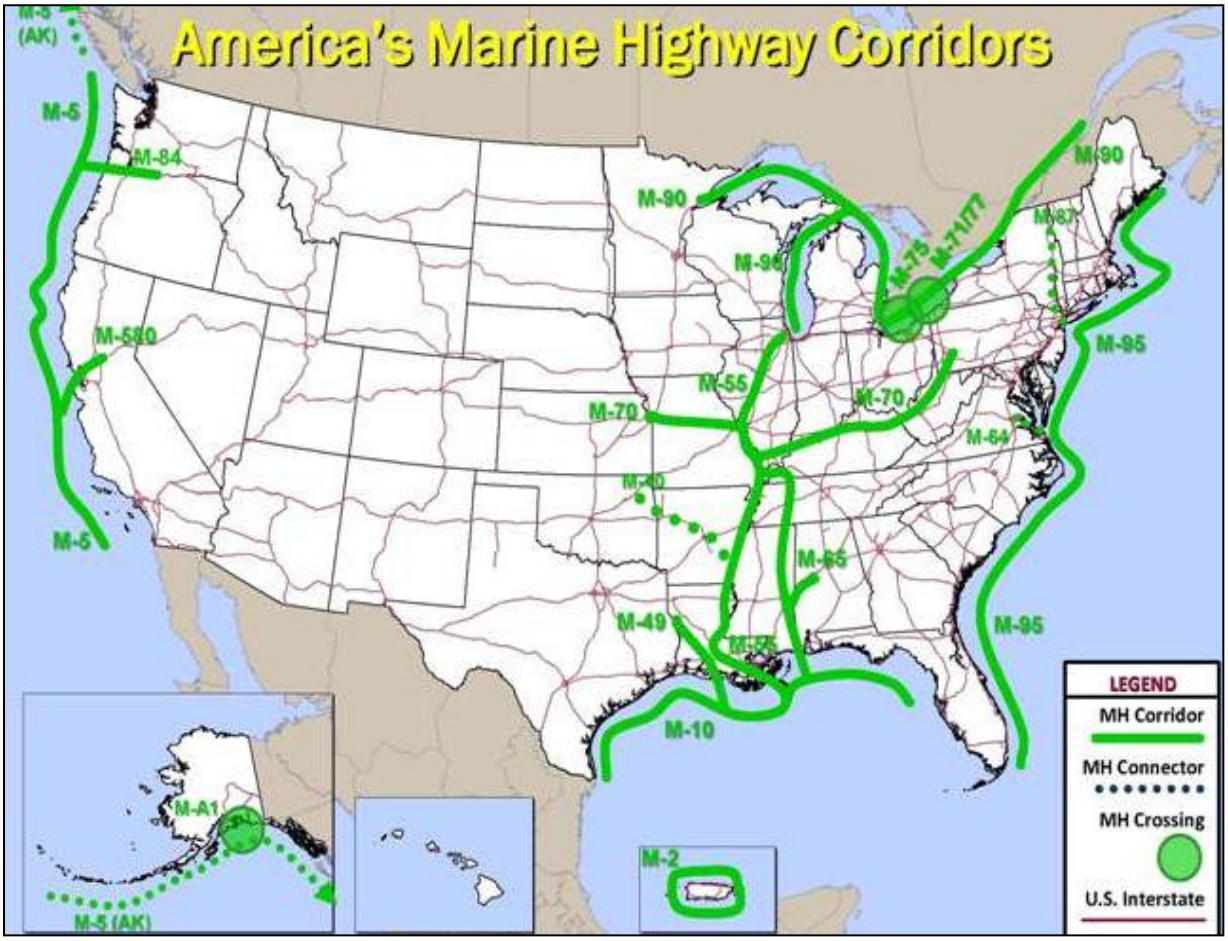
The USDOT published an interim final rule on October 9, 2008, establishing a framework to provide federal support to expand the use of America's Marine Highway. The four primary components of the framework are:

- **Marine Highway Corridors:** Designated corridors will integrate the Marine Highway into the surface transportation system and encourage the development of multi-jurisdictional coalitions to focus public and private efforts and investment.
- **Marine Highway Project Designation:** Designation of marine highway projects is aimed at mitigating landside congestion by starting new or expanding existing services to provide the greatest benefit to the public in terms of congestion relief, improved air quality, reduced energy consumption, and other factors. Designated Projects will receive direct support from the USDOT.
- **Incentives, Impediments and Solutions:** The Maritime Administration, in partnership with public and private entities, will identify potential incentives and seek solutions to impediments to encourage utilization of the Marine Highway and incorporate it, including ferries, in multi-state, state, and regional transportation planning.

[122] Maritime Administration News Release, August 2010 http://www.marad.dot.gov/news_room_landing_page/news_releases_summary/news_release/MARAD_13-10_Marine_highway_Projects_release.htm

- **Research:** The USDOT, working with the Environmental Protection Agency, will conduct research to support America's Marine Highway, within the limitations of available resources. Research would include environmental and transportation benefits, technology, vessel design, and solutions to impediments.

Figure 2-53: MARAD Gulf Coast and America's Heartland Marine Highway Corridors Map[123]



2.14.7 Texas Ferry Systems

There are two main ferry locations in Texas: at Port Aransas and Galveston-Port Bolivar. Throughout the year, more than 8 million people use these TxDOT ferry systems. The peak months for ferry use are June, July, and August. Ferry service has been a part of the Texas transportation system since the 19th century when a skiff, *The Tarpon*, began operating from Galveston Island.

[123] USDOT, Maritime Administration, America's Marine Highway Corridors, Available at: http://www.marad.dot.gov/ships_shipping_landing_page/mhi_home/mhi_home.htm

This ferry operation consists of five boats, each of which can carry approximately 70 vehicles, 500 passengers, and 6 crewmembers. Each ferry is capable of carrying eight 18-wheel trucks weighing 80,000 pounds each.

The Port Aransas Ferry System provides free transportation service 7 days a week, 24 hours a day connecting Mustang Island and Port Aransas with the mainland via Aransas Pass. The number of ferryboats in service at any time depends on demand.

Port Aransas has six identical large vessels that can carry 20 regular passenger vehicles on each trip. Each boat can move 100 vehicles per hour. A total overall length (for combined vehicles such as a car and boat) is 85 feet. The maximum width allowed is 96 inches. A maximum of 13 feet 6 inches in height is allowed.

There are three ferry services within the state not operated by TxDOT. They are:

- Lynchburg Ferry – located near Channelview, Texas, and operated by Harris County; provides service to historic San Jacinto State Park.
- Los Ebanos Ferry – located in Los Ebanos, Texas, and privately owned and operated. This ferry is a hand drawn ferry across the Rio Grande and provides service between the U.S. and Mexico.
- Jetty Boat – located near Port Aransas, Texas, and privately owned and operated; provides service to St. Jo Island.

Table 2-41 presents average ferry trip time and total annual passengers and vehicles for the ferries described above.

Table 2-41: Texas Ferries Total Annual Passengers and Vehicles[124]

Ferry	Average Trip Time	Passengers			Vehicles		
		2000	2006	2008	2000	2006	2008
Galveston – Port Bolivar Ferry	50	6,648,007	6,320,648	5,789,737	2,105,953	2,134,999	1,843,101
Port Aransas Ferry	6	NA	26,254	54,494	2,500,000	1,084,654	2,135,054
Lynchburg Ferry	3	1,270,200	NA	NA	1,058,500	372,915	372,915
Los Ebanos	5	122,000	NA	NA	77,000	NA	NA
Jetty Boat. Inc. (Passenger Only)	15	18,000	18,238	NA	-	-	-

[124] National Census of Ferry Operators, 2008

2.14.8 Texas Port Freight Forecasts

FHWA's FAF[2] provides historic and forecast freight flows (in dollars and tons) between origins and destinations for U.S. port regions. Within this data, freight flows are categorized by origin and destination, port region, commodity, and connecting mode (i.e., truck, rail, etc.) of connection to the port region. The historic base year for FAF[2] is 2002. Freight data for 2008 presented in this section is an estimate and may not reflect final yearly summaries provided by the other sources such as the USACE (Table 2-38). As shown in Table 2-42 pipelines have been, and will remain, the dominant mode of freight transport from Texas seaport regions, followed by trucks. Rail and multiple modes play a much smaller part in the movement of freight to/from Texas seaport regions.

Table 2-42: Texas Seaport Regions, Foreign Tonnage (Millions of Tons) Shipped by Connecting Mode[125]

Mode	2008	% of 2008	2035	% of 2035	% Change 2008–2035
Truck Alone	94.5	26.5	201.9	38.7	***113.8***
Pipeline, Water	240.2	67.3	288.1	55.1	***19.9***
Rail Alone	20.2	5.7	29.8	5.7	***47.5***
Multiple Modes*	2.2	0.6	2.5	0.5	***11.8***
Total	**357.1**	**100.0**	**522.3**	**100.0**	**46.3**

*Includes Truck & Rail, Air & Truck, and Other Intermodal

As shown in Table 2-43, according to forecasts published as part of the FHWA's FAF[2], from 2008 to 2035 the value of exports/imports shipped through Texas Ports is expected to increase by 220 percent. Alternatively, the weight of exports/imports shipped through Texas Ports is expected to increase by only 46 percent. By weight and value, the Houston seaport region will continue to handle the bulk of exports/imports with 41.1 percent of the total tonnage and 59.9 percent of the total value of goods in 2035. However, the remaining seaport regions will continue to play an equally important role. Combined, these seaport regions will handle 58.9 percent of the total tonnage and 40.1 percent of the total value of exports/imports in 2035.

[125] FAF[2] Commodity Origin-Destination Data: 2002–2035; Available at http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_com.htm; and Provisional Annual Commodity Origin-Destination Data – 2008 available at http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf2_pro.htm

Table 2-43: Texas Seaport Regions, Seaport Foreign Exports/Imports 2008–2035[126]

Seaport Region*	2008				2035				% Change Totals
	Foreign Exports	Foreign Imports	Total	% of Total	Foreign Exports	Foreign Imports	Total	% of Total	
Tons (Millions)									
Brownsville/ Hidalgo	0.5	0.4	0.9	0.2	0.3	1.4	1.7	0.3	93
Houston	55.1	83.4	138.5	38.8	91.8	122.9	214.7	41.1	55
Beaumont	7.9	49.1	57.0	16.0	10.6	78.3	88.9	17.0	56
Corpus Christi	12.7	50.9	63.6	17.8	19.4	59.6	79.0	15.1	24
Texas Remaining	22.2	75.0	97.2	27.2	38.9	99.1	138.0	26.4	42
Total Tons	98.3	258.8	357.1	100	161.0	361.2	522.3	100	46
Dollars (Millions)*									
Brownsville/ Hidalgo	52	130	181	0.1	109	863	972	0.2	436
Houston	48,831	37,394	86,225	58.4	169,469	113,195	282,664	59.9	228
Beaumont	3,381	10,143	13,524	9.2	13,631	26,683	40,313	8.5	198
Corpus Christi	5,852	8,600	14,451	9.8	24,929	15,901	40,830	8.6	183
Texas Remaining	15,409	17,763	33,172	22.5	65,912	41,337	107,248	22.7	223
Total Dollars	73,525	74,028	147,553	100	274,050	197,978	472,028	100	220

Note: The Freight Analysis Framework[2] aggregates ports into regions.
For example, the Houston region would be inclusive of the Port of Houston and the Port of Galveston.
[#]2002 Dollars (based on the earliest reported FAF[2] year, which is 2002)

Table 2-44 illustrates cross-tabulations of total Texas seaport exports and imports by international origin/destination. As indicated in both figures, trade with Mexico and the Americas will continue to make up a considerable portion of the international trade through Texas' seaports in 2035. Of total exports/imports combined, these two international regions contribute 47.5 percent of tonnage and 42.1 percent of total dollars. However, Europe and Asia (Southwest Asia and Asia East and South) will play an equally important role. Of total exports/imports combined, these international regions will contribute 33.1 percent of tonnage and 45.3 percent of total dollars in 2035.

126 Ibid

Table 2-44: Total Seaport Foreign Exports/ Imports by Trading Partner 2008–2035[127]

Summary	Tons (Millions)				
	2008	% of 2008 Total	2035	% of 2035 Total	% Change
Americas	91.5	**25.6**	135.9	**26.1**	**48.5**
Asia East & South	22.9	**6.3**	47.3	**9.1**	**106.9**
Canada	7.4	**2.1**	11.6	**2.2**	**56.6**
Europe	48.3	**13.5**	77.7	**14.9**	**60.8**
Mexico	84.2	**23.6**	111.7	**21.4**	**32.6**
Southwest Asia	38.5	**10.9**	48.4	**9.1**	**25.9**
Rest of World	64.3	**18.0**	89.6	**17.2**	**39.4**
Totals	**357.1**	**100.0**	**522.3**	**100.0**	**46.3**
Summary	**Dollars (Millions)***				
Americas	41,530.7	**28.1**	129,716.8	**27.5**	**212.3**
Asia East & South	20,774.9	**14.1**	79,887.2	**16.9**	**284.5**
Canada	2,885.3	**2.1**	10,098.7	**2.2**	**250.0**
Europe	32,380.3	**21.9**	111,515.8	**23.6**	**244.4**
Mexico	22,493.2	**15.2**	68,699.7	**14.6**	**205.4**
Southwest Asia	10,221.4	**6.9**	22,816.6	**4.8**	**123.2**
Rest of World	17,267.1	**11.7**	49,292.9	**10.4**	**185.5**
Totals	**147,552.9**	**100.0**	**472,027.7**	**100.0**	**219.9**

#2002 Dollars (based on the earliest reported FAF[2] year, which is 2002)

Table-45 presents exports/imports shipped though Texas's seaports by commodity. As shown in Table-45, in terms of 2035 tonnages raw materials will continue to make up the largest portion of total exports/imports at 60.8 percent of total exports/imports, followed by processed chemical/petroleum goods at 25.9 percent. However, for 2035 in terms of value, processed chemical/petroleum goods will make up 57.0 percent of total dollars, followed by machinery at 20.2 percent.

127 Ibid

Table 2-45: Texas Seaport Foreign Exports/Imports by Commodity 2008–2035[128]

Commodity	2008				2035			
	Foreign Exports	Foreign Imports	Total	%of Total	Foreign Exports	Foreign Imports	Total	%of Total
Tons (Millions)								
Agriculture	3.7	2.5	**6.2**	**1.7**	5.8	6.4	**12.2**	**2.3**
Raw Materials*	31.5	230.9	**262.4**	**73.5**	19.3	298.3	**317.6**	**60.8**
Food	15.5	0.3	**15.8**	**4.4**	13.4	0.3	**13.7**	**2.6**
Textiles	0.0	0.0	**0**	**0.0**	0	0	**0**	**0.0**
Wood	0.8	0.5	**1.3**	**0.4**	0.9	2.0	**2.9**	**0.6**
Processed Chemicals/Petroleum	41.3	9.7	**51.1**	**14.3**	112.4	23.0	**135.5**	**25.9**
Building Materials	0.6	5.0	**5.6**	**1.6**	1.4	7.9	**9.4**	**1.8**
Machinery	2.3	2.0	**4.2**	**1.2**	4.7	7.8	**12.4**	**2.4**
Miscellaneous Mixed	2.5	7.9	**10.4**	**2.9**	3.0	15.6	**18.6**	**3.6**
Other/Unclassified Cargo	0.0	0.0	**0.0**	**0.0**	0.0	0.0	**0.0**	**0.0**
Total Tons	**98.3**	**258.8**	**357.1**	**100.0**	**161.0**	**361.2**	**522.3**	**100.0**
Dollars (Millions)*								
Agriculture	950	681	**1,631**	**1.1**	2,892	2,476	**5,368**	**1.1**
Raw Materials*	1,864	39,332	**41,196**	**27.9**	3,467	79,712	**83,179**	**17.6**
Food	699	13	**713**	**0.5**	1,338	42	**1,381**	**0.3**
Textiles	0	0	**0**	**0.0**	0	0	**0**	**0.0**
Wood	815	368	**1,183**	**0.8**	1,266	1,398	**2,664**	**0.6**
Processed Chemicals/Petroleum	50,510	14,179	**64,688**	**43.8**	226,210	42,718	**268,928**	**57.0**
Building Materials	222	1,534	**1,757**	**1.2**	1,125	6,297	**7,422**	**1.6**
Machinery	16,609	15,887	**32,496**	**22.0**	35,839	59,284	**95,123**	**20.2**
Miscellaneous Mixed	1,855	2,034	**3,889**	**2.6**	1,914	6,050	**7,964**	**1.7**
Other/Unclassified Cargo	-	-	**-**	**<1.0**	-	-	**-**	**<1.0**
Total Dollars	**73,525**	**74,028**	**147,553**	**100.0**	**274,050**	**197,978**	**472,028**	**100.0**

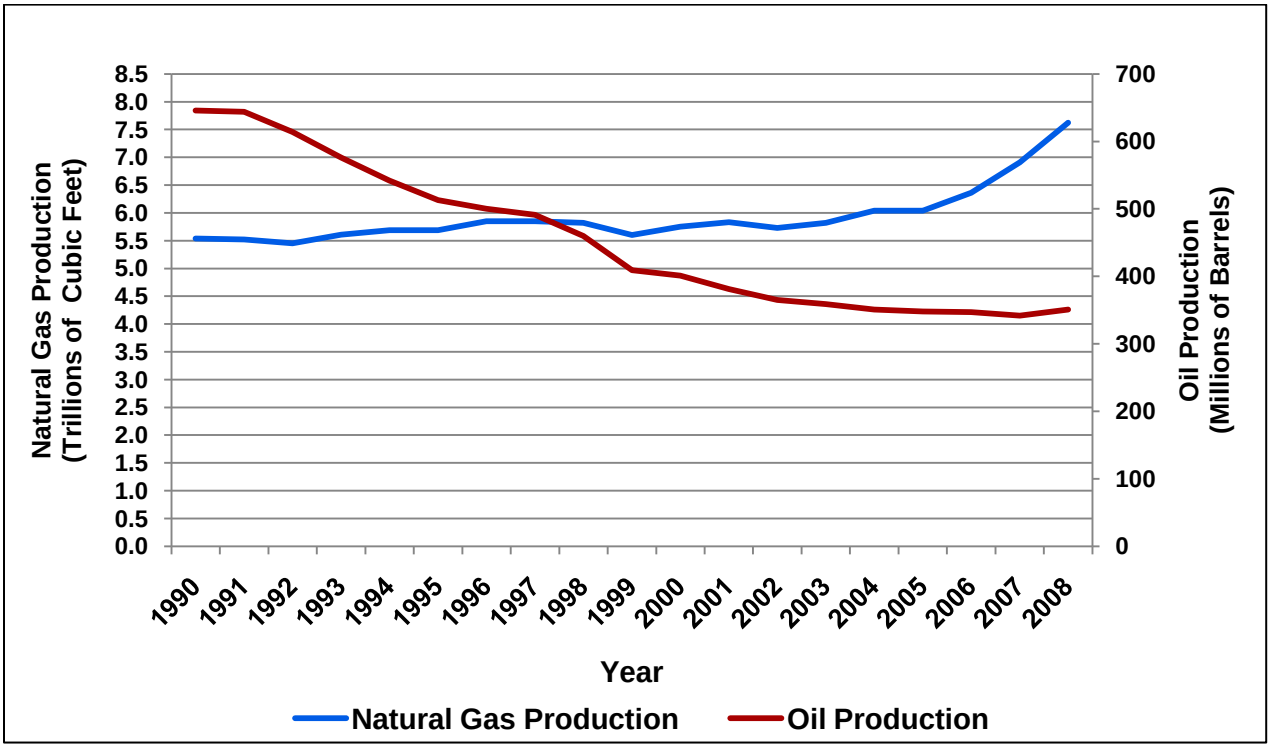
#2002 dollars (based on the earliest reported FAF[2] year, which is 2002)

[128] Ibid

2.15 Texas Pipelines

Texas leads the nation in refining capacity and the production of crude oil and natural gas. Its marketed production represents 30 percent of total U. S. natural gas production[129] and 20 percent of crude oil production.[130] Pipelines are a major mode of transportation of crude oil and natural gas in Texas, providing an economic and efficient way to move these commodities. Texas is a net exporter of natural gas both nationally and internationally. Although oil production in the state is in decline, natural gas production in the state continues to increase rapidly due to in increased production from unconventional sources in Northeast Texas (Figure 2-54).

Figure 2-54: Texas Natural Gas Production and Oil Production 2000–2008[131]



Most of the state's 27 oil refineries are clustered near major ports along the Gulf Coast, including Houston, Port Arthur, and Corpus Christi. These facilities can process more than 4.7 million barrels of crude oil per day. Refined-product pipelines spread out from

[129] Energy Information Administration Independent Analysis and Statistics http://www.eia.doe.gov/oil_gas/natural_gas/info_glance/natural_gas.html

[130] Texas Petrofacts – Monthly Data Review from the Railroad Commission of Texas March 2010 http://www.rrc.state.tx.us/data/petrofacts/2010/petro0310.pdf

[131] Ibid

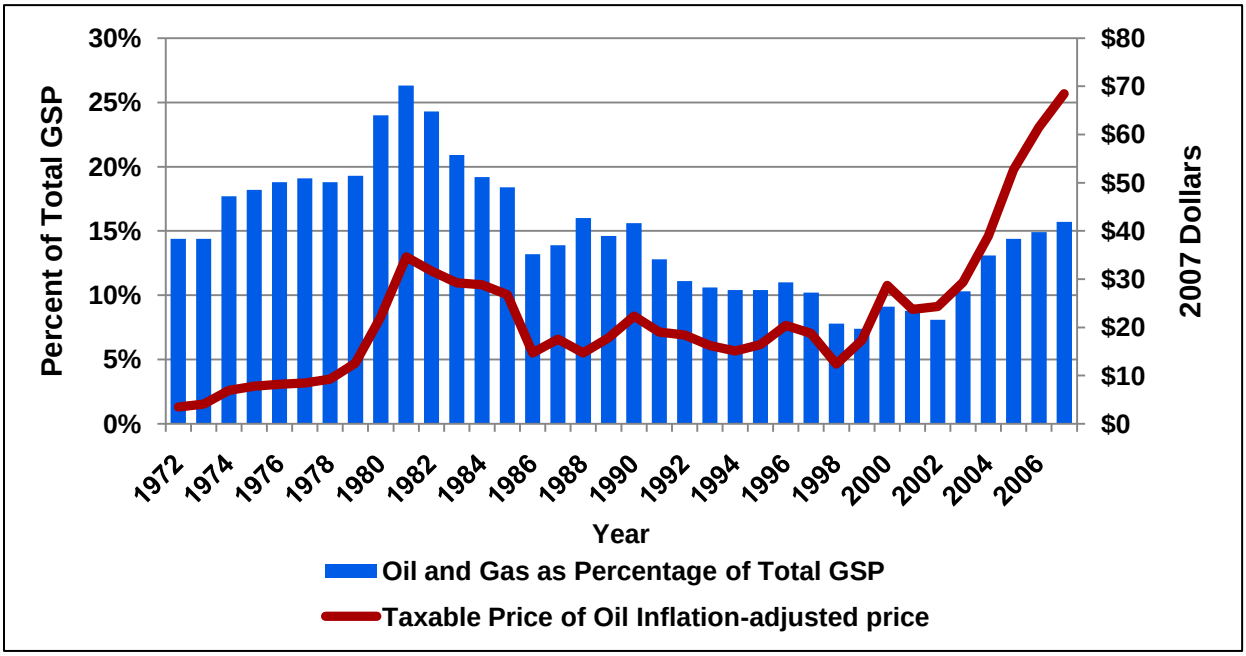
Houston across the country, allowing Texas petroleum products to reach virtually every major consumption market east of the Rocky Mountains.[132]

2.15.1 Contribution of Pipelines to the Texas Economy

In 2006, more than 312,000 Texans, or 3.1 percent of the state work force, were employed in the oil and natural gas industry, which accounted for $159.3 billion or 14.9 percent of Texas' GSP. For comparison, in 2003 the industry contributed $85.6 billion to GSP, 10.3 percent of the state GSP. Likewise, oil and gas industry wages have risen substantially in recent years. In 2006, wages totaled $30.6 billion, or about 6.9 percent of all wages in Texas. In Texas in 2003, oil and gas industry wages were $20.9 billion or 5.8 percent of all wages.

Historically, the oil and natural gas industry have accounted for approximately 10 to 25 percent of the state's GSP, a trend that roughly tracks the price of oil (Figure 2-55). (The price indicated in the figure is based on the taxable value of oil from in-state production, in dollars adjusted for inflation.)

Figure 2-55: Texas Oil and Gas Industry Contribution to the Texas Economy[133]



[132]Energy Information Administration. State Energy Profiles – Texas http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=TX

[133]The Energy Report 2008, Comptroller of Public Accounts http://www.window.state.tx.us/specialrpt/energy/nonrenewable/

2.15.2 Types of Pipelines

There are three primary types of pipelines: gathering pipelines, transmission pipelines, and distributing pipelines. Gathering pipeline systems collect raw natural gas or crude oil from production wells. Transmission pipeline systems transport natural gas thousands of miles across different states in the continental United States. These are usually large diameter long-distance lines and connect supply areas to markets and points of export. Distribution pipeline systems deliver natural gas to our homes and businesses across several communities. In addition, refined products pipeline systems transport products from oil refineries such as gasoline, kerosene, and other petrochemicals to storage and distribution terminals.[134]

The overall total mileage of all pipelines in Texas is 222,285 miles.[135] Table 2-46 provides a breakdown of pipeline mileage by use—transmission, gathering, and distribution. Natural gas and crude oil are the major commodities transported by pipelines—these together constitute 67 percent of pipeline miles. Other products transported by pipeline include Carbon Dioxide, Nitrogen, and Hydrogen.

Table 2-46: Texas Pipeline Mileage[136]

Pipeline System	Mileage (miles)
Hazardous liquid line mileage	56,375
Gas transmission line mileage	66,918
Gas gathering line mileage	6,659
Gas distribution mileage	92,333
Total Pipeline Mileage	**222,285**

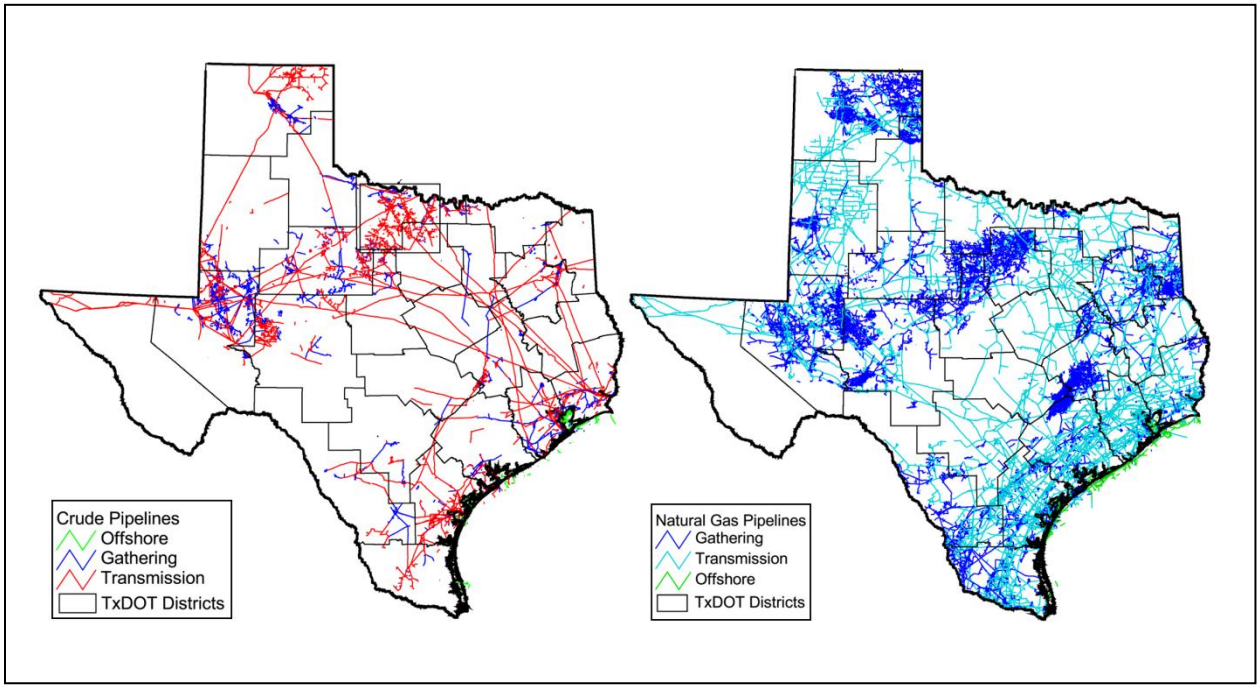
Figure 2-56 illustrates crude petroleum and natural gas pipelines in Texas.

[134] Pipeline and Hazardous Materials Safety Administration. Pipeline Significant Incidents and Mileage Overview http://primis.phmsa.dot.gov/comm/reports/safety/PSI.html

[135] Office of Pipeline Safety Statistics: http://primis.phmsa.dot.gov/comm/reports/safety/TX_detail1.html

[136] Ibid

Figure 2-56: Crude Petroleum and Natural Gas Pipeline in Texas[137]



2.15.3 Ownership and Maintenance

Both natural gas and oil pipeline systems are owned and operated and maintained by several different private companies. These are constructed in response to the evolving supply and demand dynamics of the market. Federal Energy Regulatory Commission (FERC) regulates the construction, operation, and safety of interstate pipelines whereas intrastate gas and petroleum pipelines are regulated by the Texas Railroad Commission (RRC).

2.15.4 Pipeline Forecasts

As discussed in this section, oil and natural gas production and transportation are thriving in Texas. Because pipelines are privately owned and operated, growth and needs are determined based on market forces. Quantitative needs estimates were not prepared for the expansion of the pipeline network. During the development of this plan, representatives of pipeline companies expressed no concerns about needed capacity or the ability of the industry to address future capital investment needs.

[137] FHWA, TxDOT, and TTI, The Value of Pipelines to the Transportation System Of Texas: Year One Report, October 2000