



Mobility and Economic Effects of System Investments in Texas: 2010 to 2020

Technical Report 0-6655-TI-2

Cooperative Research Program

**TEXAS TRANSPORTATION INSTITUTE
THE TEXAS A&M UNIVERSITY SYSTEM
COLLEGE STATION, TEXAS**

TEXAS DEPARTMENT OF TRANSPORTATION

in cooperation with the
Federal Highway Administration and the
Texas Department of Transportation

1. Report No. FHWA/TX-11/0-6655-TI-2		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle MOBILITY AND ECONOMIC EFFECTS OF SYSTEM INVESTMENTS IN TEXAS: 2010 TO 2020				5. Report Date August 2011 Published: December 2011	
				6. Performing Organization Code	
7. Author(s) Tim Lomax				8. Performing Organization Report No. Report 0-6655-TI-2	
9. Performing Organization Name and Address Texas Transportation Institute The Texas A&M University System College Station, Texas 77843-3135				10. Work Unit No. (TRAIS)	
				11. Contract or Grant No. Project 0-6655-TI	
12. Sponsoring Agency Name and Address Texas Department of Transportation Research and Technology Implementation Office P.O. Box 5080 Austin, Texas 78763-5080				13. Type of Report and Period Covered Technical Report: December 2009–August 2011	
				14. Sponsoring Agency Code	
15. Supplementary Notes Project performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration. Project Title: System Operation and Preservation Optimization					
16. Abstract The report summarizes estimates of the consequences of current funding levels and a range of greater and lesser funding amounts. The report describes the population, travel, system extent and expenditure data and analyses used to develop the mobility and economic effect analyses. An associated study by the Center for Transportation Research analyzed pavement maintenance spending and condition. Both the mobility and pavement studies were used as part of the March 2011 Texas 2030 Committee report.					
17. Key Words Congestion, Mobility, Performance Measures, Congestion Cost, Transportation Needs			18. Distribution Statement No restrictions. This document is available to the public through NTIS: National Technical Information Service Alexandria, Virginia 22312 http://www.ntis.gov		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 42	22. Price

**MOBILITY AND ECONOMIC EFFECTS OF SYSTEM INVESTMENTS
IN TEXAS: 2010 TO 2020**

by

Tim Lomax, P.E., Ph.D.
Research Engineer
Texas Transportation Institute

Report 0-6655-TI-2
Project 0-6655-TI
Project Title: System Operation and Preservation Optimization

Performed in cooperation with the
Texas Department of Transportation
and the
Federal Highway Administration

August 2011
Published: December 2011

TEXAS TRANSPORTATION INSTITUTE
The Texas A&M University System
College Station, Texas 77843-3135

DISCLAIMER

This research was performed in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA). The contents of this report reflect the views of the author, who is responsible for the facts and the accuracy of the data presented here. The contents do not necessarily reflect the official view or policies of the FHWA or TxDOT. This report does not constitute a standard, specification, or regulation.

ACKNOWLEDGMENTS

This project was conducted in cooperation with TxDOT and FHWA. The author recognizes the contributions of the project director, Jeff Seiders of the Texas Department of Transportation. His substantial efforts resulted in a better, more relevant product from this research study, as well as providing information to decision makers about the possible results from investments in pavement quality and mobility. In addition, the author thanks the following members of the Project Monitoring Committee for providing suggestions and guidance:

- Jeff Seiders, CST-CP.
- Jessica Castiglione, SAT.
- Wayne Dennis, TPP.
- Doug Eichorst, LBB.
- Ron Hagquist, SPPM.
- Carlos Lopez, AUS.
- Tonia Norman, SPPM.

TABLE OF CONTENTS

	Page
List of Tables	viii
Chapter 1 – Introduction	1
Chapter 2 – Expenditure Estimates for Pavement and Mobility Projects.....	3
Methodology	3
Chapter 3 – Updated Transportation Planning Data	7
Chapter 4 – Near-Term Added Road Capacity	13
Chapter 5 – Description of 2020 Mobility Improvement Scenarios.....	15
Chapter 6 – 2020 Scenarios—Mobility and Economic Consequences	21
Mobility and Economic Data for Each Region.....	22
Chapter 7 – Conclusions	31
References.....	33

Note: There is a CD-ROM in a sleeve on the last page of the report which contains a PowerPoint presentation of the research findings.

LIST OF TABLES

	Page
Table 2-1. Revenue from TxDOT Sources (2010 \$ Million).	4
Table 2-2. Revenue from Non-TxDOT Sources (2010 \$ Million).	5
Table 2-3. Revenue from All Sources (2010 \$ Million).	6
Table 3-1. Regional Population Estimates (Million).	8
Table 3-2. Regional Commuter Estimates (Million).	9
Table 3-3. Regional Household Estimates (Million).	10
Table 3-4. Estimated Daily Vehicle Miles of Travel for 2020.	11
Table 4-1. Lane-Miles Added from 2006 to 2009.	14
Table 5-1. 2015 Lane Miles.	17
Table 5-2. 2020 Lane Miles Added.	18
Table 5-3. 2015 Implementation Cost (2010 \$ Million).	19
Table 5-4. 2020 Implementation Cost (2010 \$ Million).	20
Table 6-1. 2015 Total Daily Delay (Hours).	23
Table 6-2. 2015 Annual Congestion Cost (2010 \$ Million).	24
Table 6-3. 2015 Delay Per Commuter (Hours).	25
Table 6-4. 2015 Congestion Cost per Commuter (2010 \$).	26
Table 6-5. 2020 Total Daily Delay (Hours).	27
Table 6-6. 2020 Annual Congestion Cost (2010 \$ Million).	28
Table 6-7. 2020 Delay per Commuter (Hours).	29
Table 6-8. 2020 Congestion Cost per Commuter (2010 \$).	30
Table 7-1. Total Annual Cost of 2020 Mobility Scenarios (2010 \$ Million).	32

CHAPTER 1 – INTRODUCTION

The 2009 2030 Committee report (1) prepared a number of scenarios for pavement and mobility improvements. Over the past two years, the 2030 Committee has updated and revised their report and several additional analyses have taken place that informed the 2011 2030 Committee report (2). The report documented here investigated the mobility and economic consequences of a range of transportation investment levels in Texas' metropolitan and urban regions. Several factors suggested the need to revise the 2009 2030 Committee report even before the 2011 update was begun. There seemed to be a particular need to examine the near-term period covered by the period of the Unified Transportation Program (between 2010 and 2020).

- Several urban area transportation models were extended and improved to provide a better picture of future demand and the mobility solutions.
- Cost estimates were refined from projects on the most congested road sections.
- The Texas Revenue Estimation and Needs Determination System (TRENDS) (3) model was refined and provided a better picture of likely funding to 2035.
- Expenditure information was expanded and refined to develop an improved estimate of the current trend in mobility funding as described in this report.

The scenarios summarized in this report include a different set of conditions than the 2009 2030 Committee report—those tied more closely to what is possible, rather than what is desirable. Most of the tools were similar, but they were re-tasked to use different funding levels and focused on the next 10 years to assist TxDOT in determining the most appropriate set of investment decisions.

The report summarizes estimates of the consequences of current funding levels and a range of greater or lesser funding amounts. It describes the data and analyses used to develop the mobility and economic effect analyses. An associated study by the Center for Transportation Research analyzed pavement maintenance spending and condition. Both the mobility and pavement studies included lower funding levels than were in the 2009 2030 Committee report; estimates that were in line with the TRENDS revenue projections. The results of the two studies will be used to examine different mixes of spending on mobility, pavement, and other TxDOT spending categories.

CHAPTER 2 – EXPENDITURE ESTIMATES FOR PAVEMENT AND MOBILITY PROJECTS

The Texas Revenue Estimation and Needs Determination System (3) is the spreadsheet method used to estimate revenue available and expected expenses by TxDOT over the next 25 years. The spreadsheet data is based on the near-term projections from TxDOT's Finance Division for the next 10 years, as well as expected growth in population and vehicle use. The consequent revenue from taxes on gas and diesel fuel purchases and motor vehicle registration fees are the primary revenue components.

A combination of historic growth rates and expected future expenses for administrative, retirement, planning, operating, right-of-way, and other expenses is used to estimate those categories. This memo describes the funding estimated for pavement maintenance and for added capacity in metropolitan and urban areas. The working assumption is that the state component of these funds can be moved between these categories to address significant problems and capitalize on opportunities. This memo seeks to identify the funding that could be reasonably expected for these purposes. The funding estimates will be used to identify the expected pavement conditions and mobility levels in subsequent tasks.

METHODOLOGY

The most recent estimates from TxDOT's Finance Division were used for the 10-year forecast; at the beginning of the System Operation and Preservation Optimization project, these were produced in January 2010. Expected funding for pavement maintenance (Category 1) from 2010 through 2020 was \$11.41 billion. Expected TxDOT funding for Categories 2 and 3 was \$2.02 billion and \$0.40 billion, respectively. Funding in these categories (Table 2-1) was allocated to each urban and metropolitan area according to a formula created by a combination of staff from the metropolitan planning organizations and TxDOT districts.

A key element of mobility project funding comes from local and regional agencies including cities, counties, toll road authorities, and other funding sources outside of TxDOT control. Those funding estimates were initially obtained in the summer of 2009 and confirmed in December 2009 from the long-range transportation plans of each metropolitan planning organization (MPO) (Table 2-2). These are posted on the websites of each MPO and are

periodically updated. Table 2-3 provides the metropolitan and urban area totals for added capacity funding.

Table 2-1. Revenue from TxDOT Sources (2010 \$ Million).

Metro Areas	FY 2010 to 2015 TOTALS	FY 2010 to 2020 TOTALS
Austin	594	890
Corpus Christi	59	168
Dallas-Fort Worth	3,270	4,094
El Paso	304	460
Hidalgo	33	77
Houston	967	1,981
Lubbock	26	43
San Antonio	265	528
Metro Total	\$5,519	\$8,240
Abilene	-	-
Amarillo	9	32
Beaumont	40	78
Brownsville	4	4
Bryan-College Station	23	32
Harlingen	-	-
Killeen-Temple	42	42
Laredo	18	25
Longview	14	21
Midland-Odessa	7	7
San Angelo	4	11
Sherman-Denison	6	19
Texarkana	195	195
Tyler	1	16
Victoria	23	36
Waco	39	61
Wichita Falls	-	-
Urban Total	\$425	\$582
Total	\$5,944	\$8,822

Table 2-2. Revenue from Non-TxDOT Sources (2010 \$ Million).

Metro Areas	FY 2010 to 2015 TOTALS	FY 2010 to 2020 TOTALS
Austin	2,626	4,890
Corpus Christi	1	2
Dallas-Fort Worth	3,270	8,306
El Paso	446	515
Hidalgo	127	283
Houston	4,403	9,669
Lubbock	59	132
San Antonio	862	1,725
Metro Total	\$11,794	\$25,523
Abilene	42	84
Amarillo	77	155
Beaumont	14	28
Brownsville	60	110
Bryan-College Station	—	—
Harlingen	—	—
Killeen-Temple	15	30
Laredo	—	—
Longview	6	12
Midland-Odessa	—	53
San Angelo	8	8
Sherman-Denison	—	—
Texarkana	36	72
Tyler	125	250
Victoria	—	—
Waco	60	120
Wichita Falls	—	—
Urban Total	\$443	\$921
Total	\$12,236	\$26,444

Table 2-3. Revenue from All Sources (2010 \$ Million).

Metro Areas	FY 2010 to 2015 TOTALS	FY 2010 to 2020 TOTALS
Austin	3,220	5,780
Corpus Christi	60	170
Dallas-Fort Worth	6,540	12,400
El Paso	750	975
Hidalgo	160	360
Houston	5,370	11,650
Lubbock	85	175
San Antonio	1,128	2,253
Metro Total	\$17,313	\$33,763
Abilene	42	84
Amarillo	86	187
Beaumont	54	106
Brownsville	64	114
Bryan-College Station	23	32
Harlingen	—	—
Killeen-Temple	57	72
Laredo	18	25
Longview	20	33
Midland-Odessa	7	60
San Angelo	11	19
Sherman-Denison	6	19
Texarkana	231	267
Tyler	126	266
Victoria	23	36
Waco	99	181
Wichita Falls	—	—
Urban Total	\$868	\$1,503
Total	\$18,180	\$35,266

CHAPTER 3 – UPDATED TRANSPORTATION PLANNING DATA

The researcher examined the data from the regional models and the State Data Center (4) to estimate the key demographic variables. Population estimates from the 2000 to 2007 growth trend scenario were used for this study. This scenario most closely matched the population estimates used in the regional travel demand models. The State Data Center includes estimates for each five-year increment from 2010 to 2040. The population data were used to create estimates of the number of commuters and households, which were used in the subsequent analysis and performance measurement steps. These demographic values were not used to re-run or alter the regional travel demand models.

Table 3-1 shows the population estimates for 2010, 2015, and 2020. Growth in a few of the small urban areas is less than can be shown with two decimal places for some time periods. Growth in the metro areas is both larger and faster (on an annual percentage basis) than growth in the urban areas.

TTI's *Urban Mobility Report* (5) uses delay per commuter as a key performance measure. The same ratios for commuters developed in the report were used in preparing the estimates of Texas regional commuters. The values in Table 3-2 include the ratios along with the number of commuters for 2010, 2015, and 2020. Like the population values, the changes in commuters for several regions are too small to be presented with two decimal places.

A conversion similar to that used to generate the number of commuters from the population estimates was used to generate the estimate of households (Table 3-3). The household value was used in the presentation of implementation and congestion costs in subsequent analyses.

The amount of vehicle travel on the main road system—freeways and arterial streets—resulting from the population estimates for 2020 are illustrated in Table 3-4. The 2020 estimates were developed using the ratio of population to vehicle travel in 2010 and 2035.

Table 3-1. Regional Population Estimates (Million).

Metro Areas	2010	2015	2020
Austin	1.57	1.79	2.00
Corpus Christi	0.48	0.50	0.53
Dallas-Fort Worth	6.24	6.95	7.65
El Paso	0.80	0.90	1.00
Hidalgo	0.77	0.87	0.96
Houston	5.12	6.36	7.60
Lubbock	0.23	0.23	0.24
San Antonio	1.86	2.01	2.15
Metro Total	17.06	19.60	22.13
Abilene	0.13	0.13	0.13
Amarillo	0.26	0.27	0.29
Beaumont	0.38	0.40	0.42
Brownsville	0.24	0.28	0.31
Bryan-College Station	0.16	0.18	0.19
Harlingen	0.16	0.17	0.18
Killeen-Temple	0.33	0.36	0.39
Laredo	0.25	0.29	0.33
Longview	0.12	0.13	0.14
Midland-Odessa	0.26	0.26	0.27
San Angelo	0.11	0.12	0.12
Sherman-Denison	0.11	0.12	0.13
Texarkana	0.09	0.09	0.10
Tyler	0.15	0.17	0.19
Victoria	0.09	0.09	0.10
Waco	0.21	0.22	0.23
Wichita Falls	0.16	0.16	0.17
Urban Total	3.21	3.44	3.66
State Metro & Urban Total	20.27	23.03	25.79

Table 3-2. Regional Commuter Estimates (Million).

Metro Areas	Popn. per Commuter	2010	2015	2020
Austin	1.80	0.87	1.00	1.11
Corpus Christi	1.82	0.26	0.28	0.29
Dallas-Fort Worth	1.68	3.71	4.16	4.54
El Paso	1.83	0.44	0.50	0.55
Hidalgo	1.82	0.42	0.48	0.53
Houston	1.71	2.99	3.79	4.44
Lubbock	1.82	0.12	0.13	0.13
San Antonio	1.80	1.03	1.12	1.19
Metro Total		9.85	11.45	12.79
Abilene	1.82	0.07	0.07	0.07
Amarillo	1.82	0.14	0.15	0.16
Beaumont	1.82	0.21	0.22	0.23
Brownsville	1.82	0.13	0.15	0.17
Bryan-College Station	1.82	0.09	0.10	0.10
Harlingen	1.82	0.09	0.09	0.10
Killeen-Temple	1.82	0.18	0.20	0.21
Laredo	1.82	0.14	0.16	0.18
Longview	1.82	0.07	0.07	0.08
Midland-Odessa	1.82	0.14	0.14	0.15
San Angelo	1.82	0.06	0.06	0.07
Sherman-Denison	1.82	0.06	0.06	0.07
Texarkana	1.82	0.05	0.05	0.05
Tyler	1.82	0.08	0.09	0.10
Victoria	1.82	0.05	0.05	0.05
Waco	1.82	0.12	0.12	0.13
Wichita Falls	1.82	0.09	0.09	0.09
Urban Total		1.77	1.90	2.01
State Metro & Urban Total		11.62	13.35	14.80

Table 3-3. Regional Household Estimates (Million).

Metro Areas	Popn. Per Household	2010	2015	2020
Austin	2.49	0.80	0.90	1.01
Corpus Christi	2.69	0.23	0.23	0.25
Dallas-Fort Worth	2.81	2.83	3.09	3.41
El Paso	3.09	0.33	0.36	0.41
Hidalgo	3.39	0.29	0.32	0.35
Houston	2.85	2.27	2.79	3.34
Lubbock	2.45	0.12	0.12	0.12
San Antonio	2.85	0.83	0.88	0.94
Metro Total		7.69	8.70	9.82
Abilene	2.41	0.07	0.07	0.07
Amarillo	2.70	0.12	0.13	0.13
Beaumont	2.50	0.19	0.20	0.21
Brownsville	3.68	0.08	0.09	0.11
Bryan-College Station	2.55	0.08	0.09	0.09
Harlingen	3.39	0.06	0.06	0.07
Killeen-Temple	2.79	0.15	0.16	0.17
Laredo	3.68	0.09	0.10	0.11
Longview	2.78	0.05	0.06	0.06
Midland-Odessa	2.72	0.12	0.12	0.12
San Angelo	2.47	0.06	0.06	0.06
Sherman-Denison	2.55	0.05	0.06	0.06
Texarkana	2.60	0.04	0.04	0.05
Tyler	2.61	0.07	0.08	0.09
Victoria	2.71	0.04	0.04	0.05
Waco	2.67	0.10	0.10	0.11
Wichita Falls	2.40	0.08	0.08	0.09
Urban Total		1.49	1.55	1.65
State Metro & Urban Total		9.18	10.25	11.47

Note: Totals shown are actual values; may appear different due to rounding.

Table 3-4. Estimated Daily Vehicle Miles of Travel for 2020.

Metro Area	Arterial	Freeway	Total
Austin	13,392,344	7,376,066	20,768,411
Corpus Christi	3,276,914	2,475,401	5,752,315
Dallas-Fort Worth	37,029,449	37,209,372	74,238,821
El Paso	4,705,728	3,227,057	7,932,785
Hidalgo	2,840,417	1,484,362	4,324,780
Houston	44,439,772	39,660,228	84,100,000
Lubbock	2,050,064	894,570	2,944,634
San Antonio	11,400,711	12,213,832	23,614,543
Urban Area	Arterial	Freeway	Total
Abilene	550,501	324,817	875,318
Amarillo	897,945	804,984	1,702,929
Beaumont	2,302,813	2,144,169	4,446,982
Brownsville	1,035,829	378,691	1,414,519
Bryan-College Station	1,097,751	421,963	1,519,714
Harlingen	583,379	546,829	1,130,208
Killeen-Temple	1,325,724	1,260,168	2,585,892
Laredo	1,468,170	309,603	1,777,773
Longview	1,588,485	393,776	1,982,260
Midland-Odessa	1,788,337	1,092,222	2,880,559
San Angelo	368,414	126,182	494,597
Sherman-Denison	411,922	509,843	921,765
Texarkana	467,729	607,951	1,075,680
Tyler	2,610,108	600,234	3,210,342
Victoria	539,551	442,514	982,065
Waco	851,421	1,150,955	2,002,376
Wichita Falls	407,538	417,995	825,533

CHAPTER 4 – NEAR-TERM ADDED ROAD CAPACITY

The base year for the most recent metro and urban mobility studies was 2006. The base year for this study was 2010; the estimate of roadway additions needed to achieve the scenario goals specified in subsequent tasks should use the system that was operating in 2009 as a starting point. TxDOT's Roadway-Highway Inventory (RHiNO) System database (6) was used to identify the added roadway network. RHiNO specifies the number of lanes and road segment length for all Texas public roads. The database was analyzed for changes in total road length for the major road classifications—freeways and arterials—in the counties included in the regional travel models. Minor road classifications are not included in the mobility performance analysis.

Table 4-1 illustrates the estimated roadway additions between 2006 and 2009 for each region. The lane-miles within each region were further sub-allocated to area types according to the difference between the model base and future years. This allocation process is required to more appropriately estimate the cost of additional roadways. The added roadway needed to accomplish each scenario goal (see Task 5) will use the 2009 network lane-miles as the base for calculating scenario costs.

Table 4-1. Lane-Miles Added from 2006 to 2009.

Region	Arterial Lane Miles	Freeway Lane Miles	Total Lane Miles
Austin	196.0	138.0	334.0
Corpus Christi	9.1	-	9.1
Dallas-Fort Worth	323.3	499.1	822.4
El Paso	34.4	-	34.4
Hidalgo	51.0	-	51.0
Houston	665.0	254.0	919.0
Lubbock	29.6	8.1	37.7
San Antonio	68.4	80.2	148.6
Metro Total	1,376	980	2,356
Abilene	0	0	0
Amarillo	7.6	-	8
Beaumont-Port Arthur	75.8	-	76
Brownsville	15.1	-	15
College Station-Bryan	14.9	-	15
Harlingen	4.6	-	5
Killeen-Temple-Fort Hood	52.5	9.8	62
Laredo	39.2	9.7	49
Longview	11.1	-	11
Midland-Odessa	25.1	6.7	32
San Angelo	-	-	0
Sherman-Denison	5.8	-	6
Texarkana	2.0	-	2
Tyler	37.6	-	38
Victoria	3.5	-	4
Waco	-	7.7	8
Wichita Falls	0.9	-	1
Urban Total	296	34	330
Total	1,672	1,014	2,686

CHAPTER 5 – DESCRIPTION OF 2020 MOBILITY IMPROVEMENT SCENARIOS

The mobility scenarios for 2020 are relatively similar to the 2030 Needs Studies completed in 2009 and 2011 (1, 2). The specific scenarios that are used in the analysis are a function of the intent of the study, and other scenarios could be developed in other analyses. In general, the System Operation and Pavement Optimization study is a near-term analysis of several relatively low funding levels (i.e., more likely values, rather than an aspirational analysis). The target year of 2020 was designed to identify a closer, more easily understandable set of scenarios. A set of six scenarios is described below.

Lane-miles added between 2006 and 2009 were subtracted from the total lane-miles added for each scenario to estimate a net addition amount needed to achieve the scenario goal in Tables 5-1 and 5-2 (as described in the Task 4 technical memorandum). The unit costs (per lane-mile and per hour of delay) were updated to 2010 and applied to the new calculations. The cost of these lane-miles (see Tables 5-3 and 5-4) was designed to represent a full spectrum of improvement types necessary to achieve the scenario goals; the use of roadway-based cost elements should not be interpreted as an indication that road improvements are the only strategy that will be used.

- **Unacceptable Conditions (Current Trend)**—The best estimate of the financially constrained Metropolitan Transportation Plans as of 2010 was used as the benchmark scenario. A comprehensive set of planning model analyses was conducted in 2006, and the results were updated to a 2010 base year.
- **Continue 2010 Congestion**—This scenario added enough lanes to bring travel delay per commuter values to current levels. In a few cases, current congestion is below the future reduce-congestion levels. In these regions, the reduce-congestion values were used for this scenario on the theory that all the meaningful congestion would have been eliminated.
- **Percentages of the 2006 MTP**—The Metropolitan Transportation Plans were collected as part of the 2009 Texas 2030 Committee Study (1). A comprehensive set of planning model analyses was conducted at that time. The lane-miles that were estimated to be added in the financially constrained plan for each region were identified. Percentages of the lane-miles that would be accomplished in the 2006

MTP were used to give a sense of the congestion trade-off between implementation cost and congestion levels. Values of 75 percent and 60 percent of the 2006 MTP were used for the 2020 analysis year because those were two reasonable values for the funding that would be included in the updated MTPs. The actual value varies from region to region, but these offered two easily understood benchmark comparisons.

- **Minimum Competitive** —The 2030 Committee developed this scenario to recognize that some of the congestion expectations are based on regional population size. Larger metropolitan regions expect and operate with more congestion than small regions, and their businesses, economy, and quality-of-life have some allowance for more travel time. The goal of this scenario was for all Texas regions to have a congestion level that is no worse than the median value of similar-sized U.S. regions. The targets were expressed in delay hours per commuter for each of four population ranges (i.e., 3+ million, 1 to 3 million, 500,000 to 1 million, and below 500,000).
- **Worst Acceptable**—This scenario was developed by adding only enough roadway lanes to solve the worst congestion problems and keep the congestion levels in the range of the bottom quarter of U.S. regions of similar size.

Table 5-1. 2015 Lane Miles.

Region	75% of 2006 MTP	60% of 2006 MTP	Prevent Worse Congestion	Minimum Competitive	Worst Acceptable	Current Trend
Austin	550	404	551	1,038	1,038	1,038
Corpus Christi	63	49	81	12	12	12
Dallas-Fort Worth	2,402	1,827	4,538	4,538	1,916	1,916
El Paso	162	123	224	235	235	235
Hidalgo	126	96	153	79	79	79
Houston	1,095	876	2,192	2,628	1,223	1,223
Lubbock	76	57	140	140	42	42
San Antonio	148	118	223	144	144	144
Metro Total	4,622	3,551	8,103	8,815	4,690	4,690
Abilene	15	12	35	20	20	20
Amarillo	12	9	18	12	12	12
Beaumont	22	17	47	47	26	26
Brownsville	45	34	63	37	37	37
Bryan-College Station	25	19	63	63	8	8
Harlingen	21	16	41	41	-	-
Killeen-Temple	62	50	99	31	31	31
Laredo	144	115	152	152	12	12
Longview	43	34	46	46	3	3
Midland-Odessa	8	6	12	12	2	2
San Angelo	2	1	2	3	3	3
Sherman-Denison	6	4	17	2	2	2
Texarkana	88	70	25	167	167	167
Tyler	14	8	39	39	99	99
Victoria	24	19	16	33	24	24
Waco	9	7	16	20	20	20
Wichita Falls	8	6	11	-	-	-
Urban Total	548	429	702	725	465	465
Total	5,170	3,980	8,805	9,540	5,155	5,155

Table 5-2. 2020 Lane Miles Added.

Region	75% of 2006 MTP	60% of 2006 MTP	Prevent Worse Congestion	Minimum Competitive	Worst Acceptable	Current Trend
Austin	1,101	808	1,102	1,864	1,864	1,864
Corpus Christi	126	99	161	33	33	33
Dallas-Fort Worth	4,804	3,654	9,232	9,232	3,967	3,632
El Paso	323	247	420	305	305	305
Hidalgo	253	192	306	178	178	178
Houston	2,190	1,752	5,083	4,828	3,145	2,654
Lubbock	152	114	309	293	87	87
San Antonio	295	236	461	288	288	288
Metro Total	13,659	10,623	17,074	23,805	14,714	12,217
Abilene	31	25	50	41	41	41
Amarillo	25	18	35	26	26	26
Beaumont	43	34	94	94	50	50
Brownsville	90	69	125	65	65	65
Bryan-College Station	50	37	127	72	39	11
Harlingen	42	33	85	33	21	-
Killeen-Temple	124	100	198	33	62	33
Laredo	289	231	304	304	152	17
Longview	86	68	92	92	53	4
Midland-Odessa	15	11	24	15	15	15
San Angelo	3	2	2	5	5	5
Sherman – Denison	12	9	34	5	5	5
Texarkana	176	140	47	193	193	193
Tyler	28	15	118	118	210	210
Victoria	48	38	26	38	38	38
Waco	18	14	33	36	36	36
Wichita Falls	16	13	23	-	-	-
Urban Total	1,097	858	1,418	1,170	1,012	750
Total	14,756	11,481	18,492	24,975	15,726	12,967

Table 5-3. 2015 Implementation Cost (2010 \$ Million).

Region	75% of 2006 MTP	60% of 2006 MTP	Prevent Worse Congestion	Minimum Competitive	Worst Acceptable	Current Trend
Austin	\$1,771	\$1,350	\$1,770	\$3,220	\$3,220	\$3,220
Corpus Christi	\$317	\$251	\$426	\$60	\$60	\$60
Dallas-Fort Worth	\$8,000	\$6,237	\$14,500	\$14,500	\$6,540	\$6,540
El Paso	\$506	\$394	\$800	\$750	\$750	\$750
Hidalgo	\$249	\$194	\$342	\$160	\$160	\$160
Houston	\$4,979	\$4,131	\$11,000	\$13,116	\$5,370	\$5,370
Lubbock	\$145	\$115	\$250	\$85	\$85	\$85
San Antonio	\$1,034	\$924	\$1,600	\$1,365	\$1,128	\$1,128
Metro Total	\$17,000	\$13,597	\$30,688	\$33,255	\$17,313	\$17,313
Abilene	\$32	\$25	\$70	\$42	\$42	\$42
Amarillo	\$88	\$68	\$130	\$86	\$86	\$86
Beaumont	\$46	\$41	\$80	\$80	\$54	\$54
Brownsville	\$77	\$60	\$105	\$64	\$64	\$64
Bryan-College Station	\$71	\$55	\$125	\$103	\$23	\$23
Harlingen	\$64	\$50	\$86	\$50	-	-
Killeen-Temple	\$129	\$109	\$200	\$67	\$67	\$67
Laredo	\$212	\$173	\$280	\$144	\$18	\$18
Longview	\$298	\$254	\$300	\$339	\$20	\$20
Midland-Odessa	\$27	\$23	\$32	\$32	\$7	\$7
San Angelo	\$6	\$4	\$5	\$11	\$11	\$11
Sherman-Denison	\$21	\$15	\$30	\$6	\$6	\$6
Texarkana	\$121	\$97	\$35	\$231	\$231	\$231
Tyler	\$26	\$16	\$50	\$126	\$126	\$126
Victoria	\$23	\$18	\$15	\$23	\$23	\$23
Waco	\$49	\$42	\$60	\$99	\$99	\$99
Wichita Falls	\$26	\$20	\$35	\$12	-	-
Urban Total	\$1,314	\$1,071	\$1,638	\$1,516	\$878	\$878
Total	\$18,314	\$14,667	\$32,326	\$34,771	\$18,191	\$18,191

Table 5-4. 2020 Implementation Cost (2010 \$ Million).

Region	75% of 2006 MTP	60% of 2006 MTP	Prevent Worse Congestion	Minimum Competitive	Worst Acceptable	Current Trend
Austin	\$3,541	\$2,701	\$3,541	\$5,780	\$5,780	\$5,780
Corpus Christi	\$634	\$502	\$853	\$170	\$170	\$170
Dallas-Fort Worth	\$15,999	\$12,475	\$29,500	\$21,848	\$13,532	\$12,400
El Paso	\$1,011	\$789	\$1,500	\$975	\$975	\$975
Hidalgo	\$499	\$388	\$683	\$360	\$360	\$360
Houston	\$9,958	\$8,262	\$25,500	\$23,221	\$13,860	\$11,650
Lubbock	\$291	\$229	\$550	\$175	\$175	\$175
San Antonio	\$2,067	\$1,848	\$3,300	\$2,655	\$2,253	\$2,253
Metro Total	\$34,000	\$27,193	\$65,427	\$55,185	\$37,104	\$33,763
Abilene	\$64	\$51	\$100	\$84	\$84	\$84
Amarillo	\$177	\$135	\$250	\$187	\$187	\$187
Beaumont	\$91	\$81	\$160	\$124	\$106	\$106
Brownsville	\$154	\$120	\$210	\$114	\$114	\$114
Bryan-College Station	\$141	\$109	\$250	\$168	\$109	\$32
Harlingen	\$128	\$101	\$180	\$101	\$62	-
Killeen-Temple	\$258	\$218	\$400	\$118	\$118	\$72
Laredo	\$424	\$346	\$560	\$424	\$288	\$25
Longview	\$595	\$508	\$600	\$595	\$339	\$33
Midland-Odessa	\$54	\$46	\$65	\$63	\$60	\$60
San Angelo	\$11	\$9	\$6	\$19	\$19	\$19
Sherman-Denison	\$42	\$31	\$60	\$36	\$19	\$19
Texarkana	\$242	\$194	\$65	\$267	\$267	\$267
Tyler	\$52	\$31	\$150	\$266	\$266	\$266
Victoria	\$46	\$36	\$25	\$36	\$36	\$36
Waco	\$98	\$85	\$125	\$181	\$181	\$181
Wichita Falls	\$51	\$41	\$70	\$41	-	-
Urban Total	\$2,628	\$2,142	\$3,276	\$2,825	\$2,257	\$1,503
Total	\$36,629	\$29,335	\$68,703	\$58,010	\$39,362	\$35,266

CHAPTER 6 – 2020 SCENARIOS—MOBILITY AND ECONOMIC CONSEQUENCES

The six scenarios in the System Operation and Pavement Optimization study were described in the Task 5 technical memorandum (7). The scenario performance measures for 2020 were calculated at the MPO region level; the statewide values are a sum (or average) of the 25 metro and urban regions. In each case, the scenario travel volume and roadway lane-mile values for 2020 were an interpolated value from the 2010 to 2035 trend, based on the annual rates. The key performance measures were estimated from the relationship between volume, lane-miles, population, and other key statistics.

The scenarios are described below:

- **Unacceptable Conditions (Current Trend)**—The best estimate of the financially constrained Metropolitan Transportation Plans as of 2010 was used as the benchmark scenario. A comprehensive set of planning model analyses were conducted in 2006, and the results were updated to a 2010 base year.
- **Continue 2010 Congestion**—This scenario added enough lanes to bring travel delay per commuter values to current levels. In a few cases, current congestion is below the future reduce-congestion levels. In these regions, the reduce-congestion values were used for this scenario on the theory that all of the meaningful congestion would have been eliminated.
- **Percentages of the 2006 MTP**—The Metropolitan Transportation Plans were collected as part of the 2009 Texas 2030 Committee Study (1). A comprehensive set of planning model analyses was conducted at that time. The lane-miles that were estimated to be added in the financially constrained plan for each region were identified. Percentages of the lane-miles that would be accomplished in the 2006 MTP were used to give a sense of the congestion trade-off between implementation cost and congestion levels. Values of 75 percent and 60 percent of the 2006 MTP were used for the 2020 analysis year because those were two reasonable values for the funding that would be included in the updated MTPs. The actual value varies from region to region, but these offered two easily understood benchmark comparisons.

- **Minimum Competitive**—The 2030 Committee developed this scenario to recognize that some of the congestion expectations are based on regional population size. Larger metropolitan regions expect and operate with more congestion than small regions, and their businesses, economy, and quality of life have some allowance for more travel time. The goal of this scenario was for all Texas regions to have a congestion level that is no worse than the median value of similar-sized U.S. regions. The targets were expressed in delay hours per commuter for each of four population ranges (i.e., 3+ million, 1 to 3 million, 500,000 to 1 million and below 500,000).
- **Worst Acceptable**—This scenario was developed by adding only enough roadway lanes to solve the worst congestion problems and keep the congestion levels in the range of the bottom quarter of similar-sized U.S. regions.

The 2020 congestion estimates were based on the same information developed in the 2030 Needs studies (1, 2) unless an updated transportation planning model was available. New models from the following regions were incorporated: Houston-Galveston, Killeen-Temple, Laredo, Longview, Midland-Odessa, San Antonio, Tyler, and Waco.

MOBILITY AND ECONOMIC DATA FOR EACH REGION

Several performance measures are included in the 2020 analysis to describe the outcomes of the investments. The measures included both regional totals and per commuter measures to capture the area-wide effects and measures relevant to individuals.

- **Daily Delay**—Daily person-hours of travel delay. The extra travel time for all travelers in the six peak period hours (6 to 9 a.m. and 4 to 7 p.m.).
- **Congestion Cost**—Estimated annual cost using the delay hours and cost information from the detailed model data. The hourly cost value for each region is based on the combination of person and truck congestion derived in the 2030 Committee reports (1, 2) and includes an estimate of both travel delay and fuel costs.
- **Delay per commuter**—Extra travel time in the six peak period hours (6 to 9 a.m. and 4 to 7 p.m.) per person traveling during the peak.
- **Congestion cost per commuter**—The value of the extra travel time and fuel per commuter.

Table 6-1. 2015 Total Daily Delay (Hours).

Region	75% of 2006 MTP	60% of 2006 MTP	Continue 2010 Congestion	Minimum Competitive	Worst Acceptable	Current Trend
Austin	132,333	140,354	132,333	119,742	119,742	119,742
Corpus Christi	18,868	19,978	17,758	22,298	22,298	22,298
Dallas-Fort Worth	915,677	998,920	832,434	832,434	984,621	984,621
El Paso	29,806	32,787	21,858	24,129	24,129	24,129
Hidalgo	17,281	18,241	15,361	18,639	18,639	18,639
Houston	929,720	967,572	799,578	757,044	919,377	919,377
Lubbock	9,097	9,481	8,200	9,631	9,631	9,631
San Antonio	174,909	186,121	134,545	156,970	171,931	171,931
Metro Total	2,227,691	2,373,454	1,962,067	1,940,886	2,270,369	2,270,369
Abilene	542	571	440	514	514	514
Amarillo	1,780	1,810	1,690	1,784	1,784	1,784
Beaumont	13,232	13,541	12,350	12,350	13,001	13,001
Brownsville	3,466	3,772	3,067	3,699	3,699	3,699
Bryan-College Station	4,204	4,498	3,520	3,911	4,693	4,693
Harlingen	3,363	3,736	2,989	3,736	4,110	4,110
Killeen-Temple	5,580	5,979	4,783	6,306	6,306	6,306
Laredo	7,060	7,381	6,419	7,702	8,836	8,836
Longview	5,892	6,179	5,476	5,734	6,973	6,973
Midland-Odessa	3,563	3,650	3,477	3,477	3,934	3,934
San Angelo	345	353	362	317	317	317
Sherman-Denison	566	592	514	619	619	619
Texarkana	1,724	1,825	2,028	1,450	1,450	1,450
Tyler	8,350	8,536	7,423	4,479	4,479	4,479
Victoria	1,818	1,839	1,870	1,815	1,815	1,815
Waco	2,056	2,178	1,958	1,651	1,651	1,651
Wichita Falls	923	977	888	1,065	1,065	1,065
Urban Total	64,465	67,417	59,252	60,609	65,246	65,246
Total	2,292,156	2,440,871	2,021,318	2,001,495	2,335,615	2,335,615

Table 6-2. 2015 Annual Congestion Cost (2010 \$ Million).

Region	75% of 2006 MTP	60% of 2006 MTP	Continue 2010 Congestion	Minimum Competitive	Worst Acceptable	Current Trend
Austin	\$794	\$842	\$794	\$718	\$718	\$718
Corpus Christi	\$141	\$149	\$132	\$166	\$166	\$166
Dallas-Fort Worth	\$5,402	\$5,893	\$4,911	\$4,911	\$5,809	\$5,809
El Paso	\$165	\$182	\$121	\$134	\$134	\$134
Hidalgo	\$100	\$106	\$89	\$108	\$108	\$108
Houston	\$6,509	\$6,774	\$5,598	\$5,300	\$6,437	\$6,437
Lubbock	\$54	\$57	\$49	\$58	\$58	\$58
San Antonio	\$781	\$831	\$601	\$701	\$768	\$768
Metro Total	\$13,947	\$14,834	\$12,296	\$12,097	\$14,198	\$14,198
Abilene	\$4	\$5	\$4	\$4	\$4	\$4
Amarillo	\$17	\$17	\$16	\$17	\$17	\$17
Beaumont	\$89	\$91	\$83	\$83	\$87	\$87
Brownsville	\$20	\$22	\$18	\$22	\$22	\$22
Bryan-College Station	\$29	\$31	\$25	\$27	\$33	\$33
Harlingen	\$20	\$22	\$17	\$22	\$24	\$24
Killeen-Temple	\$32	\$35	\$28	\$37	\$37	\$37
Laredo	\$55	\$57	\$50	\$60	\$69	\$69
Longview	\$41	\$43	\$38	\$40	\$49	\$49
Midland-Odessa	\$25	\$25	\$24	\$24	\$27	\$27
San Angelo	\$3	\$3	\$3	\$2	\$2	\$2
Sherman-Denison	\$4	\$4	\$4	\$5	\$5	\$5
Texarkana	\$15	\$16	\$17	\$12	\$12	\$12
Tyler	\$53	\$54	\$47	\$28	\$28	\$28
Victoria	\$15	\$15	\$15	\$15	\$15	\$15
Waco	\$5	\$5	\$5	\$4	\$4	\$4
Wichita Falls	\$6	\$7	\$6	\$7	\$7	\$7
Urban Total	\$433	\$452	\$399	\$409	\$441	\$441
Total	\$14,380	\$15,286	\$12,695	\$12,506	\$14,639	\$14,639

Table 6-3. 2015 Delay Per Commuter (Hours).

Region	75% of 2006 MTP	60% of 2006 MTP	Continue 2010 Congestion	Minimum Competitive	Worst Acceptable	Current Trend
Austin	33	35	33	30	30	30
Corpus Christi	17	18	16	20	20	20
Dallas-Fort Worth	55	60	50	50	59	59
El Paso	15	17	11	12	12	12
Hidalgo	9	10	8	10	10	10
Houston	61	64	53	50	61	61
Lubbock	18	19	16	19	19	19
San Antonio	39	42	30	35	38	38
Metro Average	49	52	43	42	50	50
Abilene	2	2	2	2	2	2
Amarillo	3	3	3	3	3	3
Beaumont	15	15	14	14	15	15
Brownsville	6	6	5	6	6	6
Bryan-College Station	11	12	9	10	12	12
Harlingen	9	10	8	10	11	11
Killeen-Temple	7	8	6	8	8	8
Laredo	11	12	10	12	14	14
Longview	21	22	19	20	24	24
Midland-Odessa	6	6	6	6	7	7
San Angelo	1	1	1	1	1	1
Sherman-Denison	2	2	2	2	2	2
Texarkana	9	9	10	7	7	7
Tyler	23	23	20	12	12	12
Victoria	9	9	9	9	9	9
Waco	4	4	4	3	3	3
Wichita Falls	3	3	3	3	3	3
Urban Average	8	9	8	8	9	9
Average	43	46	38	37	44	44

Table 6-4. 2015 Congestion Cost per Commuter (2010 \$).

Region	75% of 2006 MTP	60% of 2006 MTP	Continue 2010 Congestion	Minimum Competitive	Worst Acceptable	Current Trend
Austin	\$792	\$840	\$792	\$717	\$647	\$717
Corpus Christi	\$507	\$536	\$477	\$599	\$570	\$599
Dallas-Fort Worth	\$1,298	\$1,416	\$1,180	\$1,180	\$1,279	\$1,396
El Paso	\$333	\$366	\$244	\$269	\$245	\$269
Hidalgo	\$209	\$221	\$186	\$226	\$205	\$226
Houston	\$1,720	\$1,790	\$1,479	\$1,370	\$1,448	\$1,701
Lubbock	\$425	\$443	\$383	\$383	\$437	\$450
San Antonio	\$697	\$742	\$536	\$685	\$643	\$685
Metro Average	\$1,218	\$1,295	\$1,074	\$1,056	\$1,110	\$1,240
Abilene	\$59	\$62	\$48	\$56	\$56	\$56
Amarillo	\$113	\$115	\$107	\$113	\$109	\$113
Beaumont	\$403	\$413	\$376	\$376	\$379	\$396
Brownsville	\$132	\$144	\$117	\$141	\$127	\$141
Bryan-College Station	\$301	\$322	\$252	\$252	\$314	\$336
Harlingen	\$209	\$232	\$186	\$186	\$241	\$255
Killeen-Temple	\$163	\$175	\$140	\$184	\$171	\$184
Laredo	\$343	\$358	\$311	\$311	\$385	\$429
Longview	\$574	\$601	\$533	\$533	\$632	\$679
Midland-Odessa	\$171	\$175	\$166	\$166	\$184	\$188
San Angelo	\$40	\$41	\$42	\$37	\$36	\$37
Sherman-Denison	\$66	\$69	\$60	\$72	\$67	\$72
Texarkana	\$289	\$306	\$340	\$243	\$236	\$243
Tyler	\$567	\$580	\$504	\$504	\$278	\$304
Victoria	\$280	\$283	\$288	\$272	\$264	\$280
Waco	\$42	\$44	\$40	\$33	\$32	\$33
Wichita Falls	\$70	\$74	\$67	\$80	\$79	\$80
Urban Average	\$228	\$238	\$210	\$215	\$219	\$232
Average	\$1,077	\$1,145	\$951	\$936	\$989	\$1,096

Table 6-5. 2020 Total Daily Delay (Hours).

Region	75% of 2006 MTP	60% of 2006 MTP	Continue 2010 Congestion	Minimum Competitive	Worst Acceptable	Current Trend
Austin	146,667	164,444	146,667	125,102	125,102	125,102
Corpus Christi	20,967	23,297	18,637	27,530	27,530	27,530
Dallas-Fort Worth	1,090,261	1,271,971	908,551	999,406	1,217,458	1,275,814
El Paso	41,530	48,087	24,044	41,530	41,530	42,599
Hidalgo	21,099	23,209	16,879	23,569	23,569	23,569
Houston	1,244,444	1,333,333	938,830	977,778	1,137,778	1,191,885
Lubbock	10,286	11,077	8,440	11,359	11,359	11,359
San Antonio	229,333	253,222	143,333	200,667	223,090	223,090
Metro Total	2,804,587	3,128,641	2,205,381	2,406,940	2,807,415	2,920,946
Abilene	648	707	442	591	591	591
Amarillo	1,942	2,004	1,754	1,932	1,932	1,932
Beaumont	14,769	15,415	12,923	13,846	14,351	14,351
Brownsville	4,292	4,974	3,407	5,097	5,097	5,097
Bryan-College Station	5,220	5,846	3,758	5,011	5,846	6,347
Harlingen	3,956	4,747	3,165	4,747	5,143	5,538
Killeen-Temple	6,857	7,714	5,143	8,571	8,571	9,007
Laredo	8,571	9,286	7,143	8,571	10,000	12,627
Longview	6,769	7,385	5,877	6,769	8,000	9,110
Midland-Odessa	3,738	3,916	3,560	3,560	3,620	3,618
San Angelo	335	351	369	297	297	297
Sherman-Denison	659	714	549	687	752	752
Texarkana	1,462	1,670	2,088	1,399	1,399	1,399
Tyler	10,165	10,571	8,132	5,964	5,964	5,964
Victoria	1,868	1,912	1,978	1,912	1,912	1,912
Waco	2,224	2,477	2,022	1,533	1,533	1,533
Wichita Falls	979	1,088	907	1,088	1,269	1,269
Urban Total	74,455	80,778	63,216	71,577	76,278	81,345
Total	2,879,043	3,209,420	2,268,597	2,478,517	2,883,693	3,002,291

Table 6-6. 2020 Annual Congestion Cost (2010 \$ Million).

Region	75% of 2006 MTP	60% of 2006 MTP	Continue 2010 Congestion	Minimum Competitive	Worst Acceptable	Current Trend
Austin	\$880	\$987	\$880	\$751	\$751	\$751
Corpus Christi	\$156	\$174	\$139	\$205	\$205	\$205
Dallas-Fort Worth	\$6,432	\$7,504	\$5,360	\$5,896	\$7,182	\$7,527
El Paso	\$230	\$267	\$133	\$230	\$230	\$236
Hidalgo	\$123	\$135	\$98	\$137	\$137	\$137
Houston	\$8,713	\$9,335	\$6,573	\$6,846	\$7,966	\$8,345
Lubbock	\$62	\$66	\$51	\$68	\$68	\$68
San Antonio	\$1,024	\$1,131	\$640	\$896	\$997	\$997
Metro Total	\$17,620	\$19,598	\$13,874	\$15,029	\$17,536	\$18,265
Abilene	\$5	\$6	\$4	\$5	\$5	\$5
Amarillo	\$19	\$19	\$17	\$18	\$18	\$18
Beaumont	\$99	\$104	\$87	\$93	\$96	\$96
Brownsville	\$25	\$29	\$20	\$30	\$30	\$30
Bryan-College Station	\$36	\$41	\$26	\$35	\$41	\$44
Harlingen	\$23	\$28	\$18	\$28	\$30	\$32
Killeen-Temple	\$40	\$45	\$30	\$50	\$50	\$52
Laredo	\$67	\$72	\$56	\$67	\$78	\$98
Longview	\$47	\$52	\$41	\$47	\$56	\$64
Midland-Odessa	\$26	\$27	\$25	\$25	\$25	\$25
San Angelo	\$2	\$3	\$3	\$2	\$2	\$2
Sherman-Denison	\$5	\$5	\$4	\$5	\$6	\$6
Texarkana	\$12	\$14	\$18	\$12	\$12	\$12
Tyler	\$64	\$67	\$51	\$38	\$38	\$38
Victoria	\$15	\$15	\$16	\$15	\$15	\$15
Waco	\$6	\$6	\$5	\$4	\$4	\$4
Wichita Falls	\$7	\$7	\$6	\$7	\$8	\$8
Urban Total	\$498	\$539	\$426	\$480	\$514	\$550
Total	\$18,118	\$20,137	\$14,300	\$15,509	\$18,050	\$18,815

Table 6-7. 2020 Delay per Commuter (Hours).

Region	75% of 2006 MTP	60% of 2006 MTP	Continue 2010 Congestion	Minimum Competitive	Worst Acceptable	Current Trend
Austin	33	37	33	28	28	28
Corpus Christi	18	20	16	24	24	24
Dallas-Fort Worth	60	70	50	55	67	70
El Paso	19	22	11	19	19	19
Hidalgo	10	11	8	11	11	11
Houston	70	75	53	55	64	67
Lubbock	20	21	16	22	22	22
San Antonio	48	53	30	42	47	47
Metro Average	55	61	43	47	55	57
Abilene	2	2	2	2	2	2
Amarillo	3	3	3	3	3	3
Beaumont	16	17	14	15	16	16
Brownsville	6	7	5	7	7	7
Bryan-College Station	13	14	9	12	14	15
Harlingen	10	12	8	12	13	14
Killeen-Temple	8	9	6	10	10	11
Laredo	12	13	10	12	14	18
Longview	22	24	19	22	26	30
Midland-Odessa	6	7	6	6	6	6
San Angelo	1	1	1	1	1	1
Sherman-Denison	2	3	2	3	3	3
Texarkana	7	8	10	7	7	7
Tyler	25	26	20	15	15	15
Victoria	9	9	9	9	9	9
Waco	4	5	4	3	3	3
Wichita Falls	3	3	3	3	4	4
Urban Average	9	10	8	9	9	10
Average	49	54	38	42	49	51

Table 6-8. 2020 Congestion Cost per Commuter (2010 \$).

Region	75% of 2006 MTP	60% of 2006 MTP	Continue 2010 Congestion	Minimum Competitive	Worst Acceptable	Current Trend
Austin	\$792	\$888	\$792	\$676	\$676	\$676
Corpus Christi	\$536	\$596	\$477	\$704	\$704	\$704
Dallas-Fort Worth	\$1,416	\$1,652	\$1,116	\$1,116	\$1,581	\$1,657
El Paso	\$421	\$488	\$244	\$432	\$421	\$432
Hidalgo	\$233	\$256	\$186	\$260	\$260	\$260
Houston	\$1,960	\$2,100	\$1,269	\$1,206	\$1,792	\$1,878
Lubbock	\$467	\$503	\$383	\$364	\$516	\$516
San Antonio	\$858	\$947	\$536	\$834	\$834	\$834
Metro Average	\$1,378	\$1,532	\$1,085	\$1,175	\$1,371	\$1,428
Abilene	\$70	\$77	\$48	\$64	\$64	\$64
Amarillo	\$119	\$122	\$115	\$118	\$118	\$118
Beaumont	\$430	\$449	\$376	\$376	\$418	\$418
Brownsville	\$147	\$171	\$117	\$175	\$175	\$175
Bryan-College Station	\$350	\$392	\$252	\$322	\$392	\$425
Harlingen	\$232	\$279	\$186	\$279	\$302	\$325
Killeen-Temple	\$186	\$209	\$140	\$245	\$233	\$245
Laredo	\$374	\$405	\$311	\$311	\$436	\$550
Longview	\$614	\$670	\$614	\$614	\$726	\$826
Midland-Odessa	\$175	\$183	\$166	\$169	\$169	\$169
San Angelo	\$38	\$40	\$42	\$34	\$34	\$34
Sherman-Denison	\$72	\$78	\$60	\$82	\$82	\$82
Texarkana	\$238	\$272	\$340	\$228	\$228	\$228
Tyler	\$630	\$655	\$504	\$504	\$370	\$370
Victoria	\$272	\$278	\$288	\$278	\$278	\$278
Waco	\$44	\$49	\$40	\$30	\$30	\$30
Wichita Falls	\$72	\$80	\$67	\$94	\$94	\$94
Urban Average	\$247	\$268	\$211	\$239	\$255	\$273
Average	\$1,224	\$1,360	\$966	\$1,048	\$1,219	\$1,271

CHAPTER 7 – CONCLUSIONS

The information developed in this research project demonstrates the trade-offs between implementation costs and the mobility and economic consequences of those investments. The several scenarios used to investigate these trade-offs were a combination of those used in the 2030 Committee report (1, 2) and others designed to add to the dataset. The information presented in the report covers the time period from 2010 to 2020. The data and performance measures were designed to be a part of a larger investigation of the possible trade-offs between mobility investments and pavement quality expenditures.

The mobility consequences are best illustrated with a total cost measure calculated by adding the implementation cost of the projects and programs to the cost of the extra travel time and wasted fuel consumed as a result of the transportation system that is in place. This type of comparison is usually shown in a benefit-to-cost ratio that defines the benefits in terms of lower costs and compares them to some baseline scenario. The definition of the baseline scenario can be problematic; the do-nothing alternative is not typically a real option and the current trend or metropolitan transportation plan that identifies the expected spending amounts has been altered several times in many regions over the past few years as revenue projections have changed. The total cost measure does not rely on a baseline scenario. The two costs that the public and businesses will pay are added together; the lowest cost option is easy to identify. The policy debate can proceed on the basis of which mobility goal is most appropriate or how much system improvement is desired.

For purposes of this study, one complication noted is that the time period from 2010 to 2020 is shorter than the life of the projects being analyzed. For example, the projects that will be built in 2018 and 2019 will have only two years and one year of benefits included in the calculation of total cost. In effect, the project life is being modeled as much less than the typical 20-year to 25-year period that roads are designed to achieve. Table 7-1 uses an annualized value approach to at least partially address this; the differences between scenarios are likewise illustrated—more spending on infrastructure lowers overall costs. These differences were even more apparent in the 2011 2030 Committee report (2) when the full effect of higher investment levels was incorporated in the calculations from 2010 to 2035.

Table 7-1. Total Annual Cost of 2020 Mobility Scenarios (2010 \$ Million).

Region	75% of 2006 MTP	60% of 2006 MTP	Continue 2010 Congestion	Minimum Competitive	Worst Acceptable	Current Trend
Austin	927	942	927	949	949	949
Corpus Christi	165	168	166	170	170	170
Dallas-Fort Worth	5,995	6,343	6,046	5,862	6,270	6,303
El Paso	204	212	180	187	187	189
Hidalgo	120	121	116	121	121	121
Houston	6,841	7,047	6,521	6,343	6,791	6,789
Lubbock	66	66	71	64	64	64
San Antonio	857	898	729	812	852	852
Metro Total	\$ 15,175	\$ 15,796	\$14,755	\$14,508	\$15,406	\$15,438
Abilene	7	7	8	7	7	7
Amarillo	24	23	26	25	25	25
Beaumont	92	94	89	89	91	91
Brownsville	26	27	26	26	26	26
Bryan-College Station	35	36	34	35	36	34
Harlingen	24	26	24	26	26	24
Killeen-Temple	43	43	44	41	41	40
Laredo	71	71	72	74	75	70
Longview	66	65	63	65	61	51
Midland-Odessa	27	27	27	27	28	28
San Angelo	3	3	3	3	3	3
Sherman-Denison	6	6	6	6	5	5
Texarkana	24	23	20	24	24	24
Tyler	54	55	52	45	45	45
Victoria	16	16	16	16	16	16
Waco	9	9	10	11	11	11
Wichita Falls	8	8	9	8	7	7
Urban Total	\$536	\$536	\$529	\$528	\$530	\$508
Total	\$15,712	\$16,332	\$15,284	\$15,037	\$15,935	\$15,945

REFERENCES

1. *Texas Transportation Needs Report*. Texas 2030 Committee. February 2009. <http://texas2030committee.tamu.edu/>.
2. *It's About Time: Investing in Transportation to Keep Texas Economically Competitive*. Texas 2030 Committee. March 2011. <http://texas2030committee.tamu.edu/>.
3. Development of the Texas Revenue Estimator and Needs Determination System (T.R.E.N.D.S.) Model. Texas Transportation Institute Research Report 0-6395-T1-1. October 2009.
4. Texas Population Projections Program—2008 Population Projections. Texas State Data Center. <http://txsdc.utsa.edu/Data/TPEPP/Projections/2008/Index.aspx>
5. *2010 Urban Mobility Report*. Prepared by the Texas Transportation Institute for the University Transportation Center for Mobility, College Station, Texas. 2010. <http://mobility.tamu.edu/ums/>.
6. *2009 Roadway Highway Inventory Network (RHiNO) Database*. Texas Department of Transportation. December 2010.
7. Technical Memorandum Task 5, Description of 2020 Mobility Improvement Scenarios. Texas Transportation Institute. August 2011.

 **Texas
Transportation
Institute**
Texas Transportation Institute
College Station, Texas 77843-3135
<http://tti.tamu.edu>

Transmittal:
December 2011

 **Texas
Department
of Transportation**

Project 0-6655-TI

PowerPoint Presentation
to accompany Report 0-6655-TI-2,
Mobility and Economic Effects of
System Investments in Texas:
2010 to 2020

Texas Transportation Institute
The Texas A&M University System
College Station, TX 77843-3135
979-845-1734
<http://tti.tamu.edu>