MARCH 2011

Appendices

It's About Time: Investing in Transportation to Keep Texas Economically Competitive

APPENDICES

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The *2030 Committee Report* and Executive Summary can be found on the 2030 Committee's website at: **texas2030committee.tamu.edu**.

APPENDIX A – PAVEMENT QUALITY

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The pavement maintenance and rehabilitation (M&R) needs consist of two parts that will be analyzed separately: 1) the needs to maintain the existing pavements of TxDOT highway network; and 2) the needs to maintain newly added highway pavements from the mobility analysis. Both parts of the needs were established based on the four predefined analysis scenarios. The needs are expressed in term of 2010 costs.

1) Needs to Maintain the Existing Pavements of TxDOT Highway Network: The needs analysis of existing pavements will be based on historical data from the TxDOT Pavement Management Information System (PMIS). Using the PMIS data and calibrated pavement deterioration models developed at UT, the average condition of the pavement network for the base year (2010) was first calculated. The base-year average condition was then compared with the scenario goals, to determine the difference between them for each PMIS pavement section. This difference was used to determine the M&R projects required for the base year. Finally, combining unit cost information with the required M&R projects produced the base-year pavement needs in dollars. This process continued as a loop for the whole analysis period from year 2011 to 2035, yielding the pavements needs for each individual year and the total pavement needs for the analysis period. The overall analysis procedure is illustrated in Exhibit A1.

2) Needs to Maintain Newly Added Highway Pavements from the Mobility Analysis: The M&R needs for newly added pavements were based on the information produced from the TTI mobility analysis. The information on newly added pavement lane-miles is provided by the mobility research team. Once the lane-miles are determined for each year of the analysis period, an average cost approach was employed to determine the M&R needs.

Basic assumptions for the pavement need analysis include: 1) only state-maintained highways are considered; 2) toll-roads, such as the Trans-Texas Corridor, are self-sustainable; 3) costs include not only the pavement materials but also other costs that are required to deliver the pavement as a completed project; 4) truck size and weight remain unchanged over the analysis period.

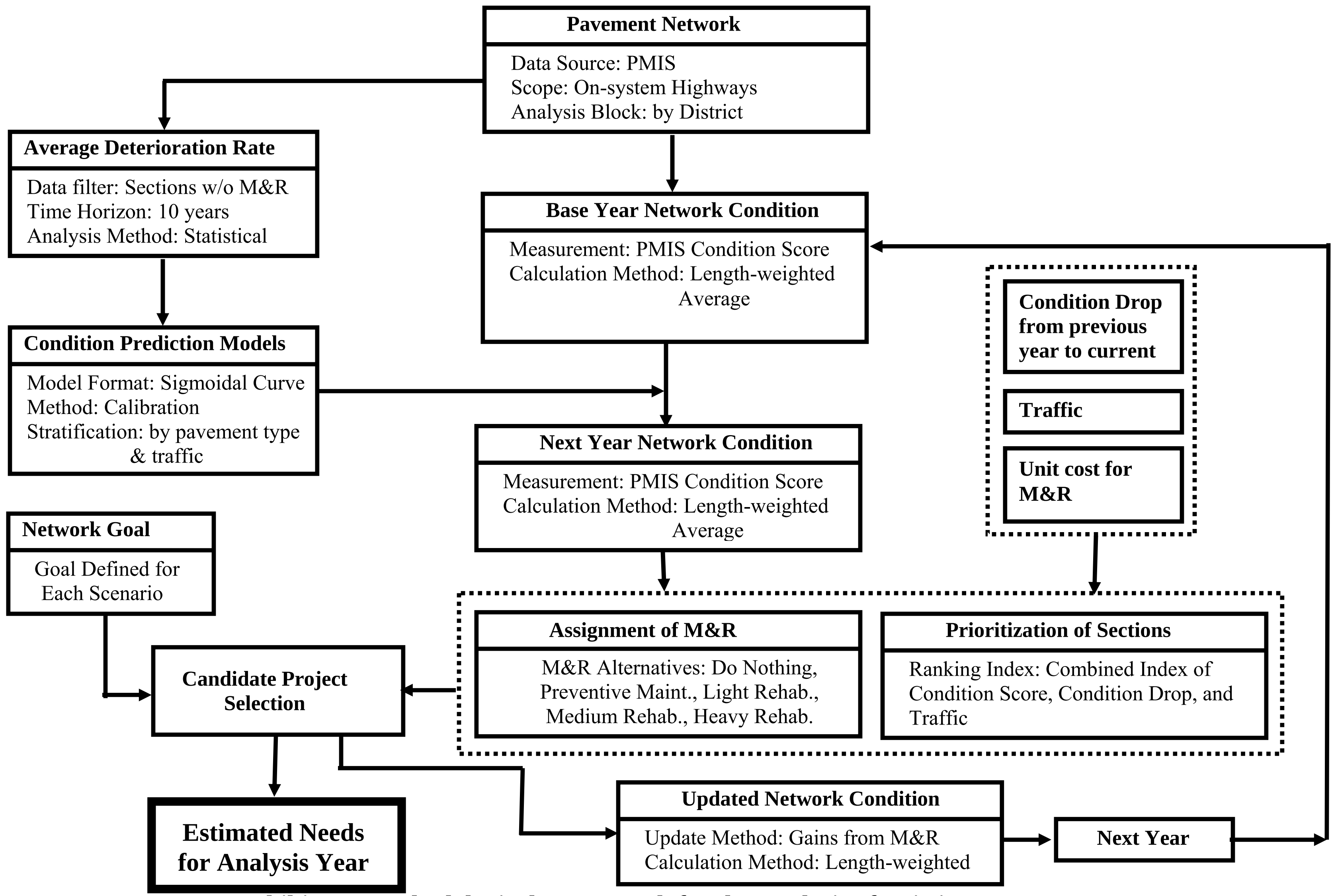

Exhibit A1. Methodological Framework for the Analysis of Existing Pavements.

I. NEEDS ANALYSIS FOR EXISTING PAVEMENTS

The needs analysis of the existing pavements of TxDOT's highway network has been addressed with the development of a methodological framework by the Transportation Infrastructure and Information Systems (TIIS) Lab of the Center of Transportation Research (CTR). Major components of the methodological framework are shown schematically in Exhibit A1 and discussed as follows.

Pavement Network

The pavement network of the analysis concerned the existing pavements under TxDOT's jurisdiction and in particular the highway network whose sections are part of the existing PMIS database. The most current version of the PMIS database was used in the analysis, based on the 2010 data collection. The analysis blocks of the network were TxDOT's 25 districts.

Base Year Network Condition

The base year of the analysis was 2010. The condition of the entire state's pavement network was initially determined based on the individual scores of the pavement sections in the PMIS database. The Condition Score of these sections was used as the performance measurement index, and the state's network condition was determined by averaging the individual Condition Scores of all the sections in all 25 districts, weighted by their respective length and number of lanes (aggregated in one measure, i.e., section lane-miles).

Average Deterioration Modeling

Before planning for the Maintenance and Rehabilitation (M&R) actions for the road network, the deterioration process of the pavements was studied in order to understand when their condition would reach a critical level that would trigger intervention. The process that was followed in order to calculate the average yearly deterioration rate consisted of a number of steps as explained in the following.

Data filtering: A dataset was queried from the PMIS for a period of 10 years (1995 to 2005). The dataset contained the following information: section reference markers, pavement type, Annual Average Daily Traffic (AADT), Condition Score, Distress Score and Ride Score. The deterioration rate was defined as the difference in the pavement condition between consecutive years. Since any M&R action would result in an improvement of the condition, the dataset was filtered in order to exclude these effects. The filtering was carried out by removing the data entries that showed condition improvement between two consecutive years.

Pavement stratification: It is well known that rigid pavements and flexible pavements have different load distribution mechanisms. Moreover, for different Highway Functional Classes, the pavement structures, which are usually designed as a function of the traffic, are also different. In this study, a statistical analysis was carried out to analyze the deterioration rate distribution for the different structure types and pavement functional classifications. As a result, nine broad groups were defined:

- Group 1: flexible interstate highways, flexible US highways.
- Group 2: flexible state highways.
- Group 3: flexible farm-to-market and flexible others.
- Group 4: CRCP-interstate highways, CRCP US highways.
- Group 5: CRCP state highways.
- Group 6: CRCP farm-to-market and CRCP others.
- Group 7: JCP interstate highways.
- Group 8: JCP US highways.
- Group 9: JCP farm-to-market.

These nine groups were found to have distinctive deterioration rates; and therefore a different set of models were developed for each group.

Climatic regions: It is also known that the daily temperature range and the precipitation play an important role in the pavement deterioration process. As a result, instead of developing pavement condition models for every district in Texas, these models were developed instead for the four climatic zones of Texas, as shown in Exhibit A2. For each zone, separate pavement condition models pertaining to the Distress Score and the Ride Score were developed.

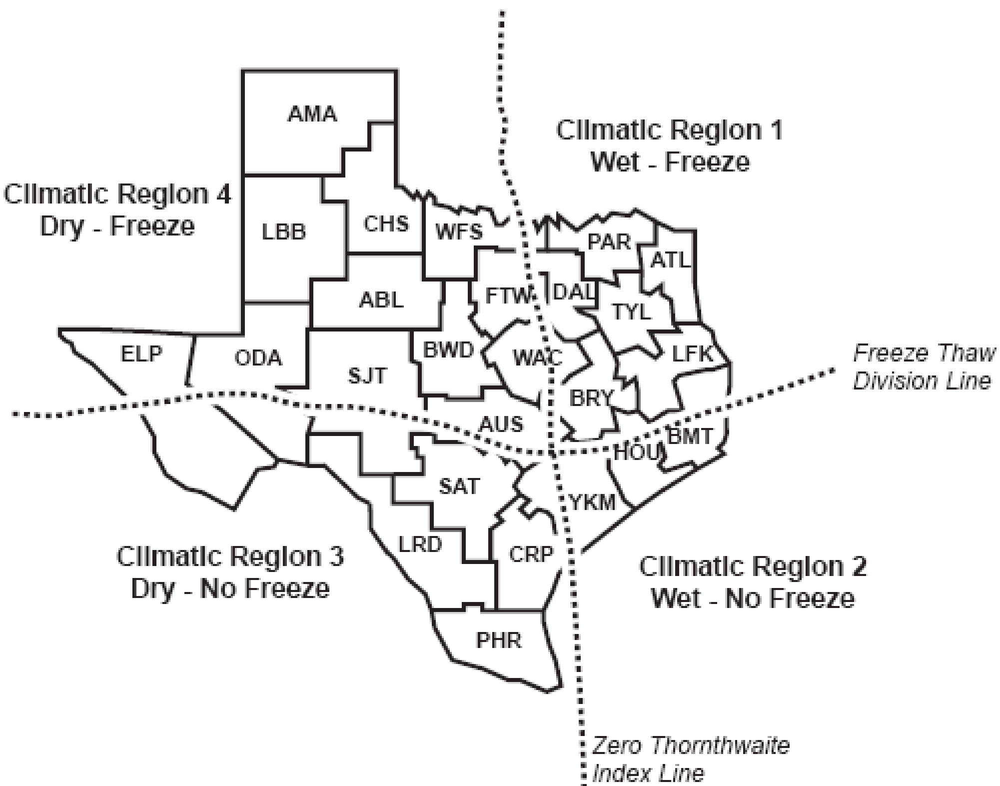

Exhibit A2. Climatic Regions in the State of Texas.

Next Year Network Condition

The condition of the network for each subsequent year was based on the condition of the previous year with the addition of the effect of the natural deterioration, as predicted by the developed condition prediction models. The models were used in order to predict the deterioration of each individual section in terms of the Ride Score and their Distress Score. Once these new values were determined then they were combined together to calculate the new Condition Score of each section. The new Condition Scores of each sections were then averaged together weighted by their respective lane-miles to get the new state-wide Condition Score.

Network Goal

The needs analysis was conducted according to the condition goals defined for each of the following analysis scenarios:

Grade F: Unacceptable Conditions
Grade D: Worst Acceptable Conditions
Grade C: Minimum Competitive Conditions
Grade B: Continue 2010 Conditions

The score in compliance with each of the goals was calculated for each year of the analysis period by summing together all the lane-miles of the individual sections with a Condition Score greater than or equal to 70 and dividing them with the overall number of lane-miles in the state, according to the following equation:

$$\text{\% of fair, poor, and very poor} = \frac{\sum \left(\text{section lane-miles for sections with CS} < 70\right)}{\Sigma \left(\text{section lane-miles}\right)}$$

Candidate Project Selection

The selection of candidate projects was based on the assignment of Maintenance and Rehabilitation actions to the various individual pavement sections, as well as on their subsequent prioritization.

Assignment of M&R actions: The assignment of M&R actions to the various individual pavement sections was performed by considering two criteria: 1) the section's current Ride Score; and 2) the drop of the Ride Score between the current year and the previous year. Based on these defined categories of Ride Score and Ride Score drop, the M&R actions were assigned to form a decision matrix. Using the decision matrix, the current Ride Score as well as the drop of the Ride Score between the current and the previous year were simultaneously considered for every section in order for a specific treatment to be assigned. Furthermore, a few restrictions were placed in the number of M&R actions of each type that any individual section could receive during the planning horizon. This was determined based on the minimum cycle length of each action/treatment type, which was set according to past experience and current practice at TxDOT. Each M&R action was assumed to have a specific effect on the section it was applied to in terms of the section's Ride Score and Distress Score. The correspondence between the various M&R actions and their respective effect on the pavement sections are set also based on past experience and current practice at TxDOT. Finally, the implementation of each action corresponded to a specific cost for the agency, based on the unit cost of the action by lane-mile treated and the lane-miles of the treated section(s). The unit costs of each action were set to values that reflect the total delivery cost of a project.

Prioritization of Sections: Once the various M&R actions had been assigned the sections planned to receive them were prioritized in order to be selected for implementation based on three criteria:

- The section's Ride Score.
- The section's Distress Score.
- The section's traffic.

The final outcome of the prioritization algorithm was a ranking number ranging from 0 to 5 with the value of 5 denoting a very high priority for M&R actions and 0 denoting no need for any action.

Updated Network Condition

After the various projects were selected so that the Texas Transportation Commission goal was accomplished for the current analysis year, the analysis for the following year would begin. The individual sections that had received a treatment would get their Condition Scores updated based on the improvement of the Ride and Distress Scores and the overall Condition Score of the entire network would be calculated. This would lead again to the prediction of the deterioration based on the prediction models and the whole process would again be repeated until all years in the planning horizon have been analyzed.

Estimated Needs for Analysis Year

Based on the number of sections treated during the analysis year in order to reach the defined scenario goal the overall state-wide needs were determined. There results were reported for each year of the analysis period.

II. NEEDS ANALYSIS FOR ADDED CAPACITY MOBILITY LANE-MILES

The added capacity (urban mobility and rural connectivity) lane-miles were provided to the Pavement Needs Analysis Team based on the TTI Mobility Team's analysis. The added capacity lane-miles used by the Pavement Needs Team included only on-system added lane-miles. Four added capacity lane-mile scenarios were analyzed by the Mobility Team including:

Scenario	Added Capacity Lane-Miles	(On-System)
Grade F: Unacceptable Conditions	18,500	(12,400)
Grade D: Worst Acceptable Conditions	26,300	(17,600)
Grade C: Minimum Competitive Conditions	35,500	(23,800)
Grade B: Continue 2010 Conditions	46,500	(31,100)

This analysis only considered the Maintenance & Rehabilitation costs for added capacity lane-miles. The capital cost for constructing the pavement was captured in the Urban Mobility and Rural Corridor Appendices. The cost of treating the added capacity lane-miles is a small fraction of the cost to treat the existing 192,150 on-system lane miles. This is because the added capacity lane-miles are being added over a 25-year period, rather than all at once, and are new lane-miles that do not require as much heavy treatment as does the older and much larger existing system.

III. PROJECT DELIVERY TREATMENT COSTS

Treatment costs used in the Pavement Needs analysis were based on total project delivery costs rather than just the cost to provide the paving materials in place. Total project delivery costs include additional costs such as contractor mobilization, traffic control, storm water pollution prevention procedures, and other costs that are related to constructing a pavement Preventative Maintenance or Rehabilitation project.

These costs were determined through interviews with TxDOT Construction and Maintenance Division personnel, the Associated General Contractors, a pavement engineer expert task group that was convened and information provided through the TxDOT online average bid price system. These costs were then converted to 2010 dollars, using the Highway Cost Index (HCI) provided by TxDOT.

APPENDIX B – BRIDGE QUALITY

by
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INTRODUCTION

This appendix summarizes the methodology employed to generate the forecasts for bridge costs for the several bridge-deficiency scenarios included in the main part of this report. These costs are subdivided in two major categories: 1) costs for the rehabilitation and replacement of deficient bridges, and 2) costs borne by the users of the system due to deficient bridges such as additional Vehicle Operating Costs (VOC) due to ride quality on deficient bridge decks and risks of detour due to load posted bridges. In addition, annual costs for regular maintenance and inspection of the bridge network are included and are based on estimates from the first 2030 Committee report. Culvert replacement costs are also discussed.

The bridge analysis was driven by a 2030 Committee consensus: the current priorities for bridge preservation under a restricted funding scenario over the planning horizon must target *Structurally Deficient* and *Substandard for Load Only* bridges. This is a departure from previously established forecasts that addressed substandard bridges overall, including *Functionally Obsolete* bridges.

Structurally Deficient bridges present significant deterioration of one or several bridge elements, such as the deck or supporting beams, as measured during routine inspections. *Functionally Obsolete* bridges are unable to accommodate existing traffic due to geometric characteristics that may include roadway alignment, clearances, and traffic capacity.

A bridge is considered *Substandard for Load Only* if it is classified neither as Structurally Deficient nor as Functionally Obsolete, but its original as-built capacity was not designed to carry current legal loads. A *Substandard for Load Only* structure is load-posted or recommended for load posting.

The calculations reported in the body of this report summarize the impacts of different funding scenarios, using as performance variable the percentage of surface bridge deck area classified as deficient. <u>For the purpose of this report, deficient surface bridge deck area encompasses both Structurally Deficient and Substandard for Load Only bridges. It does not include Functionally Obsolete bridges.</u>

DATA AVAILABILITY AND STATISTICS

Bridge inspection data at TxDOT are stored separately for the On- and Off-systems. The On-system encompasses the bridges managed by the state of Texas. Examples of roadways comprising the On-system are Interstates, US Highways, FM and RM roads. Off-system bridges are managed by cities, counties, and other entities. Examples of roadways comprising the Off-system are county roads and city streets.

The main data source for the analysis included in this report was the bridge inspection information available from TxDOT's Bridge Inventory, Inspection and Appraisal Program (BRINSAP). BRINSAP is a dynamic database with new inspection results being included in a daily basis. For this analysis, end of fiscal year (August 31) snapshots of the data were retrieved for years 1995 through 2010. On-system record count for the 2010 BRINSAP data is 34,208. From these records, 20,390 belong to bridges, with the remaining records belonging to culverts. Off-system counts for 2010 BRINSAP data are 18,225 with 12,384 belonging to bridges and with the remaining records belonging to culverts. In this study, bridges and culverts were analyzed separately due to their different performance characteristics.

Exhibits B1 and B2 present the distribution of bridge deck area by age as of 2010 for the On- and Off-systems, respectively. According to the 2010 BRINSAP data, the total deck area for On- and Off-system bridges was 364 million and 65 million square feet, respectively. Considering an average bridge design life of 50 years, Exhibits B1 and B2 indicate significant funding requirements from now to the year 2035 for the upkeep of Texas bridges; a significant amount of deck area will be reaching the end of their design lives for both systems.

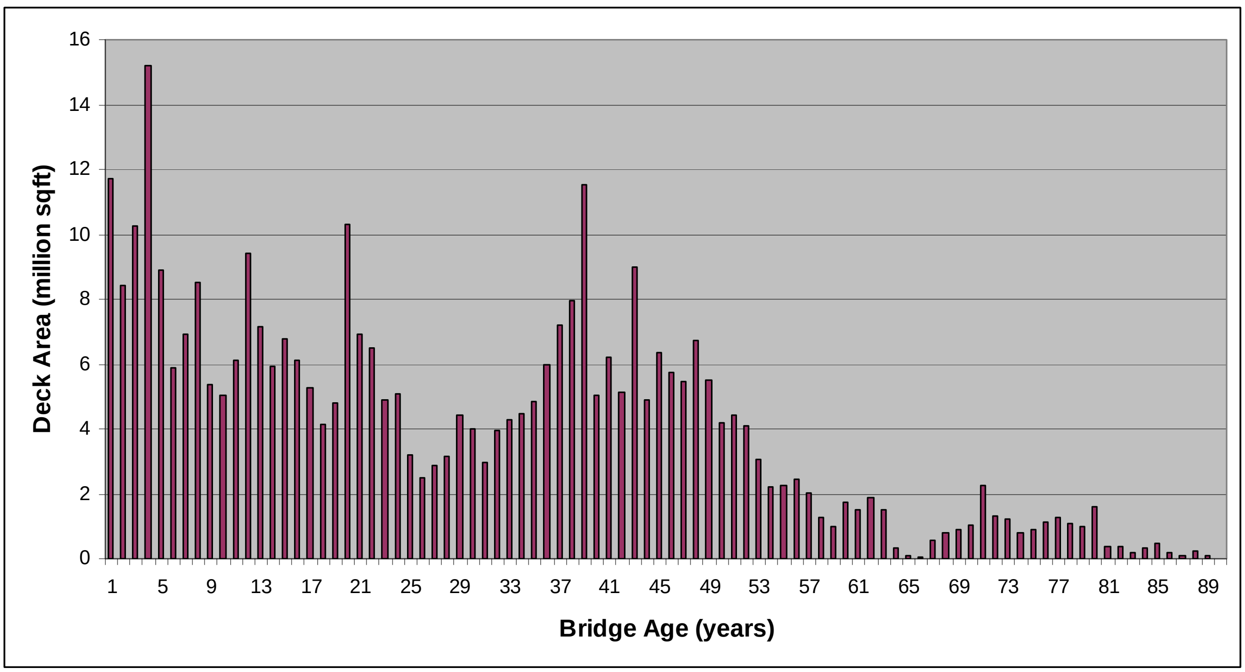

Exhibit B1. Deck Area Age Distribution for the On-System Bridges.

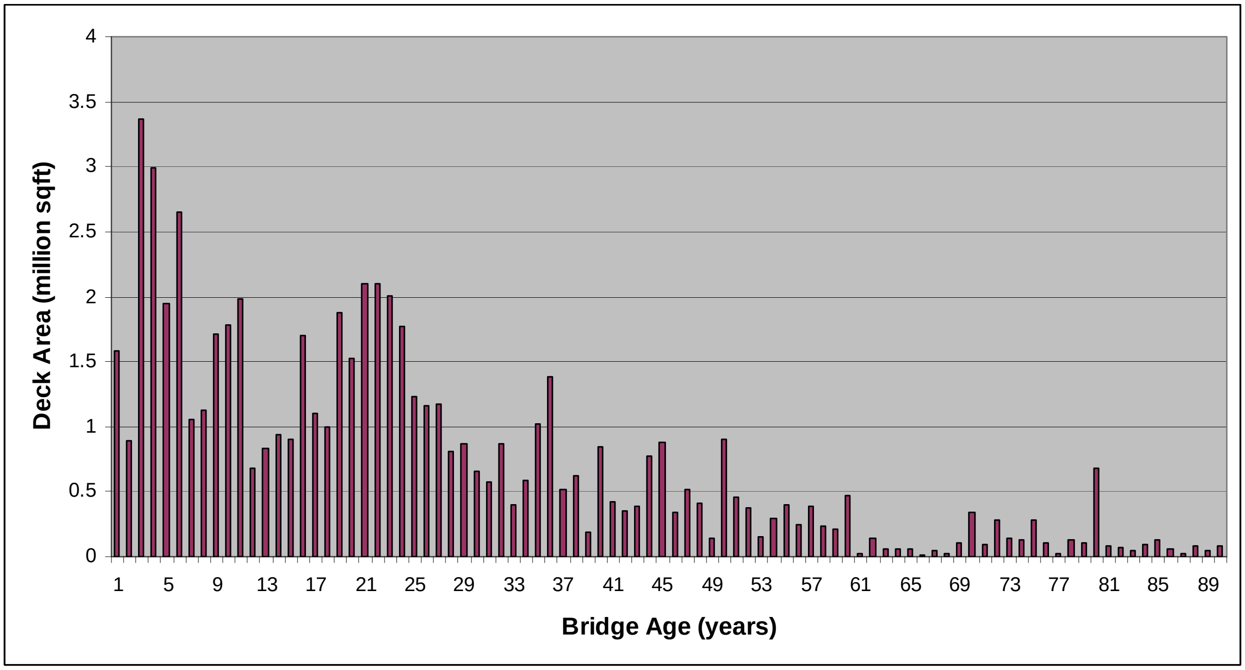

Exhibit B2. Deck Area Age Distribution for the Off-System Bridges.

NEEDS ANALYSIS APPROACH FOR DEFICIENT BRIDGES

The analysis approach was implemented separately for the On- and Off-systems. To implement necessary calculations, several supporting SAS programs were developed and extensive analysis of the historical BRINSAP data for both On- and Off-Systems from 1995 to 2010 was performed. The analysis approach encompassed the six steps listed below. Steps three, four, and six are explained in more detail subsequently.

Steps:

1. Read the 2010 BRINSAP data. This is the base-year data.
2. Extract the records for bridges (excluding culverts).

The next steps were repeated for each year in the planning horizon (2010 to 2035):

3. Add the amount of deck area that becomes deficient for that year.
4. Apply annual budget. Sort the deficient bridges by age and traffic and program bridge rehabilitation or replacement for the deficient bridges until annual scenario budget is exhausted. *Substandard for Load Only* bridges are programmed first.

5. Calculate percentage of deficient deck area for that year after budget is exhausted and record the number.
6. Calculate potential Vehicle Operating Costs (VOCs) for that year due to bridge deficiencies (ride quality and detours), separating the results for passenger cars and trucks.

Step 3 Methodology– Deck Area that Becomes Deficient on a Yearly Basis

Several statistical analyses were performed to estimate the area of bridge deck that becomes deficient on a yearly basis. These calculations were based on the historical BRINSAP data spanning 1995 through 2010. Exhibit B3 presents the distribution of deck area that became *Structurally Deficient* for the On-system, based on the historical BRINSAP database. On average, on a yearly basis, 1.1 million square feet of bridge deck surface area deteriorate to a *Structurally Deficient* condition. Similarly, about 0.25 million square feet on an annual basis become *Substandard for Load Only*. On average, the total bridge deficient deck area to be added on a yearly basis is 1.35 million square feet. A similar analysis of the Off-system historical data leads to 0.5 million square feet of deficient bridge deck area being added on a yearly basis to the needs.

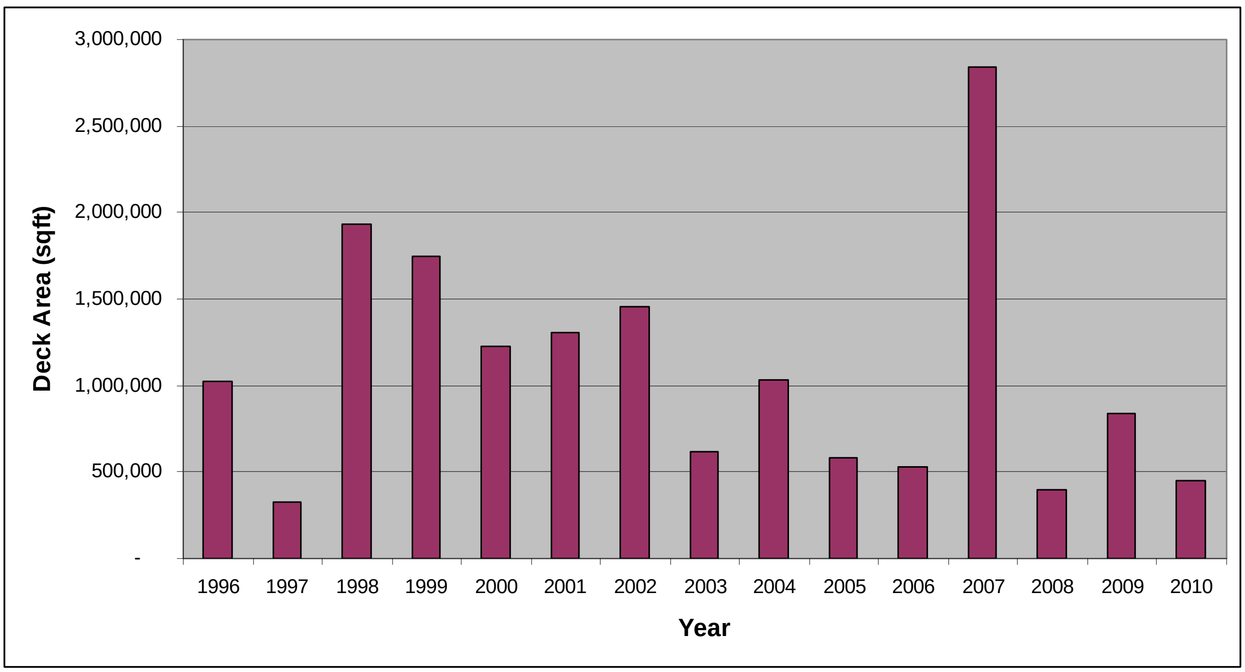

Exhibit B3. Distribution of Deck Area that Became Structurally Deficient for the On-System.

Step 4 Methodology – Apply Annual Budget

The 2030 Committee established goals for bridge condition for the different scenarios, which are detailed in the main body of this report. These goals are defined by percentages of deficient deck area that are acceptable for each scenario. These percentages are associated with separate annual budget levels for the On- and Off-systems and are reported in Step 5 of the analysis.

The procedures in Step 4 include an average expansion factor for the deficient bridges that are prioritized for intervention of 50 percent. This expansion factor recognizes what is common practice for bridge managers when programming work for deficient bridges and is driven by coordination with other factors such as required traffic capacity.

Deficient bridges that are unable to undergo improvements due to annual budget restrictions become part of the backlog of deficient bridges that is processed in the next year of the planning horizon. Unit costs of bridge interventions were discussed in the 2030 Committee report published in 2009 and were reevaluated to be consistent with 2010 unit costs.

Step 6 Methodology –Calculate Potential Vehicle Operating Costs due to Bridge Deficiencies

Impacts on users of trucks and passenger cars are calculated separately and are based on costs per mile discussed in the Vehicle Operating Costs Appendix (Appendix G) of this report. Two types of costs are estimated: (1) increased VOC due to vehicles operating on rough, *Structurally Deficient* decks, which are calculated using traffic data recorded in BRINSAP and bridge length, and (2) potential detours caused by *Substandard for Load Only* bridges included in the backlog for each year of the planning horizon. Costs due to ride quality and detours are calculated for all the deficient bridges in the backlog for a given year in the planning horizon.

ANNUAL COSTS FOR REGULAR BRIDGE MAINTENANCE, INSPECTIONS, AND CULVERTS

These annual costs are considered as fixed throughout the planning horizon and were discussed in detail in the 2009 *2030 Committee Report* (with the exception of culvert costs). The 2009 report values were updated to reflect 2010 dollars. These calculations estimate that costs for inspection of the On- and Off-systems amount to $44 million on an annual basis. Regular bridge maintenance requires $53 million on an annual basis for On-system bridges.

Analysis of the historical BRINSAP database from 1995 to 2010 shows that, on the average, 19 culverts transition to a deficient status on a yearly basis. Exhibit B4 shows this distribution for the On-system. The average for the Off-system is also 19 culverts per year. Further analysis involving average culvert replacement costs results in an annual cost to replace On- and Off-system deficient culverts of $15 million. Annual costs for bridge maintenance, inspections, and culverts are included in each one of the scenario costs reported in the 2011 *2030 Committee Report*.

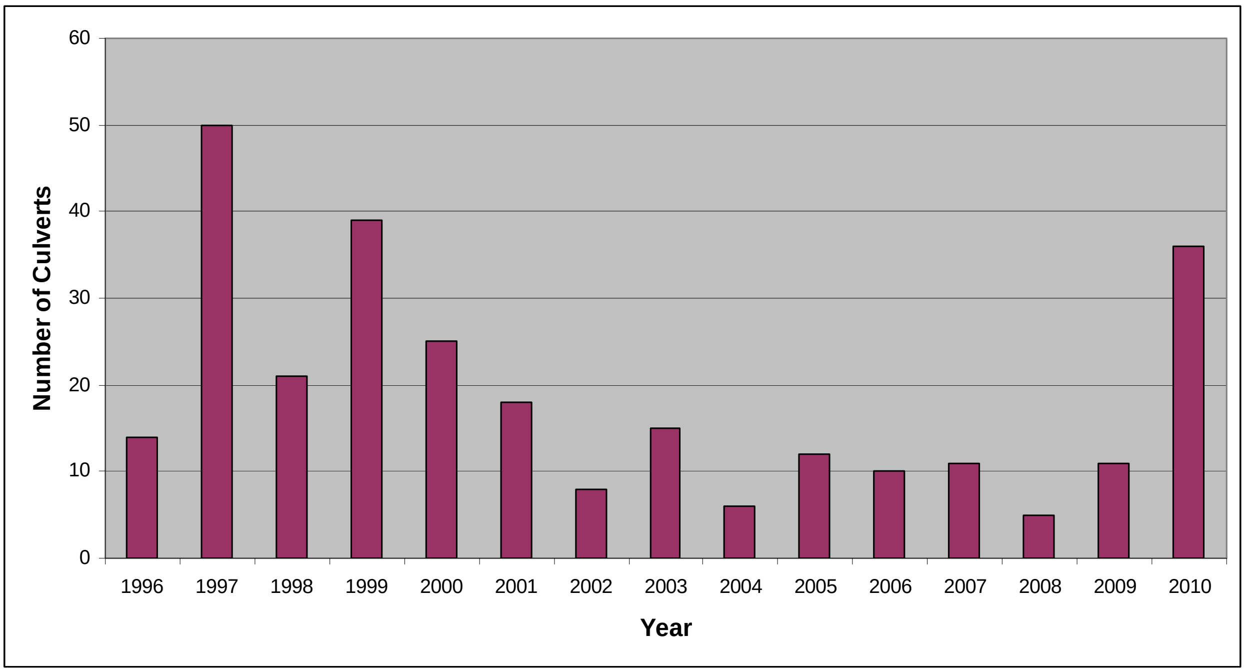

Exhibit B4. Yearly Number of Culverts Transitioning to a Deficient State.

APPENDIX C – URBAN TRAFFIC CONGESTION

by
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INTRODUCTION

For more than three decades, our state's largest cities have experienced increasing congestion. Texas Transportation Institute's (TTI's) *2010 Urban Mobility Report* (*1*) found that the cost of annual travel delay and extra fuel consumed in stop-and-go traffic by Texans was $9.8 billion. Congestion is worse in large cities, but it is getting worse in medium and small cities as well. The cost, difficulty, frustration, and inability to plan a trip affects everyone whether they are traveling to work, school, doctor's appointments, or leisure activities. With the Texas population expected to grow from 25 million in 2010 to more than 40 million by 2035, congestion will affect even more trips, cities, regions, and times of day.

Mobility challenges affect everyone—people who live and work in big cities, small towns, and rural areas between them. Our state's favorable business, economic, and social climate will bring significant growth in Texas. The question is how will Texans address the transportation challenges presented by this growth? Will we develop a set of policies, programs, projects, plans, and partnerships in a conscious, planned, cooperative decision-making process? Or will we pay for our lack of attention to the growth issues with more time and wasted fuel but less time with our families, at our jobs, with social and civic groups, and at parks and schools? Will the challenges overwhelm our ability to craft a meaningful plan to deal with travel mobility? What actions will be taken by transportation agencies, private businesses, the public, and decision-makers? This chapter describes the mobility choices facing Texans and offers a basis to craft solutions that will meet the travel challenges we face.

Q. What cities make up "urban" Texas?

Abilene
Amarillo
Austin
Beaumont-Port Arthur-Orange
Brownsville
College Station-Bryan
Corpus Christi
Dallas-Fort Worth
El Paso
Harlingen-San Benito
Hidalgo County
Houston-Galveston
Killeen-Temple
Laredo
Longview
Lubbock
Midland-Odessa
San Angelo
San Antonio
Sherman-Denison
Texarkana
Tyler
Victoria
Waco
Wichita Falls

ORGANIZATION OF THIS APPENDIX

This appendix explains the state's current travel mobility in urban areas and looks at possible ways that policy-makers, decision-makers, and the public can view the future of mobility to prevent or respond to the challenges Texas faces. The 2030 Committee established several potential scenarios for handling growing mobility issues and identifying ways to specify desired mobility outcomes. This chapter explains those scenarios and presents possible outcomes and recommendations. Topics include:

- Current and future mobility conditions in Texas.
- The costs of investments and benefits from investments in mobility.
- Cost saving effect of mobility improvement options.

CURRENT CONDITIONS

The congestion levels for the Texas cities included in the *Urban Mobility Report* are compared to regions of similar size from around the US in Exhibit C1. The extra travel time spent by Texas auto commuters is displayed with the averages for other urban areas in the United States within four population groups. Dallas-Fort Worth, San Antonio, El Paso, and Beaumont have congestion levels near the midpoint of all US regions their size, with the average declining as population decreases. Houston and Austin, however, have congestion levels ranked in the top five in their size group. The average urban Texas auto commuter spends an extra 43 hours in traffic each year with a value of wasted time and fuel of $970 per year, 60 percent more than a decade ago.

Mobility challenges are manifest in two ways: 1) increasing congestion and 2) inadequacy of travel options. Both of these problems result in additional hours spent traveling, more fuel purchased, interference with work, loss of leisure time with family and friends, and increased cost of goods. Mobility is reduced when travel demand is greater than the available capacity of the transportation system or when crashes, vehicle breakdowns, weather, or other events conspire to increase congestion.

Exhibit C1. 2009 Urban Congestion Levels, Texas and US.

Urban Area and Population Range	Hours of Delay Per Auto Commuter[1]
Houston	58
US Very Large Area Average (over 3 million)	*50*
DFW-Arlington	48
Austin	39
US Large Area Average (1 to 3 million)	*31*
San Antonio	30
US Medium Area Average (500,000 to 1 million)	*22*
El Paso	21
McAllen	7
Beaumont	21
US Small Area Average (less than 500,000)	*18*
Brownsville	14
Laredo	12
Corpus Christi	10

[1]Delay per Auto Commuter: Expresses the extra travel time during the year divided by the number of people who commute in private vehicles in the urban areas. This measure estimates the amount of time, on average, that each traveler would spend in congested traffic each year.
Source: (*1*)

THE MOBILITY SCENARIOS

The 2030 Committee developed a range of scenarios to achieve goals that reflect both the aspirations of Texans and prudent long-term investment strategies. Those scenarios represent trade-offs between investment levels, economic benefits, and personal user costs. They provide a range of mobility levels using a variety of cost estimates. The goals that most improve mobility will put Texas in a more competitive position compared to peer regions and cities around the nation.

The development of regional mobility estimates were facilitated by the ongoing planning activity of the state's 25 metropolitan planning organizations (MPOs); all of the Committee's recommendations draw heavily on the local knowledge captured in those MPO plans. Mobility needs have been the subject of substantial analysis by TxDOT (*2*), the MPOs (*3*), the 2030 Committee (*4*) and the Governor's Business Council (*5*).

The computerized planning models combine population, job, and land development forecasts with estimates of the transportation network to describe travel and congestion for future years. The area covered is typically larger than the urban area used in the *Urban Mobility Report*; there are differences in the data and estimates between the two sources, but the information and conclusions are similar. Using the regional models ensured that the different characteristics of each region were included in the results while using a common analytical approach to congestion forecasts. Each model generated trips for work, school, shopping, medical, and other purposes and applied them to roadway sections; these traffic volumes were combined with the capacity of each road to estimate traffic speed and then congestion levels.

SCENARIO DESCRIPTIONS

Four mobility scenarios were examined by the 2030 Committee, with the conditions that will result from current funding trends providing the baseline for comparison to three improvement options. The comprehensive studies of urban mobility funding and long-range projects and programs in Texas prepared by each of the Texas metropolitan planning organizations were used as the analytical basis for the scenarios.

The Committee used letter grades ranging from F to B to describe the scenarios. The strategies range from doing nothing new to implementing enough programs and projects to maintain conditions as they are now. **The Committee did not assign a letter grade of A to any scenario due to the significant funding required to achieve this level of quality for the transportation system.** The scenarios incorporated goals for pavement quality, bridge quality, urban mobility, and rural connectivity; the full 2030 Committee report describes the development of each scenario. The urban mobility scenarios described below use the regional transportation model data and forecasts as the base information; additional computations were performed by the Texas Transportation Institute.

- **GRADE F: Unacceptable Conditions –** The current policies, planning processes, and funding schemes would continue under this scenario. The expected growth in jobs and people will not be addressed by new transportation projects:
    - Urban congestion is projected to rise from 37 extra hours of travel today to 44 hours in 2015 and 50 hours in 2019. This represents the equivalent of 4½ days of vacation today and more than 6 days of vacation by 2019.
    - The projections are worse from 2020 to 2035. Congestion will grow to an average of 130 hours of extra travel time in 2035; transportation investments will not keep pace with the growth in jobs and people over this period.
    - Many of the benefits from one-time funding sources will slow congestion growth through 2019.
    - More travel time means less productive time at work, less time with family and friends, and larger delivery and service fleets to handle the same number of customers.

- **GRADE D: Worst Acceptable Conditions –** Investments would be made to maintenance programs to reduce the amount of roads and bridges that will require expensive rebuilding.
    - Urban congestion will grow at a rapid rate. Congestion will be better than the current Unacceptable Conditions scenario, but will more than double to an average of 84 hours of extra travel time per urban commuter by 2035.

- **GRADE C: Minimum Competitive Conditions –** Texas' infrastructure and congestion levels would remain in a condition equal to or better than its peer states or metropolitan regions.
    - Urban regions would have congestion levels better than at least half of the US regions with similar populations.
    - The average urban area delay will be 57 hours in 2035.

- **GRADE B: Continue 2010 Conditions –** Under this scenario, the transportation system conditions experienced in 2010 would be maintained throughout the period from 2011 to 2035.
    - The urban road networks would have the same congestion levels as in 2010.

Q: How are scenario costs defined?

A: Cost estimates are defined by the amount of investment required between 2011 and 2035 for each scenario. This estimate includes many projects for which funding has already been identified.

HOW WILL SOLUTIONS BE IMPLEMENTED OVER THE NEXT 25 YEARS?

Whatever scenario is pursued, the long-range transportation plans are evolutionary processes—changes are made to elements every few years when the plans are updated. The analysis in the 2030 Committee Report should be a part of the process of identifying the need for improvements and the general costs and benefits from any large-scale transportation investment program. Community leaders and the public will be responsible for developing specific plans, projects, and programs; the important element at this time is to define the size of the problem and the goals, and mobilize the resources needed to address the long-term solutions. The 2030 Committee Report can be used by decision-makers and the public to assess progress toward long-range goals.

Q: What is the "funding gap"?

A: The term "funding gap" defines the difference between the funded projects and needed investment.

WHAT WILL THE IMPROVEMENTS COST?

The leaders of the state's 25 metropolitan planning organizations (MPOs) adopted an approach to consistently estimate the cost of mobility solutions in their Texas Mobility Plans (*3*). These organizations consider all transportation modes when developing solutions—a multi-modal approach. Not every region will adopt the same mix of strategies, so the cost estimating approach had to use available data and consistent analytical techniques as well as reflect an average cost of all solutions.

Like the analysis conducted by the MPOs, the cost estimating approach for the 2030 Committee analysis began by identifying problems in the transportation network. Additional spending to address congestion would be targeted at those locations. Recognizing that each region would develop a different mix of strategies targeted at corridors and sections, the rich historical database of roadway costs and the long-range transportation planning model were used. Project or program cost estimates from each MPO were used whenever possible (and updated to 2010). Where more capacity was needed, the scenario cost was estimated as the funding required to add roadway lane-miles. The specific projects and programs to be deployed will be drawn from a broad array of modes that are used to improve urban mobility—such as walking, cycling, bus rapid transit, light rail and commuter rail transit, high-technology improvements to highway operations, and even using telecommuting to accomplish a trip without physical travel.

The 2030 Committee encourages the reader to recognize the importance of viewing the urban mobility investment recommendation as a broad expression of the dollars needed, not simply an estimate of future highway infrastructure. Future mobility solutions will require a broad mix of transportation strategies, so the investment

Q: How were the problem locations determined?

A: The planning organizations from Texas' larger regions (above 50,000) developed an approach using long-range planning models. If a road link was projected to have more traffic volume than the scenario goal (for example, "reduce congestion"), enough road lanes were added to reduce congestion to acceptable levels.

needed for each mobility scenario is expressed in both "lane-miles" and "person-miles of capacity." The person-mile expression reflects the Committee's strong intent to focus on investing in moving people, rather than concentrating on any one travel mode. A mix of modes, programs, projects, policies, and partnerships, such as those described by the North Central Texas Council of Governments, will make sense in Texas communities, especially as the cost of traditional highway construction increases with rising urban land values and changing urban land use patterns. Cost estimates also include allocations for freeway-to-freeway interchanges and right-of-way.

POTENTIAL REDUCTIONS IN BOTH TOTAL IMPLEMENTATION COSTS AND THE STATE'S SHARE OF THOSE COSTS

The cost estimates used in this report are a representation of the total cost of addressing mobility needs through a variety of projects, programs, policies, and plans that will be developed and implemented by multiple agencies or partners over the next 20 years. The 2030 Committee did not presume to identify the appropriate mix of strategies or methods that regions will choose to solve their mobility challenges, but the cost estimates used in the report assume a more aggressive deployment of non-road widening solutions than the current situation. This section describes the process used to estimate the scenario costs in the 2030 Committee report.

The 2030 Committee recognizes the importance of using every improvement technique to enhance the transportation system and infrastructure conditions. The needs are large, but they can be reduced by doing things smarter, more efficiently, with advanced technology and with greater participation by employers, commuters, and businesses. There will be a different mix of strategies in every region based on the size, scale, and scope of the problems and the interests of the public in matching their goals for the region to the investments and strategies they support. In all cases, the solutions must work together to provide an interconnected set of transportation infrastructure and services.

The Transportation Action Program

Three general methods can be used to reduce the state share of future transportation funding requirements. All of these strategies will play an important role in Texas' future, but the size of the problem in the largest regions is more significant than these actions will be able to address alone.

- Commute options – Businesses are finding that they can save office costs and improve productivity by offering employees a variety of ways to accomplish their jobs without traveling to work in the rush hours. Electronic communications can be used in place of physical travel to an office. Support can be provided to workers who wish to carpool or use public transportation. Flexible work hours can be offered to encourage workers to commute to work during off-peak hours. More aggressive actions might include monetary incentives to encourage travel outside the peak hours or to use electronic communication methods. These have been successful in improving employee productivity and satisfaction, as well as allowing flexibility to meet the needs of both family and job. The 2030 Committee analysis assumed these programs would cost 10 percent of the program benefits.

- Operating improvements – Several methods have been deployed on streets and freeways to get as much service as possible from the existing roads. Many of these are relatively low-cost projects and programs; they have broad public support and can be rapidly implemented. These ideas require innovation, constant attention, and adjustment, but they pay dividends in faster, safer, and more reliable travel. Rapidly removing crashed vehicles, timing the traffic signals so that more vehicles see green lights, improving road and intersection designs, or adding a short section of roadway are relatively simple actions with big payoffs. The 2030 Committee analysis assumed these programs would cost 15 percent of the operational project benefits.
- Revenue from local sources, toll road projects, and transit projects – The traditional mix of funding could be altered to rely less on state and federal funding sources and more on a variety of other agencies, projects, and programs. The effect of revenue enhancement scenarios can be estimated but the specific elements of any scenario were not identified. The 2030 Committee analysis assumed these programs would have no cost to obtain the benefits.

Action Program Scenarios

Three levels of improvement were studied as part of the 2011 2030 Committee report and two time horizons were evaluated, 2020 and 2035, to examine the near- and long-term needs. The possible outcomes and resulting decreases in funding required to achieve the goals were identified in the scenario cost analysis. Other combinations are possible, but the scenarios listed below are a reasonable demonstration of a system of balanced improvements.

- Enhanced – Strategies and levels of effort that are beyond those currently deployed, but appear to have broad public support and are within current regulatory frameworks were used to construct this scenario. A 10 percent increase in local, public transportation, or tolling projects was also assumed.
- Aggressive – In addition to the Enhanced level, actions that have been tested in North America but are not deployed in Texas would be used to expand commute options and increase system efficiencies. Local regions would have flexibility in choosing the actions that best meet their needs. In some cases, these would require changes in regulations, methods of enforcement, and policies. A 15 percent increase in local, public transportation, or tolling projects was also assumed.
- Very Aggressive – Most of the possible commute options and system efficiency increases would have to be widely deployed and operated to achieve the very aggressive scenario. Some of these will require legislative action to change enforcement regulations and Texans would have many incentives to make different travel choices, and may be rewarded for choosing home and job locations that can be reached by travel modes other

than private vehicles. A 20 percent increase in local, public transportation, or tolling projects was also assumed.

Results

The net revenue enhancement from the Action Program Strategies shown in Exhibit C2 is based on a level of needs keyed to the Continue 2010 Congestion scenario; it was assumed that the actions would be independent of the chosen 2030 report scenario. The net revenue displayed in Exhibit C2 ranges between $4 and $10 billion from 2011 to 2020 and between $10 and $29 billion from 2011 to 2035. These values represent substantial contributions to closing the funding gap. If the least aggressive set of enhancement options are chosen, the Worst Acceptable Scenario in 2020 appears to be within reach. Better goals have remaining state funding levels that appear to require additional actions. The scenario analysis suggests additional funding or actions will be needed to achieve any of the 2035 scenarios, even if the most aggressive set of options are pursued.

Exhibit C2 identifies the importance of addressing congestion levels with every possible strategy. The projections also suggest that more funding will be one of those strategies. Additional information is included in Exhibits C7 to C11 at the conclusion of Appendix C.

Exhibit C2. Possible Contributions to Funding Needs from Commuting Options, Operating Strategies, and Funding Sources.

Amounts in 2010 $Million	Share	2011 to 2020			2011 to 2035		
		D – Worst Acceptable	C – Minimum Competitive	B – Continue 2010 Conditions	D – Worst Acceptable	C – Minimum Competitive	B – Continue 2010 Conditions
State Funding Forecast		$ 8,822	$ 8,822	$ 8,822	$ 13,137	$ 13,137	$ 13,137
Other Revenue Sources		$ 26,444	$ 26,444	$ 26,444	$ 54,754	$ 54,754	$ 54,754
Current Funding Trend		$ 35,266	$ 35,266	$ 35,266	$ 67,891	$ 67,891	$ 67,891
Total Funding Needed		$ 39,362	$ 58,010	$ 68,703	$ 105,990	$ 145,158	$ 182,509
The Funding Gap		$ 4,095	$ 22,744	$ 33,437	$ 38,099	$ 77,267	$ 114,618
Summary of "Buying Down" the State Share							
Total Net Revenue Enhancement							
Enhanced		$ 3,948	$ 3,948	$ 3,948	$ 9,945	$ 9,945	$ 9,945
Aggressive		$ 7,160	$ 7,160	$ 7,160	$ 19,159	$ 19,159	$ 19,159
Very Aggressive		$ 10,371	$ 10,371	$ 10,371	$ 28,373	$ 28,373	$ 28,373
Remaining State Share							
Enhanced		$ 147	$ 18,795	$ 29,488	$ 28,154	$ 67,321	$ 104,673
Aggressive		$ (3,064)	$ 15,584	$ 26,277	$ 18,940	$ 58,108	$ 95,459
Very Aggressive		$ (6,276)	$ 12,373	$ 23,065	$ 9,727	$ 48,894	$ 86,245

Exhibit C3 presents the size of the existing and possible future Texas urban networks along with investment required for each mobility scenario. The investment levels described in Exhibit C3 represent the additional amount necessary to meet the scenarios by 2035 in 2010 dollars. Costs for achieving the scenarios range from $68 billion (the best estimate of the amount

> **Q: What is a lane-mile?**
>
> A: A measure of roadway space. A 10-mile-long, 4-lane road has 40 lane-miles.

that will be spent if policies and funding scenarios do not change) to $183 billion. The large amount of additional roadway might be surprising, but many road sections have heavy traffic volumes now, and the growth in population, employment, and trade will place great strain on the network. The measure of equivalent lane-miles used throughout this Appendix is simply a consistent way of estimating the cost of the full range of strategies that will be deployed to improve mobility over the next 25 years, regardless of transportation mode. The added lane-miles are also included in the pavement maintenance cost requirements to ensure funding will be available if the road miles are built. The cost of urban projects reflects the higher cost of construction in large, congested metropolitan regions.

Exhibit C3. Investment Required for Each Mobility Scenario.

Mobility Scenario	Estimated Equivalent Lane-Miles Needed	Investment Required (Billions of 2010 $)
Urban Network Size		
Completed by 2010	82,100	NA
Urban Scenarios		
F – Unacceptable Conditions	18,400	$68
D – Worst Acceptable	26,000	$96
C – Minimum Competitive	36,500	$135
B – Continue 2010 Congestion	46,600	$173

Note: Costs are the median value of a range of cost estimates.
2010 dollars used in the calculations.

USER COSTS RESULTING FROM MOBILITY CONDITIONS

Two types of user costs were estimated based on the improved transportation service in the scenarios. Identifying the appropriate target scenario involves considering both elements—the taxes and fees paid to construct the improvement projects, programs, policies, and plans; and the congestion effects that result from the scenario. The scenarios studied provide a range of congestion reduction in exchange for additional investment in transportation facilities and services.

The 2030 Committee estimated the cost of congestion for the urban mobility investment and used the value of travel delay and additional fuel consumption by persons and commercial vehicles as a conservative estimate of the user costs. The cost of providing the system is generically referred to as "taxes and fees" recognizing that no matter how the projects are deployed, there will be some cost to implementing the strategy.

Other effects were not included in the 2011 Committee report, although they are also important considerations. Effects on Texas businesses will be apparent with higher congestion levels, and companies will not be able to serve the same number of customers with the same equipment and personnel as companies in regions with less congestion. Local government tax revenue from the transportation expenditures and the jobs and payroll from construction programs are also not included in the effects on communities.

CONGESTION COSTS TO TEXANS

Congestion costs were estimated for personal vehicles and commercial trucks based on the results from the computerized transportation planning models. The extra travel time above that which could be achieved at free-flow conditions was the baseline for the calculation of congestion. Commercial vehicle costs were calculated for each region using the percentage of total travel by trucks.

- ***Time Costs* –** The speed of travel in the peak period is determined for arterial streets and freeways. The value of delay for personal vehicles and for commercial vehicles is estimated using a unit value of $16 per hour for person travel and $105 per hour for truck travel. A value of 1.25 persons per vehicle was used for personal vehicles.
- ***Fuel Costs* –** The speed of travel and amount of stop-and-go traffic results in an estimate of the fuel consumed in congested travel; this value is compared to fuel consumed in free-flow travel. The less efficient fuel burn means higher costs for both personal and commercial vehicle travel. Fuel costs are included in the truck operating costs. The 20-year historic average for fuel costs as a proportion of travel delay costs is 8.4 percent; this value was used in the analysis.

CALCULATING HOUSEHOLD TRAVEL COSTS

A key element of the 2030 Committee report is the calculation of the effects of mobility problems on the average Texas household. To accomplish this, the congestion costs developed for each region were separated into personal and commercial vehicle travel. While the commercial vehicle costs are ultimately paid for by individuals in the costs that they pay for goods and services, the conservative approach used in this analysis only used personal vehicle travel to illustrate the household cost effects.

The commercial vehicle congestion costs are 30 percent of the state total congestion costs in urban regions Exhibit C4. This varies from below 30 percent for most of the larger urban regions to above 60 percent in smaller regions. Trucks comprise approximately 6.1 percent of urban travel statewide. The value of commercial delay was subtracted from the total congestion costs when presenting household costs.

Exhibit C4. Truck Cost Component of Urban Congestion Cost.

Urban Area	Truck Cost as a Percent of Total Urban Congestion Costs
Abilene	60%
Amarillo	57%
Austin	32%
Beaumont	39%
Brownsville	30%
Bryan-College Station	46%
Corpus Christi	48%
Dallas-Fort Worth	26%
El Paso	22%
Harlingen	29%
Hidalgo	30%
Houston	27%
Killen-Temple	37%
Laredo	52%
Longview	44%
Lubbock	32%
Midland-Odessa	49%
San Angelo	47%
San Antonio	27%
Sherman-Denison	51%
Texarkana	64%
Tyler	31%
Victoria	61%
Waco	41%
Wichita Falls	41%
Average	**30%**

Mobility Results from Investment Scenarios

Texans will realize many benefits from any mobility improvements pursued. Current trends, however, result in high congestion levels. Average trip times, as estimated by long-range planning models, will increase substantially from today's conditions in the absence of additional funding sources and new policies. The cost of congestion will rise from $820 per urban Texas household commuter today to $2,800 per average household in 2035 (expressed in 2010 dollars) (Exhibit C5).

Mobility improvements described in the scenarios produce significant time, fuel, and financial savings. Exhibit C5 summarizes the key mobility outcomes of each scenario. In addition to the scenario costs from 2011 to 2035 (see Exhibit C3), three measures of congestion are also displayed. Congestion cost is the combination of wasted fuel and time for trucks and personal vehicle travel for 2035. The annual hours of delay per commuter is an estimate of the time spent in congestion by the average person who travels in the peak period; larger regions typically have more delay per commuter (see Exhibit C9 for regional delay per commuter values).

Q: How are the needs identified in the 2030 Report different from a "wish list"?

A: Through computer models, traffic volume indicators identify the pieces of the transportation network that will be more congested than the scenario goal. Scenario costs are related to the amount of lanes needed to treat only the problem locations.

Exhibit C5. Summary of Urban Mobility Scenario Outcomes.

Current Congestion Level	Congestion Cost per Household $820		Annual Delay per Commuter* 37 hours	
	2035 Mobility Scenarios			
2035 Mobility Outcomes	**F – Unacceptable Conditions**	**D – Worst Acceptable**	**C – Minimum Competitive**	**B – Continue 2010 Congestion**
2011 to 2035 Scenario Cost ($ Billion)	$68	$96	$135	$173
2035 Congestion Cost ($ Billion)	$61	$39	$26	$18
2035 Delay per Commuter (hours)	130	84	57	39
2035 Congestion Cost per Household	$2,710	$1,730	$1,170	$810

**Hours of extra travel time per urban area traveler during the peak period*
Note: See Exhibits C7 to C11 for regional values and more information on congestion in 2015, 2020, 2025, and 2035.

<u>Unacceptable Conditions</u> – By definition, the baseline mobility scenario has no associated congestion benefits. However, congestion would be much worse if no improvements were made between 2011 and 2035. The Unacceptable Conditions scenario includes investments between now and 2035 that will provide a congestion reduction effect. But the mobility picture is not good. Many of the Texas regions will have congestion levels above the median value of their population group in the country. The average urban commuter will spend the equivalent of

more than three extra work weeks of time in congestion (130 hours) and pay a "household tax" of $2,710 in time and fuel each year. In 2035 alone, congestion costs will exceed $63 billion.

Worst Acceptable Conditions – This 2030 Committee scenario focuses most of its investment on maintaining reasonable pavement and bridge quality. As a result, congestion will increase dramatically, although less rapidly than under the Unacceptable Conditions scenario. Congestion will cause the average Texas commuter to spend an extra 84 hours per year and cost the average household an additional $1,730 in 2035. Larger regions will have even greater time penalties

Minimum Competitive Conditions – Congestion levels will improve from the Worst Acceptable Conditions if each region achieves a mobility level equal to or better than urban areas of similar size. All of the metropolitan regions would be expected to have congestion levels at least on par with peer US regions. Extra travel time will only consume the equivalent of 7 work days (57 hours) and cost almost $1,200 per household each year.

Continue 2010 Congestion – Using current congestion levels as a target for 2035 mobility, while not desirable, would put Texas cities in a favorable competitive position with regions of similar size. Even the relatively congested Texas regions would be better than US regions of similar size. The average commuter delay will be about 39 hours in 2035. The congestion cost would be $810 per household in 2035. The average statewide delay per commuter increases slightly from the 37 hours in 2010 due to larger, more congested regions comprising a higher percentage of urban travel in 2035 than in 2010.

Q: What's the connection between mobility and the economy?

A: A qualified workforce, reasonable tax and regulatory environment, and access to markets are key elements in business location and expansion decisions. Access to markets is provided by a reliable and well-maintained transportation network. Without an adequate network, Texas businesses are at a competitive disadvantage—costing Texas jobs and economic opportunity.

Comparing the Total Costs for the Mobility Scenarios

All of the investments provide returns that are far greater than the additional costs. The Unacceptable Conditions Scenario, the most likely estimate of what will occur is much better than if no expansions were accomplished, but the $68 billion cost will result in more than $1.3 trillion in congestion costs (Exhibit C6). The total of the two cost elements that the public will pay is more than $1.4 trillion in 2010 dollars. The other three scenarios substantially reduce total costs for each successively larger scenario cost. The improvement gained by additional investment (as shown in the congestion costs savings) is between 7.5 and 13.5 times the additional scenario cost. Said another way, for each additional dollar invested in the next scenario, there are between $7 and $14 returned to taxpayers and businesses. This suggests an economic case could be made to adopt any of the scenarios other than the Current Trend scenario because at each level of investment, there are substantially more benefits than the program costs required to fund that scenario.

Exhibit C6. Investment and Return for Urban Mobility Scenarios.

Scenario and Congestion Costs	F – Unacceptable Conditions	D – Worst Acceptable	C – Minimum Competitive	B – Continue 2010 Congestion
2011 to 2035 Scenario Cost ($ Billion)	$68	$96	$135	$173
2011 to 2035 Congestion Cost ($ Billion)	$1,338	$961	$704	$555
2011 to 2035 Congestion Cost Savings ($ Billion)	N A	$377	$634	$783
2011 to 2035 Total of Congestion & Scenario Cost ($ Billion)	$1,406	$1,057	$839	$728

Note: Values shown are the median of a range.

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Additional Appendix C Exhibits
Urban Mobility Summary Statistics

The additional Appendix tables provide a summary of the Urban Mobility scenario findings for each urban region.

Type of Measure	Exhibit No.	Mobility Measure
Regional congestion	Exhibit C7	Total Daily Delay (Person-Hours)
Regional congestion	Exhibit C8	Annual Congestion Cost (2010$ Millions)
Individual person	Exhibit C9	Delay Per Commuter (Hours)
Regional system needs	Exhibit C10	Implementation Cost For Mobility Scenarios - 2011 Through 2035 (2010$ Millions)
Regional congestion	Exhibit C11	Congestion Cost - 2011 Through 2035 (2010$ Million)

Total Daily Delay – The daily delay is expressed in person-hours. Delay is the difference in travel time between peak period conditions and free-flow (or light volume) periods.

Annual Congestion Cost – Congestion cost is comprised of the value for travel delay and extra fuel consumed. Unit values are $16 per person hour and $105 per truck hour. Fuel is estimated as 8.4 percent of the delay value (average of last 20 years).

Delay per Commuter – This statistic is the amount of extra travel time for a year for the average peak period traveler. Delay per peak period traveler (termed commuter) works well at a regional or statewide level. Between 50 percent and 60 percent of a region's population travels in the peak; commuter in this case does not just refer to those traveling for a work purpose.

Implementation Cost – Cost for equivalent lane-miles, interchanges, and rights-of-way estimated to be required to achieve each mobility scenario without the benefits of operational improvements, commute options and other funding sources (expressed in 2010 dollars).

Congestion Cost – Value of delay and fuel costs for personal and commercial vehicles in the 25-year period from 2011 to 2035.

Exhibit C7. Total Daily Delay (Person-Hours).
Unacceptable Congestion Scenario

Metro Areas	2010	2015	2020	2025	2035
Austin	115,133	119,742	125,102	175,095	428,138
Corpus Christi	16,703	22,298	27,530	40,006	67,162
Dallas-Ft. Worth	741,093	984,621	1,275,814	2,119,596	4,403,811
El Paso	19,235	24,129	42,599	49,138	65,911
Hidalgo	13,538	18,639	23,569	39,222	84,334
Houston	632,475	919,377	1,191,885	1,883,480	4,022,859
Lubbock	7,912	9,631	11,359	12,818	15,928
San Antonio	124,000	171,931	223,090	285,667	426,667
METRO TOTAL	1,670,090	2,270,369	2,920,946	4,605,023	9,514,810

Urban Areas	2010	2015	2020	2025	2035
Abilene	437	514	591	660	838
Amarillo	1,727	1,784	1,932	3,137	5,871
Beaumont	11,662	13,001	14,351	18,568	24,849
Brownsville	2,659	3,699	5,097	7,317	13,274
Bryan-College Station	3,234	4,693	6,347	8,948	14,043
Harlingen	2,778	4,110	5,538	8,054	14,835
Killeen-Temple	4,352	6,306	9,007	17,591	38,348
Laredo	5,549	8,836	12,627	18,177	34,722
Longview	5,754	6,973	9,110	11,514	16,876
Midland-Odessa	3,376	3,934	3,618	4,570	6,299
San Angelo	352	317	297	336	387
Sherman-Denison	473	619	752	868	1,405
Texarkana	1,956	1,450	1,399	1,844	2,917
Tyler	6,571	4,479	5,964	8,290	11,625
Victoria	1,741	1,815	1,912	2,520	3,755
Waco	1,881	1,651	1,533	2,544	4,272
Wichita Falls	865	1,065	1,269	1,548	1,879
URBAN TOTAL	55,368	65,246	81,345	116,487	196,195
GRAND TOTAL	1,725,457	2,335,615	3,002,291	4,721,509	9,711,005

Exhibit C7. Total Daily Delay (Person-Hours) (Continued).
Worst Acceptable Scenario

Metro Areas	2015	2020	2025	2035
Austin	119,742	125,102	175,095	390,000
Corpus Christi	22,298	27,530	40,006	61,890
Dallas-Ft. Worth	984,621	1,217,458	1,631,235	2,612,827
El Paso	24,129	41,530	48,197	65,574
Hidalgo	18,639	23,569	39,222	84,334
Houston	919,377	1,137,778	1,553,216	2,495,906
Lubbock	9,631	11,359	12,818	15,928
San Antonio	171,931	223,090	247,222	346,667
METRO TOTAL	2,270,369	2,807,415	3,747,012	6,073,125

Urban Areas	2015	2020	2025	2035
Abilene	514	591	660	838
Amarillo	1,784	1,932	3,137	5,871
Beaumont	13,001	14,351	18,568	24,849
Brownsville	3,699	5,097	7,317	12,857
Bryan-College Station	4,693	5,846	7,932	12,088
Harlingen	4,110	5,143	7,615	12,363
Killeen-Temple	6,306	8,571	12,862	20,659
Laredo	8,836	10,000	14,598	25,275
Longview	6,973	8,000	9,659	11,604
Midland-Odessa	3,934	3,620	4,570	6,299
San Angelo	317	297	336	387
Sherman-Denison	619	752	868	1,405
Texarkana	1,450	1,399	1,844	2,917
Tyler	4,479	5,964	8,290	11,625
Victoria	1,815	1,912	2,520	3,755
Waco	1,651	1,533	2,379	4,272
Wichita Falls	1,065	1,269	1,548	1,879
URBAN TOTAL	65,246	76,278	104,704	158,944
GRAND TOTAL	2,335,615	2,883,693	3,851,715	6,232,069

Exhibit C7. Total Daily Delay (Person-Hours) (Continued).

Minimum Competitive Scenario

Metro Areas	2015	2020	2025	2035
Austin	119,742	125,102	175,095	330,000
Corpus Christi	22,298	27,530	37,582	49,231
Dallas-Ft. Worth	832,434	999,406	1,193,587	1,662,708
El Paso	24,129	41,530	48,197	65,574
Hidalgo	18,639	23,569	39,222	74,256
Houston	757,044	977,778	1,164,912	1,588,304
Lubbock	9,631	11,359	12,818	14,857
San Antonio	156,970	200,667	237,333	293,333
METRO TOTAL	1,940,886	2,406,940	2,908,747	4,078,263

Urban Areas	2015	2020	2025	2035
Abilene	514	591	660	838
Amarillo	1,784	1,932	3,137	4,220
Beaumont	12,350	13,846	15,051	19,560
Brownsville	3,699	5,097	7,317	12,000
Bryan-College Station	3,911	5,011	7,051	10,637
Harlingen	3,736	4,747	6,769	10,879
Killeen-Temple	6,306	8,571	11,943	15,495
Laredo	7,702	8,571	12,976	22,242
Longview	5,734	6,769	7,727	10,549
Midland-Odessa	3,477	3,560	4,570	6,299
San Angelo	317	297	336	387
Sherman-Denison	619	687	752	1,187
Texarkana	1,450	1,399	1,844	2,917
Tyler	4,479	5,964	8,290	11,625
Victoria	1,815	1,912	2,330	3,538
Waco	1,651	1,533	2,379	4,272
Wichita Falls	1,065	1,088	1,252	1,503
URBAN TOTAL	60,609	71,577	94,383	138,149
GRAND TOTAL	2,001,495	2,478,517	3,003,130	4,216,412

Exhibit C7. Total Daily Delay (Person-Hours) (Continued).
Continue 2010 Congestion Scenario

Metro Areas	2015	2020	2025	2035
Austin	132,333	146,667	165,000	198,000
Corpus Christi	17,758	18,637	20,044	22,505
Dallas-Ft. Worth	832,434	908,551	994,656	1,187,648
El Paso	21,858	24,044	25,246	28,852
Hidalgo	15,361	16,879	18,901	22,848
Houston	799,578	938,830	1,025,301	1,202,573
Lubbock	8,200	8,440	8,615	9,143
San Antonio	134,545	143,333	148,333	160,000
METRO TOTAL	1,962,067	2,205,381	2,406,096	2,831,570

Urban Areas	2015	2020	2025	2035
Abilene	440	442	445	602
Amarillo	1,690	1,754	1,828	4,149
Beaumont	12,350	12,923	13,169	13,692
Brownsville	3,067	3,407	3,703	6,000
Bryan-College Station	3,520	3,758	3,966	4,352
Harlingen	2,989	3,165	3,385	4,945
Killeen-Temple	4,783	5,143	5,512	6,218
Laredo	6,419	7,143	8,110	10,110
Longview	5,476	5,877	6,150	7,736
Midland-Odessa	3,477	3,560	3,646	4,504
San Angelo	362	369	377	385
Sherman-Denison	514	549	501	593
Texarkana	2,028	2,088	2,275	2,527
Tyler	7,423	8,132	8,703	9,670
Victoria	1,870	1,978	2,097	2,275
Waco	1,958	2,022	1,903	3,067
Wichita Falls	888	907	920	940
URBAN TOTAL	59,252	63,216	66,690	81,766
GRAND TOTAL	2,021,318	2,268,597	2,472,786	2,913,337

Exhibit C8. Annual Congestion Cost (2010$ Millions).
Unacceptable Congestion Scenario

Metro Areas	2010	2015	2020	2025	2035
Austin	$691	$718	$751	$1,051	$2,569
Corpus Christi	$124	$166	$205	$298	$500
Dallas-Ft. Worth	$4,372	$5,809	$7,527	$12,504	$25,980
El Paso	$107	$134	$236	$272	$365
Hidalgo	$79	$108	$137	$228	$490
Houston	$4,428	$6,437	$8,345	$13,187	$28,165
Lubbock	$47	$58	$68	$77	$95
San Antonio	$554	$768	$997	$1,276	$1,906
METRO TOTAL	$10,402	$14,198	$18,265	$28,893	$60,072

Urban Areas	2010	2015	2020	2025	2035
Abilene	$3	$4	$5	$5	$7
Amarillo	$17	$17	$18	$30	$56
Beaumont	$78	$87	$96	$125	$167
Brownsville	$16	$22	$30	$43	$78
Bryan-College Station	$23	$33	$44	$63	$98
Harlingen	$16	$24	$32	$47	$86
Killeen-Temple	$25	$37	$52	$102	$223
Laredo	$43	$69	$98	$142	$270
Longview	$40	$49	$64	$80	$118
Midland-Odessa	$23	$27	$25	$32	$44
San Angelo	$3	$2	$2	$3	$3
Sherman-Denison	$4	$5	$6	$6	$11
Texarkana	$17	$12	$12	$16	$25
Tyler	$41	$28	$38	$52	$73
Victoria	$14	$15	$15	$20	$30
Waco	$5	$4	$4	$6	$11
Wichita Falls	$6	$7	$8	$10	$13
URBAN TOTAL	$373	$441	$550	$782	$1,311
GRAND TOTAL	$10,775	$14,639	$18,815	$29,675	$61,383

Exhibit C8. Annual Congestion Cost (2010$ Millions) (Continued).
Worst Acceptable Scenario

Metro Areas	2015	2020	2025	2035
Austin	$718	$751	$1,051	$2,340
Corpus Christi	$166	$205	$298	$461
Dallas-Ft. Worth	$5,809	$7,182	$9,623	$15,414
El Paso	$134	$230	$267	$363
Hidalgo	$108	$137	$228	$490
Houston	$6,437	$7,966	$10,875	$17,475
Lubbock	$58	$68	$77	$95
San Antonio	$768	$997	$1,104	$1,549
METRO TOTAL	$14,198	$17,536	$23,523	$38,188

Urban Areas	2015	2020	2025	2035
Abilene	$4	$5	$5	$7
Amarillo	$17	$18	$30	$56
Beaumont	$87	$96	$125	$167
Brownsville	$22	$30	$43	$75
Bryan-College Station	$33	$41	$55	$85
Harlingen	$24	$30	$44	$72
Killeen-Temple	$37	$50	$75	$120
Laredo	$69	$78	$114	$197
Longview	$49	$56	$67	$81
Midland-Odessa	$27	$25	$32	$44
San Angelo	$2	$2	$3	$3
Sherman-Denison	$5	$6	$6	$11
Texarkana	$12	$12	$16	$25
Tyler	$28	$38	$52	$73
Victoria	$15	$15	$20	$30
Waco	$4	$4	$6	$11
Wichita Falls	$7	$8	$10	$13
URBAN TOTAL	$441	$514	$703	$1,067
GRAND TOTAL	$14,639	$18,050	$24,226	$39,255

Exhibit C8. Annual Congestion Cost (2010$ Millions) (Continued).

Minimum Competitive Scenario

Metro Areas	2015	2020	2025	2035
Austin	$718	$751	$1,051	$1,980
Corpus Christi	$166	$205	$280	$367
Dallas-Ft. Worth	$4,911	$5,896	$7,042	$9,809
El Paso	$134	$230	$267	$363
Hidalgo	$108	$137	$228	$432
Houston	$5,300	$6,846	$8,156	$11,120
Lubbock	$58	$68	$77	$89
San Antonio	$701	$896	$1,060	$1,310
METRO TOTAL	$12,097	$15,029	$18,160	$25,471

Urban Areas	2015	2020	2025	2035
Abilene	$4	$5	$5	$7
Amarillo	$17	$18	$30	$40
Beaumont	$83	$93	$101	$131
Brownsville	$22	$30	$43	$70
Bryan-College Station	$27	$35	$49	$74
Harlingen	$22	$28	$39	$63
Killeen-Temple	$37	$50	$69	$90
Laredo	$60	$67	$101	$173
Longview	$40	$47	$54	$74
Midland-Odessa	$24	$25	$32	$44
San Angelo	$2	$2	$3	$3
Sherman-Denison	$5	$5	$6	$9
Texarkana	$12	$12	$16	$25
Tyler	$28	$38	$52	$73
Victoria	$15	$15	$19	$28
Waco	$4	$4	$6	$11
Wichita Falls	$7	$7	$8	$10
URBAN TOTAL	$409	$480	$633	$925
GRAND TOTAL	$12,506	$15,509	$18,793	$26,396

Exhibit C8. Annual Congestion Cost (2010$ Millions) (Continued).
Continue 2010 Congestion Scenario

Metro Areas	2015	2020	2025	2035
Austin	$794	$880	$990	$1,188
Corpus Christi	$132	$139	$149	$168
Dallas-Ft. Worth	$4,911	$5,360	$5,868	$7,006
El Paso	$121	$133	$140	$160
Hidalgo	$89	$98	$110	$133
Houston	$5,598	$6,573	$7,178	$8,420
Lubbock	$49	$51	$52	$55
San Antonio	$601	$640	$663	$715
METRO TOTAL	$12,296	$13,874	$15,150	$17,844

Urban Areas	2015	2020	2025	2035
Abilene	$4	$4	$4	$5
Amarillo	$16	$17	$17	$40
Beaumont	$83	$87	$89	$92
Brownsville	$18	$20	$22	$35
Bryan-College Station	$25	$26	$28	$30
Harlingen	$17	$18	$20	$29
Killeen-Temple	$28	$30	$32	$36
Laredo	$50	$56	$63	$79
Longview	$38	$41	$43	$54
Midland-Odessa	$24	$25	$25	$31
San Angelo	$3	$3	$3	$3
Sherman-Denison	$4	$4	$4	$4
Texarkana	$17	$18	$19	$21
Tyler	$47	$51	$55	$61
Victoria	$15	$16	$17	$18
Waco	$5	$5	$5	$8
Wichita Falls	$6	$6	$6	$6
URBAN TOTAL	$399	$426	$450	$553
GRAND TOTAL	$12,695	$14,300	$15,600	$18,397

Exhibit C9. Delay per Commuter (Hours).
Unacceptable Congestion Scenario

Metro Areas	2010	2015	2020	2025	2035
Austin	33	30	28	35	71
Corpus Christi	16	20	24	32	48
Dallas-Ft. Worth	50	59	70	107	185
El Paso	11	12	19	21	25
Hidalgo	8	10	11	17	30
Houston	53	61	67	97	177
Lubbock	16	19	22	24	28
San Antonio	30	38	47	58	80
METRO AVERAGE	42	50	57	83	146

Urban Areas	2010	2015	2020	2025	2035
Abilene	2	2	2	2	3
Amarillo	3	3	3	5	8
Beaumont	14	15	16	20	25
Brownsville	5	6	7	10	15
Bryan-College Station	9	12	15	20	29
Harlingen	8	11	14	19	30
Killeen-Temple	6	8	11	19	37
Laredo	10	14	18	22	34
Longview	19	24	30	36	48
Midland-Odessa	6	7	6	8	10
San Angelo	1	1	1	1	1
Sherman-Denison	2	2	3	3	5
Texarkana	10	7	7	8	12
Tyler	20	12	15	19	24
Victoria	9	9	9	11	15
Waco	4	3	3	5	7
Wichita Falls	3	3	4	4	5
URBAN AVERAGE	8	9	10	14	21
AVERAGE	37	44	51	74	130

Exhibit C9. Delay per Commuter (Hours) (Continued).
Worst Acceptable Scenario

Metro Areas	2015	2020	2025	2035
Austin	30	28	35	65
Corpus Christi	20	24	32	44
Dallas-Ft. Worth	59	67	82	110
El Paso	12	19	21	25
Hidalgo	10	11	17	30
Houston	61	64	80	110
Lubbock	19	22	24	28
San Antonio	38	47	50	65
METRO AVERAGE	50	55	67	93

Urban Areas	2015	2020	2025	2035
Abilene	2	2	2	3
Amarillo	3	3	5	8
Beaumont	15	16	20	25
Brownsville	6	7	10	15
Bryan-College Station	12	14	18	25
Harlingen	11	13	18	25
Killeen-Temple	8	10	14	20
Laredo	14	14	18	25
Longview	24	26	30	33
Midland-Odessa	7	6	8	10
San Angelo	1	1	1	1
Sherman-Denison	2	3	3	5
Texarkana	7	7	8	12
Tyler	12	15	19	24
Victoria	9	9	11	15
Waco	3	3	5	7
Wichita Falls	3	4	4	5
URBAN AVERAGE	9	9	12	17
AVERAGE	44	49	60	84

Exhibit C9. Delay per Commuter (Hours) (Continued).
Minimum Competitive Scenario

Metro Areas	2015	2020	2025	2035
Austin	30	28	35	55
Corpus Christi	20	24	30	35
Dallas-Ft. Worth	50	55	60	70
El Paso	12	19	21	25
Hidalgo	10	11	17	26
Houston	50	55	60	70
Lubbock	19	22	24	26
San Antonio	35	42	48	55
METRO AVERAGE	42	47	52	63

Urban Areas	2015	2020	2025	2035
Abilene	2	2	2	3
Amarillo	3	3	5	6
Beaumont	14	15	16	20
Brownsville	6	7	10	14
Bryan-College Station	10	12	16	22
Harlingen	10	12	16	22
Killeen-Temple	8	10	13	15
Laredo	12	12	16	22
Longview	20	22	24	30
Midland-Odessa	6	6	8	10
San Angelo	1	1	1	1
Sherman-Denison	2	3	3	4
Texarkana	7	7	8	12
Tyler	12	15	19	24
Victoria	9	9	10	14
Waco	3	3	5	7
Wichita Falls	3	3	3	4
URBAN AVERAGE	8	9	11	15
AVERAGE	37	42	47	57

Exhibit C9. Delay per Commuter (Hours) (Continued).
Continue 2010 Congestion Scenario

Metro Areas	2015	2020	2025	2035
Austin	33	33	33	33
Corpus Christi	16	16	16	16
Dallas-Ft. Worth	50	50	50	50
El Paso	11	11	11	11
Hidalgo	8	8	8	8
Houston	53	53	53	53
Lubbock	16	16	16	16
San Antonio	30	30	30	30
METRO AVERAGE	43	43	43	43

Urban Areas	2015	2020	2025	2035
Abilene	2	2	2	2
Amarillo	3	3	3	6
Beaumont	14	14	14	14
Brownsville	5	5	5	7
Bryan-College Station	9	9	9	9
Harlingen	8	8	8	10
Killeen-Temple	6	6	6	6
Laredo	10	10	10	10
Longview	19	19	19	22
Midland-Odessa	6	6	6	7
San Angelo	1	1	1	1
Sherman-Denison	2	2	2	2
Texarkana	10	10	10	10
Tyler	20	20	20	20
Victoria	9	9	9	9
Waco	4	4	4	5
Wichita Falls	3	3	3	3
URBAN AVERAGE	8	8	8	9
AVERAGE	38	38	39	39

Exhibit C10. Implementation Cost for Mobility Scenarios - 2011 through 2035 (2010$ Millions).

Unacceptable Congestion Scenario

Metro Areas	FY 2010-2015 TOTAL	FY 2010-2020 TOTAL	FY 2010-2025 TOTAL	FY 2010-2035 TOTAL
Austin	$3,220	$5,780	$7,850	$9,000
Corpus Christi	60	170	220	331
Dallas-Ft. Worth	6,540	12,400	17,000	25,200
El Paso	750	975	1,265	1,845
Hidalgo	160	360	505	550
Houston	5,370	11,650	15,550	22,800
Lubbock	85	175	230	343
San Antonio	1,128	2,253	3,139	4,911
METRO TOTAL	$17,313	$33,763	$45,759	$64,980

Urban Areas	FY 2010-2015 TOTAL	FY 2010-2020 TOTAL	FY 2010-2025 TOTAL	FY 2010-2035 TOTAL
Abilene	$42	$84	$114	$144
Amarillo	86	187	277	455
Beaumont	54	106	139	205
Brownsville	64	114	154	204
Bryan-College Station	23	32	37	46
Harlingen	-	-	-	-
Killeen-Temple	67	72	87	117
Laredo	18	25	28	35
Longview	20	33	108	281
Midland-Odessa	7	60	87	167
San Angelo	11	19	23	30
Sherman-Denison	6	19	26	38
Texarkana	231	267	321	348
Tyler	126	266	307	390
Victoria	23	36	43	56
Waco	99	181	253	395
Wichita Falls	-	-	-	-
URBAN TOTAL	$878	$1,503	$2,002	$2,911
GRAND TOTAL	$18,191	$35,266	$47,761	$67,891

Exhibit C10. Implementation Cost for Mobility Scenarios - 2011 through 2035 (2010$ Millions) (Continued).

Worst Acceptable Scenario

Metro Areas	FY 2010-2015 TOTAL	FY 2010-2020 TOTAL	FY 2010-2025 TOTAL	FY 2010-2035 TOTAL
Austin	3,220	5,780	7,850	9,989
Corpus Christi	60	170	220	882
Dallas-Ft. Worth	6,540	13,532	22,715	42,042
El Paso	750	975	1,265	1,862
Hidalgo	160	360	505	550
Houston	5,370	13,860	19,740	35,603
Lubbock	85	175	230	343
San Antonio	1,128	2,253	4,107	8,684
METRO TOTAL	$17,313	$37,104	$56,632	$99,956

Urban Areas	FY 2010-2015 TOTAL	FY 2010-2020 TOTAL	FY 2010-2025 TOTAL	FY 2010-2035 TOTAL
Abilene	$42	$84	$114	$144
Amarillo	86	187	277	455
Beaumont	54	106	139	194
Brownsville	64	114	154	228
Bryan-College Station	23	109	150	294
Harlingen	-	62	70	272
Killeen-Temple	67	118	363	713
Laredo	18	288	382	731
Longview	20	339	615	1,580
Midland-Odessa	7	60	87	167
San Angelo	11	19	23	30
Sherman-Denison	6	19	29	38
Texarkana	231	267	321	348
Tyler	126	266	307	390
Victoria	23	36	43	56
Waco	99	181	253	395
Wichita Falls	-	-	-	-
URBAN TOTAL	$878	$2,257	$3,327	$6,034
GRAND TOTAL	18,191	39,362	59,959	105,990

Exhibit C10. Implementation Cost for Mobility Scenarios - 2011 through 2035 (2010$ Millions) (Continued).

Minimum Competitive Scenario

Metro Areas	FY 2010-2015 TOTAL	FY 2010-2020 TOTAL	FY 2010-2025 TOTAL	FY 2010-2035 TOTAL
Austin	$3,220	$5,780	$7,850	$11,851
Corpus Christi	60	170	434	1,885
Dallas-Ft. Worth	14,500	21,848	34,453	54,809
El Paso	750	975	1,265	1,862
Hidalgo	160	360	505	991
Houston	13,116	23,221	33,198	54,490
Lubbock	85	175	230	400
San Antonio	1,365	2,655	4,778	11,200
METRO TOTAL	$33,255	$55,185	$82,713	$137,489

Urban Areas	FY 2010-2015 TOTAL	FY 2010-2020 TOTAL	FY 2010-2025 TOTAL	FY 2010-2035 TOTAL
Abilene	$42	$84	$114	$144
Amarillo	86	187	277	750
Beaumont	80	124	304	607
Brownsville	64	114	154	285
Bryan-College Station	103	168	214	423
Harlingen	50	101	162	339
Killeen-Temple	67	118	392	814
Laredo	144	424	506	835
Longview	339	595	1,060	1,832
Midland-Odessa	32	63	87	167
San Angelo	11	19	23	30
Sherman-Denison	6	36	70	169
Texarkana	231	267	321	348
Tyler	126	266	307	390
Victoria	23	36	61	74
Waco	99	181	253	395
Wichita Falls	12	41	52	67
URBAN TOTAL	$1,516	$2,825	$4,355	$7,668
GRAND TOTAL	$34,771	$58,010	$87,068	$145,158

Exhibit C10. Implementation Cost for Mobility Scenarios - 2011 through 2035 (2010$ Millions) (Continued).

Continue 2010 Congestion Scenario

Metro Areas	FY 2010-2015 TOTAL	FY 2010-2020 TOTAL	FY 2010-2025 TOTAL	FY 2010-2035 TOTAL
Austin	$1,770	$3,541	$8,530	$18,659
Corpus Christi	426	853	1,829	3,812
Dallas-Ft. Worth	14,500	29,500	39,299	59,195
El Paso	800	1,500	2,434	4,330
Hidalgo	342	683	1,440	2,977
Houston	11,000	25,500	37,716	62,517
Lubbock	250	550	643	831
San Antonio	1,600	3,300	7,908	17,263
METRO TOTAL	$30,688	$65,427	$99,799	$169,585

Urban Areas	FY 2010-2015 TOTAL	FY 2010-2020 TOTAL	FY 2010-2025 TOTAL	FY 2010-2035 TOTAL
Abilene	$70	$100	$148	$246
Amarillo	130	250	420	764
Beaumont	80	160	374	809
Brownsville	105	210	326	562
Bryan-College Station	125	250	501	1,012
Harlingen	86	180	360	726
Killeen-Temple	200	400	670	1,217
Laredo	280	560	1,115	2,241
Longview	300	600	1,027	1,893
Midland-Odessa	32	65	166	370
San Angelo	5	6	14	31
Sherman-Denison	30	60	226	562
Texarkana	35	65	204	486
Tyler	50	150	278	539
Victoria	15	25	64	143
Waco	60	125	462	1,147
Wichita Falls	35	70	105	177
URBAN TOTAL	$1,638	$3,276	$6,460	$12,924
GRAND TOTAL	$32,326	$68,703	$106,259	$182,509

Exhibit C11. Congestion Cost - 2011 through 2035 (2010$ Millions).

Metro Areas	Unacceptable Conditions	Worst Acceptable	Minimum Competitive	Continue 2010 Congestion
Austin	$55,485	$52,053	$46,652	$35,343
Corpus Christi	$11,908	$11,318	$9,768	$5,302
Dallas-Ft. Worth	$561,092	$379,275	$264,912	$211,391
El Paso	$9,639	$9,542	$9,542	$4,987
Hidalgo	$10,490	$10,490	$9,611	$3,951
Houston	$606,357	$426,761	$299,772	$252,058
Lubbock	$2,753	$2,753	$2,657	$1,825
San Antonio	$48,368	$41,720	$36,980	$23,282
METRO TOTAL	$1,306,093	$933,914	$679,896	$538,139

Urban Areas	Unacceptable Conditions	Worst Acceptable	Minimum Competitive	Continue 2010 Congestion
Abilene	$193	$193	$193	$143
Amarillo	$1,286	$1,286	$1,049	$932
Beaumont	$4,556	$4,556	$3,807	$3,089
Brownsville	$1,779	$1,742	$1,667	$916
Bryan-College Station	$2,384	$2,109	$1,854	$975
Harlingen	$1,963	$1,717	$1,529	$797
Killeen-Temple	$4,623	$2,860	$2,370	$1,135
Laredo	$6,059	$4,645	$4,096	$2,290
Longview	$3,030	$2,343	$2,045	$1,628
Midland-Odessa	$1,213	$1,213	$1,195	$960
San Angelo	$92	$92	$92	$98
Sherman-Denison	$266	$266	$233	$143
Texarkana	$652	$652	$652	$684
Tyler	$1,923	$1,923	$1,923	$1,919
Victoria	$786	$786	$748	$588
Waco	$257	$254	$254	$210
Wichita Falls	$359	$359	$300	$215
URBAN TOTAL	$31,422	$26,996	$24,007	$16,722
TOTAL	$1,337,515	$960,909	$703,902	$554,861

APPENDIX D – RURAL CORRIDORS

by
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Texas' rural transportation network is very large and serves a diverse set of personal trips and freight shipments. Transportation needs in rural areas fall into four basic categories: infrastructure preservation, mobility, connectivity, and safety. The infrastructure preservation needs assessments include the large preservation investment needs for rural Texas. This Appendix focuses on estimating the investment associated with addressing high volume roads and connectivity in rural Texas. The safety needs are not completely addressed, although there are significant safety benefits to the projects that address high volumes and connectivity needs.

There are more than 60,000 lane miles of rural highway in Texas, with the Texas Trunk System forming the core of the rural network. This 10,175-mile network (adopted by the Texas Transportation Commission in 1990 and last updated in 2000) will provide connectivity between communities of 20,000 population or more, as well as linking small rural communities to markets in urban areas. This network of divided highways is the rural equivalent of the metropolitan transportation plans produced by each urban area in Texas. Using the Trunk System as the base network provides consistency between urban and rural estimation methodologies. The Trunk System includes those sections of major intercity corridors that will experience congestion, such as the rural segments of IH 35, IH 45, and IH 20.

Connecting the small towns in Texas' rural areas with divided roadways (at least four lanes wide with a median separating the traffic directions) will improve safety for travelers and provide more expeditious and reliable travel for freight shipments. According to the Statewide Long-Range Transportation Plan (*1*), the tons of freight shipped in the state is forecast to increase by approximately 80 percent by 2035, with the value of that freight increasing by more than 160 percent. Miles of truck travel is expected to grow by more than 120 percent from now to 2035. The Plan notes that this is approximately double the rate of passenger vehicle travel growth. The increased heavy freight traffic on the rural roads connecting Texas' ports of entry, border crossings, and major distribution centers will necessitate upgrading many current roads to a divided highway status. Current funding forecasts that include minimum increases for rural route capacity and maintenance/upgrades are inadequate to address the projected person and freight transportation needs.

The 2030 Committee used the Long-Range Plan (*1*) rural system improvements as a basis for the cost of the rural connectivity needs estimate. The Long-Range Plan analysis focused on the Texas Trunk System, the designated system of roads that connect towns of 20,000 or more, ports, border crossings, tourism sites, and major truck routes. The 2030 Committee believes the Trunk System (last updated in 2000) should be immediately and periodically updated to ensure that it is aligned with projected freight growth and supports economic development opportunities in rural Texas. **Until that update, the current cost and service estimates were used as a starting point for a final cost projection.** In addition, rural road sections that are not on the

Trunk System, but are projected to have heavy usage or congestion concerns by 2035 were also examined.

Capacity concerns are only one element of the rural connectivity issue. In many economic development studies, the close proximity of a community to a designated Interstate route is an important site selection factor. Cities and towns along an Interstate route are given preference in such studies. The consideration of increasing miles of Interstate highways within Texas, either by building new capacity or upgrading current highways to Interstate standards is beyond the scope of the 2030 Committee study. However the economic advantage of increasing miles of Interstate highways within the state further heightens the need to periodically re-examine the Texas Trunk System designations and other factors that impact achieving Interstate designation. This would ensure that consideration be given to targeting rural road funds to projects that could generate substantial economic benefit for shippers using the Interstate system and for the communities adjacent to the Interstate Highway System.

SCENARIOS

The improvements were grouped into three scenarios. The Unacceptable Conditions scenario (part of scenario grade "F") shows congested roadways increasing from 7 percent to 25 percent (Exhibits D1 and D2).

- Worst Acceptable Conditions (Grade D) – The initial improvements from the current trend focused on the Texas Trunk System road segments with high volumes for the number of lanes of the roadway. These were two-lane or four-lane roads that required additional lanes to provide free-flow freight and person movement. The scenario cost is based on an estimate of the amount of roadway required to keep the high-volume rural road miles from growing beyond 2010 levels. These projects will improve the travel on roads that provide intercity person movement and address important freight corridors in many Texas regions. These modest project concepts are consistent with the limited funding available over the next two decades in that they focus on providing basic freight and person movement capacity, but do not provide Interstate-type roads.
  Cost estimate – $4.2 billion for high-volume Texas Trunk System Corridors (in 2010 dollars) (addresses 1,900 miles of road)

- Minimum Competitive (Grade C) – Providing a major rural road network that has no sections of high-volume road will allow Texas businesses in both urban and rural areas to compete on equal footing with shippers and manufacturers in other regions. This will be particularly important in the major trade corridors that are developing between Asia and the US, using routes through Mexico and the Panama Canal, connecting to Texas' ports. The focus of the second level of rural connectivity improvement cost is the remaining rural road miles that are carrying a higher volume of trucks and cars than their road was designed to handle. Providing a wider road with a median separation improves the safety, speed, and reliability of these corridors.
  Cost estimate – An additional $3.2 billion for high-volume rural roads (in 2010 dollars) (addresses 1,430 miles of road)

- Continue 2010 Conditions (Grade B) – Additional roads must be widened to accommodate the growing freight and person movement in rural Texas and retain the current service provided by the rural road network. While the specific roads needing attention may change, the third level of rural improvements was designed in a manner similar to the second level; in this case adding capacity to Trunk System roads with traffic volumes that approach the road capacity. The conditions for both 2010 and 2035 were calculated and the difference used to estimate the amount of road widening required to maintain 2010 conditions in 2035.
  Cost estimate – An additional $0.6 billion for high-volume Texas Trunk System Corridors above the first two levels of improvement (in 2010 dollars) (addresses 250 miles of road)

The cost of each rural scenario was estimated using the same type of process used by the metropolitan planning organizations and described in the Urban Mobility Appendix. The locations of transportation network problems were identified according to the goals of each scenario. The main principle was to make capacity additions to only those sections of the network where there were problems; this resulted in an efficient use of financial resources. The actual mix of strategies, modes, operating systems, and programs that will be developed will be different from region-to-region and from decade-to-decade. Rural capacity requirements were indicated by lower traffic volume per lane values than in the urban regions. This reflects the different operating characteristics and the difference in expectations between cities and rural areas.

Exhibit D1. 2010 Rural System Mileage and Congestion Levels.

2010 Miles

Road Categories	Not Trunk				Trunk System				Grand
	Congest	Near	Not	Total	Congest	Near	Not	Total	Total
Rural Art	334	163	10,336	10,833	645	176	6,151	6,971	17,804
Divided	105	46	690	840	381	65	2,002	2,448	3,288
Undivided	229	117	9,646	9,992	263	111	4,149	4,523	14,516
Rural Fwy	6	0	5	12	178	44	1,824	2,046	2,058
Divided	6	0	5	12	178	44	1,824	2,046	2,058
Urban Art	3,187	696	9,844	13,727	179	32	398	609	14,336
Divided	375	95	792	1,263	88	19	130	237	1,500
Undivided	2,812	601	9,051	12,464	91	13	268	372	12,836
Urban Fwy	794	141	1,450	2,385	59	21	440	520	2,905
Divided	727	126	1,125	1,978	58	21	427	507	2,485
Undivided	66	15	325	407	1		13	13	420
Grand Total	4,321	1,001	21,635	26,956	1,061	274	8,813	10,147	37,103
Divided	1,213	267	2,612	4,093	706	149	4,384	5,239	9,331
Undivided	3,107	734	19,023	22,863	355	124	4,429	4,909	27,772

Deficient Rural System	6.96%
Deficient miles	1,383
Total rural miles	19,862

Exhibit D2. 2035 Rural System Mileage and Congestion Levels.

2035 Miles

Road Categories	Not Trunk				Trunk System				Grand
	Congest	Near	Not	Total	Congest	Near	Not	Total	Total
Rural Art	1,758	377	8,698	10,833	2,015	363	4,593	6,971	17,804
Divided	389	45	406	840	917	133	1,398	2,448	3,288
Undivided	1,368	332	8,292	9,993	1,098	230	3,195	4,523	14,516
Rural Fwy	10	1	1	12	694	103	1,248	2,046	2,058
Divided	10	1	1	12	694	103	1,248	2,046	2,058
Urban Art	7,316	558	5,844	13,718	382	34	202	618	14,336
Divided	849	60	353	1,263	166	7	65	237	1,500
Undivided	6,467	498	5,491	12,455	217	27	137	381	12,836
Urban Fwy	1,443	80	862	2,385	230	25	265	520	2,905
Divided	1,340	72	566	1,978	225	25	257	507	2,485
Undivided	102	8	296	407	6		8	13	420
Grand Total	10,527	1,015	15,405	26,947	3,327	551	6,278	10,156	37,103
Divided	2,589	178	1,326	4,093	2,002	268	2,968	5,239	9,331
Undivided	7,938	837	14,079	22,855	1,320	257	3,340	4,917	27,772

Deficient Rural System	24.9%
Deficient miles	4,944
Total rural miles	19,862

CALCULATING RURAL TRAVEL COSTS

The costs associated with high traffic volumes for the rural network scenario in the 2009 *2030 Committee Report* were used as the basis for the 2011 report. As with the urban scenarios, the value of travel time delay and extra fuel consumed were used as the rural "congestion" cost components. The "full build" scenario in the 2009 report reduced travel costs by $1 billion between 2009 and 2030 with 17,200 lane-miles of additional rural road. Time and fuel savings are not substantial (Exhibit D3) because the mobility-related capacity additions and the traffic volumes are lower than those in the urban scenarios, but the benefits of connectivity represent an additional important, but unquantified, component of the mobility picture. The benefits of the rural scenarios were calculated using the ratio of added lane-miles to the 17,200 value from the 2009 report (Exhibit D3).

To calculate the household level "congestion" costs for rural regions, the component of costs that are due to commercial vehicles was removed. A ratio of costs was developed using the urban region values (for which there are more data) and the percentage of trucks in the urban and rural traffic streams.

Commercial vehicles are 30 percent of the state total congestion costs in urban regions. This varies from below 30 percent for most of the larger urban regions to above 60 percent in smaller regions (Exhibit D4). Trucks comprise approximately 6.1 percent of travel in the 25 urban areas and 20.3 percent of rural travel. The distribution of vehicle-miles of travel share is 78 percent urban and 22 percent rural. The value of rural commercial delay was estimated at

69 percent of total rural "congestion" costs; 31 percent of the "congestion" costs shown in Exhibit D3 will be used for calculations of the household costs.

Exhibit D3. Summary of Costs Associated with High-Volume Rural Roads ($2010 billions) 2011 to 2035.

Rural Scenario	Added Lane-Miles	Fuel and Time Costs	Scenario Costs
Unacceptable Conditions	0	$ 1.0	$ 0
Worst Acceptable	3,770	$0.78	$4.2
Minimum Competitive	6,630	$0.62	$7.5
Continue 2010 Conditions	7,120	$0.59	$8.0

Note: Costs and benefits from individual projects are difficult to estimate at this level of detail and specificity.

Exhibit D4. Truck Cost Component of Urban Congestion Cost.

Urban Area	Truck Cost as a Percent of Total Urban Congestion Costs
Abilene	60%
Amarillo	57%
Austin	32%
Beaumont	39%
Brownsville	30%
Bryan-College Station	46%
Corpus Christi	48%
Dallas-Fort Worth	26%
El Paso	22%
Harlingen	29%
Hidalgo	30%
Houston	27%
Killen-Temple	37%
Laredo	52%
Longview	44%
Lubbock	32%
Midland-Odessa	49%
San Angelo	47%
San Antonio	27%
Sherman-Denison	51%
Texarkana	64%
Tyler	31%
Victoria	61%
Waco	41%
Wichita Falls	41%
Average	30%

Source: Metropolitan transportation planning models and TTI Analysis

REFERENCES

1. *Texas Statewide Long-Range Transportation Plan 2035*. Texas Department of Transportation, 2010. http://www.txdot.gov/public_involvement/transportation_plan/report.htm.

APPENDIX E – ADDITIONAL REVENUE SOURCE OPTIONS FOR PAVEMENT AND BRIDGE MAINTENANCE

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EXECUTIVE SUMMARY

HIGHWAY FUND REVENUE

Additional revenue is required to close the gap between maintenance funding needs and inadequate, projected future funding available from current revenue sources for both pavements and bridges [Zhang et al. 2010] [Zhang et al. 2009] [DYE 2009] [Stockton et al. 2009]. The menu of potential revenue source options shown in Exhibit E1 could provide an additional $2.6 billion annually for pavement and bridge construction and maintenance needs. Details regarding each of these revenue source options are contained in this Appendix.

OVERWEIGHT TRUCK FINE RESTRUCTURING

Reducing the number of overweight trucks operating on the state highway system will reduce accelerated pavement and bridge deterioration rates. Based on information provided by the Texas Department of Public Safety and the State Comptroller's Office, the majority of the over 30,000 overweight truck fines issued by Texas courts each year are $100 each. This is the minimum overweight truck fine permitted by state statutes. Low overweight truck fines do little to discourage overweight truck operations.

Consideration should be given to implementing an overweight vehicle fine structure with a specified fine rate schedule as is used by 37 other states. This would help Texas courts determine appropriate overweight vehicle fines and provide a clear understanding to highway system users of the potential cost of operating an overweight vehicle without a permit.

ADDITIONAL OPTIONS

Consider re-authorizing TxDOT to enter into Comprehensive Development Agreements (CDAs) and Public Private Partnerships (PPPs) with oversight from the State Legislature. The

2030 Committee notes that CDAs have provided the means for development of projects that otherwise could not have been funded in the near-term with traditional revenue sources. On average, TxDOT has funded an additional $1 billion per year in new projects since authorized to enter into CDAs. These projects have attracted commercial developments to Texas that create jobs and tax revenue.

Seek new opportunities for TxDOT and trucking, rail, port, air, and container shipping industries to share data and information about freight operations. This will provide the detailed information needed to supplement previous freight transport studies and to help make decisions about freight corridor upgrades, Longer Combination Vehicle (LCV) operations, and container cargo fees in Texas.

Consider implementing an annual 5 percent fee increase for all TxDOT oversize/overweight permits. This will address inflation and provide funding for continued improvement and staffing of Oversize/Overweight (OS/OW) permitting processes.

Exhibit E1. Additional Possible Revenue Sources for Pavement and Bridge Maintenance.

Menu of Revenue Source Options	Additional Annual HWY Revenue (millions)
TxDOT Permits	
1547 Over Axle Tolerance	$9.3
General OS / OW	$9.6
Super Heavy Load	$0.8
Other Specialized Permits	$5.0
New Permits for overweight vehicles not currently required to be Permitted	
Ready Mix Concrete and Concrete Pump Trucks TTC 622.011 - 622.017	$8.3
Garbage, Solid Waste and Recycling Trucks TCC 621.206(b)	$8.0
Farm trucks operating at 12% over-axle weight limits TCC 621.101	$15.0
Delivery vehicles operating overweight under TCC 621.102(g)	$1.5
Milk Trucks operating overweight under TCC 622.031 - 622.032	$1.5
Cotton Seed and Chili Pepper Trucks operating overweight under TCC 622.953	$1.0
Subtotal - Additional Revenue from increased and new Permit Fees	**$60.0**
Redirect OS/OW Permit Fees from General Revenue to HWY Fund	$18.3
Automatic 5% increase in oversize/overweight permits annually	$5.0
Redirect Overweight Truck Fines from GR to HWY & Restructure fines	$12.4
New Permits and Registration fees for Long Combination Vehicles	$318.0
New Cargo Container Fee of $12	$25.1
Increase 18-wheeler tractor-trailer combination registration fees to $1,000	$47.0
Increase token trailer registration fee from $15.30 to $35.30	$3.5
New tire HWY maintenance fee of $2 for light vehicles and $3.50 for trucks	$59.0
Transfer Tire taxes from GR to HWY	$138.0
Increase Motor Vehicle Sales and Use tax by 1/4% and deposit 75% in HWY	$78.9
Re-authorize TxDOT to initiate Comprehensive Development Agreements	$1,000.0
Move debt service from HWY fund to State General Fund	$596.2
Privatize collection of claims for damages to TxDOT highway infrastructure	$13.0
Market advertising space on the TxDOT.gov website	$0.5
Market 'naming rights' for TxDOT transportation infrastructure components	$5.0
Privatize selected, existing safety rest areas and future new rest areas	$27.0
New TxDOT Highway Develoment Impact Fee for Maintenance / New Construction	$75.0
Reduce the amount of motor fuel taxes retained by oil companies & the Comptroller	$80.25
Total Potential Annual Additional HWY Revenue	**$2,562.2**

Note: CDAs are (technically) a funding source, not necessarily a revenue source.

The 2030 Committee has identified several possible revenue options and suggests that TxDOT consider conducting a more thorough study on the following topics:

1. Evaluate the potential benefits and impacts of implementing a state Development Impact Fee (DIF) to repair existing state roadways that are damaged by new residential and commercial developments. In addition, consider providing TxDOT with the ability to charge a DIF for new highway facilities required to address traffic needs for new residential and commercial construction.

2. Evaluate impacts, such as 'jurisdiction shopping," and more accurate revenue projections due to potential increases in registration fees for 5-axle truck tractor trailer combinations and potential new registration fees for LCV configurations.
3. Evaluate impacts and more accurate revenue projections due to potential increases in overweight vehicle fines and weight enforcement activities on overweight vehicles operations in Texas.
4. Evaluate impacts and potential revenue if a cargo container fee is implemented at Texas ports of entry (truck, rail, and shipping). Evaluate cargo container fee legislation that has been passed by other states, such as California, and provide a summary for review by the Texas State Legislature and staff.
5. Evaluate impacts and consider developing a plan of action for Texas to lead a national effort to remove the federal ban against further implementation of Longer Combination Vehicle corridors. Consider conducting further evaluation of LCV configurations that Texas freight operators want to operate on and off the Interstate Highway System and the National Network. Report on how LCVs can deliver products in urban areas (last mile) logistics. Help create a level playing field among states.
6. Evaluate potential safety improvements, cost savings, and revenue through privatization of existing and future planned safety rest areas. Provide members of the Texas state legislature and Texas' US Members of Congress with information needed to support removing the federal ban on commercialization of Interstate Safety Rest Areas. Help create a level playing field among states.
7. Evaluate the impacts of agricultural vehicles overweight loads on the state highway system and evaluate weights permitted by state statutes to determine equitable overweight farm vehicle permit fees.
8. Evaluate the impacts of certain overweight vehicle loads on the state highway system that are currently permitted by state statute to operate without a permit. These include concrete, solid waste, milk, recycling, timber, cotton seed modules, and chili peppers among others. Consider evaluating state statutes to determine equitable overweight special vehicle permit fees.
9. Evaluate bonding as a method for TxDOT and counties to collect funds to repair pavements or bridges damaged by overweight vehicles. Identify potential alternatives to bonds for TxDOT as a mechanism for reimbursement of damages by overweight vehicles.
10. Evaluate the potential for developing additional Special Permit Corridors such as SH 4/SH 48 from the Port of Brownsville to the Texas/Mexico Border. Consider recommending new routes to the Texas Transportation Commission that can be self-supporting through Special Permit fees that accrue to a maintenance fund for that corridor.
11. Evaluate the impacts of oversize (length, width, height) vehicles on the state highway system. Include an analysis of safety and congestion impacts due to wide loads on narrow roadways that affect the driving behaviors of other motorists. Evaluate existing state statutes and determine equitable oversize vehicle permit fees.

12. Consider conducting a more thorough study and marketing analysis of revenue potentials from sponsoring, or selling 'naming or branding rights' for state highway infrastructure components such as roadway segments, freeways, corridors, safety rest areas, bridges, and ferries.
13. Consider conducting a more thorough study and marketing analysis of revenue potentials from selling advertizing space on the TxDOT government website and on state infrastructure components.
14. Consider providing TxDOT with sufficient additional funding and staff to implement an enhanced Pavement Management Information System (PMIS) that incorporates pavement layer and structural condition index data, maintenance work history information, and future pavement condition score prediction capabilities [2030 Committee 2009] [Zhang et al. 2003].
15. Consider providing TxDOT with sufficient additional funding and staff to implement a comprehensive, statewide vehicle weigh-in-motion system. This will provide the department with more accurate and complete traffic weight data for planning, pavement design, and system management.

In addition, the 2030 Committee suggests that the following options be reviewed by the appropriate state authority.

16. Evaluate the impacts and potential revenue through a 0.25 percent increase in vehicle sales tax (from 6.25 percent to 6.5 percent) with 75 percent of the additional revenue deposited in the Highway Fund 6 and the remaining 25 percent deposited in the School Fund.
17. Evaluate the impacts and potential revenue through re-appropriation of tire sales tax from General Revenue to the Highway Fund 6. Evaluate state legislation that would be necessary to require a tire sales tax to be reported as a separate item by retailers and in the State Comptroller's Revenue Summary.
18. Evaluate impacts and potential revenue through a new HWY Maintenance fee assessed on sales of light and commercial vehicle tires. Evaluate state legislation that would be necessary to require a tire HWY Maintenance fee to be reported as a separate item by retailers and in the State Comptroller's Revenue Summary.
19. Evaluate the percentage of motor fuel tax revenues allocated to the Texas Comptroller of Public accounts for administration and enforcement of motor fuel tax laws. Determine if a portion of this amount can be redirected to Highway Fund 6 while providing adequate funding to TCPA for administration and enforcement of motor fuel tax laws [TxLBB 2008].
20. Evaluate the option of redirecting a portion of the motor tax receipts retained by motor fuel Suppliers, and Distributors/Importers for timely payment of motor fuel taxes to Highway Fund 6.

ADDITIONAL REVENUE SOURCE OPTIONS FOR PAVEMENT AND BRIDGE MAINTENANCE

Oversize/Overweight Permit Fees

The Texas Department of Transportation – Motor Carrier Division issues over 500,000 Oversize/Overweight permits per year. Exhibit E2 provides a summary of the different types and numbers of overweight vehicle permits issued in FY 2010.

Exhibit E2. Oversize/Overweight Permits Issued by MCD [TxDOT FIN 2010a] [TxDOT MCD 2010a].

TxDOT Motor Carrier Division - Annual Totals by Permit Type				
Permit Type	**FY Totals**	**% of Total**	**Fees to General Revenue 2010**	**Fees to Highway Fund 2010**
General Oversize/Overweight	**314,254**	62.79%	$9,414,060	$40,124,320
Temporary Registration	**17,187**	3.43%	$850,560	
Manufactured Housing	**65,746**	13.14%	$1,295,117	$1,334,563
Manufactured Housing (Annual)	**4**	0.00%	$5,880	$120
Portable Building	**16,637**	3.32%	$124,733	$124,733
Over-Axle Weight Tolerance (1547)	**30,095**	6.01%	**$7,533,485**	$4,066,965
30/60/90 day Width	**17,209**	3.44%	$1,645,590	$1,645,590
30/60/90 day Length	**6,184**	1.24%	$569,400	$569,400
Well Service Unit (S/P Mileage)	**2,738**	0.55%		$217,266
Well Service Unit (Annual)	**74**	0.01%		$11,284
Crane (S/P Mileage)	**1,535**	0.31%	$45,900	$167,745
Crane (Annual)	**431**	0.09%	$21,400	$21,400
HUB	**18,643**	3.72%		$6,348,720
Envelope (Annual)	**2,181**	0.44%	$1,755,000	$5,265,000
Envelope (Annual Non-Specific)	**2,511**	0.50%	$2,469,000	$7,407,000
Cylindrical Bales of Hay (Annual)	**933**	0.19%	$9,300	
Implement of Husbandry (Annual)	**584**	0.12%	$77,760	$97,035
Concrete Beam/Girder	**1,152**	0.23%	$34,560	$82,725
Rig-Up Truck/ Unladen Lift (Annual)	**300**	0.06%		$15,600
Utility Pole (Annual)	**134**	0.03%		$15,720
Super Heavy	**631**	0.13%	$18,930	$266,570
Multi State	**901**	0.18%	**$137,922**	
Self Propelled Off-Road Equipment	**71**	0.01%	$2,130	$4,980
Water Well Drilling Machinery & Related Equipment	**52**	0.01%	$7,020	$9,120
Fracing Trailer (Annual)	**2**	0.00%		$561
Credit Card Fees & Route Inspection				$410,795
	500,189	**100.00%**	**$26,017,747**	**$68,207,211**
GR Fund Balance - 1547 Permits & Multi-State GR Funds			**$18,346,340**	

These permits resulted in total sales of approximately $94,224,958 with $37,142,361 in permit fees and $31,064,850 in HWY maintenance fees deposited in Fund 6 for a total of $68,207,211. A total of $26,017,747 from permit sales was deposited in Fund 1 General Revenue. Of the permit fees deposited in General Revenue, approximately $7,533,485 was distributed to counties as the result of Over-Axle Weight Tolerance (1547) Permit sales and $137,922 was paid to other states through Multi-State Permit sales. The remaining $18,346,340 from permit sales remained in General Revenue for other uses, but was not deposited in Highway Fund 6. The following sections discuss specific permit types and the need to increase permit fees to provide additional funds for pavement and bridge maintenance [TxDOT FIN 2010] [TxDOT MCD 2010b] [TxDOT MCD 2008].

Permit Fees Accrued to General Revenue

The 2030 Committee identified a possible option that TxDOT permit fees paid to General Revenue, which are not associated with the county 1547 permit apportionment or multi-state permits, could be deposited in Highway Fund 6 for pavement and bridge maintenance [TxDOT MCD 2010b]. Referring to Exhibit E2, over $26 million is paid to General Revenue from the sale of TxDOT Motor Carrier Division Permits [TxDOT FIN 2010]. Of this amount, approximately $7.3 million is paid to counties identified during the issuance of 1547 Over Axle Weight Tolerance permits. In addition, over $137,000 is paid to other states through the issuance of Multi-State Permits. The remaining approximately $18.3 million remains in General Revenue for other uses.

Annual Increase in Permit Fees

The 2030 Committee identified a possible option to implement an annual 5 percent permit increase for all oversize/overweight permits. The annual increase will support further implementation of improved permitting processes, additional permit personnel, and increased pavement and bridge maintenance revenue.

The 5 percent annual permit fee increase takes into consideration inflation rates and the fact that as the highway system ages, damage due to overweight loads will increase. As a pavement or bridge structure ages, the structural condition deteriorates and therefore the load carrying capacity decreases. This means that the ability of highway system to carry increased numbers and sizes of overweight loads will decrease over time unless sufficient funds are made available to make necessary repairs and perform needed rehabilitation and reconstruction.

In addition, routing of oversize and overweight loads will become more complicated as bridges are load zoned due to structural deficiencies. Further, certain bridges that carry mid-heavy and super-heavy loads may only be capable of carrying a load of this size once during its operational life. For this reason, the number of bridges and associated routes that mid-heavy and super-heavy loads can be transported necessarily diminishes over time. The TxDOT Motor Carrier Division (MCD) must track and record these moves and the bridges that are affected by these heavy loads either through load posting or one-time only heavy load use. The additional fee will also help MCD maintain day-to-day personal support to accommodate the increasing numbers of permits due to future economic development and increased population growth.

Load Zoned Pavements and 1547 over Axle Weight Tolerance Permits

Texas currently has about 16,300 miles of load zoned roadways on the state system. These pavements were primarily constructed in the 1940s and 1950s when truck design was different and maximum truck loads were much lower than today. A typical 2 axle tractor with 1 axle semi trailer of that era is shown in Exhibit E3.

Exhibit E3. 2-Axle Tractor – 1 Axle Semi-Trailer (2S-1) Configuration of the 1940s and Early 1950s [Ken Goudy 2010].

The maximum allowable Gross Vehicle Weight (GVW) in Texas in 1950 was 48,000 lb. In 1953, the allowable GVW was increased to 58,420 lb to encourage truckers to add an additional axle (assumed weight 1,420 lb) in order to gain an additional 9,000 lb in cargo load (48,000 + 9,000 + 1,420 = 58,420 lb GVW). This resulted in a reduction in the number of over weight axles on the state highway system, which was the goal of the allowable GVW increase [THD 1953] [Prozzi 2007].

During this same period, the Texas Highway Department was engaged in a major rural road building effort to 'get the farmer out of the mud' and thousands of miles of Farm-to-Market roads were constructed. Exhibit E4 shows a cross-section of a thin FM road pavement. These pavements typically were constructed with a 6 in. to 8 in. of crushed aggregate base layer and a thin surface treatment of asphalt and rock. The thin surface treatment sealed the crushed aggregate base layer to prevent penetration of moisture and provided skid resistance. The base layer reduced stresses due to tire loads and protected the existing soil from rutting as had been the case when the farm vehicles traveled these roadways when they were unpaved.

Exhibit E5 shows a cross section of IH 35 in Waco District, which is constructed of a thick asphalt concrete surface layer and thick granular and stabilized base, which is designed to carry heavy truck loads. The thick pavement structure is designed to reduce the stresses applied by heavy truck tire loads and prevent rutting of the subgrade and cracking and rutting of each pavement layer.

Exhibit E4. Thin Surface Treated FM Road.

Exhibit E5. Thick IH 35 Pavement.

In the late 1950s, the federal government announced that, in conjunction with development of the Interstate Highway System, the national weight limit was to be increased to 73,280 lb GVW [USDOT 2000a]. In order to prevent damage to the newly constructed Farm-to-Market Road system that had been designed to the 58,420 lb standard, the Texas Highway Department load posted over 17,000 miles of roadway at the 58,420 lb load limit through Commission Minute 46593. A further increase in the national truck Gross Vehicle Weight limit to 80,000 lb was introduced in 1974.

HB 2060 and 1547 Permits

In 1989, HB 2060 authorized the Texas Department of Highways and Public Transportation to issue Over Axle/Gross weight tolerance permits. These permits allowed 18-wheeler tractor semi-trailer units to operate on Texas roads, including load zoned roads and bridges (excluding the Interstate Highway System) at a maximum GVW of 84,000 lb. Exhibit E5 shows rock haulers operating on a Farm-to-Market Road. Exhibit E6 shows a typical permitted 3-axle tractor, 2 axle trailer (3S-2) trucks operating on a load zoned FM roadway.

HB 1547 later amended the Texas Transportation Code 623.0113 'Route Restrictions' to restrict operation on load zoned bridges except in cases where crossing a load zoned bridge with an 84,000 lb permitted truck was the only route between the origin and the destination. Each 1547 permit authorizes operation of a single 84,000 lb GVW truck in multiple counties depending on the option selected by the purchaser. Exhibit E7 shows the current cost of a 1547 permit and the number of associated county authorizations.

Exhibit E5. Rock Haulers on an FM Road.

Exhibit E6. Heavy Trucks on a Load Zoned FM Road.

Exhibit E7. 1547 Permit Cost Range and Current Cost per County Authorization [TxDOT MCD 2010b].

Number of Counties	Permit Cost*	Permit Cost per maximum County authorization
1–5	$225	$45.00
6–20	$330	$16.50
21–40	$530	$13.25
41–60	$705	$11.75
61–80	$880	$11.00
81–100	$980	$9.80
101–254	$1080	$4.25

*Includes base fee of $75 + $5 Administration fee

Since each permit authorizes operation of an 84,000 lb GVW truck in multiple counties, the purchase of 30,095 1547 permits resulted in approximately 636,500 county authorizations [TxDOT MCD 2010c]. Exhibit E8 shows the distribution of county authorizations, which range from a minimum of 275 to a maximum of 8,600 per county. Exhibit E9 shows the TxDOT Pavement Management Information System (PMIS) Distress Score for each county for comparison purposes. As can be seen, the eastern portion of the state and metro areas including Houston, Dallas, Fort Worth, Austin, and San Antonio tend to have the highest numbers of permits and worse distress scores [TxDOT CST 2010a] [TxDOT CST 2010b].

Exhibit E10 provides an overview of which districts have the greatest activity in terms of 1547 permitted trucks and the relationship between number of county authorizations and the number of lane miles of FM road and FM load zoned roads. Fort Worth District has the greatest number of county authorizations at just over 57,000. Although Texas currently has approximately 16,300 center line miles of load zoned roadway, road length information was only available in this analysis for approximately 15,300 center line miles (or 30,600 lane miles).

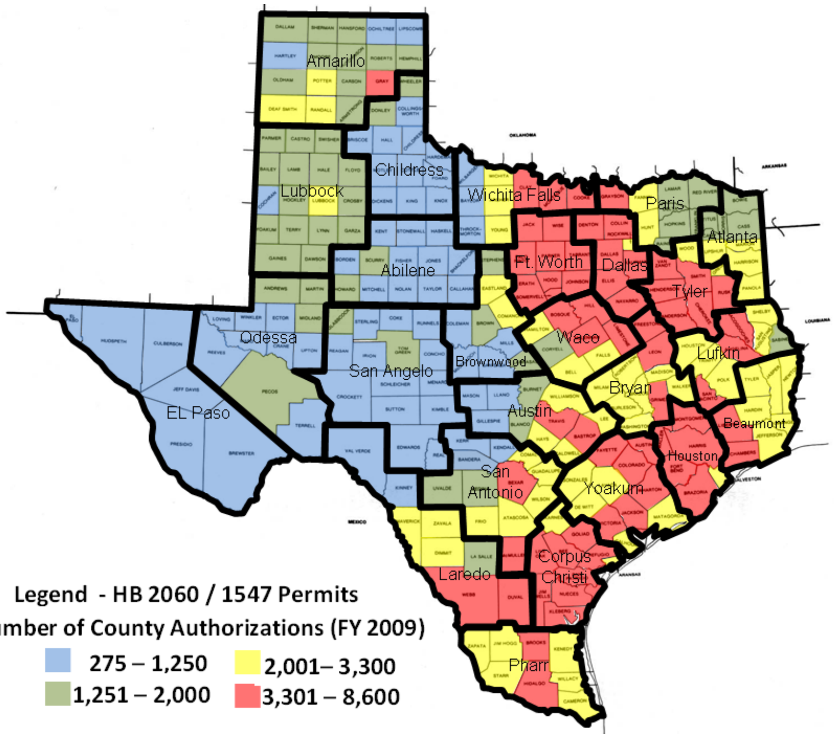


Exhibit E8. Distribution of 1547 Permit Authorizations by County and District.

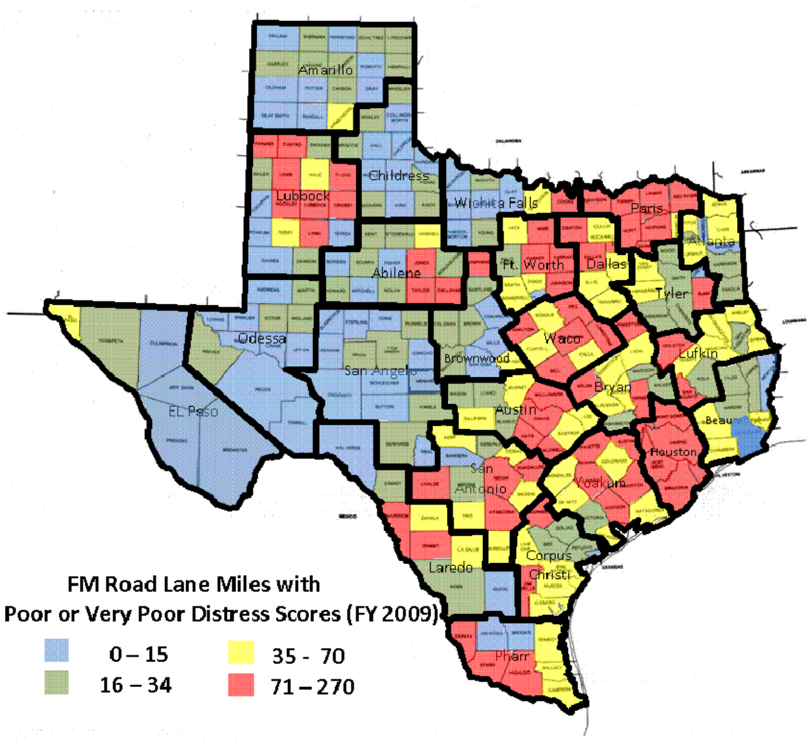


Exhibit E9. Distribution of FM Road Lane Miles with Fair, Poor, or Very Poor Distress Scores.

Exhibit E10. Load Zoned Roads Ranked by Number of 1547 County Authorizations.

District	Number of Load Zoned FM Lane miles	Number of FM Road Lane miles	% FM Roads that are Load zoned	Number of 2060/1547 county authorizations
Ft. Worth	2110.75	3048.1	69.25%	57,225
Dallas	1565.53	3174.4	49.32%	43,644
Yoakum	1946.80	3914.1	49.74%	40,630
Corpus Christi	2145.02	3083.9	69.56%	38,794
Bryan	1207.79	3749.4	32.21%	32,954
Houston	610.04	2878.2	21.20%	30,182
Waco	2741.88	4071.6	67.34%	30,176
Amarillo	1461.57	4073.9	35.88%	28,882
Tyler	2976.62	4297.7	69.26%	28,015
Lubbock	0.00	6763.4	0.00%	27,852
San Antonio	1650.90	3902.8	42.30%	27,162
Lufkin	904.66	3531	25.62%	26,753
Pharr	691.98	2774.4	24.94%	26,373
Austin	1258.41	3672.2	34.27%	25,196
Wichita Falls	2843.03	3163.9	89.86%	24,922
Beaumont	951.70	2231.5	42.65%	22,139
Paris	2855.99	3892.3	73.38%	20,436
Atlanta	113.44	3054.8	3.71%	20,167
Laredo	676.63	2022.8	33.45%	17,237
Brownwood	192.19	3074.8	6.25%	13,772
Odessa	0.00	2422.9	0.00%	13,483
San Angelo	263.83	3013.6	8.75%	13,242
Abilene	1322.89	4468.4	29.61%	12,974
Childress	66.81	2750	2.43%	11,662
El Paso	85.28	1247.3	6.84%	2,631
Totals	**30,643.74**	**84,277.40**	**36.36%**	**636,503**

The American Association of State Highway and Transportation Officials (AASHTO) Equivalent Single Axle Load (ESAL) concept provides a standard approach for relating the damage relationship between vehicles of different weight and/or axle configurations [AASHTO 1993]. An 18 kip (kip = 1,000 lb or a **ki**lo **p**ound) ESAL was the baseline or standard axle load established at the AASHO Road Test conducted in the late 1950s to early 1960s. The amount of damage caused by an 18,000 lb axle was related to axles of other weights and configurations (e.g., tandem axles) during testing that was conducted on hundreds of different pavement sections. These pavement sections were of different thicknesses and provided a means for relating the amount of damage done by an 18 kip axle compared with axles of other weights on pavements of different strengths. The AASHTO Guide for the Design of Pavement Structures provides an Appendix with tables that list ESAL factors that relate the damage of different axle groupings and weights to an 18,000 lb axle for pavements of different strengths. Tables are provided for single, tandem (two axles spaced 4 ft apart), and tridem axles (3 axles closely spaced and acting as one group). Damage is defined as 'serviceability loss,' which is primarily due to increased pavement roughness.

Relative Damage due to a 1547 Permitted 84,000 lb Truck on a Load Zoned Road

The AASHO Road Test showed that the damage relationship for increased axle weights is not linear; it is non-linear to the 4th power. This means that if the axle weight is doubled, the amount of damage is not doubled it is actually increased by 2^4, which is 16 time greater [Prozzi et al. 2008] [Leidy 1995]. Based on these concepts and information contained in the AASHTO Guide Appendix –D, Exhibit E11 shows the number of ESALs attributed to a 1547 permitted 84,000 lb truck compared to an unpermitted truck operating on a load zoned roadway at 58,000 lb.

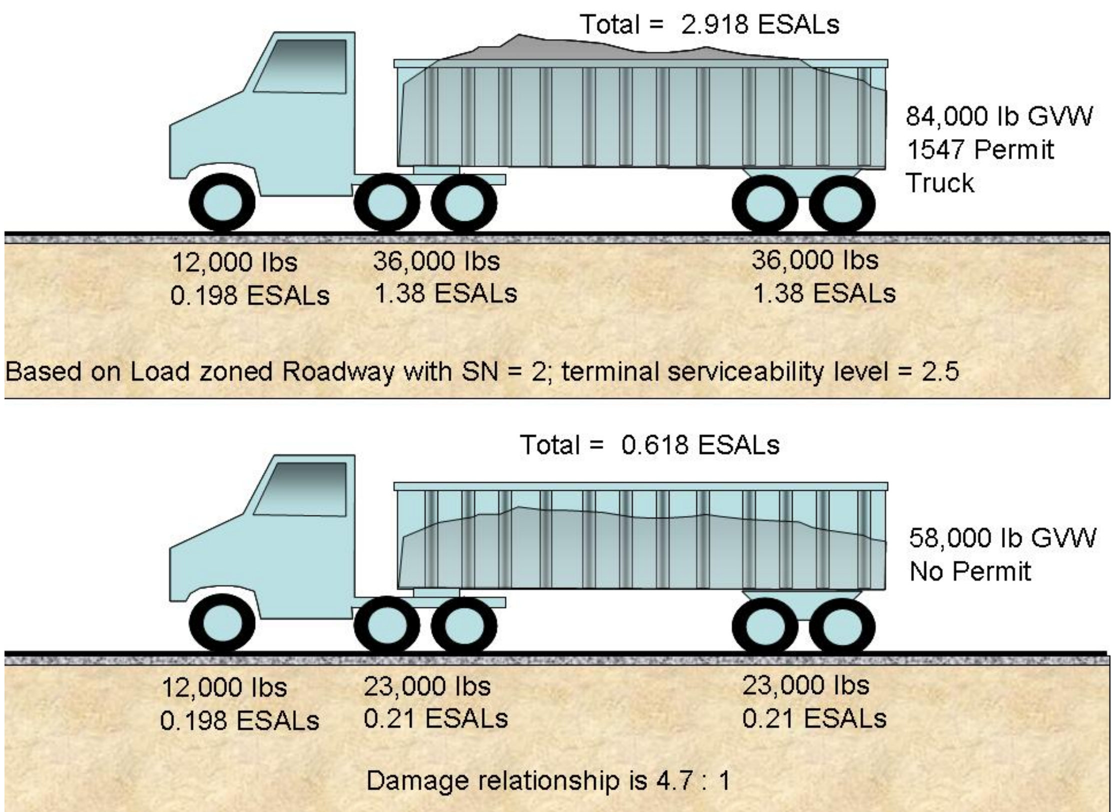


Exhibit E11. Damage Relationship between an 84,000 lb and a 58,000 lb 18-Wheeler.

As can be seen the 84,000 lb truck does 4.7 times the damage to the pavement as the 58,000 lb truck. This information will be used in the following section, which provides an example analysis showing the relative rehabilitation costs associated with each truck/load on a load zoned roadway.

For this example, two gravel trucks, one operating with a 1547 permit at 84,000 lb and the other operating at 58,000 lb are assumed to travel from a quarry or rock crusher to a series of construction sites over an average 80 mile round trip length during the year. Exhibit E12 shows the hypothetical route and the length of roadway that is either load zoned/not load zoned over which both trucks operate in either loaded or unloaded conditions.

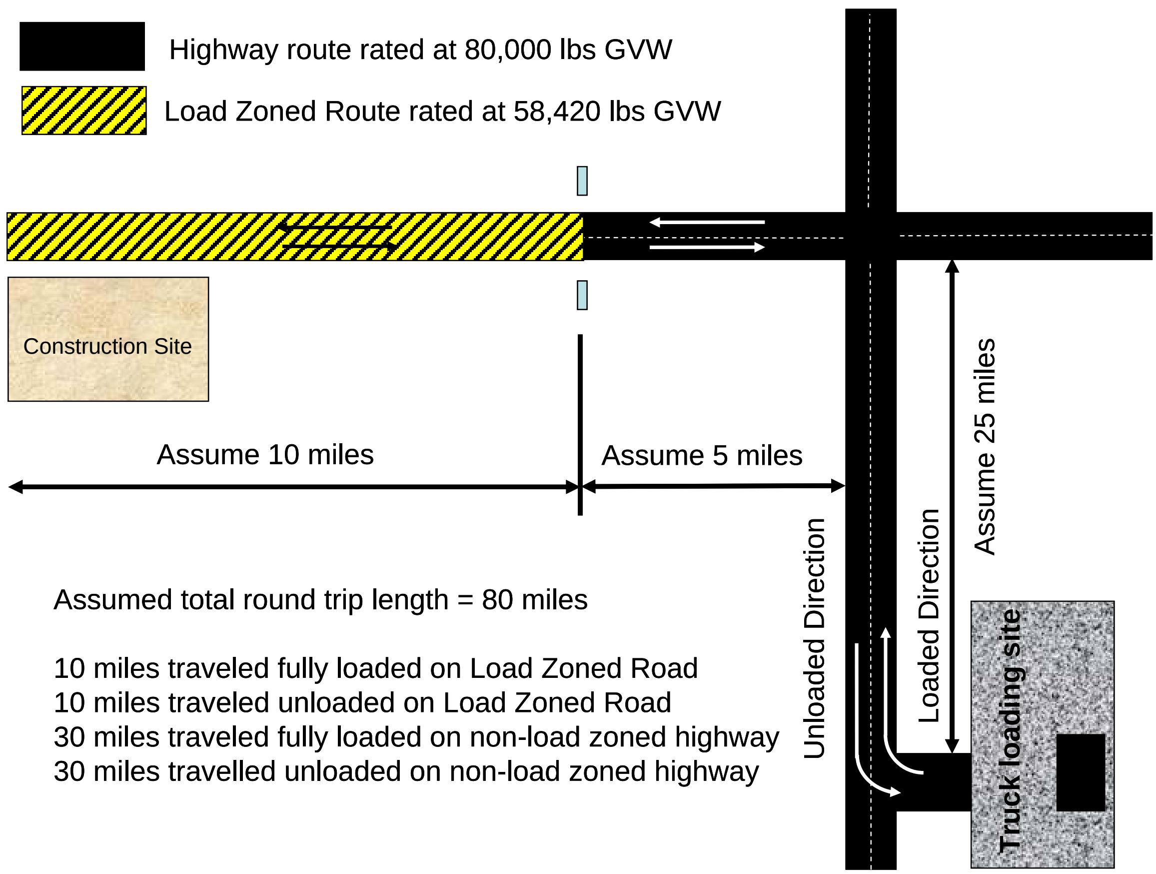


Exhibit E12. Example 80 Mile Route Traveled by 1547 Permitted Truck.

Analysis – Comparison of Cost and Damage due to 1547 Permitted Truck

Assumptions

a. A 1547 permitted 84,000 lb gravel truck operating partially on the load zone roadway network and partially on state-system roadways that permits 80,000 lb GVW, 20,000 lb single axle, and 34,000 lb tandem axle.

b. The baseline truck for comparison purposes is an 18-wheeler gravel truck weighing 58,000 lb – based on Texas load zone limit for 96% of load zoned roadways = 58,420 lb GVW.

c. The dead load weight of the 18-wheeler tractor-trailer combination is 30,000 lb.

d. The unit price for Flexible Base delivered on site (not placed or compacted) (gravel) = $19 Cubic Yard (CY).

e. The cargo weight for 84,000 lb truck hauling gravel = 84,000 − 30,000 lb = 54,000 lb / 2,700 (lb per CY of aggregate) = 20 CY × $19 = $380 per load.

f. The cargo weight for 58,000 lb truck hauling gravel = 58,000 − 30,000 = 28,000 lb / 2,700 (lb per CY of aggregate) = 10.4 CY × $19 = $198 per load.

g. The difference in total load value between trucks with and without permits = $182.

h. The average truck operation is 120,000 miles per year. This is based on 480 miles of operation per day × 250 days per year.

i. 60,000 miles are operated with a load (travel to work site); 60,000 miles are unloaded (travel back to quarry or crushing unit). The damage to the pavement system would be the same for both truck configurations if the trailers are unloaded. Therefore, the difference in damage due to the permitted load will be when the trailers are loaded = 60,000 miles of travel.

j. Average trip length = 80 miles (40 miles to the job site and 40 miles return to plant or quarry). 480 miles per day / 80 miles = 6 trips per day.

k. For a regional gravel hauler, the routes immediately adjacent to the quarry or crushing plant would receive the greatest number of load repetitions. At locations beyond a certain radius from the plant, the truck would take divergent routes to deliver product to various work site locations.

l. Of the 40 mile trip to the construction site, 30 miles are on routes immediately adjacent to the quarry or crushing plant and the remaining 10 miles are on load zoned roads in the vicinity or at the construction location. 6 trips per day × 250 days per year = 1500 trips on 10.0 miles of load zoned roadway.

m. Since the permitted truck carries 20 CY and the unpermitted truck carries 10.4 CY the unpermitted truck will need to make 1.92 more trips to deliver the same amount of gravel. However, since the number of trips per year is fixed at 1,500 for both trucks the result is that the unpermitted truck delivers less gravel and makes less profit.

n. Compare damage due to 58,000 lb GVW truck due to 1,500 load repetitions vs. an 84,000 lb GVW truck due to 1,500 load repetitions. Assume 10 trucks of each type per day travel this route.

o. Assume 12,000 lb steering axle, 36,000 lb drive tandem and 36,000 lb trailer tandem axle loads for 84,000 lb truck. See Exhibit E11. The 84,000 lb truck does 4.7 times the damage to the load zoned road as the 58,000 lb truck based on AASHTO load equivalencies [AASHTO 1993].

p. Assume 12,000 lb steering axle, 23,000 lb drive axle, and 23,000 lb trailer axle for the 58,000 lb truck. See Exhibit E11. The 84,000 lb truck does 2.45 times the damage, or in other words the load zoned pavement would wear out 2.45 times faster if 84,000 lb trucks are operating on the route compared to 58,000 lb trucks.

q. The load zoned roadway consists of a 2 course surface treatment over 6 in. of flexible base and is designed for 500,000 ESALs over a 20 year period. 2.918 ESALs × 1500 trips / year × 10 (84,000 lb) trucks = 43,077 ESALs per year. 0.618 ESALs × 1500 trips / year × 10 (58,000 lb) trucks = 9,270 ESALs per year. 500,000 ESALs / 42,432 ESALs per year = 9.4 years operation until rehabilitation is required.

r. The loaded direction would require a more expensive repair (additional base failure repairs; edge repairs prior to resurfacing, etc.) than the unloaded direction. Assume the average treatment cost for a rehabilitation is $95,000 per lane mile × 20 lane-miles = $1,900,000.

s. Relative amount of rehab cost that should be assigned to the 84,000 lb truck = $1,900,000 × [4.7 / (4.7 + 1)] = $1,566,667. Relative amount of rehab cost that should be assigned to the 58,000 lb truck = $1,900,000 × [1 / (4.7+1)] = $333,333.

t. Relative cost of rehabilitation per day of operation assigned to each of the 84,000 lb trucks = $1,566,667 / [(9.4 years × 1,500 trips per year) × 10 trucks/day] = $11.11/day per truck. Annual cost of operation is $11.11 × 250 days/year = $2,777.

u. Relative cost per day of rehabilitation assigned to the 58,000 lb trucks = $333,333 / [(9.4 years × 1,500 trips per year) × 10 trucks/day] = $2.36/day per truck. Annual cost of operation is $2.36 × 250 = $590.

v. 1500 trips × $198 / load for 58,000 lb truck = $297,000. 1500 trips × $380 / load for 84,000 lb truck = $570,000.

w. Assume 18% profit margin for 58,000 lb truck = $297,000 × 0.18 = $53,460 per year.

x. Assume 18% profit margin for 84,000 lb truck = $570,000 × 0.18 = $102,600 per year.

y. Difference in Gross value of cargo = $273,000. Additional profit = $49,140 / 1500 trips or approximately **$33 per trip** for 84,000 lb truck. Profit is approximately double compared to 58,000 lb truck.

z. Proposed cost increase of a 1547 permit for 1–5 counties = $245. Cost of proposed permit increase per trip = $245 / 1500 = 16.3 cents.

aa. Proposed cost increase of a 1547 permit for 1–5 counties per mile travelled on a load zoned road = $245 / (60,000 miles) = 0.4 cents per mile.

bb. The profit per trip-mile (load zone roadway) = $33 / 10.0 = $3.33 with permit.

A truck operating with a 1547 permit can generate almost twice the profit compared to a truck operating legally without a permit. Further, it is shown that the new proposed permit fee cost shown in Exhibit E13 represents between 1.0 percent ($500 permit fee cost / $49,140 profit) to 4.0 percent ($2,000 permit fee cost / $49,140 profit) depending on the number of counties authorized on the permit. Based on this analysis, Exhibit E13 shows the proposed new permit fees for different numbers of county authorizations. For each level of county authorizations, the proposed increased fee is to be deposited in Highway Fund 6 [Straus and Semmons 2006] [Luskin et al. 2000] [Crockford 1993] [Middleton et al. 1988].

Exhibit E13. Assumed 1547 Permit Fees Used for This Analysis.

1547 Over axle Weight Tolerance Permits						
Number of Counties authorized on 1547 Permit	Current Permit Cost per maximum County authorization	Number of Permits Sold (2009)	Additional Highway Maintenance fee (all to HWY)	Proposed New Permit Fee	New Permit Cost per maximum County authorization	Estimated Additional Revenue (increase x FY 2010 Permits sold
1 - 5	$45	4,193	$245	$500	$100	$1,027,285
6 - 20	$16.50	19,780	$270	$600	$30	$5,340,600
21 - 40	$13.25	3,883	$370	$900	$23	$1,436,710
41 - 60	$11.75	1,185	$495	$1,200	$20	$586,575
61 - 80	$11.00	131	$720	$1,600	$20	$94,320
81 - 100	$9.80	17	$820	$1,800	$18	$13,940
101 - 254	$4.25	906	$920	$2,000	$8	$833,520
		30,095				**$9,332,950**

The profit gained through purchase of a 1547 permit would vary depending on the unit value of the commodity being hauled, the number of trips per year, length of trip, and profit margin among other factors. Estimated addition revenue is $9,332,950.

Possible Study Option

In order to determine the scope and effect of the possible permit and fee changes, the 2030 Committee identified an additional option for TxDOT to work with the trucking industry to obtain more specific information about permitted truck operations to help in setting future costs for each permit type.

Referring to the column labeled 'New Cost per maximum County authorization,' the cost per county is higher if fewer counties are selected for authorization on the permit. This is reasonable considering that damage is related to both the weight of the vehicle and the number of repetitions the vehicle will make over a given roadway or network of roadways.

If the permitted vehicle travels over roads in 1 to 5 counties, it can reasonably be assumed that the number of repetitions each road will be receive is greater than if the truck travels over roads in 100 counties. Further refinement of the relative amount of damage and associated costs could be determined if the actual routes and trip lengths for permitted vehicles was known. However, this information is not available.

Referring again to Exhibit E10, even districts with no load zoned roads have a fairly large number of permit authorizations. For example, Lubbock has over 27,000 county authorizations but no load zoned roads. A total of 79,850 county authorizations (about 12.5 percent of the total) were purchased in the 62 Texas counties that have no load zoned roads on the state network.

Based on discussions with MCD personnel the additional 4,000 lb pay load that a 1547 permit allows encourages truckers to purchase a permit to operate on roads that would otherwise limit their payload to 80,000 lb GVW. In these cases, the additional profit due to just a 4,000 lb increase in payload apparently provides sufficient additional profit incentive to purchase a 1547 permit.

General Oversize/Overweight OS/OW Permits

Exhibit E14. Typical OS/OW Loads and Vehicle Types.

The TxDOT Motor Carrier Division issues more General Oversize/Overweight loads permits than any other permit type. Many General OS/OW permits are purchased for a single trip although 30/60/90 day permits and Annual Permits can be purchased for certain types of loads. These permits are associated with specialized equipment configurations designed for mid-heavy loads (< 254,300 lb) associated with industries such as oil exploration and extraction, movement of heavy construction equipment, movement of non-divisible loads associated with the energy industry, and many others as illustrated in Exhibit E14.

This specialized equipment incorporates trailer configurations; numbers and groupings of axles; and axle and tire types, which are customized to accommodate each load. In addition, these loads may travel short distances to move construction equipment from one project location to another or may travel across the entire state. For this reason, the permitted load travel distance may differ significantly for vehicles in the same weight class. Due to the number of OS/OW permits issued, the complexity of vehicle configurations, variation in route length, range of weight classes, and other factors, it is not feasible to perform a thorough permit cost vs. weight class analysis within the scope of the Committee's charge. However, some general observations about the General OS/OW vehicles loads and potential damage to pavements and bridges can be made.

Damage due to Wide, Heavy Loads at Pavement Edge

Exhibit E15. Heavy Tire Loads Applied at a Pavement Edge Can Result in Failures.

Due to the height, length, and/or weight of many OS/OW loads, these vehicles must often travel on roads without overpass structures or long span bridges. This may require the OS/OW load to travel on low volume FM roads with narrow lanes and no paved shoulder. Due to the width of the load, the tires may travel along the pavement edge and can cause pavement edge failures (see Exhibits E15 and E16).

This type of damage affects the structural condition of the pavement and also can result in a safety problem. Drop offs caused by failures at pavement edges may be hazardous if a vehicle drives off the road and the driver makes an abrupt steering maneuver in an attempt to get back on the pavement. This may cause the vehicle to roll or result in a head-on collision if the vehicle enters the approaching lane of traffic.

Exhibit E16. Damage that Can Occur from OS/OW Loads.

These loads must be moved and are an important part of the state economy. However, in consideration of the additional impacts these loads have on the state highway system permit fees should include funds to help maintain or repair pavements and bridges. The proposed new permit fees shown in Exhibit E17 include a modest increase to supplement the HWY maintenance fund.

Exhibit E17. HWY Maintenance Fee Increases for Selected General OS/OW Permits.

General OS/OW Permits						
Weight Classes (lbs)	Number of Permits Sold	Current General OS/OW Permit Fee	Proposed New Permit Fee	Current HWY Maintnenance Fee	Proposed New HWY Maintenance Fee	Estimated Additional Revenue to HWY
80,001 - 120,000	52,858	$210	$250	$150	$190	$2,114,320
	22	$215	$300	$150	$235	$1,870
	4	$220	$330	$150	$260	$440
	566	$235	$390	$150	$305	$87,730
	456	$260	$380	$150	$270	$54,720
120,001 - 160,000	61,909	$285	$360	$225	$300	$4,643,175
	10	$290	$385	$225	$320	$950
	554	$310	$425	$225	$340	$63,710
	111	$335	$470	$225	$360	$14,985
160,001 - 200,000	20,899	$360	$460	$300	$400	$2,089,900
	1	$365	$485	$300	$420	$120
	1	$370	$510	$300	$440	$140
	140	$385	$545	$300	$460	$22,400
	51	$410	$590	$300	$480	$9,180
	10	$460	$650	$300	$490	$1,900
200,001 - 254,300	5,364	$470	$560	$410	$500	$482,760
	5	$495	$590	$410	$505	$475
	18	$520	$640	$410	$530	$2,160
	2	$545	$690	$410	$555	$290
	7	$570	$790	$410	$630	$1,540
	143,440			**Proposed additional Revenue**		**$9,592,765**

Super Heavy Load Permits

Super Heavy Loads are the heaviest loads carried on the state highway network and can range from 254,300 lb to over 2,000,000 lb. This load range includes the weight of the specialized equipment used to carry the load and the load itself. Super Heavy Loads are high value, non-divisible loads that are often associated with the petro-chemical industry, energy industry, mining, and heavy construction equipment among others.

The equipment used to move a Super Heavy load is specialized and customized for each load to ensure stability during transport and to meet Motor Carrier Division, Bridge Division, and Construction Division – Materials and Pavements Section requirements for tire and axle group weights.

These loads may travel a distance as short as 10 miles or may traverse the entire state on state and county roads. The load may arrive in Texas at a port or by rail car where it is loaded onto the super heavy load carrier as shown in Exhibits E18–E19. In other cases the super heavy load arrives in Texas from an adjoining state on the roadway system.

Exhibit E18. Pressure Vessel Delivered on Carrier by Barge at a Texas Gulf Port.

Exhibit E19. Transformer Delivered by Rail Car and Off Loaded to Carrier.

The routes are analyzed by Motor Carrier Division to ensure that the height, width, and length of these loads can be accommodated. The Bridge Division analyzes bridges along the proposed route to ensure that the load can be carried safely. For certain load classes, the CST-Pavements and Materials Branch analyzes the pavements along the route and may perform field testing to identify areas of potential pavement damage. These three TxDOT divisions work together to identify a route that will ensure delivery of the load with least risk to the safety of the travelling public or system damage. The analyses may recommend adding axles, matting crossovers, and other measures to reduce bridge or pavement stresses (see Exhibit E20).

Often, re-routing of the load is required during this analysis due to size or load restrictions on a portion of the network. In these cases additional analysis must be performed by MCD, Bridge, and CST-Pavements engineers to evaluate a potential new route.

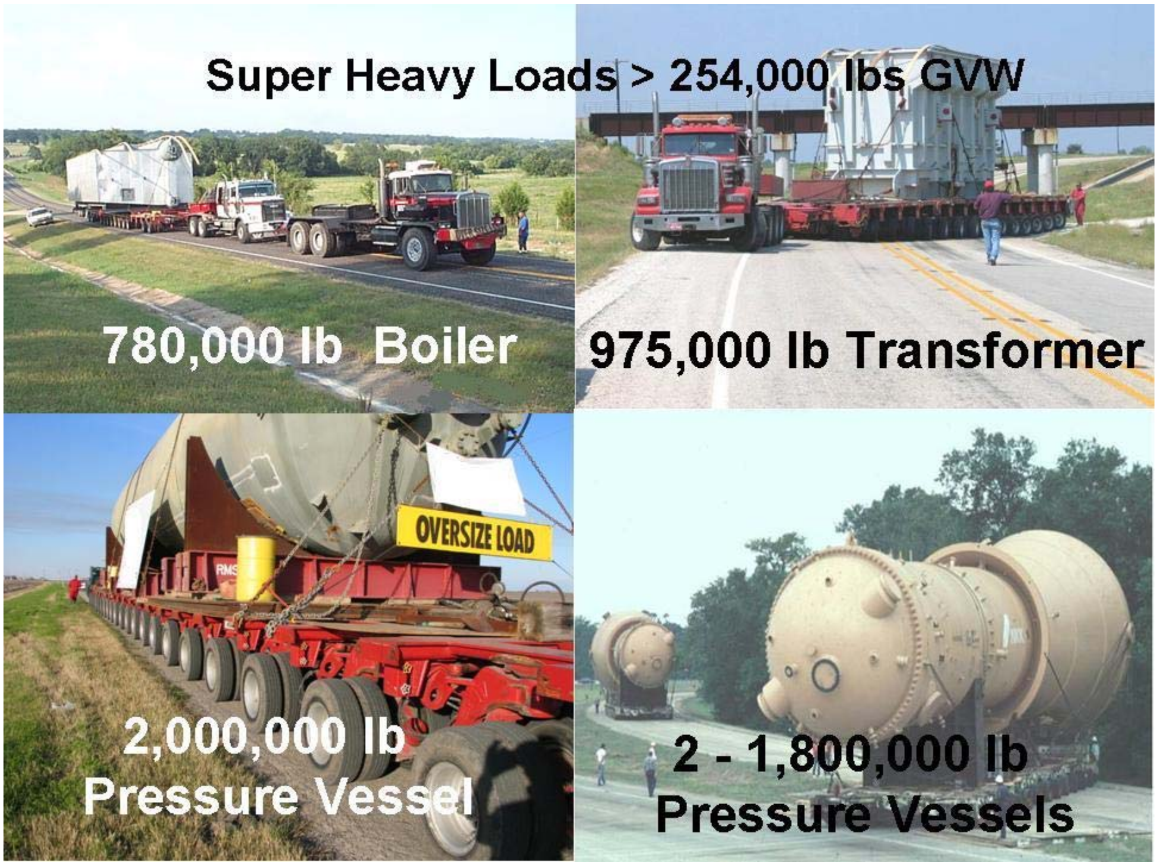


Exhibit E20. Super Heavy Loads Operating on the State Highway System [photo credits TXDOT CST 2010].

Super Heavy Load Permits require the carrier to pay for damages that occur along the route. However, the current permit fee does not cover the cost of the bridge or pavement analysis, and in some cases, site visits and/or field testing that is required by MCD, Bridge, and CST-Pavements. In this regard, Exhibit E21 lists proposed increased permit fees are to reimburse TxDOT for these expenses.

Exhibit E21. New Super Heavy Load Permit Fee Used in This Analysis.

Super Heavy Load Permits				
Current Super Heavy Load Permit Fee	**Proposed Super Heavy Load Fee with Additional bridge and pavement Fee**	**Number of Permits**	**Proposd Additional Permit ADMIN Fee deposited in HWY**	**Estimated Additional Revenue to HWY**
$285	$1,000	1	$715	$715
$435	$1,500	281	$1,065	$299,265
$460	$1,750	8	$1,290	$10,320
$470	$2,000	312	$1,530	$477,360
$485	$2,250	18	$1,765	$31,770
$510	$2,500	1	$1,990	$1,990
$520	$3,000	6	$2,480	$14,880
$535	$3,500	3	$2,965	$8,895
$570	$5,000	1	$4,430	$4,430
	Total Number of Permits	**631**	**Total Additional Revenue**	**$849,625**

Other Specialized Permits

A permit is required to transport a mobile/manufactured home on the state highway system. These loads are often wider than a single highway lane and can affect the behavior of other drivers who must either pass by in the opposite direction or must drive behind the unit until an opportunity to pass occurs as shown in Exhibit E22. In this instance, the weight of the load being transported is not the primary reason a permit is required, it is the height, width, and/or length of the load.

The current permit fee for a mobile/manufactured home is $40 per trip. This fee was increased from $20 by HB 2093, which became effective on September 1, 2007. The additional HWY revenue funds obtained through a modest fee increase in the permit types listed in Exhibit E23 can provide sufficient funds for one or two projects to add passing lanes or build a Super 2 pavement at locations where these loads cause the greatest congestion.

Exhibit E22. Manufactured Housing Being Transported on a State Highway.

Exhibit E23. Permit Fees and Estimated HWY Revenue – Other Specialized Permits.

Fee Adjustments for other Specialized Permits				
Permit Type	**Current Permit Fee**	**Proposed Permit Fee**	**Number of Permits**	**Additional HWY Revenue**
Mobile / Manufactured Home	$40	$100	65,742	$3,944,520
Portable buildings	Varies	Current fee + $25	16,637	$415,925
30/60/90 Day Length	Varies	Current fee + $25	6,184	$154,600
30/60/90 Day Width	Varies	Current fee + $25	17,209	$430,225
		Totals	**105,772**	**$4,945,270**

New Permits for Overweight Vehicles

State statutes currently allow operation of trucks with axle or gross vehicle weights that exceed the legal limits if the vehicle is of a certain type or carrying a specific product. Certain of these statutes require the vehicle operator to post a $15,000 bond, but purchase of a permit to operate at the higher weight limits is not required. Other statutes do not require operators to purchase either a bond or a permit to operate over the legal axle or gross vehicle weight limits. Exhibit E24 summarizes the unpermitted vehicle types, related statute, and a description of the product and allowable axle or gross vehicle limits.

Exhibit E24. Overweight Vehicles that Do Not Require a Permit [TxDOT MCD 2010b].

Keywords	Statute	Description
Grocery, Farm Products and Liquefied Petroleum (LP) on State roads	**Texas Transportation Code §621.102(g)**	Provides for vehicles making deliveries of groceries, farm products and liquefied petroleum (LP) to exceed maximum posted limits on state farm-to-market and ranch-to-market roads and bridges.
Ready Mix Concrete Trucks Concrete Pump Trucks	**Texas Transportation Code §§622.011-622.017** Formerly TVCS 6701d-12	Provides that vehicles transporting ready-mixed concrete or concrete pump trucks may operate with tandem axle weights up to 46,000 lbs., a single axle up to 23,000 lbs., and a gross weight up to 69,000 lbs. This excludes travel on Interstate and Defense highways for tandem weight vehicles. Additionally, these vehicles may not exceed load-zoned road or bridge postings.
Milk Trucks	**Texas Transportation Code §§622.031-622.032** Formerly TVCS 6701d-12a	Provides that vehicles used exclusively for transporting milk may operate on a public highway if the load carried on any group of axles does not exceed 68,000 lbs. and where the distance between the forward tandem axle and rear tandem axle is 28 feet or more. Excludes travel on Interstate and Defense highways.
Recyclable Materials	**Texas Transportation Code §§622.131-622.136** Formerly TVCS 6701d-19c	Provides for vehicles transporting recyclable materials to operate on public highways, excluding the Interstate and Defense highways, with a tandem axle not to exceed 44,000 lbs., a single axle not to exceed 21,000 lbs., and a gross load not to exceed 64,000 lbs. This exclusion only applies to the tandem weight, not the single axle weight. Per the bond the filing is done due to the tandem weight. Additionally, these vehicles may not exceed load-zoned road or bridge postings.
Seed Cotton and Chile Pepper Modules with weight exceptions	**Texas Transportation Code §622.953**	Vehicles used exclusively to transport seed cotton modules may not exceed 64,000 lbs. Vehicles used exclusively to transport chile pepper modules may not exceed 54,000 lbs.
Solid Waste	**Texas Transportation Code §§623.161– 623.165** Formerly TVCS 6701d-19a	Provides that vehicles transporting solid waste may operate on public highways, excluding Interstate and Defense highways, with a tandem axle not to exceed 44,000 lbs., a single axle not to exceed 21,000 lbs., and a gross load not to exceed 64,000 lbs. This exclusion only applies to the tandem weight, not the single axle weight. Per the bond the filing is done due to the tandem weight.

Referring to Exhibit E25, these trucks typically are a 3-axle straight truck with a single steering axle and a tandem drive axle. The legal weight limits in Texas for single- and tandem-axle, respectively, are 20,000 lb and 34,000 lb. Based on the AASHTO axle load equivalency tables and the exponential load-damage concept, these trucks actually do more damage to a pavement or bridge than a legally loaded 18-wheeler at 80,000 lb.

Exhibit E25. Examples of Trucks that by Statute Can Operate Overweight without a Permit [NAME 2011] [Concord 2011].

Exhibit E26 illustrates a standard 'Reference' 18-wheeler tractor-trailer combination operating at legal axle and Gross Vehicle Weight limits and a 1547 permitted truck. Exhibit E27 compares the damage relationships between a legally loaded 18-wheeler and different types of overweight vehicles that are allowed to operate without a permit under state statute.

At these maximum allowable load limits, the concrete truck does 2.9 times and a garbage truck does 2.2 times the damage of a fully loaded 18-wheeler. The damage relationships will vary depending on the structural design and materials of the pavement. However, in every case, the higher axle loads permitted by these specialty trucks will cause more damage [Kawa 1998].

Since these types of trucks do not include two pieces as does an 18-wheeler (a tractor and a trailer) and therefore do not bend when turning at an intersection, they are often called straight trucks. Although an exhaustive analysis will not be presented here, these shorter wheel-base straight trucks, which operate at higher allowable axle loads, also do more damage to bridges.

This is because the load carried by an 18-wheeler is distributed across 3 groups of axle that are spaced apart—the steering axle, the tandem drive axle, and the tandem trailer axle. However, the load on straight trucks is distributed across just two axle groups and the allowable overweight axle loads are higher.

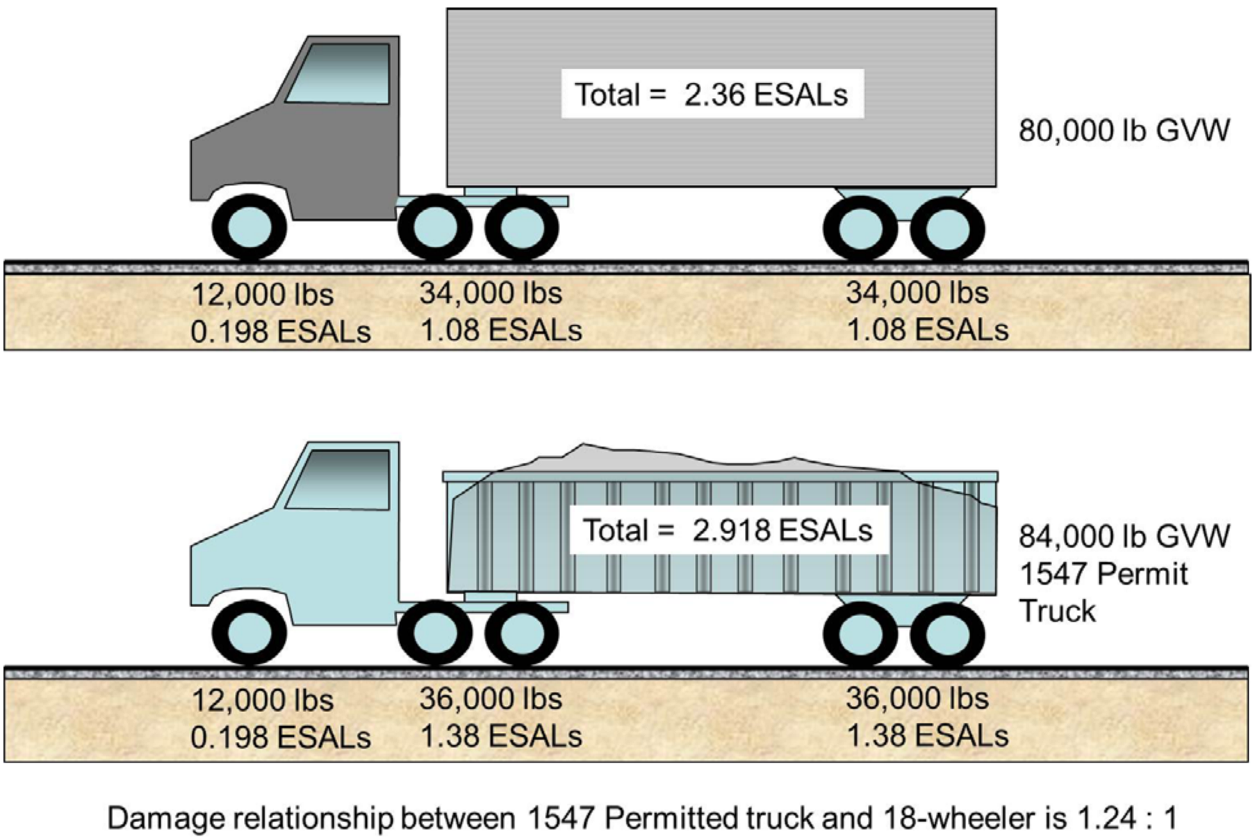


Exhibit E26. Damage Relationship between a 1547 Permit Truck and the Reference 18-Wheeler.

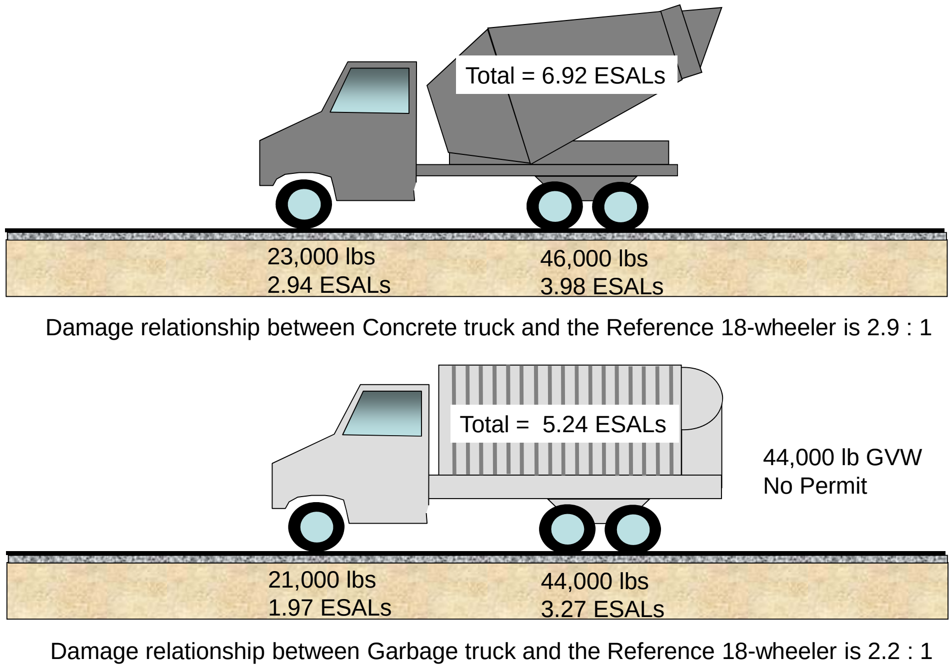


Exhibit E27. Damage Relationships for Straight Trucks and the Reference 18-Wheeler.

Referring to Exhibits E28–E29, it is seen that an 18-wheeler load is distributed across bridge spans and supports so that only a portion of its load is carried on each span. Straight trucks are shorter than an 18-wheeler; therefore the entire truck is may be carried by just one bridge span. This results in higher stresses in the bridge structure especially when the truck is overweight [Euritt 1988] [USDOT 2000b].

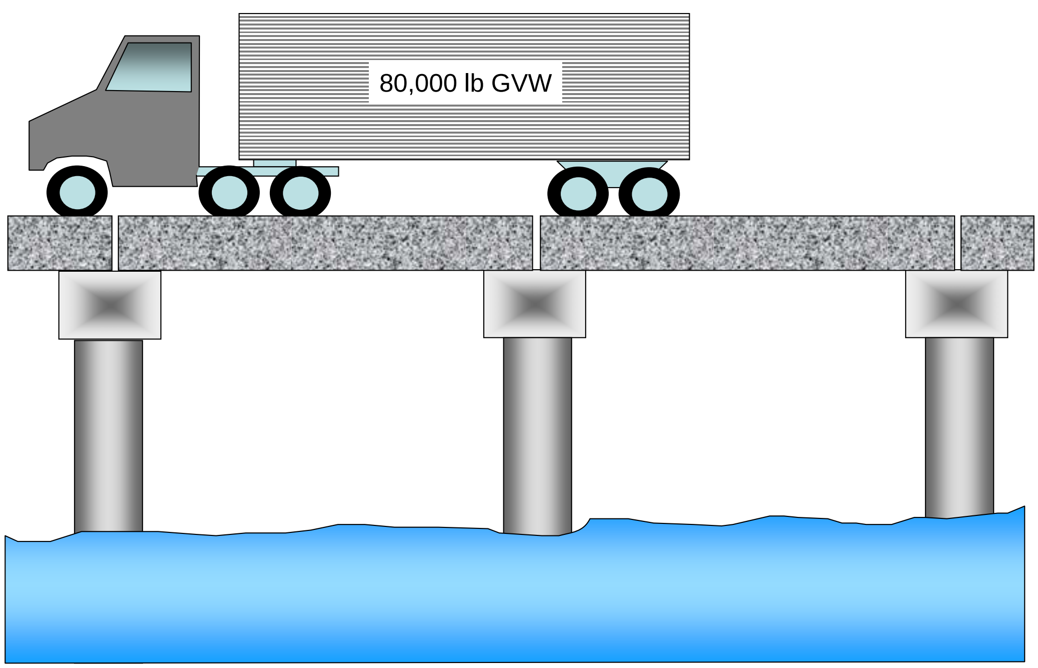


Exhibit E28. 18-Wheeler Travelling across Multiple Bridge Spans.

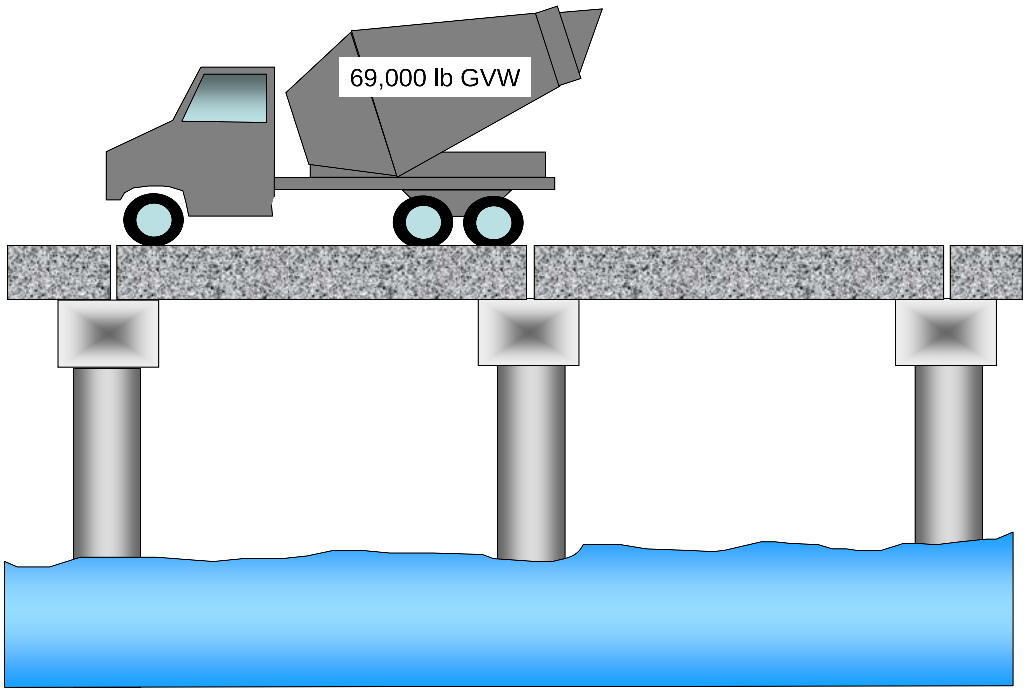
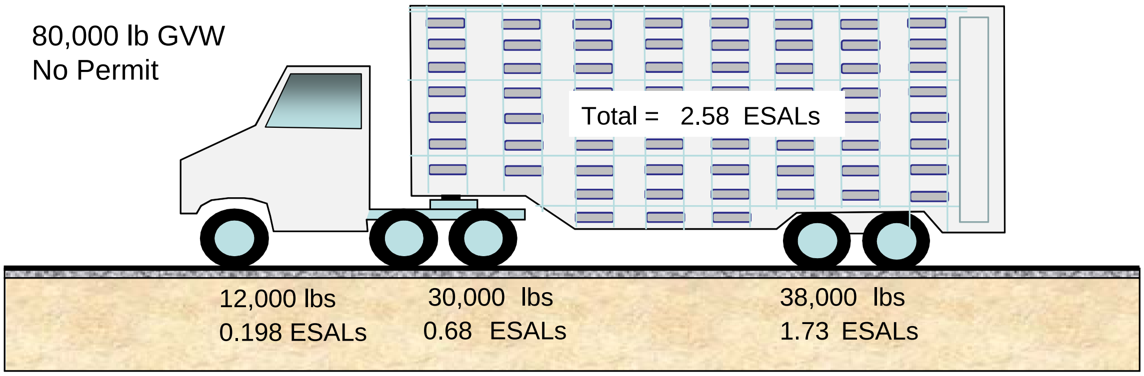


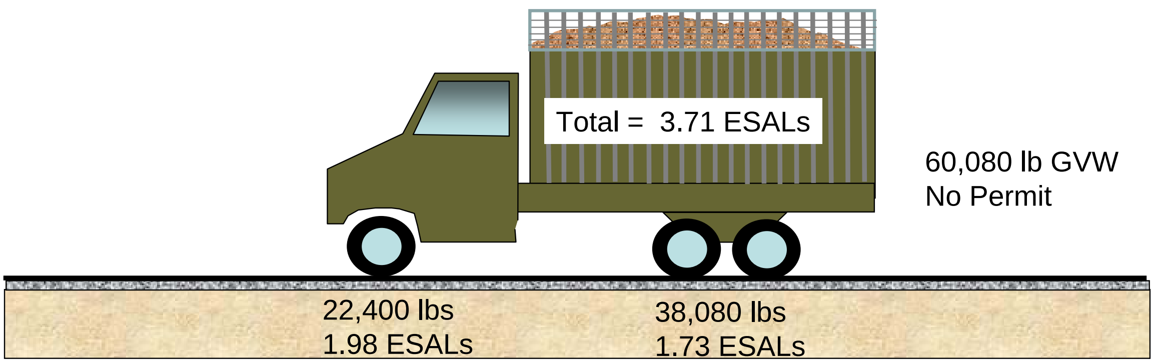
Exhibit E29. Concrete Truck Travelling across a Single Bridge Span.

New Permit for Farm Trucks Operating at 12 Percent over Legal Axle Weight Limits

State statute TCC 621.101 authorizes trucks hauling timber, pulp wood, wood chips or cotton, livestock, or other agricultural products to operate at 12 percent above the legal axle load limits. This results in permissible 22,400 lb single axle and 38,080 lb tandem axle loads, although an additional tolerance for Gross Vehicle Weight is not permitted [TxDPS 2010a]. This additional weight is only permitted from the point of production to the first point of processing or delivery such as a railway loading facility. The additional axle loadings would likely occur during harvest time and would involve repetitive trips from the farm to delivery point along the same route. In recent years, due to the decline in rural rail terminals, farm product deliveries routes have increased in length [Prozzi 2007]. Further study of the impacts of agricultural vehicles loadings on the highway system should be undertaken to evaluate weights permitted under state statutes and equitable overweight farm vehicle permit fees.



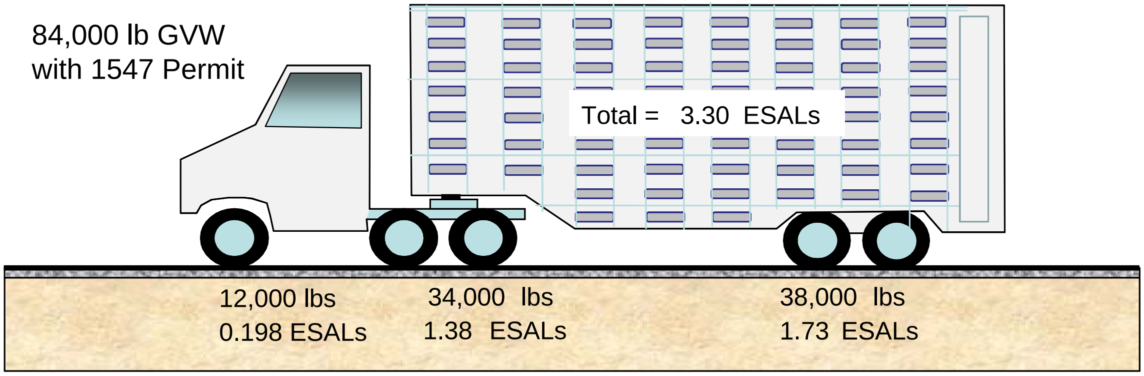
Damage relationship between Farm truck and the Reference 18-wheeler is 1.1 : 1



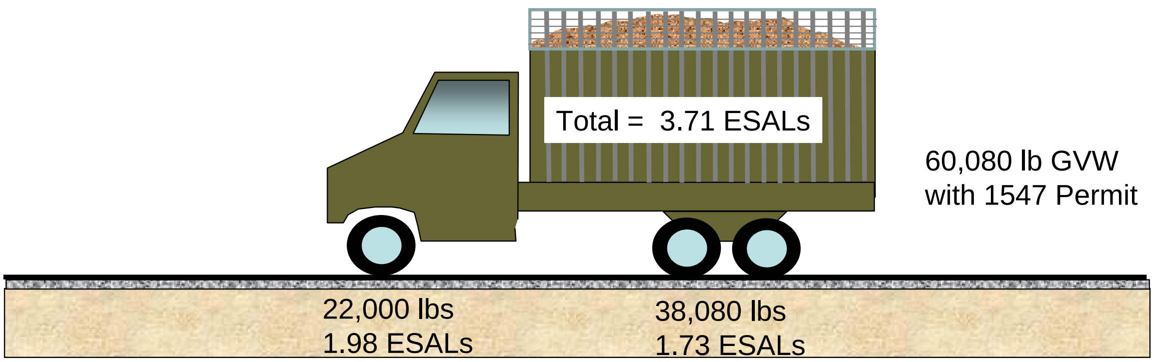
Damage relationship between Farm truck and the Reference 18-wheeler is 1.6 : 1

Exhibit E30. Damage Relationship between Farm Vehicles and Reference 18-Wheeler.

In addition, the 1547 Over Axle Weight Tolerance permit allows different axle loads for farm vehicles than for vehicles of other types. The 1547 permit allows one axle, either single or tandem to be 12 percent over legal weight, the remaining axles to be 10 percent over legal weight and the vehicle GVW to be 5 percent over legal weight [TxDPS 2010a]. Exhibits E30–E31 show the damage relationship between farm vehicles operating with a 1547 permit compared to a legally loaded 18-wheeler.



Damage relationship between Farm truck and the Reference 18-wheeler is 1.4 : 1



Damage relationship between Farm truck and the Reference 18-wheeler is 1.6 : 1

Exhibit E31. Damage Relationship between Farm Vehicles and Reference 18-Wheeler.

The 1574 permit offers additional flexibility to a farmer operating an 18-wheeler regarding axle load limits; however, a straight farm truck operator would not necessarily benefit by purchasing a 1547 permit compared to the increased axle loads for farm vehicles allowed under current state statutes. The primary benefit of purchasing a 1547 permit to both types of farm truck operators is that the permit would allow year-round operations as opposed to state statutes that limit overweight operations to transport of the farmer's own produce during the harvest.

The new permit fees shown in Exhibit E32 were used to develop the additional HWY revenue estimate in consideration of the increased damage associated with each of the currently unpermitted, overweight vehicles. In each case, these are annual fees.

Exhibit E32. Estimated Revenue from New Permits for Overweight Vehicles.

New Permits for Overweight Vehicles - Estimated HWY Revenue			
Vehicle Type	**Annual OW Permit Fee**	**Estimated Number of Vehicles**	**Estimated HWY Revenue**
Ready Mix Concrete and Concrete Pump Trucks	$750	11,000	$8,250,000
Garbage, Solid Waste & Recycling	$500	16,000	$8,000,000
Farm trucks operating at 12% over axle tolerance	$500	30,000	$15,000,000
Delivery trucks operating overweight	$150	10,000	$1,500,000
Milk Trucks operating overweight	$150	10,000	$1,500,000
Cotton Seed and Chili Pepper transport trucks	$100	10,000	$1,000,000
		Total	$35,250,000

Longer Combination Vehicle Corridor Permits and Registration Fees

The 2030 Committee identified a possible option that the Legislature and TxDOT could consider new type(s) of permits and/or work with the Texas Department of Motor Vehicles to develop proposed new registration fee(s) to allow the operation of Longer-Combination Vehicles (LCVs) in Texas on specified corridors. However, as discussed later, a federal ban currently prevents further expansion of LCV corridors and would need to be lifted before operation of LCVs in Texas would be permitted on the National Network. An additional option is for TxDOT to consider implementing additional Special Permit Corridors such as the SH 4/SH 48 Corridor in Brownsville. This will enhance Texas' economic competitiveness and would also provide routes with self-supporting revenue sources [Walton et al. 2009] [Prozzi 2007] [Hong 2007] [Luskin and Walton 2001] [Leidy 1995].

LCVs currently are only permitted to operate on the national network in several western states and on Turnpike Facilities in Florida, Ohio, Indiana, New York, and Massachusetts. Adding LCV routes in Texas would require the Texas State Legislature and Texas Congressional Representatives to work at the national level to change federal law.

An LCV consists of a truck tractor and a combination of two trailers that are longer than are currently permitted, except on designated corridors, by federal and state laws. Exhibit E33 shows a Turnpike Double, which consists of a truck tractor and twin 53-ft trailers with a total of 9-axles. LCV operations are common in Canada and Mexico. These trucks typically operate at higher allowable Gross Vehicle Weights and lengths, which may vary between Western States that permit them, Mexico, and Canada.

Exhibit E33. Turnpike Double (TPD) Longer Combination Vehicle (LCV) [Hank Suderman 2011].

A Rocky Mountain Double (RMD) consists of a truck tractor with one 53-ft and one 28 to 33-ft length trailers. RMDs usually operate with 7 or 8 axles depending on the allowable GVW for a specific state or country. Exhibits E34–E37 show other LCV configurations including a Michigan 'caterpillar rig,' which has 11 axles; a 'B-train double'; and a triple trailer unit. Triple trailer combinations were not considered in this analysis due to the additional expense that would be required to modify the geometric features of existing freight corridors to accommodate these longer vehicles.

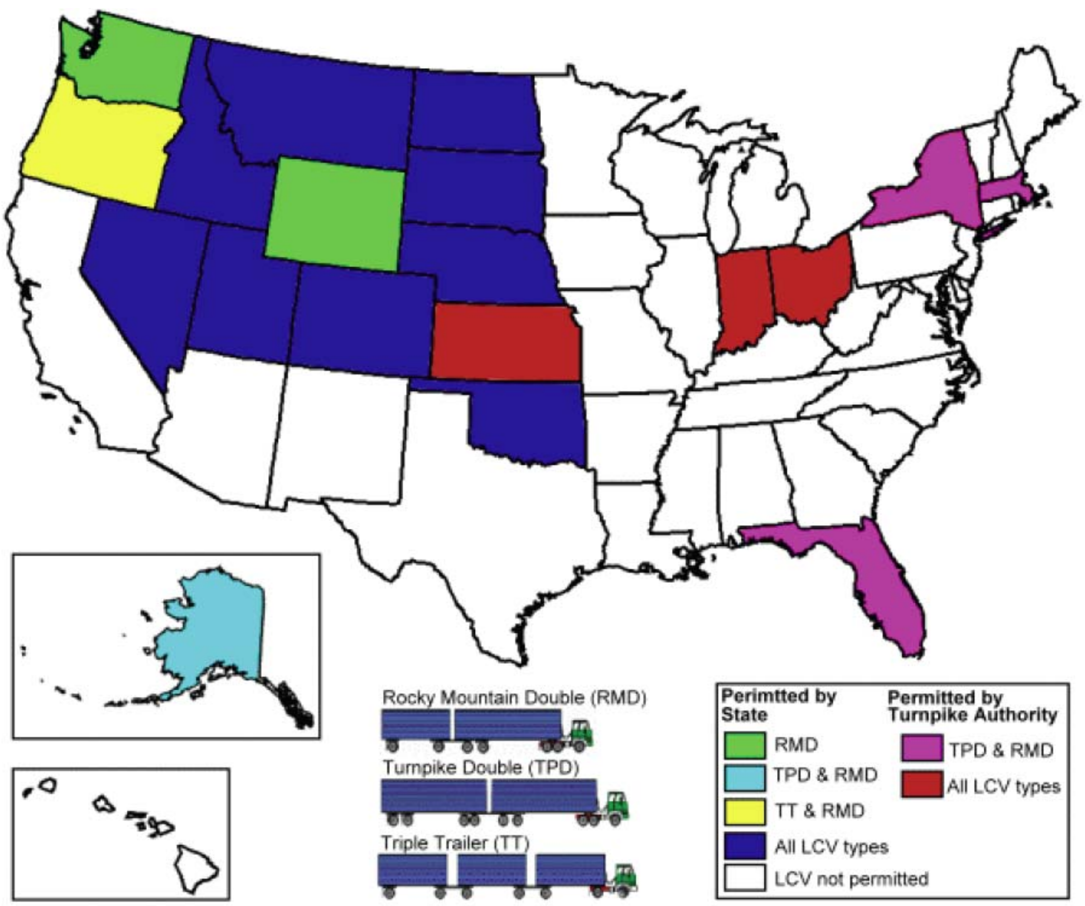
Exhibit E34. Rocky Mountain Double Long Combination Vehicle [Jim Steele 2002].

Exhibit E35. Michigan 'Caterpillar Rig' [Tim Gibson 2010].

Exhibit E36. 'B-Train Double' [Hank Suderman 2010].

Exhibit E37. LCV Triple Trailer Unit [Hank Suderman 2010].

'B-train Doubles' are popular in Canada, Mexico, the Western States, and Michigan. Although not listed as an LCV state, Michigan is permitted to operate much heavier and longer trucks than other states due to the Grandfather Clause. The Grandfather Clause means that states that allowed operation of truck sizes and weights greater than those permitted when federal truck weight and size laws were implemented are authorized to continue operation of these larger, heavier vehicles on specific corridors. The Grandfather Clause also allowed states to continue operating LCVs on the national network even though the federal government restricted further development of LCV corridors in other states. The 'ISTEA Freeze' restricted further expansion of LCV operations on the national network, which includes all Federal Aid Primary system routes designated as of FY 1991. Exhibit E38 shows the states that currently permit operations of LCVs as a result of the Grandfather Clause [Walton et al. 2010].



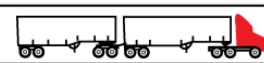
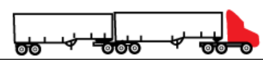
Source: U.S. Department of Energy, 2006

Exhibit E38. States Allowing Operation of Longer Combination Vehicles [Walton et al. 2010].

Although twin 28-ft trailer-units currently operate in Texas, LCVs are not permitted since Texas did not permit operation of trucks of this size or weight before the LCV Freeze. Potential LCV corridors could include north-south routes along IH 35, IH 37, and IH 45, between border crossings and major ports, to San Antonio, Austin, and Dallas. Additional, potential east-west routes could include El Paso to Dallas along IH 20. Exhibit E39 shows existing major freight corridors between the NAFTA trade partners. Approximately two-thirds of all freight movements between the US, Mexico, and Canada occur by truck. Allowing the operation of LCVs in Texas would permit more efficient freight movement within the state and between the NAFTA partners. Exhibit E40 shows LCV combinations currently operated in Mexico, but currently not permitted in Texas.

Exhibit E39. Major Truck Freight Corridors between the US, Canada, and Mexico [Walton et al. 2010].

Exhibit E40. Twin Trailer Truck Classifications Used in Mexico [Prozzi et al. 2008].

DOUBLE ARTICULATED TRACTOR TRUCK			
Nomenclature	Number of Axles	Number of Tires	Vehicle Configuration
T2-S1-R2	5	18	
T3-S1-R2	6	22	
T3-S2-R2	7	26	
T3-S2-R4	9	34	
T3-S2-R3	8	30	
T3-S3-S2	8	30	

The T3-S2-R2 configuration is comparable to the 'Rocky Mountain Double' and the T3-S2-R4 comparable to the 'Turnpike Double.' The T3-S3-S2 is comparable to the 'B-train Double' configuration. Axle weight limits in Mexico and Canada are higher than are permitted in Texas, therefore the allowable axle weights on LCVs operating from/to Mexico within Texas would necessarily need to comply with Texas state statutes regarding maximum axle loads and the permissible GVW limits listed on the new LCV permits. The federal government and various studies have indicated that LCV operations can save fuel and freight transport costs [Woodrooffe et al. 2011] [USEPA 2010] [FHWA 2009] [Loftus-Otway et al. 2009] [FHWA 2008a] [Prozzi 2007] [TRB 2002].

The registration and permit fees from LCV operations would be dedicated to modifying and maintaining corridors that permit LCV operations. These upgrades would include roadway geometrics to accommodate larger turning radii. In addition, bridges would require strengthening due to the higher allowable GVW associated with LCV operations. The average registration fee for tractor twin semi-trailer combinations in Western states that permit their operation is approximately $2,088 [FHWA 2008b]. This analysis will assume a Texas LCV registration fee of $2,100.

The analysis assumed LCV configurations including Turnpike Doubles, Rocky Mountain Doubles, and a tractor-semi trailer operating at 97,000 lb GVW with tridem axles on the trailer. No triple trailers were included due to geometric limitations and added costs to upgrade highway infrastructure. Routes would be considered that do not require extensive modifications to permit operation of these longer vehicles due to geometrics [Walton et al. 2009] [Torbic and Harwood 2006].

Trucks consisting of a 3-axle tractor/3-axle trailer currently operate along the SH 4/SH 48 Special Permit Corridor at the Port of Brownsville. Exhibit E41 shows the truck on the left with two coils of steel operating without a permit at the current legal load of 80,000 lb. With the addition of a third axle on the trailer and purchase of a single trip permit that costs $30, the truck can carry 3 coils of steel or other commodity [Fernando et al. 2006].

At the national level, the US House of Representatives, H.R. 1799, introduced in March 2009, would permit 97,000 lb GVW 6-axle trucks to operate on the IH system if enacted. The bill seeks to allow maximum 20,000 lb single-, 34,000 lb tandem-, and 51,000 lb tridem-axle weights. In addition, a 2,000 lb axle load tolerance would be permitted contingent on approval by the state legislature [USGPO 2009] [ATA 2011].

Exhibit E41. 3-Axle Tractor and 3-Axle Trailer Configuration at the Port of Brownsville [photo credit Fernando 2006].

Although technically not an LCV, a 97,000 lb 18-wheeler with a 3-axle tractor and 3-axle trailer has been included in this analysis. This configuration would not be prevented from operating on the national system with a permit as are the LCV configurations. However, due to AASHTO Bridge Formula restrictions, a 97,000 k 6-axle tractor-trailer would not be permitted to operate on Interstate Highways.

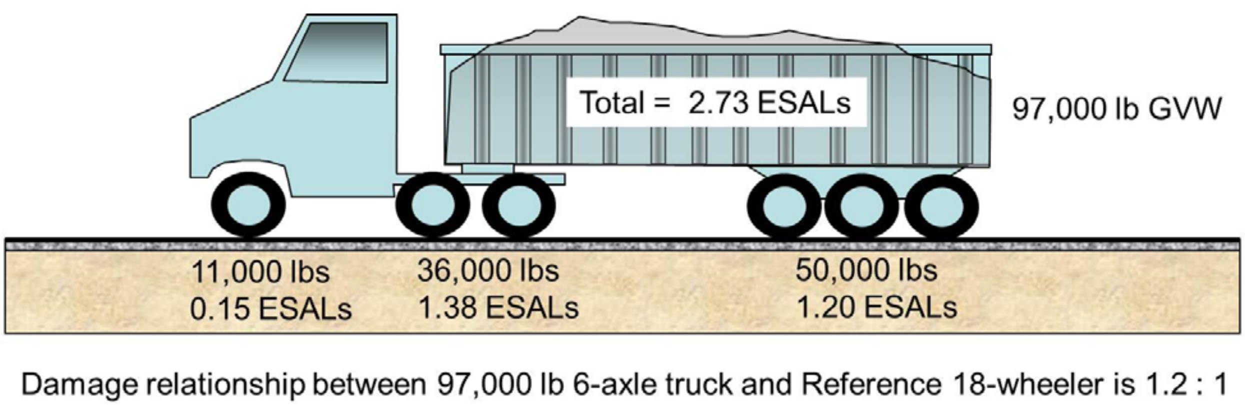


Exhibit E42. Damage Relationship for a 97,000 lb 6-Axle Truck and the Reference Truck.

This configuration results in about 20 percent more pavement damage than an 80,000 lb 5-axle truck. However, the impacts on bridges are more substantial and would require strengthening of bridges on corridors that permitted operation of this configuration. The cost of bridge strengthening would far exceed the permit revenue generated by these vehicles. Funding of corridor enhancement projects through CDAs or other actions would be required in conjunction with implementation of a 97,000 lb 6-axle truck as well as certain of the heavier LCV class vehicles [USDOT 2000b].

Assumed annual Overweight Permits fees to operate an LCV along specified corridors are shown below and only address increased pavement damage:

- 90,000 lb $1000. Tractor with twin 53 ft trailers (7 axles).
- 97,000 lb $1400. Tractor with twin 33 ft–48 ft trailers (8 axles).
- 97,000 lb $2500. Tractor with single trailer (6 axles).
- 120,000 lb $7,500. RMD (8 axles) (tractor with one 48 ft and one 28 ft–33 ft trailer).
- 138,000 lb $10,000. Turnpike Double (8-axles) (tractor with two 53 ft trailers).

For this analysis, it is assumed that 50,000 LCVs total would be registered, with 10,000 trucks operating in each of the 5 configuration categories. Based on the assumed number of LCVs, registration and permit fees. The additional HWY revenue would be:

- 90,000 lb × ($2100 reg fee + $1000 Permit weight fee) = $31,000,000.
- 97,000 lb × ($2100 reg fee + $1400 Permit weight fee) = $35,000,000.
- 97,000 lb × ($1000 reg fee + $2500 Permit weight fee) = $35,000,000.
- 120,000 lb × ($2100 reg fee + $7,500 weight fee) = $96,000,000.
- 138,000 lb × ($2100 reg fee + $10,000 weight fee) = $121,000,000.

Total additional revenue from LCV registration and permitting = $318,000,000. Operation of Long Combination Vehicles requires special training for drivers. In addition, there have been safety concerns expressed about the operation of LCVs although crash statistics do not indicate that accidents are higher for LCVs than for other types of heavy trucks [Cambridge 2009].

Cargo Container Fee

Cargo containers are a standard method of shipping goods worldwide. Exhibit E43 shows a Chinese container ship bound for the US with thousands of containers loaded inside the ship and on the deck. Once the ship arrives, the containers are off-loaded and moved by small trucks (drayage) to storage locations within the port facility. Containers are then loaded onto trains or trucks for transport. The widening of the Panama Canal will allow larger container ships, which can carry in excess of 10,000 Twenty-foot Equivalent Units (TEU), to arrive at Texas' ports [Davidson 2007].

Exhibit E43. Container Ship and Port Side Off-Loading onto Trucks or Stack Trains [photo credit Princeton 2010] [Super Stock 2011] [Aeromoe 2011] [Worldnews 2011].

Work must begin now on existing facilities, and new facilities must be constructed to provide adequate port, highway, and rail corridors to accommodate this increase in container cargo. Texas ports must be dredged as a matter of routine maintenance and to permit entry of the larger container ships. Highway and rail junctions must be separated and the location of rail lines must be adjusted to improve freight flow. Inland port facilities must be further developed as a management tool to enhance use of gulf port facilities [Prozzi 2002]. In addition, major Texas highway freight corridors must be strengthened and maintained to carry the increased container truck volumes [Walton et al. 2010] [Kruse et al. 2009] [2030 Committee 2009] [Cambridge 2007] [Harrison et al. 2007] [Siegesmund et al. 2003].

The DYE Management Report suggested a $30 fee per TEU. California passed legislation authorizing a container fee of $30 per TEU [CLH 2006] [Lindquist 2007]. Long Beach Port Authority has considered implementing a container fee of $6 to $18 per TEU. However, the economic downturn has resulted in fewer containers passing through the port and resulted in a delay in implementing the fee. Committee members have indicated that a national cargo container fee to generate transportation infrastructure funds for port cities would be more appropriate than a local fee. There is concern that local fees would reduce economic competitiveness with other container ports.

In this analysis, a fee of $12 was assumed for each passing through Texas ports of entry. The container loaded on the truck shown in Exhibit E43 is 40 ft long and would therefore equal 2 TEUs. With the opening of the widened Panama Canal, freight is expected to flood Texas ports, rail, and highway system. It is proposed that a portion of the container fee could go to TxDOT to facilitate improvements to rail and highways (grade separations, moving rail links out of urban areas; maintenance of highways and bridges; added capacity, etc.) and to ports for dredging port facilities. The Committee has indicated that Texas ports (and other US ports) are behind in maintenance including port dredging. The container fee would help Texas meet these needs. Container volumes shown below are from Harrison et al. [Kruse et al. 2009] [Harrison et al. 2007] [Harrison et al. 2005] [Prozzi et al. 2003] [Corbett et al. 2006].

In addition, the Governor's Competitiveness Council recommended in their report dated July 2008 that the state should secure funding to expand inland ports and to finance rail relocation. The state legislature has provided the mechanism, through a constitutional amendment, to fund rail relocations; however, no funding has been provided to provide revenue for the Rail Relocation Fund. A container fee could be one mechanism for providing these funds [GCC 2008] [TxLBB 2008].

Port of Houston/Galveston = $12 × 2.5 million containers/yr	=	$30,000,000
Texas City = $12 × 300,000 containers/yr	=	$3,600,000
Port of Freeport = $12 × 640,000 containers/yr	=	$7,680,000
Containers delivered to Texas by Rail= $12 × 750,000 containers/yr.	=	$9,000,000

Estimated revenue = $50.28 million.

Truck Tractor-Trailer Combination Registration Fee Increase

The current 18-wheeler truck tractor trailer combination registration fee in Texas is $840 [TTC 502.162 2011]. Exhibit E44 shows the 5-axle truck tractor-trailer combination registration fees reported by the various states as of January 1, 2008 [FHWA 2008b]. Based on this information, the national average 5-axle combination truck registration fee is $1,338.

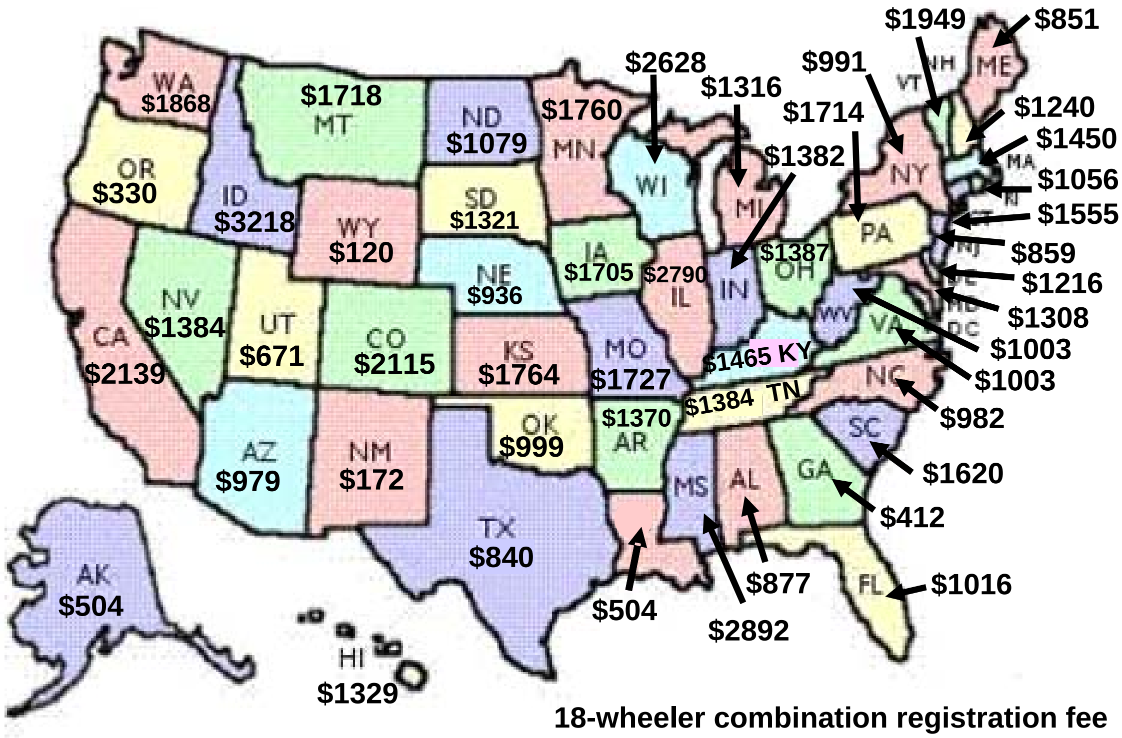


Exhibit E44. 5-Axle Combination Registration Fees.

Other comparisons for Texas' 5-axle combination registration fee with peer states are given below:

- Average 5-axle combination registration fee for the Western Association of State Highway and Transportation Officials 18 member states = $1,167 [WASHTO 2011].
- Average 5-axle combination registration fee for the 10 largest state economies including: California, Texas, New York, Florida, Illinois, Pennsylvania, New Jersey, Ohio, Virginia, North Carolina = $1,373 [USDC 2011].
- Average 5-axle combination registration fee for the 10 largest state outbound truck freight shipment volumes including: California, Texas, Illinois, Ohio, Florida, Georgia, Pennsylvania, Indiana, Michigan, North Carolina = $1,398 [RITA 2005].

The current total number of truck tractors registered in Texas = 293,939 (inclusive of IRP registrations). Current number of truck tractors registered in Texas under the International Registration Plan = 97,826 [TxDMV 2010a] [TxDMV 2010b] [TxDMV 2008].

The 2030 Committee identified the option to undertake a thorough assessment to determine the impacts and additional revenue due to an increase in the 5-axle truck tractor trailer combination registration fee. The Texas State Comptroller of Public Accounts recommended a $25 increase in truck registration fees (which would result in approximately $7 million in additional revenue) as a method of providing increased revenue for the Highway Fund [TxCPA 2011a]. For the Appendix E analysis, a 5-axle truck-tractor trailer combination registration fee of $1,000 was assumed. This figure is approximately midway between the current cost of registration ($840) and the average of the 4 peer state comparisons given above.

Estimated Additional HWY Revenue due to an Assumed Increase in the Registration Fee

Total HWY revenue generated = 293,939 trucks × $160 increase/truck = $ 47,030,240. This figure might be reduced due to 5-axle truck-tractor combinations registered for farm use. Under state statutes, trucks registered for farm use pay 50 percent of the regular registration fee that could reduce this estimate [TxDPS 2010a]. Counties retain a portion of vehicle registrations for roads and bridges maintained by the county. However, since this amount would already be apportioned to the counties through current registration fees, the increase in 5-axle tractor-trailer combination registration fees would accrue entirely to the Highway Fund [Texas State Legislative 2008].

Overweight Truck Fines Deposited in General Revenue

Texas State Statute Title 7; Chapter 621.506 'Offense of Operating or Loading Overweight Vehicle; Penalty; Defense' establishes that a justice or municipal court that collects an overweight vehicle fine shall retain 50 percent of the fine and send 50 percent of the fine to the State Comptroller for deposit in the General Fund. Based on discussions with revenue officers at the State Comptroller, this money is not transferred to the Highway Fund nor is it appropriated for a specific use.

The State Comptroller reported that approximately $1.6 million was remitted to the State Comptroller by cities and counties from overweight fines [TxCPA 2010a]. Since these fines are associated with excessive loads placed on the state highway infrastructure it is proposed that these funds are transferred to the Highway Fund for pavement and bridge maintenance.

New Overweight Truck Fine Structure

Reducing the number of overweight trucks will reduce accelerated pavement and bridge deterioration rates. The State Comptroller reported that an estimated $1.6 million was paid to General Revenue by city and county courts through overweight truck violations [TxCPA 2010a] [TxCPA F40-145 2010b] [TxCPA F40-132 2010c]. State Statute § 621.506 "Offense of Operating or Loading Overweight" requires cities and counties to report overweight truck violations to the TxDPS. Cities within 20 miles of the Texas/Mexico border are authorized to keep 100 percent of overweight fines, but still must report violations to TxDPS. Based on information provided by the TxDPS approximately 30,000 overweight truck violations are issued annually.

Therefore the average overweight truck fine is approximately $110 ($3,335,032 / 30,000 violations). State statute § 621.506 currently sets the minimum overweight fine at $100 for excess weight less than 5,000 lb over legal limits; $300 for loads but greater than 5000 lb but less than 10,000 lb over legal limit; and $500 for loads greater than 10,000 lb over legal limits. This suggests that almost all overweight truck violation fines adjudicated by cities and counties in Texas are the minimum value ($100).

Literature regarding overweight truck fines indicates that low fines do little to discourage overweight truck operations. For the minority of truckers who chose to operate over the legal load limit, estimated to be between 15–30 percent depending on truck type, over weight fines are considered "a cost of doing business." An increase in the minimum overweight truck fine could discourage illegal overweight operations and can help reduce accelerated deterioration of pavements and bridges [FOEDR 2009] [Taylor et al. 2000] [Battelle Team 1995] [Barron et al. 1994] [Euritt 1988] [Lundy and McCullough 1987].

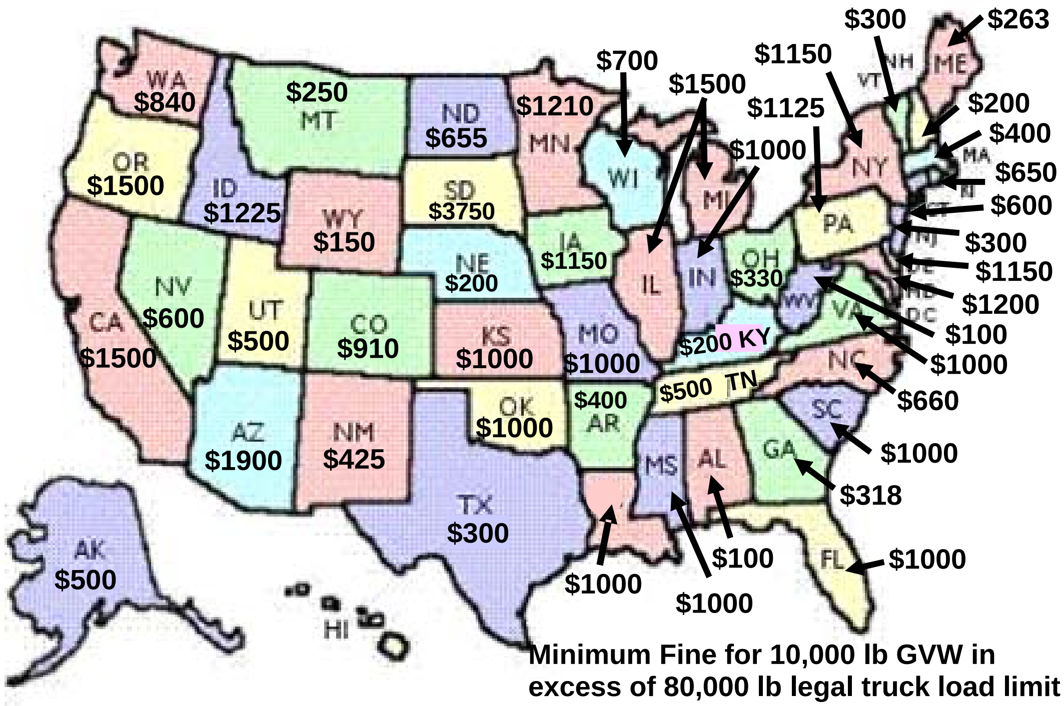


Exhibit E45. Minimum State Fines for 10,000 lb in Excess of 80,000 lb GVW Legal Limit [ATRI 2007].

Referring to Exhibit E46, *Overdrive and Truckers News* magazine publishes an annual 'Road Poll' based on trucker's opinions about state highway systems. This is not a scientific survey, but does provide interesting insights about how truckers view Texas roads, inspection, and law enforcement. Only the top three states in each category have been listed. The poll shows that although Texas consistently ranks high in overall roadway conditions, it also ranks among the weakest in terms of truck inspections and enforcement. The factors that are considered in the worst overall road condition rating include potholes, patches, cracks, congestion, and construction zones. Factors considered in the other categories have not been published [Overdrive 2010] [FDOT 2011]. The *Overdrive and Truckers News* magazine Road Poll typically has from 500–600 survey respondents and a monthly readership of 90,000. This is based on information provided in an email dated February 14, 2011, from Mr. Todd Dills, Senior Editor of *Overdrive & Truckers News* magazine.

Exhibit E46. Overdrive Magazine 'Road Poll' Annual Report.

Overdrive Magazine - Road Poll							
Rating Category	Year						
	2001	2005	2006	2007	2008	2009	2010
Best IH Roads (Specific Route)	Florida Georgia Texas		Florida Tennessee Texas		Tennessee Florida **Texas**	Tennessee Pennsylvania Florida	Tennessee Florida
Worst IH Road (specific route)	Arkansas Illinois Louisianna		Louisianna Missouri New York		Louisianna Oklahoma Arkansas	Louisianna Oklahoma California	Louisianna New York Arkansas
Most Improved IH Roads	Pennsylvania Louisianna Illinois	Arkansas Pennsylvania Georgia		Arkansas Pennsylvania Nebraska	Arkansas Pennsylvania Georgia	Pennsylvania Arkansas Louisianna	Pennsylvania Louisianna
Best Roads (Overall)	Florida Tennessee **Texas**	**Texas** Florida Tennessee	**Texas** Florida Tennessee	**Texas** Florida Tennessee	**Texas** Florida Tennessee	**Texas** Florida Georgia	Florida **Texas** Tennessee
Worst Roads (Overall)	Arkansas Illinois Pennsylvania	Pennsylvania Louisianna Missouri	Pennsylvania Missouri Louisianna	Arkansas Pennsylvania Louisianna	Louisianna Pennsylvania Oklahoma		Pennsylvania Michigan New York
Toughest on Inspections and Law Enforcement	California Ohio Tennessee	California Ohio Pennsylvania	California Ohio Pennsylvania	California Ohio Pennsylvania	California Ohio Pennsylvania	California Ohio Pennsylvania	California Ohio Maryland
Weakest on Inspections and Law Enforcement	Alabama **Texas** Indiana	Alabama **Texas** Oklahoma	Alabama Oklahoma **Texas**	Alabama Oklahoma **Texas**	Alabama **Texas** Oklahoma	Alabama **Texas** Oklahoma	Alabama Oklahoma South Carolina

Although the number of TxDPS, city, and county weight enforcement officers in Texas has increased over the past four years, on average there are only two TxDPS weight enforcement officers per Texas' county [TxDPS 2010b]. The majority of overweight truck violations are issued by TxDPS officers. However, some city and county law enforcement officers also issue a fair number of overweight citations. According to state statute, city, and county courts that collect overweight truck violation fines are required to report this information to TxDPS for record keeping purposes.

As shown in Exhibit E47, based on information provided to TxDPS the city of Houston and Harris County issue the largest number of overweight truck violations on an annual basis. Other cities and counties in Texas are not as active in issuing overweight truck violations. Cities or counties that reported less than 20 overweight truck violations per year were not included in this chart due to space limitations. A total of 4382 overweight truck violations were issued by city and county authorities in 2010. Houston and Harris County violations accounted for over 50 percent of this total.

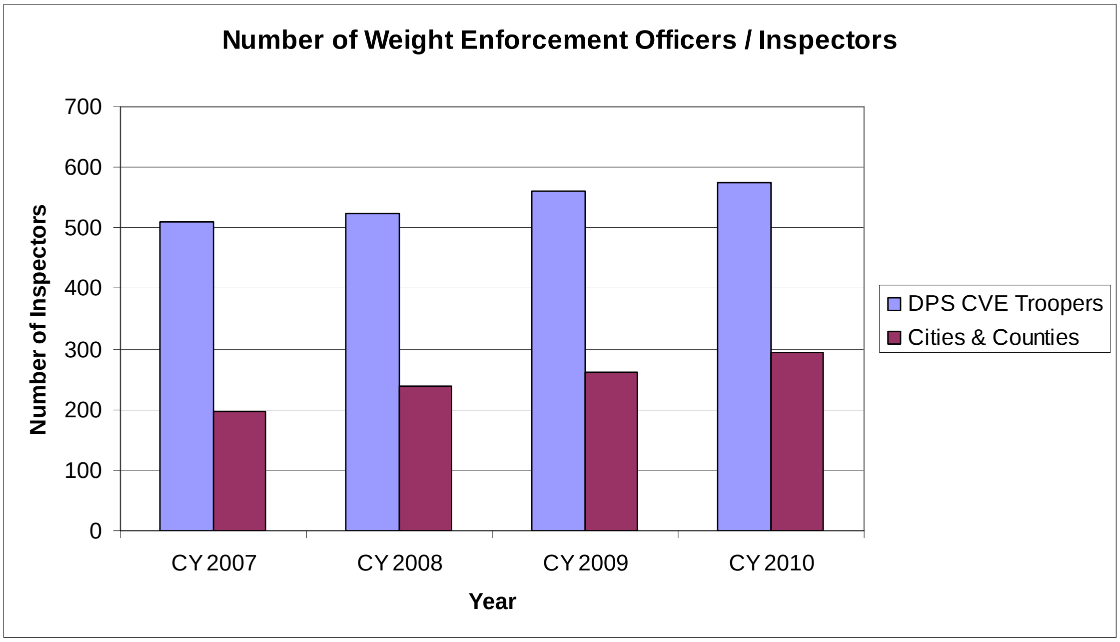


Exhibit E47. Number of TxDPS, City and County Weight Enforcement Officers.

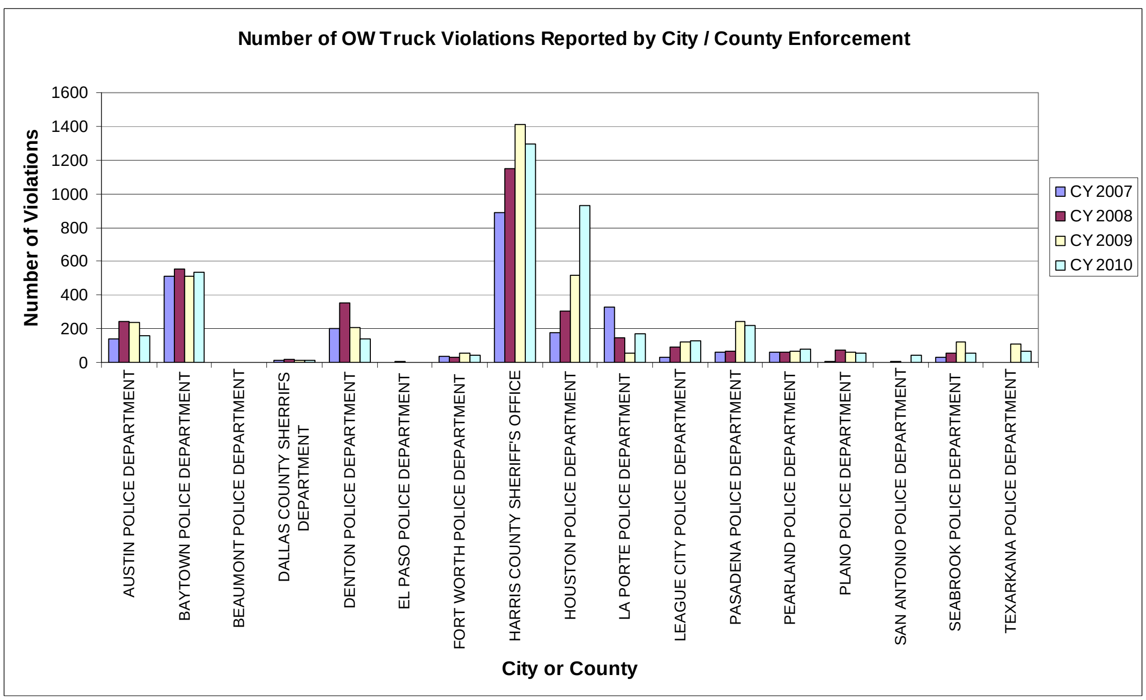


Exhibit E48. Number of Overweight Truck Citations Issued by Texas Cities and Counties.

Referring to Exhibit E48, the number of overweight truck violations reported by the Texas Department of Public Safety has average about 30,000 per year between 2007 and 2010. Increasing overweight truck fines is not intended to be punitive, but rather is meant to persuade operators of overweight trucks to operate at the legal load limit or to purchase an appropriate overweight permit [Conway and Walton 2004] [Euritt 1988].

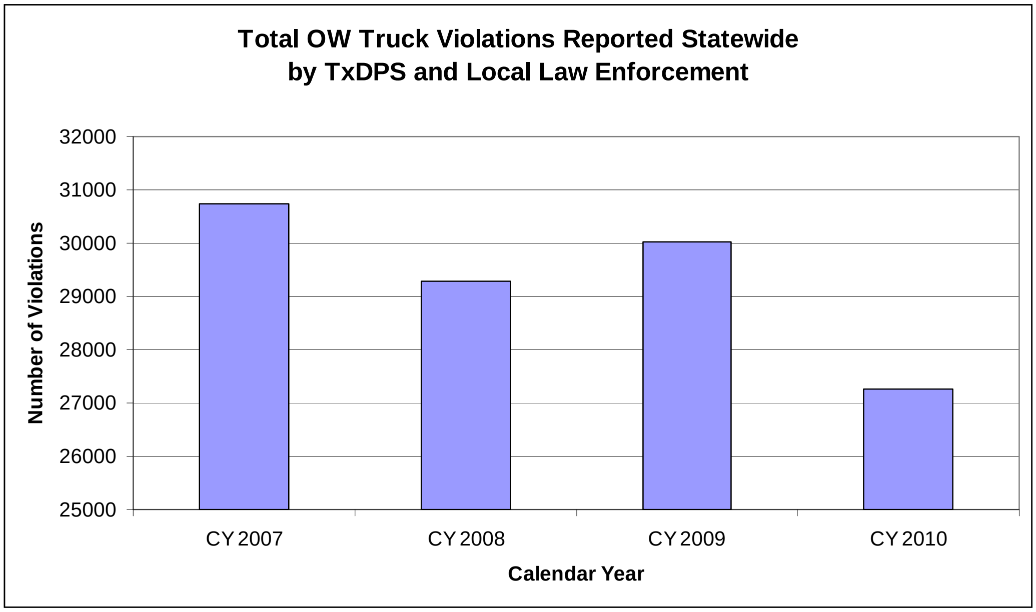


Exhibit E49. Number of Overweight Truck Violations Issued by Calendar Year [TxDPS 2010b] (Note: Number of violations for CY 2010 – as reported 11/2010).

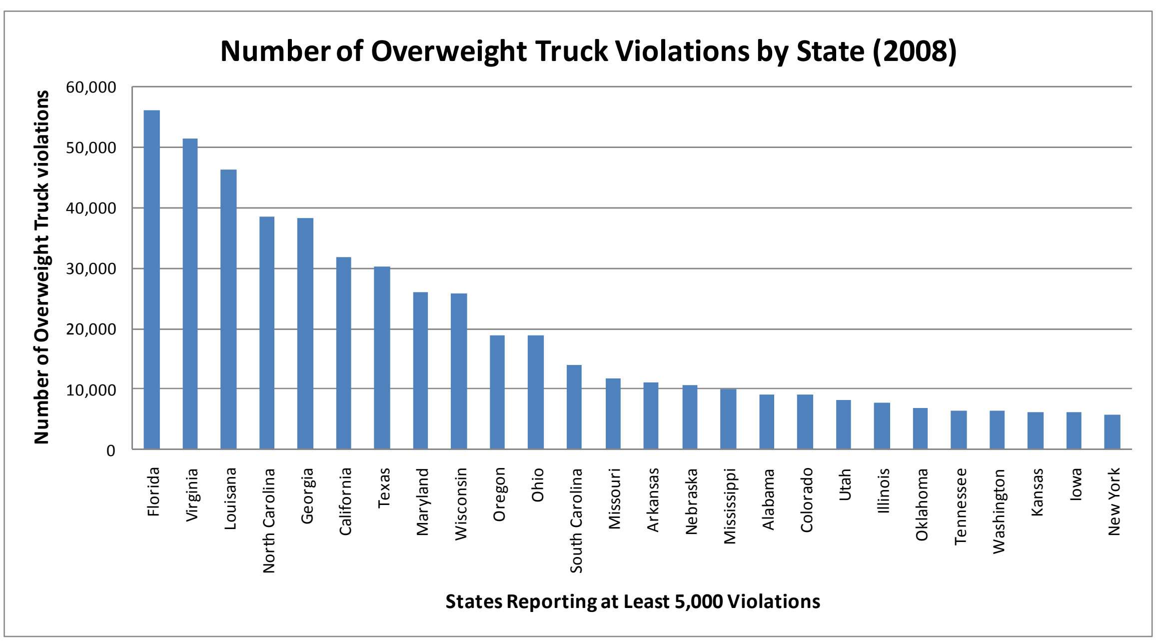


Exhibit E50. Number of Overweight Truck Violations Reported by States.

The number of overweight truck violations reported to the FHWA by states is shown in Exhibit E50. Due to space limitations, only states with at least 5,000 annual violations is shown [FHWA 2008c]. Although in the Overdrive 'Road Poll' California is considered to have strong enforcement and Texas weak enforcement, the number of overweight violations issued is about the same. Ohio, which is also considered to have strong enforcement, reported less than 20,000 violations or about two-thirds the number reported by Texas.

Unfortunately, it was not possible to obtain, from a single source, the number of overweight citations issued by each state in relation to the amount of truck traffic operating in each state. However, Exhibit E51 provides a general estimate of the number of citations issued per 10,000 loaded trucks operating in each state. The analysis method used to develop this chart is as follows:

- The total tons of freight shipment by state of origin was obtained from RITA-BTS; published in State Transportation Statistics 2009 – Chapter C.
- Based on cited references, approximately two-thirds of freight movement in the US is by truck. The total tons of freight shipped by each state was multiplied by 0.6667 to obtain 'estimated tons of freight moved by truck' [Walton et al. 2010].
- The estimated tons of freight moved by truck was then divided by an estimated number of tons of freight per truck, which was varied from 22 tons/truck for states not permitted to operate LCVs to 35 tons per truck for states that are permitted to operate LCVs. This calculation provides a rough estimate of the number of truck shipments in each state that occur annually.
- The number of reported overweight violations for each state was then divided by the estimated number of annual truck shipments (divided by 10,000) to obtain overweight citations per 10,000 loaded trucks.

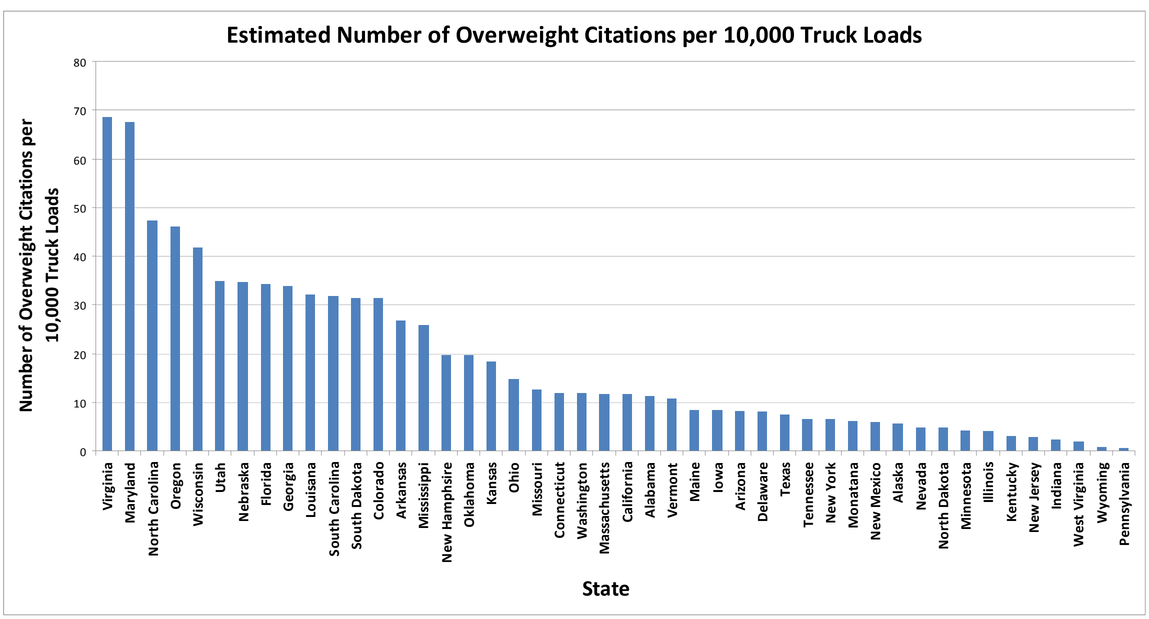


Exhibit E51. Estimated Number of Overweight Citations per 10,000 Truck Loads.

Based on this analytical approach, it appears that Virginia, Maryland, and North Carolina generally issue more overweight citations per 10,000 trucks than other states. Texas issued an estimated 7 violations per 10,000 loaded trucks, which is exceeded by peer states such as California (12); Ohio (15); Florida and Georgia (34); and North Carolina (47). The relatively low numbers of overweight citations in Texas are likely related to the enormous number of trucks operating in the state (Texas is first in terms of truck freight, followed by California, Illinois, Wyoming, Florida, Pennsylvania, and Ohio); and the fact that on average there are only two TxDPS officers per county.

At least 37 states utilize overweight truck fine violation charts, which provide courts with guidance on a fine based on the amount of overweight load. These charts are based either on a rate (cents) per pound, 100 lb or 500 lb overweight, which may increase as the overweight amount increases, or a rate per percentage of the legal axle, or Gross Vehicle Weight limit that the vehicle is overweight [ATRI 2007]. The fine structure shown in Exhibit E52 is modeled after California and was used to compute the amount of overweight fines that would accrue to the Highway Fund if adopted by the state legislature. The total amount of fines based on historic overweight violations is $12.35 million.

Exhibit E52. Overweight Truck Fine Schedule Used for the Analysis.

Overweight Amount	Fine
Less than 5,000 lb overweight	$0.03 per pound
5001–6000 lb	$0.04 per pound
6001–7000 lb	$0.05 per pound
7001–8000 lb	$0.06 per pound
8001–9000 lb	$0.08 per pound
9001–10,000 lb	$0.15 per pound
Greater than 10,001 lb	$0.20 per pound

Additional civil penalties in line with the severity of the offense for excessively overweight vehicles should be considered due to contempt for the Texas vehicle weight limit laws. Based on 30,000 overweight violations issued per year in Texas, and assuming that approximately 4,000 fines would fit in each of the above suggested categories at the mid-point weight, the total overweight violation fines issued per year would equal $24,700,000. Based on state statutes 50 percent or $12,350,000 would be retained by cities and counties for road and bridge maintenance and the remaining $12,350,000 would be deposited in the Highway Fund. It is anticipated that the amount of revenue would decrease as the number of overweight truck violations decreased due to the new fine structure. Additional consideration should be given to issuing a fine two times the fine determined by the court based on the overweight amount if the overweight truck is determined to have crossed a load posted bridge.

It is reasonable to expect that increased overweight truck fines, properly enforced and administered, are an effective management tool for reducing accelerated pavement and bridge damage. However, members of certain state legislatures have fought against increases in overweight truck fines, and in some cases, have written draft legislation to reduce fines [Dunkelberger 2007] [Kafka 2003] [Brokaw 2002].

A website is available that contains information about every truck weigh station in the United States. This site includes maps and information about the location of each weigh station in Texas and in some cases, includes photographs of the weigh station. For a fee, an individual may subscribe to the site and obtain information about how to circumvent each weigh station including which highway exits to take [Coops 2011]. Based on truck weight data collected in various states, it is a minority of truckers that operate above legal load limits and would likely utilize the services of websites such as "Coops Are Open." However, it is this minority of truckers that impact the entire trucking community and result in increased state truck weight law enforcement costs.

Re-Authorize TxDOT to Enter into Comprehensive Development Agreements

TxDOT's authority to enter into Comprehensive Development Agreements ends on August 31, 2011. Since 2001, TxDOT has let over $5.8 billion in CDA projects. Currently, there are three CDA projects under development [TxDOT 2010a] [Prozzi et al. 2009a] [Persad et al. 2009].

a. LBJ Freeway (IH 635) - $2.5 billion.
b. North Tarrant Expressway - $2.02 billion.
c. SH 130 Sections 5&6 - $1.3 billion.

However, this figure does not include Operation and Maintenance (O&M) costs, which are the responsibility of the private developer. Estimated O&M costs for these projects are $4 billion. The total value of CDA projects therefore is over $9.8 billion [TxDOT FIN 2010b]. This information was contained in a spreadsheet provided by the TxDOT Finance Division Director in an email dated January 16, 2011.

The Governor's Competitiveness Council recommended in their report dated July 2008 that the state should revisit the (CDA) funding model as a valuable and proven tool for funding transportation infrastructure [GCC 2008]. Renewing the ability to enter into CDAs can help TxDOT fund large scale projects that otherwise could not be funded within the 2030 timeframe.

No specific projects or additional revenue estimates can be given other than to consider current lettings. Based on this, an estimated $1 billion per year in additional funds can be provided to TxDOT through the CDA process.

Transfer HWY Debt Service to General Revenue

Highway Funds are currently used to service debt on Proposition 14 Bonds and Pass-Through-Tolls (PTT). $2.9 billion in Proposition 14 bonds were authorized on October 30, 2008, which were used to fund much needed projects that were delayed due to lack of funding. These included hurricane evacuation routes, projects addressing congestion or safety, and projects completing the last phases of large multi-phase projects [TxDOT 2011a]. The 2030 Committee identified a possible option of transferring this debt service to General Revenue so that these Highway Funds can be used to fund pavement and bridge projects.

Pass-Through-Toll financing allows local communities to fund construction of needed projects and then be reimbursed by the state by paying a fee for each vehicle that drives on the new highway [TxDOT 2011a] [TxDOT 2009]. A total of 18 PTT project agreements have been executed for a total of $1.465 billion. A single project agreement funded nine projects in Weatherford, Fort Worth District. An additional 22 projects have Minute Order Authority to execute agreements totaling approximately $525.5 million. The total construction value of executed and planned PTT projects is $2.91 billion [TxDOT 2011b] [TxDOT 2011c]. Based on the information contained in Exhibit E53, which lists the annual debt service for PTT and Prop 14 Bonds, the average debt service paid using Highway Funds is $596 million per year.

Exhibit E53. Projected Debt Service Paid by Highway Funds FY 2009 to FY 2024.

Projected Debt Service paid by HWY funds			
Fiscal Year	Prop 14 Bonds	Pass Through Tolls	Total Debt Service
FY2011	$290,232,780	$64,073,372	$354,306,152
FY2012	$316,824,400	$120,759,254	$437,583,654
FY2013	$433,716,828	$169,664,296	$603,381,124
FY2014	$433,715,596	$203,789,535	$637,505,131
FY2015	$433,715,664	$240,039,535	$673,755,199
FY2016	$433,717,216	$228,534,015	$662,251,231
FY2017	$433,717,296	$228,534,015	$662,251,311
FY2018	$433,716,232	$228,534,015	$662,250,247
FY2019	$433,717,236	$220,784,015	$654,501,251
FY2020	$433,718,272	$213,905,930	$647,624,202
FY2021	$433,715,700	$129,109,422	$562,825,122
FY2022		$111,530,281	$111,530,281
FY2023		$69,667,407	$69,667,407
FY2024		$35,542,167	$35,542,167
Totals	**$4,510,507,220**	**$2,264,467,259**	**$6,774,974,479**

Increase Motor Vehicle Sales and Use Tax by 0.25 Percent

The DYE Management report suggested that increasing the state sales by 1 percent would generate over $1.3 billion in revenue for transportation infrastructure needs. However, DYE's assessment of an increase in state sales tax indicated that it would not be equitable since it is not linked to transportation uses. However, an increase in the State Motor Vehicles and Use sales tax of 0.25 percent from 6.25 percent to 6.5 percent would be directly linked to transportation uses and would generate an estimated $105.2 million. This is based on information provided by the Texas Comptroller regarding revenue by source for Fiscal Year 2010 [TCS 2011] [TxCPA 2010d] [TxCPA 2008]. Motor Vehicle Sales/Rental Taxes generated over $2.6 billion in state revenue FY 2010 and increased by 1.1 percent compared to the previous year.

Based on Texas Tax Code 25 percent of the Vehicle Sales and Use tax is credited to the foundation school fund, the remaining 75 percent is deposited to General Revenue. If 75 percent of the tax revenue generated from a 0.25 percent increase in motor vehicle sales and use tax was deposited in the Highway Fund for transportation infrastructure improvements this would provide an additional $78.9 million. The DYE report indicates that generating additional revenue for transportation infrastructure needs through a tax increase is simple and easy to implement [DYE 2009].

Transfer Tire Sales Taxes from GR to HWY

The federal government taxes tires that weigh more than 40 lb for vehicles with a load capacity that exceeds 3,500 lb. A Federal Excise Tax on tires was first levied in 1918, was reduced, and then repealed in 1926. The tire tax was instituted during WWII to help pay for the war effort and was increased in 1956 to help build the Interstate Highway System; the funds were deposited in the newly created Highway Trust Fund [CRS 2005].

The federal excise tax is not applied to passenger cars or trucks in consideration of the fact that heavy trucks do more pavement structural damage than passenger cars. Based on previous estimates using the AASHTO load equivalency factors, a single 18-wheeler tractor trailer weighing 80,000 lb does as much pavement damage as 9,600 passenger cars. However, a fact not considered is that passenger cars and light trucks do cause wear to the pavement surface due to tire abrasion during braking and turning movements and normal travel. Passenger cars and light trucks constitute 17 million vehicles or about 80 percent of all vehicles in Texas. Passenger cars and light trucks contribute the majority of approximately 473 million vehicle-miles travelled (VMT) each day in Texas. This results in polishing of the aggregate surface of the pavement, which is designed to provide adequate surface friction for braking and turning maneuvers especially during wet weather. Reductions in pavement maintenance funds have resulted in increased application of maintenance treatments to restore surface friction that cover one-half a lane width and/or are placed in strips along the wheel path. These steps are taken in an attempt to stretch scarce pavement maintenance resources and to ensure that pavement surface friction is restored in areas with high accident rates exist or where testing with pavement friction test equipment has shown Skid Numbers below those necessary for traffic levels and local conditions. Exhibit E54 shows some examples of maintenance treatments currently being used by TxDOT in lieu of full lane width resurfacing.

Exhibit E54. Partial Width Strip Seals on US and SH Highways.

Although the Federal Excise Tax does not apply to passenger car tires, in September 2009, President Obama approved a 35 percent tariff on tires imported from China, which will be reduced to 30 percent the second year and 25 percent in the third year. The tariff was viewed as a tax since this increased cost is passed to consumers [NYT 2010].

The response to an open records request submitted to the State Comptroller of Public Accounts indicated that tire sales tax is not reported as a separate item to the Comptroller. Tire and auto parts dealers who sell tires lump tire taxes in with taxes collected from batteries and other auto parts sold [TxCPA 2011c]. The fact that tire taxes are not reported separately to the Texas State Comptroller by tire retailers was further clarified in email correspondence with the Texas State Comptroller – Assistant General Counsel – Open Records Division in an email dated February 7, 2011. For this reason, it was not possible to obtain direct information about tire sales tax collected by the comptroller nor was it possible to determine how much tax is collected for light duty or commercial vehicles. This required a deductive reasoning approach to arrive at a ball-park figure of tires sales in Texas based on VMT and tire wear rates.

The number of tires sold in Texas annually was estimated by determining the VMT in each county, and dividing this value by an assumed, average tire life (miles of operation) to arrive at an estimated number of tires sold in each county for the entire state. This is a simplified approach, but does generally follow the method used to compute tire tax revenue at the federal level using the Highway Revenue Forecasting Model (HRFM). The HRFM utilizes more sophisticated models that take into account vehicle class, tire wear rates based on vendor supplied information, location, and environment [FHWA 1997] [FHWA 2000].

In general, tires last longer in the northern US than in the south due to climatic conditions; last longer when driven on straight or gently curving roadways rather than in mountainous terrain, on roadways with sharp curves; or in urban environments with many turns and stop-and-go conditions [Motor Trend 2005]. With regard to commercial trucks punctures (37.3 percent) and impacts (21.6 percent) constitute over 50 percent of truck tire failures, whereas wear (tread depth less than 2/32nd inch) constitutes 4.5 percent of failures. These factors suggest that the average life of a tire is less than the advertised life (ranging from 20,000–70,000 miles). The average life of a commercial truck tire varies depending on whether it is mounted to the steering, drive, or trailer axle. Information regarding average tire life for commercial, heavy trucks was obtained from Welter and Harrison based on research they have conducted on vehicle operating costs in Texas. Additional information was provided by Mr. Rob Harrison – Deputy Director – UT- Center for Transportation Research, regarding estimated tire sales in Texas in an email dated February 9, 2011 [Welter et al. 2009].

Based on average VMT data from District-County Statistics (DISCOS), which are posted on the TxDOT website, and vehicle cost information from Welter and Harrison, it is assumed for this analysis that 28 million tires are sold annually in Texas [TxDOT 2011d]. Of these, 26,000,000 are sold for passenger cars and light trucks and the remaining 2,000,000 tires are for sold medium duty trucks and delivery vans or heavy, commercial trucks.

The cost of tires varies significantly depending on the tire life, brand, on- or off-road use and whether the tire is for a passenger car, pick up, van, delivery truck, or heavy commercial vehicle. It is not possible in this study to do an in depth analysis of the amount of tire tax collected based on the range of tire prices and number sold. For this analysis, it is assumed that an average passenger car tire costs $52; an average pickup truck tire cost $75; and a commercial truck tire cost $350. Based on these estimates, transferring tire sales tax from General Revenue to HWY would provide approximately $138 million annually for pavement and bridge maintenance.

Implement a $2 per Light Vehicle Tire and $3.50 per Truck Tire HWY Maintenance Fee

In 1991, the state legislature established the waste tire program through Senate Bill (SB) 1340, which authorized a $2 per tire fee to pay for recycling of waste tires. This original legislation was later amended by SB 1051 in 1993, which imposed a $3.50 fee on truck tires exceeding 17.5 in. in diameter and by SB 776 in 1995, which imposed a fee on agricultural tires and made several other changes to the waste tire program. In 1997, the Scrap Tire Program was ended and a free enterprise system was established to address waste tire disposal and recycling [Rubber 2011] [TCEQ 2011].

The estimate for the number of passenger vehicles and commercial vehicle tires sold in Texas each year was taken from the previous analysis on the estimated amount of tire sales tax collected annually by the State Comptroller. Reinstating a $2 fee per tire sold for light duty vehicles such as a passenger car and $3.50 per tire sold for heavier duty vehicles for highway maintenance would generate approximately $59 million annually for the Highway Fund.

Privatize Collection of Damage Claims to TxDOT Property

Each year traffic accidents result in millions of dollars in damage to state highway safety devices. These safety devices are installed by TxDOT to protect a fixed object such as bridge column from being hit directly by a car. These safety devices save lives and reduce the severity of injuries by reducing the impact forces on the vehicle and occupants. Safety devices include guard rail, guard rail Safety End Treatments (SETs), vehicle impact attenuators, energy absorption terminals, median cable barrier systems, break-away signs, and other devices. See Exhibit E55.

Thousands of safety devices are damaged or destroyed each year due to accidents, which may or may not be reported by a motorist. Due to the number of highway accidents it is unlikely that the TxDPS or local law enforcement officials, investigating an injury accident, typically documents damage that occurred to state property. Based on information provided by the TxDOT Maintenance Division, on average, about $14 million in claims have been collected annually over the last 4 years from damage to state property.

A review of the TxDOT average low price bid between December 2010 and January 2011, for repair of safety devices showed that approximately $30 million was expended. This does not include replacement of breakaway signs, illumination, traffic delineators, traffic signals, or other highway features that may be damaged during a traffic accident. A review of the TxDOT Maintenance Division 'Maintenance Efficiency and Analysis Report' (MEARS) for FY 2010 revealed that approximately $75 million was expended in FY 2010 to repair guard rail, signs, illumination, and to provide emergency repairs and traffic incident services. This figure includes repairs for other reasons such as normal wear and tear; burned out lighting, replacement of obsolete fixtures; and other reasons. Based on these two figures, it is estimated that approximately $50 million per year is expended to repair highway features damaged through traffic accidents [TxDOT 2011e]. The MEARS report was provided through email correspondence dated February 11, 2011, from Ms. Tammy Sims, P.E., TxDOT Maintenance Division.

Exhibit E55. Various Safety Devices Used by TxDOT to Protect the Travelling Public.

To increase the amount of claims revenue from damaged highway features without increasing TxDOT staffing, record keeping, or administrative requirements, the 2030 Committee identified the option to privatize the process, or a portion of this process. For purposes of this analysis, it is assumed that a private company would be responsible for:

- Collecting information about damaged state property from state and local law enforcement and TxDOT maintenance sections.
- Processing damage claims with motorists and insurance companies.
- Managing collections and accounting of damage claims.

The difference between the estimated amount of damages ($50 million per year) and the current amount of damages collected ($14 million per year) would be shared between the private company and TxDOT. For purposes of this report, it is proposed that 67 percent of the claims collected would be retained by the private company to cover expenses and provide a profit. TxDOT would receive the current $14 million per year as a base amount and an additional 33 percent of all claims collected by the private company. Based on these assumptions, TxDOT could gain an additional $13 million per year in claims revenue for a total of $27 million ($14 million currently collected plus $13 million in new claims revenue). The private company could realize an estimated gross income of up to $37 million per year with an estimated profit of $3.7 million based on a rate of return of 10 percent.

Develop Business Opportunities by Marketing TxDOT Webpage Space for Advertizing

The Washington State DOT is currently conducting a pilot test of web advertising on the WsDOT government website. A study conducted by the DOT indicated that various local municipalities, State Travel Departments, and one or two DOTs have explored this method to raise revenue. The WsDOT study evaluated different models for managing monetization of web space; each option had advantages and disadvantages and various potentials for generating revenue. The potential annual revenue, depending on the marketing model chosen, ranged from $10,000 to $1.9 million [Hill et al. 2010] [WsDOT 2010].

For purposes of this study, it is estimated that TxDOT could realize annual revenue of approximately $500,000 through leasing TxDOT.gov web space or links to external websites. A more thorough study is needed to fully understand the potential for advertising on the TxDOT.gov website, with different options for selling and managing an advertising program and estimates of the revenue that could be realized.

Develop Processes to Market Naming Rights for Highway Infrastructure Components

The Governor of Connecticut has signed into law and provided the Connecticut DOT with the authority to sell naming rights for bus and train stations under DOT jurisdiction [Rell 2011]. The new Commissioner of the New Jersey state Department of Transportation is considering selling naming rights for 12 turnpike rest stops. An advertising media executive indicated that revenue for naming rights for a rest area could be $1 million per year although further analysis is needed [Philadelphia Inquirer 2010]. The Washington State Transportation Commission has issued a study regarding selling naming rights, advertising space, or sponsorship rights for over 25 Washington State ferries [TB-Rogstad 2009]. Depending on the type of program considering sponsorships the report estimated that from $200,000 to $10,000,000 could be generated annually.

Washington State currently sells advertising space in Ferry Terminals (20) and on Ferries (26) [Ferry Media 2011]. Companies such as Lufthansa, Jansport, Washington Mutual Funds, and Air New Zealand have bought advertising space on the ferries or in terminals [Seattle Times 2008]. About 24 million passengers and 11 million vehicles are transported on Washington ferries annually. TxDOT also operates ferries at Port Aransas and Galveston-Port Bolivar, which carry about 8 million passengers per year [TxDOT 2011f].

Although detailed information is not currently available on the potential revenue that could be generated by TxDOT through sponsorships, naming, and branding rights, based on information obtained through these other sources it is estimated that approximately $500,000 per year could be realized. A more thorough study regarding these options and the types of facilities including corridors, freeways, bridges, safety rest areas, and other highway facilities might be attractive to advertisers.

Authorize TxDOT to Charge Development Impact Fees

Many companies accept economic development funding as an incentive to locate facilities regarded as job generators, making the impacts positive and desirable. Although new developments are a welcome stimulus and signal increased economic activity, a new housing subdivision or distribution center can create costs for a local municipality or TxDOT.

The 2030 Committee identified an option for the Legislature to consider enacting state statutes that ensure TxDOT has a place at the table, early in the process, when development projects are being discussed. State Legislation could also authorize TxDOT to charge a Development Impact Fee in relation to the repair and/or new infrastructure development costs that are incurred. The DIF could be based on a fee schedule agreed upon by the State Legislature. A thorough study could be conducted to develop a possible state DIF policy outline for discussion. The study could include proposed Standard Operating Procedures, a proposed schedule of State Development Impact Fees, and related supporting documentation.

State Local Government Code Title 12 'Planning and Development' Chapter 395 Section 395.001 'Impact Fees' authorizes local municipalities and counties to charge an impact fee to offset the cost of road, water, waste water, and other infrastructure to service a new development. There are no state statutes authorizing TxDOT to charge a Development Impact Fee to offset the costs of repairs to existing pavements and/or bridges damaged during construction of a new development. In addition, there is no mechanism for TxDOT to recoup expenses for providing access ramps, widening roadways, and adding continuous left turn lanes to accommodate new business developments including high truck traffic generators such as a multi-state distribution center [DYE 2009].

It is recognized that there are both costs and benefits to new job/traffic generators and it is extremely important and of great advantage to involve TxDOT as early in the planning process as possible to determine future needs. This would allow TxDOT to work with local government and the developer to identify methods to minimize damage to existing roadways and to reduce the cost of repairs due to heavy construction traffic. In addition, TxDOT would be able to discuss, negotiate, and plan for new roadways and ramps, or expansion of existing roadways, to provide access to the new development. These repairs and the new construction costs are currently borne by TxDOT and reduce funds available for maintaining existing pavements and bridges.

Based on the DYE Management report, if DIFs were available for use by TxDOT, revenues of approximately $75 million per year could be generated based on 1 percent of the annual investments in new construction in Texas. This estimate was used by the Committee in the absence of a more thorough study on this subject.

Business Opportunities through Privatization of Safety Rest Areas

The 2030 Committee identified that a thorough marketing analysis of rest area commercialization could provide more information to evaluate the potential for revenue and cost savings. Texas is near the end of completing a plan to refurbish or construct new rest areas across the state. There are about 80 safety rest areas both on and off the Interstate System. Exhibit E56 shows the location of rest areas and Tourist Welcome Centers located on the State Highway System [TxDOT 2010c].

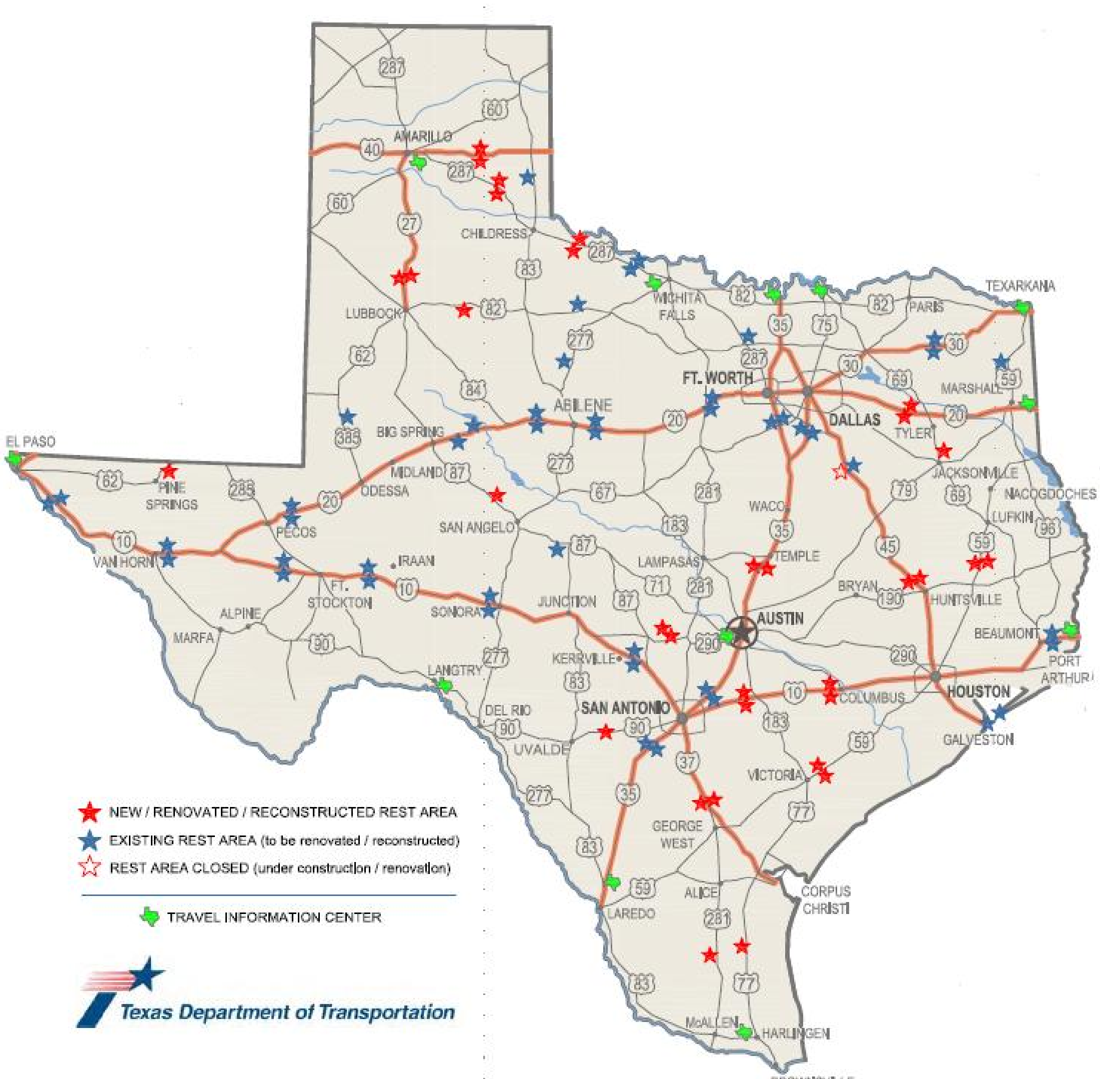


Exhibit E56. Texas Safety Rest Areas and Tourist Welcome Centers.

TxDOT spends about $21 million a year maintaining rest areas using state forces or through routine maintenance contracts. In the past, TxDOT conducted a market analysis regarding privatization of rest areas that determined that this was not a viable option. This conclusion is likely due to the fact that most safety rest areas are located on high volume IH routes. Federal regulations currently prevent privatization of rest areas on the IH system. It is unclear if the previous study considered high volume non-IH system routes such as US 183, US 287, and US 59. A study by Euritt and Harrison showed that several non-IH system rest area locations in Texas could potentially yield a rate of return exceeding 10 percent. Additional information is provided regarding other states that were considering safety rest area privatization at that time including California, Virginia, Michigan, and Illinois among others [Euritt & Harrison 1992] [VDOT 2002].

CALTRANS conducted a market analysis of safety rest areas on the state maintained highway system and a detailed study was conducted of rest areas at six locations in Feb. 2007 [Dornbusch 2007]. The analysis showed that revenues around $28 million per rest area and operating costs around $25.5–$26 million would yield a net income of $1.3 to $4.5 million per rest area analyzed. In addition, CALTRANS could potentially accrue revenues by privatizing the rest area through payments made by a private partner.

Even if TxDOT gained no additional revenue, privatization could still be a positive option since these sites would generate taxes; improve driver safety and comfort; and enhance driver attitudes/opinions about the state highway network. Note that driver fatigue is increasingly a factor in fatal and injury accidents. These benefits could be gained with no increase to state Safety Rest Area (SRA) expenditures; potential reductions in SRA expenditures could also be realized if an existing rest area could be privatized. In addition, the current funds spent by TxDOT to maintain SRAs could be reduced through privatization.

Several states are working to have the federal ban regarding privatization of the IH system rest areas changed; it is suggested that Texas could play a major role leading this effort and working with these other states. Arizona and Virginia are at the forefront of this effort [ADOT 2010] [Virginia 2010]. However, certain industry groups oppose commercialization of Safety Rest Areas on the Interstate due to potential impacts to small businesses located in nearby towns [PMAA 2011] [NATSO 2011].

Some states, such as Oklahoma (two sites on IH 44) and Delaware (IH 95) have existing facilities or are planning upgrading facilities on the IH system (Exhibits E57–E59) [Warcaba 2011] [Cordogan 2011]. These facilities will greatly enhance motorists experience when stopping at a safety rest area. Oklahoma's facilities were in place prior to the route being designated an IH so the state retained authority to privatize these locations. Delaware has recently constructed a privatized Welcome Center on IH 95. The Welcome Center cost $35 million but no state funding was involved, the Center was built using private funds [Stateline 2010].

Even though these SRAs are privatized, a motorist does not have to spend any money to use the safety rest area. However, if the motorist wants to buy a cup of coffee, sandwich, or other item, the service plaza is essentially a small airport terminal that provides a range of services 24 hours a day. Another important fact is that these privatized service plazas are well lighted, inviting, and provide a safe place for families or an unescorted woman to stop day or night. Also, interactions between cars, SUVs, and pickups are kept separate from heavy truck parking to minimize collisions.

Exhibit E57. Delaware Welcome Center and Planned Florida Toll Plaza and Rest Area [Stateline 2010] [Cordogan 2011].

Exhibit E58. Illinois Service Plaza – Oasis [Cordogan 2011].

Exhibit E59. IH 44/Will Rogers Turnpike Privatized Rest Area – Vinita, Oklahoma [photo credit Wikipedia.com 2011] [Cordogan 2011].

There is an apparent lack of heavy truck parking in Texas—even though there are truck stops along major routes. Safety rest areas along the Interstate often have several heavy trucks parked within the safety rest area along the shoulder of the IH entrance ramp and even along the IH mainlane shoulder in some cases. Heavy truck traffic is projected to increase significantly in coming years due to increase in container freight cargo flowing from China to Texas ports through the newly widened Panama Canal.

Hence, privatized safety rest areas and truck parking plazas represent a potential new business opportunity in Texas and can help meet the needs for future new rest areas without increasing TxDOT's SRA expenditures. The challenge will be to position privatized rest areas such that they do not compete with gas stations and restaurants located in small towns along the route.

For this study, it is assumed that 35 percent of existing Safety Rest Area expenditures could be saved if TxDOT was authorized to privatize safety rest areas on and off the Interstate System. In addition, if TxDOT was authorized to enter into public-private partnerships for development of new privatized safety rest areas to meet the demand of increased travel on the state network, it is assumed that TxDOT could realize an average addition annual savings of $250,000 per rest area and accrue potential revenues through private partner payments to TxDOT of approximately $5 million per rest area. Based on these assumptions, TxDOT could realize revenues and cost savings of approximately $27 million per year through privatization of rest areas considering that the number of existing rest areas is doubled over the next 20 years.

Consider Evaluating Diversions of Motor Fuel Taxes That Otherwise Would Accrue to HWY

Motor fuel tax receipts, that otherwise would accrue to Highway Fund 6 are retained by motor fuel Suppliers and Distributors or Importers for timely payment of motor fuel tax receipts. Further, the Texas State Comptroller of Public Accounts retains a percentage of Gross motor fuel tax receipts for enforcement and administration of motor fuel tax laws. The following sections provide additional details and estimates of the amount of motor fuel taxes diverted from Highway Fund 6. The estimates of diverted funds are based on gross motor fuel tax receipts of $4.5 billion annually.

Approximately $213 million in motor fuel tax revenue is diverted from Highway Fund 6 and the school fund. Based on state statutes, 75 percent of motor fuel tax revenue is paid to Highway and 25 percent to the school fund. Based on this distribution, $160 million is diverted from Highway and $73 million from the school fund. The 2030 Committee suggests that the appropriate state authority consider evaluating the percentages paid and amount of motor fuel tax that is diverted through these processes. If 50 percent of the $160 million diverted from HWY could be recaptured, this would provide approximately $80 million in additional pavement and bridge maintenance funds.

Evaluate Motor Fuel Taxes Paid to the Comptroller for Program Administration

Currently, 1 percent of the gross motor fuel tax receipts, or approximately $45 million, is allocated to TCPA for administration and enforcement of motor fuel tax laws. This is based on total gross tax collections of $4.5 billion as reported in 2008 [TxLBB 2008]. The 2030 Committee suggests that the appropriate state authority consider reviewing and determining if a portion of this revenue can be redirected to Highway Fund 6 while continuing to provide adequate funding to TCPA for administration and enforcement of motor fuel tax laws.

Evaluate Motor Fuel Taxes Retained by Suppliers and Distributors/Importers

The process by which motor fuel tax is collected and paid to TCPA is complicated and currently allows certain entities in the supply chain to retain a portion of the collected tax. Referring to Exhibit E60, motorists pay the motor fuel tax at point-of-sale to a Terminal Operator (gas station). The Terminal Operator then remits the collected tax to a Distributor or Importer who supplied the fuel to the Terminal Operator. The Distributor or Importer then remits the collected tax to a Supplier who then pays TCPA the collected tax [TxLBB 2009].

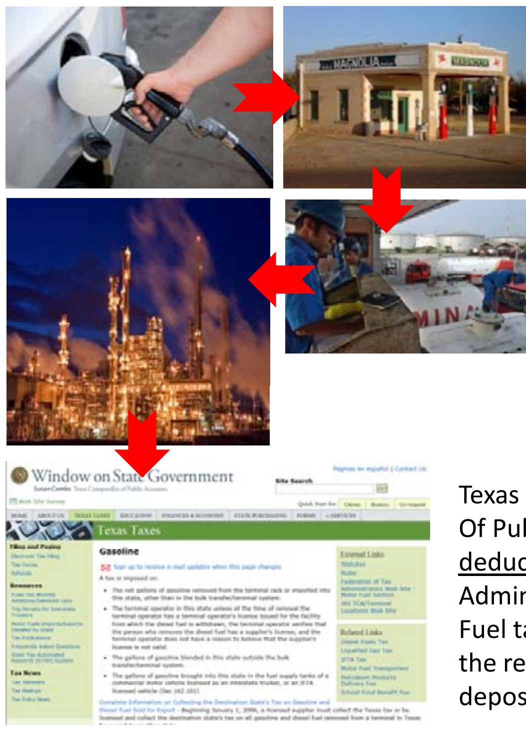


Exhibit E60. Process through which Motor Fuel Taxes Are Paid to Highway Fund 6 [photo credit WordPress 2011] [photo credit Flickr 2011] [photo credit World News 2011].

Current Tax Codes allow Distributors and Importers to retain 1.75 percent of collected taxes if motor fuel tax receipts are paid to the Supplier in a timely fashion. Based on total, gross motor fuel tax receipts of $4.5 billion, Distributors and Importers are permitted to retain approximately $78.75 million annually for on-time payment of motor fuel taxes to a Supplier.

Further, the Supplier may retain 2 percent of collected motor fuel tax receipts if paid to TCPA in a timely fashion. Based on total, gross motor fuel tax receipts of $4.5 billion, Suppliers are permitted to retain approximately $90 million annually for on-time payment of motor fuel taxes to the Texas State Comptroller of Public Accounts [TTC 2011]. A total of 4.75 percent of motor fuel tax receipts are deducted before the remainder is paid to the State Comptroller.

Advancements in technology such as 'pay-at-the-pump'; direct, electronic deposits to bank accounts and computerized, in-store, cash registers that track sale amount, item, quantity and time, and date of purchase could make direct payment of motor fuel taxes from the Terminal

Operator (gas station) possible. This would reduce the number of entities in the motor fuel tax payment supply chain as well as the amount of funds deducted for timely payment of motor fuel tax receipts. In addition, direct payment of motor fuel taxes at the gas station would expedite payment of motor fuel taxes to the State Comptroller and simplify the administration and motor fuel tax law enforcement requirements. If the payment of motor fuel taxes was made directly from the gas station operator, it is estimated that roughly $190 million of the approximately $213 million expended for administration and motor fuel tax code enforcement could be saved. If feasible, this would result in an additional $142.5 million of motor fuel tax revenue paid to HWY and $47.5 million to the school fund. This approach will still provide the State Comptroller with $23 million to administer motor fuel tax collections.

A negative impact of this possible option is that accounting and administrative jobs would be lost due to changes in the methods currently used to transfer motor fuel tax money from the point of sale to the State Comptroller. However, highway construction jobs would be created through additional revenue paid to TxDOT. Additional study is needed to fully understand the benefits and impacts of this suggested option.

Enhanced Weight Data Collection for System Management

The 2030 Committee suggests that options be considered to provide TxDOT with sufficient additional funding to implement a comprehensive, statewide vehicle weigh-in-motion system to provide more accurate and complete traffic weight data for planning, pavement design, and system management [Conway 2010] [Hong et al. 2007] [Qu et al. 1997] [Leidy et al. 1995].

Leidy and Lee found that a weigh-in-motion (WIM) system installed at a NAFTA border crossing in Laredo provided accurate data for determining the number of trucks, axle configuration, and axle loads for each day of the week. WIM data, collected over time, are critical for corridor analysis studies, accurate traffic load and volume estimates for pavement design purposes, and trend analysis to predict future traffic and traffic load growth. The 2030 Committee recognizes that truck weight data, collected along key freight corridors, at ports of entry and other key locations are critical to support TxDOT's mission.

Enhanced Pavement Management Information System Data and Functions

The 2030 Committee suggests that options be considered to provide TxDOT with sufficient additional funding to implement an enhanced Pavement Management Information System (PMIS) that incorporates pavement layer thickness and material type data and work history information [Zhang 2003]. PMIS stores pavement condition data that are collected annually through manual visual distress and automated ride and rut data collection. PMIS also stores additional information about each highway segment on more than 190,000 lane miles of pavement. This information is used by TxDOT pavement managers and administrators to evaluate pavement system conditions and to determine treatment types and funding needs. Based on a peer review of the TxDOT Maintenance Program and Practices, which was conducted in 2010, six peer state DOT Directors' of Maintenance recommended enhancements to the PMIS system. These enhancements included incorporation of more detailed pavement structure thickness and pavement treatment history information. Additional improvements to

PMIS were recommended by the 2030 Committee in the Report published in 2009 [2030 Committee 2009] [Murphy et al. 2010].

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APPENDIX F – FUNDING TRANSPORTATION IMPROVEMENTS

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REVENUE TABLES

The following is a brief description of each of the revenue related exhibits attached.

Exhibit F1, "Capture Existing Revenue," shows automotive related fees that are not dedicated to the Highway Fund. The fee or tax is listed in the first column and the non-highway funds to which they are currently dedicated are listed in the second column along with the percentage of each fee the fund receives. Also, see Exhibit E1 for permit related fees.

Exhibit F2, "State Highway Fund Revenues Disbursed to Other Agencies," shows the amount of Highway Fund revenue allocated to other agencies in 2010.

Exhibit F3, "System-Wide Solutions," lists possible solutions that would raise revenue throughout the state.

- Item 3, "Vehicle Fuel Equalization Fee," is based on the concept that fuel efficient automobiles, while using the roadways as much as less fuel efficient vehicles, consume less fuel and thus pay less tax, while doing so. The fee is assessed on the difference between the fuel actually consumed by the vehicle at the greater fuel efficiency versus what would have been consumed by the average vehicle. Exhibit F7, "Vehicle Fuel Equalization Fee Example Calculations," illustrates the fee associated with several example gasoline and diesel vehicles. Exhibit F8, "Estimated Vehicle Fuel Equalization Revenue," indicates the estimated total revenue raised each year as well as the estimated average fee for each vehicle with a MPG rating higher than that of the Texas fleet's average MPG rating.
- Item 4, "Energy Use Fee," is a graduated fee based on the amount of energy a vehicle consumes. As energy efficiency increases so does the fee. It makes up for the loss of fuel tax revenue, keeping the revenue gained from each vehicle from declining as energy efficiency rises. While similar to the "Vehicle Equalization Fee" the "Energy Use Fee" is not limited to carbon-based fuel consumption (MPG). This fee would be applied to all vehicles, regardless of how they are powered. To capitalize on this revenue stream it is best to index it to account for inflation and combine it with another fee that allows the revenue to increase as opposed to breaking even with the current returns.

- Item 5, "Vehicle Property Tax/Ad Valorem Tax," would be calculated based on a percentage of the vehicle's market value, depreciated each year. The minimum tax assessed would be $100. The yearly yield number shown in the exhibit is based on every vehicle paying only the minimum $100 tax.

Exhibit F4, "Targeted Solutions," lists possible solutions directed at increasing revenues in specific areas or locations that would be dedicated to the paying region. Item 7, "Local Option Tax," indicates various avenues of taxation for a defined area.

Exhibit F5, "MPO Local Option Sales Tax," estimates the revenue generated from a 1 percent increase in sales tax.

Exhibit F6, "MPO Local Fuel Tax 2012," lists the estimated revenue generated from a one cent tax increase on both gasoline and diesel fuel.

Exhibit F9, "Household Costs," lists the average annual household cost of various revenue options.

- Each Texas household is estimated to consist of 1.5 vehicles and 2.5 persons.
- The motor fuels tax and carbon tax are calculated assuming 12,000 annual miles per vehicle with a fuel efficiency of 20 MPG.
- To calculate the average annual vehicle fuel equalization fee per household a fleet-wide average of 12,000 miles at 20 MPG was assumed. An average 22.9 MPG was established based on combined averages for 2006 midsize sedans taken from the U.S. Department of Energy's Fuel Economy website. The 2006 midsize sedan fuel economy was compared to the fleet-wide average to determine the difference in motor fuel tax paid and the resulting fuel equalization fee.
- The vehicle property tax is based on a 2006 Ford Taurus SE with a market value of $8,325.

Exhibit F10, "Total Annual Vehicle Fees and Taxes (Ranked by Total Fees Paid)," sums up registration fees, vehicle property taxes, and other vehicle related fees for each of the 50 states and ranks them from the highest to the lowest total vehicle fees.

Exhibit F11, "Total Annual Fees and Taxes (ranked by Registration Fees)," ranks total annual registration fees by state.

Exhibit F12, "Total Annual Vehicle Fees and Taxes (Ranked by State Gas Tax Rate)," ranks all 50 states according to the gas tax rate.

Exhibit F13, "Peer States Comparison," shows where Texas ranks among its peer states. Those states having vehicle property taxes or other taxes/fees are listed in Exhibit F14. The states are grouped based on the method of calculation used.

Exhibit F15, "Registration Fee Based on Value – Personal Property Taxes," gives a detailed explanation of this particular type of tax. Also included are other state examples of a registration fee based on value and mileage, respectively.

Exhibit F16, "Jurisdiction Shopping," discusses the concern regarding commercial vehicle's registering in other states.

F-1. CAPTURE EXISTING REVENUE

	TAX/FEE		CURRENT FUND	2010 COLLECTIONS (THOUSANDS of $)
1	Automobile Burglary and Theft Prevention Authority (ABTPA) Assessment	100%	General	
2	Motor Vehicle Gross Rental Receipts Tax	75%	General	$134,070
		25%	Foundation School	$44,690
3	Motor Vehicle Sales and Use Tax	100%	General	$2,319,959
			Property Tax Relief	$1,308
4	Motor Vehicle Seller-Financed Sales Tax	100%	General	$111,902
5	Motor Vehicle Sales and Use Tax Motor	100%	General	$2
6	Motor Vehicle Registration Surcharge	100%	TERP	$9,316
7	Motor Vehicle - T.E.R.P. Surcharge	100%	TERP	$8,299
8	Oil Production Tax	75%	General	$756,056
		25%	Foundation School	$252,019
9	Oil Regulation Tax	100%	General	$590
10	Oil Well Service Tax	75%	General	$19,988
		25%	Foundation School	$6,663
11	Petroleum Products Delivery Fee	2%	General	$581
	(repealed effective 09/01/11)	98%	Petrol Store Tnk	$28,448
12	School Fund Benefit Fee on Diesel Fuel	100%	General	$342
			Available School Fund Acct	
13	T.E.R.P. Off Road Heavy Duty Diesel Surcharge	100%	TERP	$26,770
14	Automotive Oil Sales Fee		General (Admin)	$50
		100%	Used Oil Recycling Acct	$1,622
15	Battery Sales Fee		General (Admin)	$721
		100%	Haz & Sol Wst Remed Acct	$17,314
16	Motor Vehicle Local Sports & Community	100%	Venue Project	$25
17	Oversize/ Overweight Permit Fees	Varies	General	$26,018
	TOTAL REVENUE RECAPTURED FROM GENERAL FUND:			**$3,370,279**
	TOTAL REVENUE RECAPTURED FROM FOUNDATION SCHOOL FUND:			**$303,371**
	TOTAL REVENUE RECAPTURED FROM TERP FUND:			**$44,385**
	TOTAL REVENUE RECAPTURED FROM OTHER ACCOUNTS:			**$48,716**
			TOTAL:	**$3,766,751**

F-2. STATE HIGHWAY FUND REVENUES DISBURSED TO OTHER AGENCIES	
AGENCY	2010 DISBURSEMENTS (THOUSANDS of $)
Department of Public Safety	$613,066
Attorney General	$7,566
Retirement/Comptroller	$221,196
Other (MHMR/ TDC/ Other)	$81,972
TOTAL DISBURSED TO OTHER AGENCIES:	**$923,799**

F-3. SYSTEM-WIDE SOLUTIONS[1]

			YEARLY YIELD (THOUSANDS):		ACTION NEEDED:	
1	Motor Fuel Tax	Index Tax	1% Increase	$20,000	Legislative	Tax Code, Title 2, §162
		Increase Tax	1¢/ Gallon	$152,000	Legislative	Tax Code, Title 2, §162
		Sales Tax of Fuel	Current Rates	$3,576,840	Leg/ Local	Tax Code, Title 2, §151, 162
2	Registration Fee	Increase	$20/ vehicle	$428,920	Legislative	Transportation Code, Title 7, Chapter 502
		Based on Value			Legislative	Transportation Code, Title 7, Chapter 502
3	Vehicle Fuel Equalization Fee	Based on Vehicles MPG rating		See Tables F-7 & F-8	Legislative	Transportation Code (New)
4	Energy Use Fee	Graduated User Fee Based on Vehicles' Energy Use, Indexed to Inflation			Legislative	Transportation Code (New)
5	Vehicle Property Tax/ Ad Valorem Tax	Min. $100*; Depreciated over 10 years	15-30% of Market Value	$2,144,600	Legislative	Tax Code, Title 1, §11.02
6	Motor Vehicle Luxury Tax	New Vehicles over $45,000	0.4% Yearly/ One-Time		Legislative	Tax Code, Title 2, §152
7	VMT Charge	1.35¢ per Mile (To Replace Fuel Tax)	0.1¢/ Mile	$200,000	Legislative	Tax Code, Title 2, §162
8	Statewide Sales Tax	Increase	1% Increase	$1,300,000	Legislative	Tax Code, Title 2, §151
9	Vehicle Sales Tax (6.25% of sales price)	Increase	1% Increase	$470,880	Legislative	Tax Code, Title 2, §152.021, 152.028, 152.121
10	Vehicle Related Sales Tax	Create (lubricants/ battery/ oil...)			Legislative	Tax Code, Title 2, §162
11	Freight Waybill Tax	Sales Tax on Freight Shipping Costs			Legislative	Tax Code, Title 2, §162
12	Carbon Tax	Increase Gas Tax	27.5¢/ Gallon	$1,700,000	Legislative	Tax Code, Title 2, §162
13	Value Added Tax					
14	Tire Fee	New Car and After Market Tires	$1/ Tire		Legislative	Tax Code, Title 2, §162
15	Drivers License Surcharge	Added to Current Fee	$5/License	$107,230	Legislative	Transportation Code, Title 7, Chapter 521
16	Weight Distance Tax	Ton-Based Tax or Ton-Mile Tax	1¢/ Ton		Legislative	Tax Code, Title 2, §162
17	Permit Fees	Increase	Varies By Permit		Legislative	Transportation Code

1- *"Findings and Analysis" Texas Transportation Funding Challenge*, Dye Management Group, Inc., 2009; *"Paying Our Way" A New Framework for Transportation Finance*, National Surface Transportation Infrastructure Financing Commission, 2009; "*A Guide to Transportation Funding Options*", University Transportation Center for Mobility, TTI; Greene, David, et. al., *Reducing Greenhouse Gas Emissions from U.S. Transportation*, Pew Center on Global Climate Change, 2010.

F-4. TARGETED SOLUTIONS[1]						
			YEARLY YIELD:		ACTION NEEDED:	
1	Increase Tolls	Current Facilities	10¢/ trip	$50,000,000	Local	
2	New Tolls (Electronically)	New/Existing Lanes			Legislative / Local	
3	Land Development Charge	Non-Residential Building Permits	1% Increase	$75,000,000	Legislative	Local Govt Code, Title 12, Chapter 395
4	Congestion Charge	Metro and Urban Areas	$15/ day	$500,000,000	Legislative	(New) Transportation Code
5	Transportation Reinvestment Zone	Bond Against Anticipated Increase		Varies	Local	
6	Container Fee	Houston/ Galveston	$30/ TEU	$24,000,000	Local	Create a Regional Mobility Authority in Houston Area
7	Local Option Tax	Sales Fuel Tax Vehicle/Property Tax Income	1% Increase 1¢/ Gallon	See Table F-5 See Table F-6	Local	Tax Code, Title 3, Sub C

1- *"Findings and Analysis" Texas Transportation Funding Challenge*, Dye Management Group, Inc., 2009; *"Paying Our Way" A New Framework for Transportation Finance*, National Surface Transportation Infrastructure Financing Commission, 2009; "*A Guide to Transportation Funding Options*", University Transportation Center for Mobility, TTI.

F-5. MPO LOCAL OPTION SALES TAX		
MSA	TAXABLE SALES (MILLIONS)	REVENUE PER 1% of TAXABLE SALES
Abilene	$1,512.22	$15.12
Amarillo	$2,674.80	$26.75
Austin-Round Rock	$20,554.77	$205.55
Beaumont-Port Arthur	$4,094.57	$40.95
Brownsville-Harlingen	$2,560.95	$25.61
Bryan-College Station	$2,070.05	$20.70
Corpus Christi	$4,097.97	$40.98
Dallas-Fort Worth-Arlington	$78,613.55	$786.14
El Paso	$5,765.65	$57.66
Houston-Sugar Land-Baytown	$73,143.69	$731.44
Killeen-Temple-Fort Hood	$2,714.35	$27.14
Laredo	$1,784.76	$17.85
Longview	$2,622.50	$26.23
Lubbock	$3,099.85	$31.00
McAllen-Edinburg-Mission	$5,105.98	$51.06
Midland	$2,612.60	$26.13
Odessa	$1,967.77	$19.68
San Angelo	$1,081.14	$10.81
San Antonio	$21,670.37	$216.70
Sherman-Denison	$1,001.02	$10.01
Texarkana	$857.06	$8.57
Tyler	$2,325.03	$23.25
Victoria	$1,306.44	$13.06
Waco	$2,031.20	$20.31
Wichita Falls	$1,264.84	$12.65
	TOTAL REVENUE:	$2,465.33

F-6. MPO LOCAL FUEL TAX 2012			
MPO	1¢ GASOLINE TAX REVENUE (MILLIONS)	1¢ DIESEL TAX REVENUE (MILLIONS)	TOTAL 1¢ FUEL TAX REVENUE (MILLIONS)
Abilene	$0.71	$0.41	$1.13
Amarillo	$0.96	$0.52	$1.48
Beaumont	$1.94	$0.92	$2.86
Brownsville	$0.51	$0.18	$0.69
Bryan/College Station	$0.74	$0.23	$0.97
Capital Area	$6.78	$2.31	$9.10
Corpus Christi	$2.03	$0.81	$2.84
El Paso	$2.48	$0.99	$3.47
Harlingen/San Benito	$0.76	$0.28	$1.04
Hidalgo	$2.24	$0.73	$2.97
Houston/Galveston	$23.61	$7.66	$31.27
Killeen/Temple	$1.52	$0.81	$2.33
Laredo	$0.63	$0.43	$1.05
Longview	$1.50	$1.02	$2.53
Lubbock	$0.99	$0.39	$1.39
Midland/Odessa	$1.04	$0.62	$1.65
NCTCOG	$25.52	$9.23	$34.75
San Angelo	$0.36	$0.13	$0.49
San Antonio	$8.04	$2.79	$10.83
Sherman/Denison	$0.60	$0.28	$0.88
Texarkana	$0.44	$0.43	$0.88
Tyler	$1.04	$0.54	$1.58
Victoria	$0.41	$0.27	$0.69
Waco	$1.13	$0.69	$1.82
Wichita Falls	$0.54	$0.29	$0.84
TOTAL	**$86.53**	**$33.00**	**$119.53**

F-7. VEHICLE FUEL EQUALIZATION FEE EXAMPLE CALCULATIONS

Gasoline

MODEL	FUEL EFFICIENCY***	GALLONS USED	ANNUAL STATE FUEL TAX	AMOUNT OVER BASE VEHICLE**
Base Vehicle*	22.8	658	$132	$0.00
2008 Ford Taurus	20.5	732	$146	$0.00
2005 Ford Focus	23	652	$130	$1.26
2008 Toyota Corolla	29	517	$103	$28.25
2008 Honda Civic	30	500	$100	$31.69
2009 Toyota Prius	50	300	$60	$71.69

*Base vehicle assumes 22.8 average miles per gallon fuel economy, with an average of 15,000 miles traveled

Diesel

MODEL	FUEL EFFICIENCY***	GALLONS USED	ANNUAL STATE FUEL TAX	AMOUNT OVER BASE VEHICLE**
Base Vehicle*	6.1	13,115	$2,622.95	$0.00
2010 Kenworth T700	7.9	10,127	$2,025.32	$0.00
2002 Kenworth T600	6.5	12,308	$2,461.54	$436.22
Mack CH613	6.8	11,765	$2,352.94	$0.00
Mack CH600	4.5	17,778	$3,555.56	$1,202.61

*Base vehicle assumes 6.1 average miles per gallon fuel economy, with an average of 80,000 miles traveled per year

** This is the amount in motor fuels tax that the vehicle owner does not normally pay due to increased fuel efficiency

***Combined city and highway fuel economy

F-8. ESTIMATED VEHICLE FUEL EQUALIZATION REVENUE		
YEAR	REVENUE (MILLIONS)	AVERAGE FEE FOR VEHICLES WITH "ABOVE AVERAGE" FUEL
2012	$0.00	$0.00
2013	$60.10	$5.01
2014	$124.40	$10.12
2015	$193.30	$15.35
2016	$267.30	$20.73
2017	$347.10	$26.29
2018	$433.20	$32.05
2019	$526.40	$38.06
2020	$627.80	$44.36
2021	$738.40	$51.00
2022	$859.70	$58.05
2023	$993.20	$65.57
2024	$1,141.00	$73.66
2025	$1,305.60	$82.42
2026	$1,478.20	$91.27
2027	$1,659.30	$100.22
2028	$1,849.30	$109.27
2029	$2,049.00	$118.46
2030	$2,258.80	$127.79
2031	$2,422.10	$134.10
2032	$2,577.00	$139.64
2033	$2,723.90	$144.47
2034	$2,863.00	$148.64
2035	$2,994.60	$152.21
2036	$3,118.80	$155.22
2037	$3,240.80	$157.94
2038	$3,360.40	$160.39
2039	$3,482.30	$162.79
2040	$3,606.80	$165.17

F-9. HOUSEHOLD COSTS[1]		
Revenue Type	**Rate**	**Average Annual Household Cost**
State Motor Fuel Tax[2]		
Gasoline	20¢/Gal	$180
	1¢/Gal	$9
	5¢/Gal	$45
	10¢/Gal	$90
Diesel	20¢/Gal	$180
	1¢/Gal	$9
	5¢/Gal	$45
	10¢/Gal	$90
Registration Fee	$50.75/Veh	$76
	$5/Veh	$8
	$25/Veh	$38
Vehicle Fuel Equalization Fee[3]		$23
Statewide Sales Tax Increase	1%	$134
Motor Fuel Sales Tax (Gasoline)[4]	6.25%	$151
	1%	$24
VMT Fee[5]	1¢/Mile	$180
Vehicle Property Tax/ Ad Valorem Tax[6]	2.400 Tax Rate	$300
Carbon Tax[2]	27.5¢/Gal	$248
Drivers License Surcharge[7]	$5/License	$8

[1] Estimated at 1.5 vehicles per household

[2] Assumed 12,000 annual miles with a fuel efficieny of 20 mpg

[3] Assumes an average midsize sedan combined fuel efficiency of 22.9 mpg.

[4] Fuel price is the annual statewide average obtained from the Energy Information

[5] Assumes 12,000 annual vehicle miles traveled

[6] Calculation based on a 2006 Ford Taurus SE with a suggested value of $8,325

[7] FHWA Highway Statistics Publication

F-10: TOTAL ANNUAL VEHICLE FEES AND TAXES (RANKED BY TOTAL FEES PAID)							
	Passenger						
	VEHICLE REGISTRATION FEE	PROPERTY TAX	OTHER VEHICLE TAX	GAS TAX RATE	AVERAGE ANNUAL GAS TAX (12,000 miles/yr)	TOTAL ANNUAL VEHICLE FEES	TOTAL FEES RANK
Connecticut	$62.50	$1,155.91	$0.00	0.250	$130.43	$1,348.84	1
Rhode Island	$30.00	$758.59	$0.00	0.300	$156.52	$945.11	2
South Carolina	$12.00	$363.34	$0.00	0.160	$83.48	$458.82	3
Mississippi	$27.75	$328.29	$0.00	0.184	$96.00	$452.04	4
New Hampshire	$43.20	$0.00	$285.84	0.196	$102.26	$431.30	5
Montana	$217.00	$54.79	$0.00	0.278	$144.78	$416.57	6
Missouri	$54.75	$265.44	$0.00	0.170	$88.70	$408.88	7
Maine	$35.00	$0.00	$214.38	0.284	$148.17	$397.55	8
West Virginia	$30.00	$190.56	$0.00	0.322	$168.00	$388.56	9
Nebraska	$75.50	$0.00	$162.00	0.260	$135.65	$373.15	10
Virginia	$38.75	$235.02	$0.00	0.175	$91.30	$365.08	11
Arkansas	$25.00	$223.91	$0.00	0.215	$112.17	$361.08	12
Colorado	$77.50	$0.00	$161.98	0.220	$114.78	$354.26	13
California	$77.00	$0.00	$182.62	0.180	$93.91	$353.53	14
Georgia	$20.00	$0.00	$290.61	0.075	$39.13	$349.74	15
Nevada	$33.00	$0.00	$190.08	0.240	$125.22	$348.30	16
Iowa	$222.32	$0.00	$0.00	0.210	$109.57	$331.89	17
Wyoming	$253.20	$0.00	$0.00	0.140	$73.04	$326.24	18
Utah	$43.50	$0.00	$150.00	0.245	$127.83	$321.33	19
Massachusetts	$50.00	$0.00	$158.80	0.210	$109.57	$318.37	20
Arizona	$8.00	$0.00	$193.14	0.180	$93.91	$295.05	21
Kentucky	$21.00	$154.99	$0.00	0.225	$117.39	$293.38	22
Minnesota	$175.05	$0.00	$0.00	0.225	$117.39	$292.44	23
Washington	$43.75	$0.00	$47.64	0.375	$195.65	$287.04	24
North Carolina	$28.00	$97.50	$0.00	0.302	$157.30	$282.81	25
Indiana	$21.05	$0.00	$156.00	0.180	$93.91	$270.96	26
Kansas	$39.00	$105.71	$0.00	0.240	$125.22	$269.93	27
Hawaii	$151.18	$0.00	$0.00	0.170	$88.70	$239.88	28
New York	$29.50	$0.00	$80.00	0.245	$127.57	$237.07	29
Wisconsin	$75.00	$0.00	$0.00	0.309	$161.22	$236.22	30
North Dakota	$93.00	$0.00	$0.00	0.230	$120.00	$213.00	31
Ohio	$34.50	$0.00	$20.00	0.280	$146.09	$200.59	32
Maryland	$77.50	$0.00	$0.00	0.235	$122.61	$200.11	33
Illinois	$99.00	$0.00	$0.00	0.190	$99.13	$198.13	34
Alabama	$23.00	$76.22	$0.00	0.180	$93.91	$193.14	35
Pennsylvania	$36.00	$0.00	$0.00	0.300	$156.52	$192.52	36
Idaho	$56.25	$0.00	$0.00	0.250	$130.43	$186.68	37
Michigan	$86.00	$0.00	$0.00	0.190	$99.13	$185.13	38
Tennessee	$24.00	$0.00	$55.00	0.200	$104.35	$183.35	39
Oklahoma	$92.50	$0.00	$0.00	0.170	$88.70	$181.20	40
Vermont	$68.00	$0.00	$0.00	0.210	$109.57	$177.57	41
South Dakota	$43.00	$0.00	$12.00	0.220	$114.78	$169.78	42
Oregon	$43.00	$0.00	$0.00	0.240	$125.22	$168.22	43
Texas	**$62.75**	**$0.00**	**$0.00**	**0.200**	**$104.35**	**$167.10**	**44**
New Mexico	$62.00	$0.00	$0.00	0.189	$98.48	$160.48	45
Delaware	$40.00	$0.00	$0.00	0.230	$120.00	$160.00	46
Alaska	$50.00	$0.00	$60.50	0.080	$41.74	$152.24	47
Florida	$70.75	$0.00	$0.00	0.156	$81.39	$152.14	48
New Jersey	$84.00	$0.00	$0.00	0.105	$54.78	$138.78	49
Louisiana	$16.00	$0.00	$0.00	0.200	$104.35	$120.35	50

*Assumptions made for calculations: All passenger fees based on a 2008 Ford Taurus SEL Sedan having a market value of $15,880, a curb weight of 3,643 lbs, and an average fuel economy of 23 mpg.

F-11. TOTAL ANNUAL VEHICLE FEES AND TAXES (RANKED BY REGISTRATION FEES)

	Passenger						
	VEHICLE REGISTRATION FEE	PROPERTY TAX	OTHER VEHICLE TAX	GAS TAX RATE	AVERAGE ANNUAL GAS TAX (12,000 miles/yr)	TOTAL ANNUAL VEHICLE FEES	REGISTRATION FEE RANK
Wyoming	$253.20	$0.00	$0.00	0.140	$73.04	$326.24	1
Iowa	$222.32	$0.00	$0.00	0.210	$109.57	$331.89	2
Montana	$217.00	$54.79	$0.00	0.278	$144.78	$416.57	3
Minnesota	$175.05	$0.00	$0.00	0.225	$117.39	$292.44	4
Hawaii	$151.18	$0.00	$0.00	0.170	$88.70	$239.88	5
Illinois	$99.00	$0.00	$0.00	0.190	$99.13	$198.13	6
North Dakota	$93.00	$0.00	$0.00	0.230	$120.00	$213.00	7
Oklahoma	$92.50	$0.00	$0.00	0.170	$88.70	$181.20	8
Michigan	$86.00	$0.00	$0.00	0.190	$99.13	$185.13	9
New Jersey	$84.00	$0.00	$0.00	0.105	$54.78	$138.78	10
Colorado	$77.50	$0.00	$161.98	0.220	$114.78	$354.26	11
Maryland	$77.50	$0.00	$0.00	0.235	$122.61	$200.11	11
California	$77.00	$0.00	$182.62	0.180	$93.91	$353.53	13
Nebraska	$75.50	$0.00	$162.00	0.260	$135.65	$373.15	14
Wisconsin	$75.00	$0.00	$0.00	0.309	$161.22	$236.22	15
Florida	$70.75	$0.00	$0.00	0.156	$81.39	$152.14	16
Vermont	$68.00	$0.00	$0.00	0.210	$109.57	$177.57	17
Texas	**$62.75**	**$0.00**	**$0.00**	**0.200**	**$104.35**	**$167.10**	**18**
Connecticut	$62.50	$1,155.91	$0.00	0.250	$130.43	$1,348.84	19
New Mexico	$62.00	$0.00	$0.00	0.189	$98.48	$160.48	20
Idaho	$56.25	$0.00	$0.00	0.250	$130.43	$186.68	21
Missouri	$54.75	$265.44	$0.00	0.170	$88.70	$408.88	22
Massachusetts	$50.00	$0.00	$158.80	0.210	$109.57	$318.37	23
Alaska	$50.00	$0.00	$60.50	0.080	$41.74	$152.24	23
Washington	$43.75	$0.00	$47.64	0.375	$195.65	$287.04	25
Utah	$43.50	$0.00	$150.00	0.245	$127.83	$321.33	26
New Hampshire	$43.20	$0.00	$285.84	0.196	$102.26	$431.30	27
South Dakota	$43.00	$0.00	$12.00	0.220	$114.78	$169.78	28
Oregon	$43.00	$0.00	$0.00	0.240	$125.22	$168.22	28
Delaware	$40.00	$0.00	$0.00	0.230	$120.00	$160.00	30
Kansas	$39.00	$105.71	$0.00	0.240	$125.22	$269.93	31
Virginia	$38.75	$235.02	$0.00	0.175	$91.30	$365.08	32
Pennsylvania	$36.00	$0.00	$0.00	0.300	$156.52	$192.52	33
Maine	$35.00	$0.00	$214.38	0.284	$148.17	$397.55	34
Ohio	$34.50	$0.00	$20.00	0.280	$146.09	$200.59	35
Nevada	$33.00	$0.00	$190.08	0.240	$125.22	$348.30	36
Rhode Island	$30.00	$758.59	$0.00	0.300	$156.52	$945.11	37
West Virginia	$30.00	$190.56	$0.00	0.322	$168.00	$388.56	37
New York	$29.50	$0.00	$80.00	0.245	$127.57	$237.07	39
North Carolina	$28.00	$97.50	$0.00	0.302	$157.30	$282.81	40
Mississippi	$27.75	$328.29	$0.00	0.184	$96.00	$452.04	41
Arkansas	$25.00	$223.91	$0.00	0.215	$112.17	$361.08	42
Tennessee	$24.00	$0.00	$55.00	0.200	$104.35	$183.35	43
Alabama	$23.00	$76.22	$0.00	0.180	$93.91	$193.14	44
Indiana	$21.05	$0.00	$156.00	0.180	$93.91	$270.96	45
Kentucky	$21.00	$154.99	$0.00	0.225	$117.39	$293.38	46
Georgia	$20.00	$0.00	$290.61	0.075	$39.13	$349.74	47
Louisiana	$16.00	$0.00	$0.00	0.200	$104.35	$120.35	48
South Carolina	$12.00	$363.34	$0.00	0.160	$83.48	$458.82	49
Arizona	$8.00	$0.00	$193.14	0.180	$93.91	$295.05	50

*Assumptions made for calculations: All passenger fees based on a 2008 Ford Taurus SEL Sedan having a market value of $15,880, a curb weight of 3,643 lbs, and an average fuel economy of 23 mpg.

F-12: TOTAL ANNUAL VEHICLE FEES AND TAXES (RANKED BY STATE GAS TAX RATE)

	Passenger						
	VEHICLE REGISTRATION FEE	PROPERTY TAX	OTHER VEHICLE TAX	GAS TAX RATE	AVERAGE ANNUAL GAS TAX (12,000 miles/yr)	TOTAL ANNUAL VEHICLE FEES	GAS TAX RATE RANK
Washington	$43.75	$0.00	$47.64	0.375	$195.65	$287.04	1
West Virginia	$30.00	$190.56	$0.00	0.322	$168.00	$388.56	2
Wisconsin	$75.00	$0.00	$0.00	0.309	$161.22	$236.22	3
North Carolina	$28.00	$97.50	$0.00	0.302	$157.30	$282.81	4
Pennsylvania	$36.00	$0.00	$0.00	0.300	$156.52	$192.52	5
Rhode Island	$30.00	$758.59	$0.00	0.300	$156.52	$945.11	5
Maine	$35.00	$0.00	$214.38	0.284	$148.17	$397.55	7
Ohio	$34.50	$0.00	$20.00	0.280	$146.09	$200.59	8
Montana	$217.00	$54.79	$0.00	0.278	$144.78	$416.57	9
Nebraska	$75.50	$0.00	$162.00	0.260	$135.65	$373.15	10
Connecticut	$62.50	$1,155.91	$0.00	0.250	$130.43	$1,348.84	11
Idaho	$56.25	$0.00	$0.00	0.250	$130.43	$186.68	11
Utah	$43.50	$0.00	$150.00	0.245	$127.83	$321.33	13
New York	$29.50	$0.00	$80.00	0.245	$127.57	$237.07	13
Oregon	$43.00	$0.00	$0.00	0.240	$125.22	$168.22	15
Kansas	$39.00	$105.71	$0.00	0.240	$125.22	$269.93	15
Nevada	$33.00	$0.00	$190.08	0.240	$125.22	$348.30	15
Maryland	$77.50	$0.00	$0.00	0.235	$122.61	$200.11	18
North Dakota	$93.00	$0.00	$0.00	0.230	$120.00	$213.00	19
Delaware	$40.00	$0.00	$0.00	0.230	$120.00	$160.00	19
Minnesota	$175.05	$0.00	$0.00	0.225	$117.39	$292.44	21
Kentucky	$21.00	$154.99	$0.00	0.225	$117.39	$293.38	21
Colorado	$77.50	$0.00	$161.98	0.220	$114.78	$354.26	23
South Dakota	$43.00	$0.00	$12.00	0.220	$114.78	$169.78	23
Arkansas	$25.00	$223.91	$0.00	0.215	$112.17	$361.08	25
Iowa	$222.32	$0.00	$0.00	0.210	$109.57	$331.89	26
Vermont	$68.00	$0.00	$0.00	0.210	$109.57	$177.57	26
Massachusetts	$50.00	$0.00	$158.80	0.210	$109.57	$318.37	26
Texas	**$62.75**	**$0.00**	**$0.00**	**0.200**	**$104.35**	**$167.10**	**29**
Tennessee	$24.00	$0.00	$55.00	0.200	$104.35	$183.35	29
Louisiana	$16.00	$0.00	$0.00	0.200	$104.35	$120.35	29
New Hampshire	$43.20	$0.00	$285.84	0.196	$102.26	$431.30	32
Illinois	$99.00	$0.00	$0.00	0.190	$99.13	$198.13	33
Michigan	$86.00	$0.00	$0.00	0.190	$99.13	$185.13	33
New Mexico	$62.00	$0.00	$0.00	0.189	$98.48	$160.48	35
Mississippi	$27.75	$328.29	$0.00	0.184	$96.00	$452.04	36
California	$77.00	$0.00	$182.62	0.180	$93.91	$353.53	37
Alabama	$23.00	$76.22	$0.00	0.180	$93.91	$193.14	37
Indiana	$21.05	$0.00	$156.00	0.180	$93.91	$270.96	37
Arizona	$8.00	$0.00	$193.14	0.180	$93.91	$295.05	37
Virginia	$38.75	$235.02	$0.00	0.175	$91.30	$365.08	41
Hawaii	$151.18	$0.00	$0.00	0.170	$88.70	$239.88	42
Oklahoma	$92.50	$0.00	$0.00	0.170	$88.70	$181.20	42
Missouri	$54.75	$265.44	$0.00	0.170	$88.70	$408.88	42
South Carolina	$12.00	$363.34	$0.00	0.160	$83.48	$458.82	45
Florida	$70.75	$0.00	$0.00	0.156	$81.39	$152.14	46
Wyoming	$253.20	$0.00	$0.00	0.140	$73.04	$326.24	47
New Jersey	$84.00	$0.00	$0.00	0.105	$54.78	$138.78	48
Alaska	$50.00	$0.00	$60.50	0.080	$41.74	$152.24	49
Georgia	$20.00	$0.00	$290.61	0.075	$39.13	$349.74	50

*Assumptions made for calculations: All passenger fees based on a 2008 Ford Taurus SEL Sedan having a market value of $15,880, a curb weight of 3,643 lbs, and an average fuel economy of 23 mpg.

F-13. PEER STATES COMPARISONS

Assumptions made for calculations: All passenger fees based on a 2008 Ford Taurus SEL Sedan having a market value of $15,880, a curb weight of 3,643 lbs, and an average fuel economy of 23 mpg.

Total Annual Vehicle Fees and Taxes For Peer States

	Passenger						
	Vehicle Registration Fee-Passenger	Property Tax	Other Vehicle Tax	Gas Tax Rate	Average Annual Gas Tax Paid (12,000 miles)	Total Annual Vehicle Fees	Total Fees Rank
California	$77.00	$0.00	$182.62	0.180	$93.91	$353.53	14
Georgia	$20.00	$0.00	$290.61	0.075	$39.13	$349.74	15
North Carolina	$28.00	$97.50	$0.00	0.302	$157.30	$282.81	25
New York	$29.50	$0.00	$80.00	0.245	$127.57	$237.07	29
Ohio	$34.50	$0.00	$20.00	0.280	$146.09	$200.59	32
Illinois	$99.00	$0.00	$0.00	0.190	$99.13	$198.13	34
Pennsylvania	$36.00	$0.00	$0.00	0.300	$156.52	$192.52	36
Michigan	$86.00	$0.00	$0.00	0.190	$99.13	$185.13	38
Texas	**$62.75**	**$0.00**	**$0.00**	**0.200**	**$104.35**	**$167.10**	**44**
Florida	$70.75	$0.00	$0.00	0.156	$81.39	$152.14	48

Gas Tax Rates

	Gas Tax Rate	Average Annual Gas Tax Paid (12,000 miles)	State Gas Tax Rate Rank
North Carolina	0.302	$157.30	4
Pennsylvania	0.300	$156.52	5
Ohio	0.280	$146.09	8
New York	0.245	$127.57	13
Texas	**0.200**	**$104.35**	**29**
Illinois	0.190	$99.13	33
Michigan	0.190	$99.13	33
California	0.180	$93.91	37
Florida	0.156	$81.39	46
Georgia	0.075	$39.13	50

Registration Fees

	Vehicle Registration Fee-Passenger	Registration Fee Rank
Illinois	$99.00	6
Michigan	$86.00	9
California	$77.00	13
Florida	$70.75	16
Texas	**$62.75**	**18**
Pennsylvania	$36.00	33
Ohio	$34.50	35
New York	$29.50	39
North Carolina	$28.00	40
Georgia	$20.00	47

F-14. TAX BASED ON[1]:

VALUE OF VEHICLE		AGE OF VEHICLE	
Alabama	Ad Valorem Tax	Alaska	Vehicle Registration Tax
Georgia	Ad Valorem Tax	New Hampshire	Town Permit Fee
Minnesota	Ad Valorem Tax	Utah	Uniform Age-Based Fee
Mississippi	Ad Valorem Tax	OTHER	
Montana	County Tax	Hawaii	County Tax (weight)
Indiana	Excise Tax	Illinois	Mileage Tax
Maine	Excise Tax	Ohio	Permissive Tax
Massachusetts	Excise Tax	New York	Vehicle Use Tax
Nevada	Governmental Services Tax	Nebraska	Wheel Tax
Arkansas	Property Tax	South Dakota	Wheel Tax
Connecticut	Property Tax		
Kansas	Property Tax		
Kentucky	Property Tax		
Louisiana	Property Tax		
Missouri	Property Tax		
North Carolina	Property Tax		
Rhode Island	Property Tax		
South Carolina	Property Tax		
Tennessee	Property Tax		
Virginia	Property Tax		
West Virginia	Property Tax		
Washington	Regional Transit Authority		
Wyoming	Registration Fee		
Colorado	Specific Ownership Tax		
California	Vehicle License Fee		
Arizona	Vehicle License Tax		

1. *Peck's Title Book*, Stephens-Peck, Inc. www.peckstitlebook.com, 2010.

2. Rubber Manufacturers Association, http://rma.org/scrap_tires/state_issues.

F-15. REGISTRATION FEE BASED ON VALUE - PERSONAL PROPERTY TAXES[3]

Source and History	A registration fee based on value can be structured as a personal property tax and be deductible from Federal income.
Yield, Adequacy and Stability	A fee on the value of a vehicle could raise substantial revenue, and could be structured to be deductible for Federal income tax purposes, thus increasing the state's revenue yield without an equal increase in net total tax payments.
Cost-Efficiency and Equity	Registration fees for light vehicles, if collected on a flat basis, are somewhat regressive by income class. Registration fees for light vehicles on the basis of value are progressive.
Economic Efficiency	Basing registration fees on value could improve their efficiency somewhat since newer vehicles tend to be driven more than older vehicles.
Potential Applicability at Program or Project Level	Levying fee on the basis of a vehicle's value would not change the overall applicability of registration fees.
Potential Acceptability	Registration fees (in actuality, personal property taxes on vehicles) based on value have the best revenue generating potential and are less costly to taxpayers in the state.
Implementation Issues and Potential Strategies to Overcome Barriers	Some states have recently eliminated or reduced such fees despite their advantages in comparison to collecting other state taxes that are not deductible for federal income tax purposes.

3. *A Guide to Transportation Funding Options*, University Transportation Center for Mobility, utcm.tamu.edu/tfo.

EXAMPLE OF REGISTRATION FEE BASED ON VALUE:

Wyoming- Registration Fee Calculations[1]

Registration Fees-Consist of a county fee and a flat state fee.

County Fee-Computed as follows or $5.00, whichever is greater:

1st year of service..................................3% x 60% of factory price
2nd year of service.................................3% x 50% of factory price
3rd year of service ....3% x 40% of factory price
4th year of service..................................3% x 30% of factory price
5th year of service..................................3% x 20% of factory price
6th+ year of service ....3% x 15% of factory price

Equalized Highway Use Tax- (Commercial Vehicles)

Collected ***in lieu of the county registration fee*** for commercial vehicles or fleets proportionally registered, upon option of commercial vehicle registrant.

Vehicle or Combination Gross Vehicle Weight in Pounds

Up to 26,000	$ 80.00	52,001-54,000	$ 750.00
26,001-28,000	100.00	54,001-56,000	800.00
28,001-30,000	150.00	56,001-58,000	850.00
30,001-32,000	200.00	58,001-60,000	900.00
32,001-34,000	250.00	60,001-62,000	950.00
34,001-36,000	300.00	62,001-64,000	1,000.00
36,001-38,000	350.00	64,001-66,000	1,050.00
38,001-40,000	400.00	66,001-68,000	1,100.00
40,001-42,000	450.00	68,001-70,000	1,150.00
42,001-44,000	500.00	70,001-72,000	1,200.00
44,001-46,000	550.00	72,001-74,000	1,250.00
46,001-48,000	600.00	74,001-76,000	1,300.00
48,001-50,000	650.00	76,001-78,000	1,350.00
50,001-52,000	700.00	78,001-80,000*	1,400.00

* For vehicles over 80,000 lbs. add $50.00 for each additional 2,000 lbs. or fraction thereof over 80,000 lbs

1. *Peck's Title Book*, Stephens-Peck, Inc. www.peckstitlebook.com, 2010.

EXAMPLE OF REGISTRATION FEE BASED ON MILEAGE:

Illinois- Mileage Tax Registration Fee[2]

Commercial Vehicles-Trucks, truck tractors, and trailers that operate in-state only may pay Mileage Tax Registration in lieu of Flat Weight Registration. (Farm operators with more than five (5) farm plates may pay Flat Weight Registration or Mileage Tax Registration.)

Truck Mileage Tax Registration Fee

Gross Vehicle Weight (lbs.)	Minimum Fee	Mileage Max	Excess Mileage Per Mile
12000 or less	$95.00	5,000	0.026
12,001-16,000	$149.00	6,000	$0.034
16,001-20,000	$218.00	6,000	$0.046
20,001-24,000	$281.00	6,000	$0.063
24,001-28,000	$372.00	7,000	$0.063
28,001-32,000	$452.00	7,000	$0.083
32,001-36,000	$567.00	7,000	$0.099
36,001-40,000	$715.00	7,000	$0.128
40,001-45,000	$807.00	7,000	$0.139
45,001-54,999	$987.00	7,000	$0.156
55,000-59,500	$1,064.00	7,000	$0.178
59,501-64,000	$1,138.00	7,000	$0.195
64,001-73,280	$1,353.00	7,000	$0.225
73,281-77,000	$1,531.00	7,000	$0.258
77,001-80,000	$1,630.00	7,000	$0.275

Trailer Mileage Tax Registration Fee

Gross Weight (lbs)	Minimum Fee	Max Mileage	Per-Mile for Excess Mileage
14000 or less	$98.00	5,000	$0.031
14,001-20,000	$166.00	6,000	$0.036
20,001-36,000	$629.00	7,000	$0.103
36,001-40,000	$870.00	7,000	$0.150

* These fees do not include a $20.00 Alternate Fuel Fee for owners registering any combination of ten (10) or more of these vehicle types in Cook, DuPage, Kane, Lake, McHenry, or Will counties or in parts of Grundy and Kendall counties.

2. *Peck's Title Book*, Stephens-Peck, Inc. www.peckstitlebook.com, 2010.

F-16: JURISDICTION SHOPPING

The International Registration Plan is a vehicle registration reciprocity agreement that allows commercial vehicles to be registered in a single jurisdiction rather than in all jurisdictions through which they travel. The registration fees are apportioned to other states based on the percentage of miles they travel in each jurisdiction.

One concern associated with the IRP is companies attempting to profit from jurisdictions with more lenient registration policies or lower taxes and fees by headquartering their businesses or registering their vehicles in other states. This "jurisdiction shopping" can result in lost revenue for states with higher fees or more stringent procedures.

In 2002 the IRP ruled in favor of the state of Illinois in a dispute against Oklahoma stating that Oklahoma's vehicle registration regulations violated the plan by improperly allowing for the use of estimated mileage charts that skewed mileage calculations to favor jurisdictions that impose lower fees and not requiring registrants to meet the requirements for having an established place of business. In 2003 thirteen others states filed a similar complaint stating that Oklahoma's noncompliance hurt them financially. Oklahoma was forced to change their regulations and make reparations.

In 2003 the Texas Transportation Institute published a report[1] comparing the commercial registration practices of Texas with peer states. Some of the areas where Texas proved to be less attractive are listed below:

	Plates	Ad Valorem Tax or Similar Charge	IRP/IFTA Administration	Industry Views
Alabama $780[2]	Issued every 3 to 4 years	20% of market value of vehicle multiplied by local millage rate	Joint IPR and IFTA audits when possible. Separate offices. Mileage totals are not cross checked unless carrier is audited.	IRP registration system is not user friendly. Plate issuance is too frequent.
California $1,700	Permanent	2% Vehicle License Fee in lieu of ad valorem or property tax	Separate offices for IRP and IFTA. No joint audits.	IRP registration and renewal is problematic. Antiquated technology and outdated paper-based systems. Temp permits used too long because of backlogs.
Illinois $3,795	Permanent	None	Separate IRP and IFTA audits. IRP and IFTA mileage reports are not compared at time of registration.	IRP registration among the costliest in nation and not user-friendly.

Indiana $1,350	Permanent	Ad valorem tax exemption for rolling stock registered in state	One-stop shop. IRP and IFTA handled by same office. Joint audits are conducted.	One-stop shop initiative is well received. User-friendly.
Nebraska $1,280	Permanent	For-hire carriers exempt	Joint IRP and IFTA audits. One-stop shop.	IRP registration process is user-friendly.
North Carolina $963	Permanent	Ad valorem tax rate varies by county	IRP and IFTA are handled by separate offices. No joint audits. Mileage is not compared.	IRP registration process is inconvenient.
Oklahoma $954	Permanent	Motor carriers exempt	IRP and IFTA operated out of the same office and joint audits are conducted.	IRP process is receiving positive feedback.
Oregon $320+	Permanent	None	No joint IRP and IFTA audits. Mileage is only compared in audits.	Weight-distance tax complicates IRP registration and frustrates apportioned carriers.
Tennessee $1,366	Permanent	Common carriers exempt	IRP and IFTA handled by same office. Joint audits are common.	General satisfaction reported.
Texas $840	Issued every 5 to 7 years	Ad valorem tax rate varies by county and is not apportioned	Separate offices handle IRP and IFTA.	Frequent issuance of plates imposes additional costs and administrative burden on carriers. Non-apportioned ad valorem tax and lack of online registration/renewal opportunities are drawbacks.

Overall State Ranking (best to worse):	
Oklahoma	1
Tennessee	2
Illinois	3
Nebraska	4
Iowa	5
Utah	6
Indiana	7
Missouri	8
Oregon	9
Texas	**10**
Arkansas	32
Louisiana	33
New Mexico	38

Truck Regulatory Cost Ranking (low to high):	
Alaska	1
Georgia	2
Oklahoma	3
South Carolina	4
Hawaii	5
New Hampshire	6
District of Columbia	7
Louisiana	8
Alabama	9
New Jersey	10
Texas	**11**

1. Jasek, Debbie, et. al., *Heavy Truck Registration in Texas, Texas Transportation Institute, 2003.*
2. Dollar amounts reflect registration fees as of 2003.

APPENDIX G – ESTIMATING VEHICLE OPERATING COSTS AND PAVEMENT DETERIORATION

by
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In 1952, the American Association of State Highway Officials recommended that an economic approach based on engineering and user costs be used for state highway planning—a decision that formed the basis of three decades of subsequent research and cost-benefit model development.[1] In developing countries, the emphasis at that time was on building all-weather gravel highways and subsequently calculating the timing of paving these roads based on their economic impacts to users of all types. Texas built much of the all-weather rural system in the 1930s and 1940s so state cost-benefit work in the 1950s was focused on increasing highway capacity and linking the existing system with the planned National System of Interstate and Defense Highways or Interstate System, signed into law in June 1956.

Cost-benefit analysis is used in a variety of ways, from a high level network perspective to an optimizing project level analysis. It compares, in its basic form, the investment costs needed to efficiently move a given level of traffic and its projected growth, over the life of the project.[2] Investment costs comprise the capital costs of building the highway, costs of routine maintenance and rehabilitation (M&R) activities, and the costs of reconstruction at the end of its useful life. Many miles of the rural TxDOT on-system were built over 60 years ago demonstrating that many sections of a large system, such as in Texas, exhibit *equilibrium* where the lane miles being reconstructed broadly equals the lane miles nearing the end of their life cycle.[3] This desirable feature, however, is critically dependent on effective pavement and bridge maintenance. The main focus of any maintenance management cost-benefit model then is to calculate the level of funding necessary to reach this equilibrium and the consequences of moving from this position, particularly if adequate funding is not being provided.

Box 1: Users Dominate Highway Cost Analyses

On a highway with traffic levels of 1,000 vehicles per day, users account for over 80 percent of the total discounted costs for a 20 year life cycle.

Highway Design and Maintenance Model (HDM III)

User costs are critical because they measure the benefits derived from well designed and maintained highways. Moreover, on roads with an average daily traffic level exceeding 1,000

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[1] In highway engineering circles it became known as the "Red Book."
[2] Typically this was 20 years, which has grown as the system became mature. Metropolitan cycles are now at least 40 years, similar to the planned life of the typical bridge.
[3] The sections in equilibrium are largely rural, reflecting the focus on congestion and mobility at the 25 Texas MPOs where traffic demand continues to grow.

vehicles, user cost dwarfs total highway costs over the life of the pavement (see Box 1). User costs are particularly critical in Texas, for commuting, social mobility, and moving freight. The latter underpins much of the Texas economy and trucking accounts for over 70 percent of the ton-miles moved by all freight modes in the state. Simply put, failure to maintain good highways has been shown, over the past three decades, to raise operating costs, freight rates, and prices levels to all consumers. A recurring theme of many of the 2030 recommendations is that one way or another, highway costs will be paid in full and straying from the path of the best allocation—that of efficient maintenance management—increases and transfers costs to other parts of the transportation system, particularly users.

Highways and its users exhibit a basic law of physics[4] where the vehicle motion—particularly when it is a loaded truck—consumes the pavement while the pavement wears out the vehicle. When the pavement is kept in good condition, vehicle wear is light. When the vehicle exceeds the design of the pavement, the vehicle consumes a significant portion of pavement life and accelerates its deterioration. The pavement surface, when it becomes deteriorated then damages the vehicle, causing operating costs to rise, speeds to drop, and the price of transportation services to rise. This is the economic reason for regular, appropriate, and timely pavement maintenance. But what happens if maintenance funding falls, over several consecutive years, below the levels required to maintain the desired levels of service?

The consequences can be modeled at a macro level by taking models established by peer-reviewed research[5] describing the relationships between highway design characteristics and vehicle costs. For the purposes of this report, this is done with the following assumptions.

1. The pavement data for the percentages of the TxDOT on-system in good, fair, and poor conditions are provided by the pavement section of this study. The condition is expressed using the Pavement Serviceability Index[6] (PSI) where good is greater than 3.5, fair ranges between 2.0 and 3.5, and poor is less than 2.0.
2. The PSI values were based on undertaking structured maintenance constrained by an annual budget of $2 billion in 2010 prices.
3. The costs were calculated in financial terms and included taxes and transfers.
4. Four vehicle class costs were estimated—autos, light delivery trucks, three-axle heavy rigid trucks, and Class 9 trucks (the large 80,000 lb semi-trailer trucks seen on Texas interstates)—on state freight corridors and rural connectors.
5. Average annual mileage is critical when calculating operating costs—particularly the fixed cost elements like depreciation—and conservative estimates were used to ensure that cost impacts were not exaggerated. The annual mileages are autos 12,000; light delivery trucks 45,000; three axle trucks 50,000; and Class 9 trucks 100,000 miles.

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[4] The third of the 1697 Newtonian laws of motion is apt "For any action there is an equal and opposite reaction."
[5] HDM III and IV models – sponsored by World Bank and Asian Development Bank, respectively. See also Zaabar and Chatti "Calibration of HDM-4 Models for Estimating the Effect of Pavement Roughness on Fuel Consumption for U.S Conditions," TRR Number 2155 TRB 2010.
[6] A measure of pavement condition, first established at the ASSHO Road Test Experiment in 1958. It ranges from 0 to 5 on a bad to good scale. A new pavement should be around 4.75.

6. The operating costs are calculated for free flow operations and do not capture the effects of congestion. This is to avoid double-counting since the section addressing mobility needs will report congestion impacts as part of its activities.
7. Finally, the trucking estimates were validated with staff from a large Texas fleet operator to ensure output reflected average Texas operations.

The team worked closely with staff at the new Department of Motor Vehicles (DMV) to establish the size of Texas registered vehicles in various categories. This preliminary section of the 2030 report provides data on two main vehicle categories at this time—autos and heavy tractors (of the type used haul semi-trailers,[7] sometimes termed 18-wheelers). Approximate estimates are used in this report—17 million autos/pick-ups and 100,000 tractors registered in Texas.[8]

AUTOS AND HEAVY TRUCKS

Exhibit G1 shows the incremental costs incurred by the Texas registered auto/pick-up fleet owners as pavements over which they operate deteriorate from current (green) to fair (blue) and then poor (red) standards.

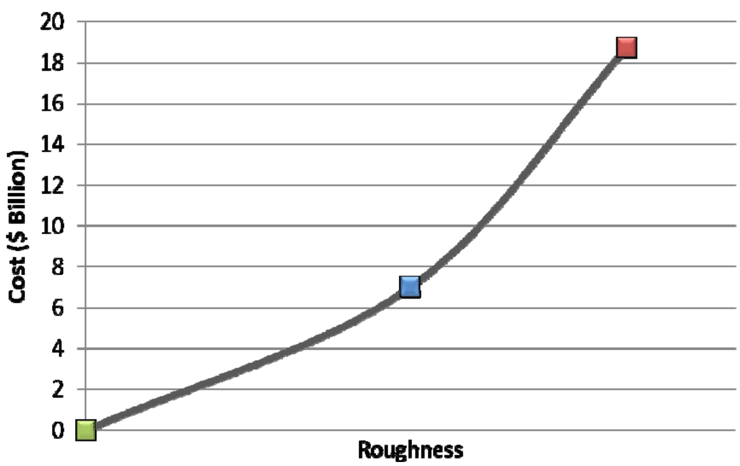

Exhibit G1. Incremental Auto/Pick-up Costs Incurred by Texas Motorists.

Exhibit G2 shows the same incremental costs for the Texas-registered heavy trucks. Operating cost-pavement condition relationships are always non-linear when the range of roughness is large. The actual shape of the curves is determined by economic factors, including the timing of new vehicle purchasing. If, for example, state highways deteriorate and vehicle damage rises, owners will change truck specifications when it comes time to purchase a replacement. This predictable reaction gives rise to short- and long-run cost curves that describe the economic response graphically.

[7] Roughly equivalent to the FHWA Class 9 vehicle classification.
[8] While the auto number is close to actual numbers of vehicles seen on Texas highways, the number of tractors is much smaller (perhaps 25 percent) of the actual trucks working in, or passing through, Texas on any given day.

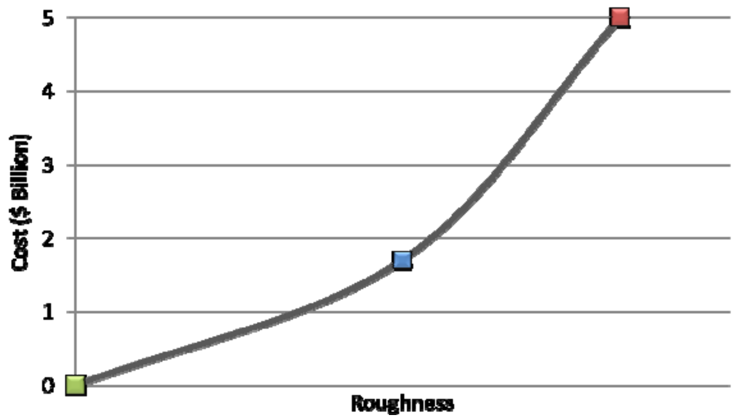

Exhibit G2. Incremental Costs for the Texas Registered Heavy Trucks.

In the two examples shown, the total annual cost for auto owners and heavy truck operators is $9 billion (at 2010 prices) if highways move to an overall score of fair. If deterioration falls to an overall score of poor, the number increases to $24 billion. Recall that these estimates are marginal costs—that is they are the extra costs users will pay over and above the current prices. These numbers, when entered into economic evaluation models, translate into high cost-benefit ratios and internal rates of return that justify efficient highway pavement and bridge maintenance strategies. This supports a key 2030 finding that maintaining good levels of pavement and bridge conditions is a desirable and efficient policy objective of any state Department of Transportation such as TxDOT.