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16. Abstract
The purpose of the Truck Facility Guidebook is to assist TxDOT engineers in understanding and replicating the process used by researchers to determine the need for truck treatments. This Guidebook provides criteria to assist TxDOT in choosing among the three types of truck facilities: 1) lane restrictions, 2) dedicated truck lanes, and 3) exclusive truck roadways. The Guidebook primary focuses on the third type, exclusive truck roadways, and guides users through a nine-step process to determine the need for these facilities. The nine steps follow.
- Step 1: Acquire truck and non-truck volume.
- Step 2: Predict future truck and non-truck volume.
- Step 3: Determine desired level of service.
- Step 4: Determine number of truck roadway lanes.
- Step 5: Acquire crash data and estimate crash costs.
- Step 6: Determine initial construction cost.
- Step 7: Determine costs of delay and fuel consumption.
- Step 8: Determine user perspectives and other measures of acceptability.
- Step 9: Total all benefits and costs.

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STRATEGIES FOR SEPARATING TRUCKS
FROM PASSENGER VEHICLES: TRUCK FACILITY GUIDEBOOK

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ACKNOWLEDGMENTS

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TRUCK FACILITY GUIDEBOOK

1.0 INTRODUCTION

The Truck Facility Guidebook provides criteria to assist TxDOT in choosing among the three types of truck facilities: 1) lane restrictions, 2) dedicated truck lanes, and 3) exclusive truck roadways. For purposes of this research, the definitions of these three treatments are as follows:

- Truck lane restrictions: On roadways with three or more lanes by direction (excluding frontage roads), TxDOT or a municipality can restrict trucks to or from certain lanes. Municipalities must get approval from TxDOT to restrict trucks by lanes. The restriction is typically from the left lane(s), keeping trucks in the rightmost two lanes. The lanes in which trucks can legally operate also allow non-trucks.

- Dedicated truck lanes: On freeways with at least four or more lanes by direction there would be two of these lanes dedicated solely to trucks (no non-trucks allowed). The reason for the minimum number of four is that both sets of lanes (one for trucks and one for non-trucks) must provide for passing. The separation between the truck and non-truck lanes could be nothing more than pavement markings or it could be a rumble strip, but it could still allow vehicles to cross in case of emergency. Some limited high-occupancy vehicle (HOV) lanes in Texas used a similar design, although vehicles crossing the separation strip during non-emergencies were a serious problem resulting in discontinuing their use.

- Exclusive truck roadways: Also referred to as exclusive truck facilities or truckways, truck roadways are designed and intended for the exclusive use of trucks. There are no non-trucks allowed on this facility under normal circumstances. It is barrier-separated and parallel to the non-truck facility built structurally and geometrically for trucks.

From this point forward, this document deals almost exclusively with truck lane restrictions and exclusive truck roadways.

2.0 PURPOSE OF GUIDEBOOK

The purpose of the Guidebook is to assist TxDOT engineers in understanding and replicating the process used by researchers to determine the need for truck treatments. It is written with the understanding that TxDOT uses CORSIM to analyze specific segments of freeway even though TTI used VISSIM in the research.

3.0 ORGANIZATION OF THE GUIDEBOOK

The Guidebook is intended to be instructive, providing the necessary information to guide an agency through a logical and methodical process to: 1) determine if a truck treatment is needed, 2) determine which treatment best fits a particular situation, and 3) provide some guidance on the timing of the implementation. It begins with the criteria that should be

considered, followed by a series of state maps showing corridors which are likely to need truck treatments over the next 20 or so years. The next step introduces the use of truck facility analysis tools developed as part of this research. These tools guide the decision-maker in the initial decision of whether a truck facility is needed. In many cases, there will still need to be some modeling of specific conditions, probably using CORSIM. The Appendices contain information on lane restrictions, level of service graphs, case study crash details, and information to assist users in the setup of CORSIM to simulate truck roadways.

4.0 PRIMARY TEXAS TRUCK CORRIDORS

Figure 1 shows thicker lines for the routes throughout the state that have truck traffic (base year 2002) exceeding an average annual daily truck traffic (AADTT) of 1000 trucks per day. At this low threshold, the only truck treatment which would probably be warranted is lane restrictions. Figure 1 also indicates the 2002 AADTT by line width and color; other maps will show future truck volumes. The definition of trucks includes only Class 5 and above in the Texas 6 classification scheme, which is vehicles with three or more axles.

5.0 CHOOSING THE APPROPRIATE TREATMENT

This section contains information on some of the criteria that need to be considered. There may be site-specific conditions which go beyond this list or there may be local policies that preclude some treatments. In some cases, right-of-way to build exclusive truck roadways would be too expensive and so would elevated structures.

5.1 Criteria for Lane Restrictions

A previous TTI study *(1)* developed the following guidelines for implementing truck lane restrictions. At that time, the applicable legislation passed in May 2003 by the 78th Texas Legislature broadened the powers of TxDOT and other agencies to establish lane restrictions and exclusive lanes. Based on the report and its application, the following list should be considered.

- The roadway should first meet the requirements of Texas Transportation Code Section 545.0651 or 545.0652 (See Appendix A).
- The minimum number of trucks in the traffic stream is 4 percent (defined as 3 or more axles) for every hour of a continuous 24-hour period.
- At least 10 percent of the total number of trucks currently using the lane from which trucks will be restricted (usually the left inside lane).
- Begin or end the restriction a minimum of 1 mile from the nearest entry or exit ramps to allow sufficient distance for traffic to enter or exit the lane.
- The minimum continuous length of the restriction should be 6 miles.
- Place signs at 1-mile intervals throughout the restricted area to notify trucks that might enter at any point along the restriction. Placement should include right side, overhead, and left side locations to maximize visibility.
- The law applies to three-or-more axle vehicles and to truck tractors regardless of whether they are pulling a trailer.

AADTT

——	< - 1,000
——	1,000 - 5,000
——	5,000 - 10,000
——	10,000 - 25,000
——	25,000 - 50,000
——	50,000 - 98,333

Miles
0 25 50   100   150
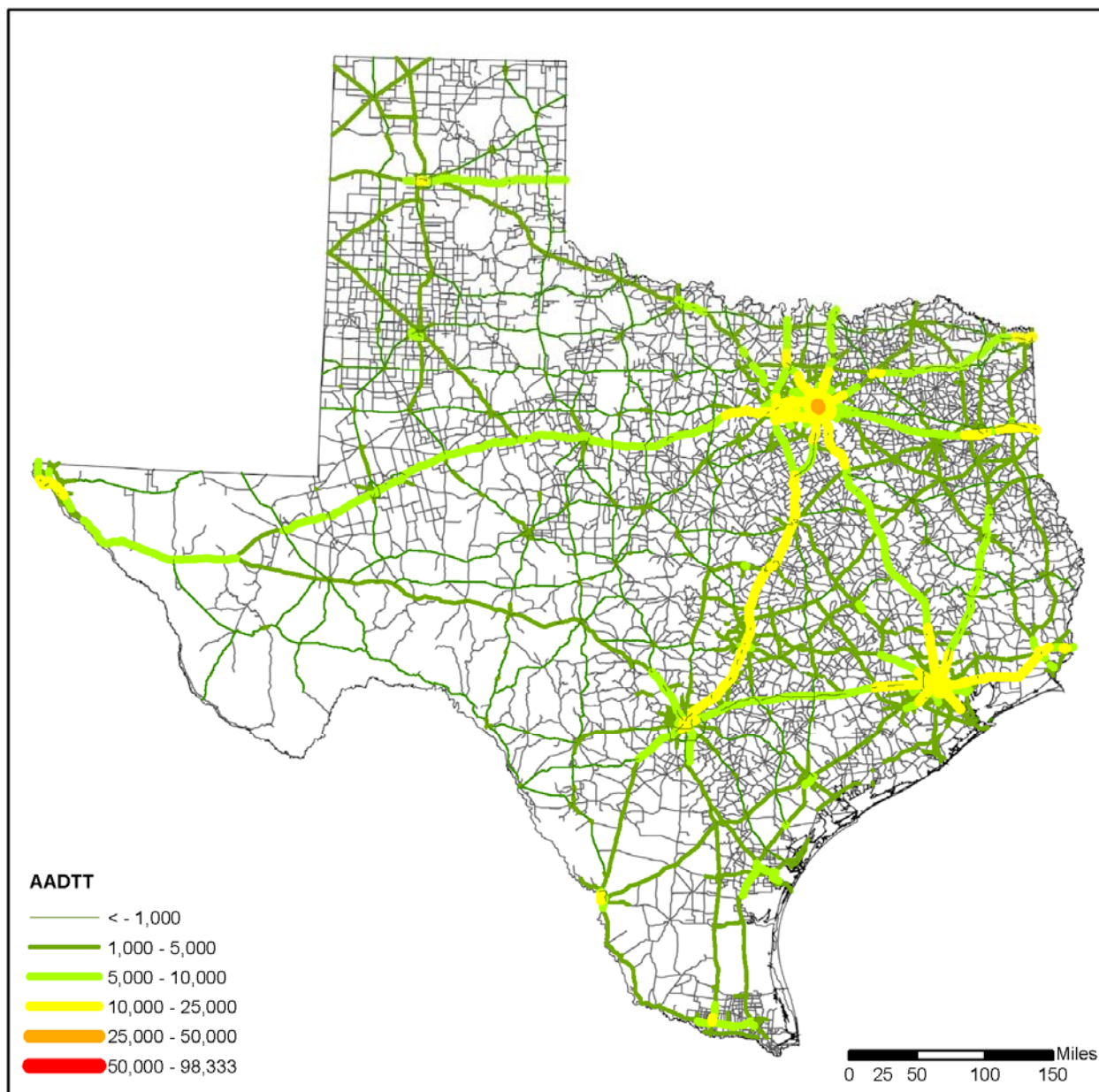
Figure 1. Highway Network with at Least 1000 Trucks/Day and 2002 AADTT.

There are also several considerations for the implementing agency. First, it should complete a brief overview of the local freeway system to develop an overall plan for implementation of lane restrictions (where guidelines are met). The agency should also continue to monitor truck and non-truck volumes and operations following implementation of lane restrictions to ensure that the minimums continue to be met and that other changes are detected in a timely manner. The agency should encourage enforcement to actively monitor the roadway segments to maximize compliance of the lane restrictions. Finally, the implementing agency should undertake a public information campaign to inform the public, with special emphasis on truck drivers who utilize the freeway(s) under study.

5.2 Criteria for Dedicated Truck Lanes

This research project did not attempt to develop criteria for dedicated truck lanes because of potential safety issues. TTI recently published results of research project 0-4434, "Safety Evaluation of HOV Lane Design Elements," in which findings indicate significantly increased crash rates on freeways with HOV facilities not separated by barriers. For example, on I-35E in Dallas, the crash rate increased from 32 to 50 crashes per hundred million vehicle-miles traveled after the HOV lanes opened in 1996. Also, on the LBJ Freeway (I-635), the rate increased from 44 to 62 after the HOV lanes opened in 1997. There is other evidence from southern California showing increases of over 10 percent where HOV lanes were not separated by barriers. These lanes are tempting to non-HOV motorists stuck in congested traffic if there is no positive separation or if strict enforcement and heavy fines are not imposed *(2, 3)*.

5.3 Criteria for Exclusive Truck Roadways

The following bullet list provides the components of the evaluation framework followed by a discussion of each and general ranges for some criteria to help decision-makers determine general needs for exclusive truck roadways.

- Step 1: Acquire truck and non-truck volume.

- Step 2: Predict future truck and non-truck volume.

- Step 3: Determine desired level of service.

- Step 4: Determine number of truck roadway lanes.

- Step 5: Acquire crash data and estimate crash costs.

- Step 6: Determine initial construction cost.

- Step 7: Determine costs of delay and fuel consumption.

- Step 8: Determine user perspectives and other measures of acceptability.

- Step 9: Total all benefits and costs.

5.3.1 Acquire Truck and Non-Truck Volume

Use the Transportation Planning and Programming (TPP) Division's latest vehicle classification counts for the corridor. Begin by defining vehicles by type that will be allowed to use the facility. Typically vehicles with three or more axles are the ones that will have the greatest impact on inter-city corridors whereas delivery vehicles which have two axles have a much greater impact in urban areas.

5.3.2 Predict Future Truck and Non-Truck Volume

General truck growth rates of 1 percent to 5 percent per year can be expected in a reasonably strong economy. Historical growth values are good predictors of future growth along with knowledge of the corridor. TxDOT's Statewide Analysis Model (SAM) is also a good tool for estimating future growth on corridors. Again, TPP is the responsible agency. Locations of major truck traffic generators along with national and international trends are also critical for accurate predictions pertaining to long design periods. Analysts extracted the starting and ending years (using as many relevant years as TPP could provide) as well as the corresponding truck traffic volumes, and calculated an equivalent constant annual growth rate using the following equation:

$$i = \left[\frac{AADTT_e}{AADTT_s} \right]^{\frac{1}{n-1}}$$

where,

i = equivalent constant annual growth rate,
$AADTT_s$ = AADTT for starting year,
$AADTT_e$ = AADTT for ending year, and
n = number of years between starting year and ending year.

5.3.3 Determine Desired Level of Service

In the context of the Trans Texas Corridor, truck roadways will generally serve intercity corridors and will generally avoid urban areas. Therefore, the desired LOS in the design year (usually 20 years hence) will be LOS C to LOS E. Use simulation results to determine LOS under expected 20-year conditions. This research project used VISSIM to determine LOS values based on prevailing vehicle characteristics, terrain factors, interchange spacing, and truck volume. Table 1 provides the LOS E (capacity) values for a variety of terrain and interchange spacing. Determining the appropriate LOS then requires using Highway Capacity Manual *(4)* (HCM) volume-to-capacity *(v/c)* values as indicated in the next step below.

5.3.4 Determine Number of Truck Roadway Lanes

Truck roadways should have a minimum of two lanes in each direction to facilitate passing; otherwise, motor carriers will not use them. To some degree, the design LOS and projected truck volume will determine the need for truck facilities. A discussion of other factors comes later. Using Tables 2 and 3, one can determine the truck demand that must exist before building a two-lane truck roadway (based on truck volume alone). This example assumes 70 mph design speed, two or five interchanges per 20 miles, gently rolling terrain (typical Texas terrain), and one-third of truck volume entering and exiting at interchanges. LOS E, or capacity, is 1125 trucks per lane per hour for two interchanges per 20 miles and 1175 trucks per lane per hour for 5 interchanges per 20 miles. The VISSIM simulation input used a percent of mainline volume exiting and entering, so fewer interchanges result in higher ramp volumes. Scaling the other LOS

Table 1. Truck Facility Capacity (t/h/l [a]) Modeling Results from VISSIM.

Geometry (Case) Description	Grade	Longitudinal Coverage of Grade (%)	Interchanges Per 20 Miles		
			0	2 [a] (higher volume per ramp)	5 [b] (lower volume per ramp)
Level	0	0	1475	1175	1200
Low Grades/Gently Rolling	2	20	1425	1125	1175
Low Grades/Rolling	2	40	1425	1125	1175
High Grades/Gently Rolling	4	20	1225	1100	1075
High Grades/Rolling	4	40	1200	1050	1025

[a] t/h/l = trucks per hour per lane
[b] Interchange volume fixed at a level where 1/3 of mainline volume exits/enters over the 20-mile simulation; where fewer interchanges are present, ramp volumes are higher.

Table 2. Maximum AADTT for Four Lanes by LOS.

LOS	Two Ramps per 20 miles	Five Ramps per 20 miles
A	24,000	25,067
B	39,750	41,517
C	55,500	57,967
D	67,500	70,500
E	75,000	78,333

Table 3. Maximum AADTT for Six Lanes by LOS.

LOS	Two Ramps per 20 miles	Five Ramps per 20 miles
A	36,000	37,600
B	59,625	62,275
C	83,250	86,950
D	101,250	105,750
E	112,500	117,500

values to maximum service flows uses the HCM values for *v/c*. Developing daily two-way truck volumes assumes 50 percent directional splits and 6 percent peak hour factors. Tables 2 and 3 provide the maximum AADTT values by LOS for four- and six-lane truck roadways for the assumed conditions of terrain, interchange spacing and entering/exiting volumes.

Based on this example and perhaps 20-year projections for the design year, decision-makers would probably not plan on building even the lowest level of truck roadways (four-lanes) unless truck volumes were about 60,000 trucks per day. The number of trucks at some locations might require even more than four lanes. Designing for more than about 75,000 trucks per day under the conditions assumed above would require six (or more) lanes.

Figures 2 and 3 indicate the expected growth of truck traffic for 20 years from the base year of 2002 using the growth equation on page 5. There was not a known source of information on actual terrain along the highway routes that was compatible with the GIS methodology used, so researchers used statewide values that most closely represented gently rolling terrain. The matrices that follow (Tables 4 through 12) provide many combinations of truck and total traffic volume, terrain factors, and enter/exit percentages at interchanges to facilitate such decisions. The intent of the VISSIM simulations was to never allow the LOS value to be worse than LOS E. Therefore, if a particular run using the input conditions resulted in LOS F, analysts added a lane until the LOS was E or better. Under the conditions examined, the LOS for a four-lane truck facility (two lanes in each direction) never exceeded LOS C, which is appropriate for rural conditions anyway.

To use Tables 4 through 12, first determine truck and non-truck traffic projections on an hourly directional basis. For ease of use, the row headings in each table, "Total ADT and Peak Hour Traffic," represent car plus truck traffic. First, determine which table best fits the terrain and the percent of trucks entering and exiting the truck roadway and enter that table with the hourly directional volume predicted to occur in the design year. Rounding the estimate up or down will be an option to the designer in order to match table values. As an example, a roadway with 4 percent grades and 10 percent of the trucks entering and exiting (Table 10) with 165,000 vehicles per day and 45,000 trucks per day could be rounded up to the next highest table entry or rounded down. To be conservative, round up to find the result under the 180,000 vehicles per day and 50,000 trucks per day cell. Table 10 gives a direct comparison of mixed versus separated flows. In this example, it indicates that a roadway with mixed traffic only will require six lanes and will operate at LOS C. With truck roadways, the LOS on the non-truck roadway will be LOS D on four lanes and the two-lane truck roadway will be LOS C.

In addition to these matrices are graphics in Appendix B which are simply another way of presenting these results. To use the Appendix B graphics, enter the appropriate graph (given the terrain factor and percent truck traffic entering and exiting) with the truck and total volume expected in the design year. Each graph has an example already plotted to guide the user. For the graph representing flat grades and 10 percent trucks entering and exiting, as an example, 1050 trucks per hour and 6000 vehicles per hour of total traffic would require four lanes for mixed traffic and three lanes for cars and small trucks (again, assuming a two-lane truck facility in each direction). The solid lines represent mixed traffic and the broken lines represent cars only (for these plots the truck facilities are always two lanes in each direction).

7
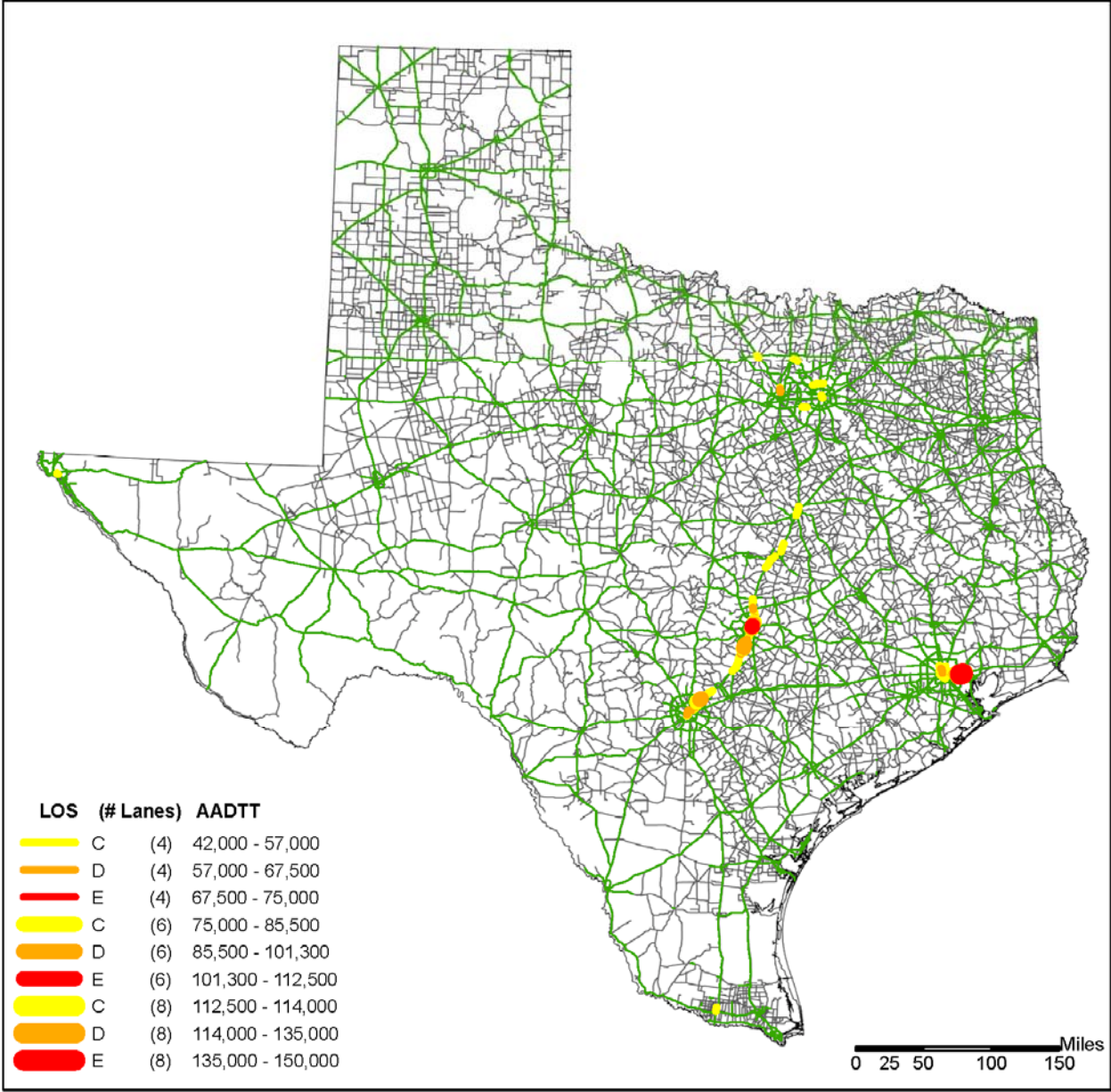
Figure 2. 2022 Statewide Truck Roadway AADTT and LOS.
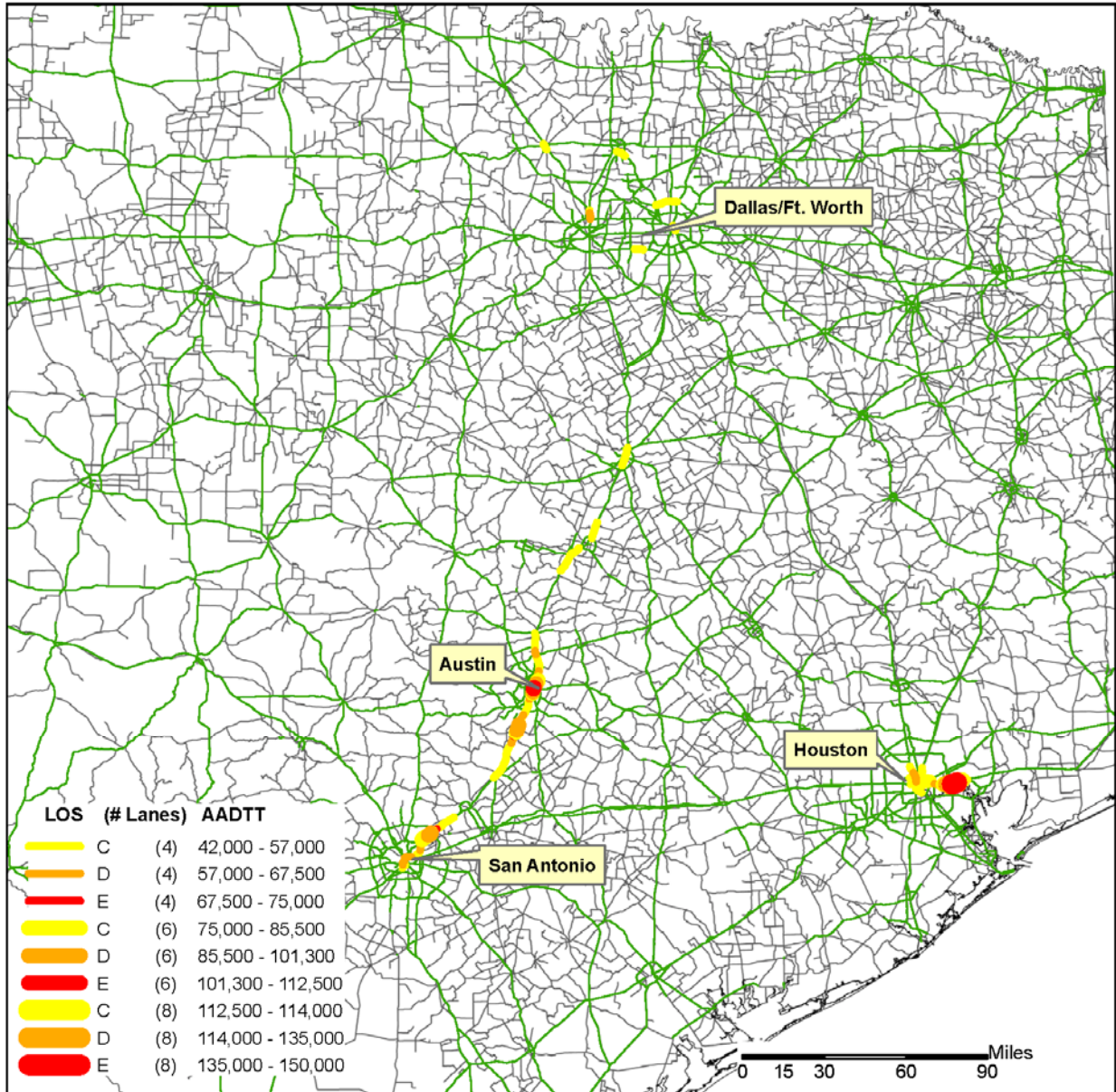
Figure 3. 2022 Central Texas Truck Roadway AADTT and LOS.

The legend reads:

LOS	(# Lanes)	AADTT
C	(4)	42,000 – 57,000
D	(4)	57,000 – 67,500
E	(4)	67,500 – 75,000
C	(6)	75,000 – 85,500
D	(6)	85,500 – 101,300
E	(6)	101,300 – 112,500
C	(8)	112,500 – 114,000
D	(8)	114,000 – 135,000
E	(8)	135,000 – 150,000

Table 4. LOS for Mixed and Separated Flows (Level Terrain, 10% Enter/Exit).

AADTT	Truck Peak Hr. Volume[1]	Total ADT and Peak Hour Volume[2]				
		60,000	90,000	120,000	150,000	180,000
		3000	4500	6000	7500	9000
10,000	300	C	E	D (3)	D (4)	D (5)
		C	D	D (3)	D (4)	D (4)
		A	A	A	A	A
20,000	600	C	C (3)	E (3)	D (4)	D (5)
		C	D	D (3)	D (4)	D (4)
		A	A	A	A	A
30,000	900	C	C (3)	C (4)	D (4)	C (6)
		B	D	D (3)	C (4)	D (4)
		B	B	B	B	B
40,000	1200	C	C (3)	C (4)	E (4)	C (6)
		B	C	C (3)	C (4)	D (4)
		C	C	C	C	C
50,000	1500	C	C (3)	C (4)	C (5)	C (6)
		B	C	C (3)	C (4)	D (4)
		C	C	C	C	C

Table 5. LOS for Mixed and Separated Flows (Level Terrain, 20% Enter/Exit).

AADTT	Truck Peak Hr. Volume[1]	Total ADT and Peak Hour Volume[2]				
		60,000	90,000	120,000	150,000	180,000
		3000	4500	6000	7500	9000
10,000	300	C	E	E (3)	E (4)	D (5)
		C	D	D (3)	D (4)	E (4)
		A	A	A	A	A
20,000	600	C	C (3)	C (4)	E (4)	D (5)
		C	D	D (3)	D (4)	E (4)
		A	A	A	A	A
30,000	900	C	C (3)	C (4)	C (5)	C (6)
		B	D	D (3)	C (4)	D (4)
		B	B	B	B	B
40,000	1200	D	C (3)	C (4)	C (5)	C (6)
		B	C	C (3)	C (4)	D (4)
		C	C	C	C	C
50,000	1500	B (3)	C (3)	C (4)	C (5)	C (6)
		B	C	C (3)	C (4)	D (4)
		C	C	C	C	C

[1] Conversion from AADTT to peak hour using a 50 percent directional split and a 6 percent peak hour factor.
[2] Conversion from ADT to peak hour using a 50 percent directional split and a 10 percent peak hour factor.

Where (in each cell): Numbers in parentheses = no. lanes (2 lanes if no parentheses).

- = LOS of the entire vehicle stream (trucks and cars) on a mixed-flow freeway facility
- = LOS of the vehicle stream (with no trucks) on an otherwise mixed-flow freeway facility
- - - - = LOS of trucks on a two-lane exclusive truck freeway facility

Table 6. LOS for Mixed and Separated Flows (Level Terrain, 30% Enter/Exit).

AADTT	Truck Peak Hr. Volume[1]	Total ADT and Peak Hour Volume[2]				
		60,000	90,000	120,000	150,000	180,000
		3000	4500	6000	7500	9000
10,000	300	C	C (3)	C (4)	C (5)	C (6)
		C	D	D (3)	D (4)	D (5)
		A	A	A	A	A
20,000	600	D	C (3)	C (4)	C (5)	C (6)
		C	D	D (3)	D (4)	D (5)
		A	A	A	A	A
30,000	900	D	D (3)	C (4)	C (5)	C (6)
		B	D	D (3)	D (4)	E (4)
		B	B	B	B	B
40,000	1200	B (3)	C (3)	C (4)	D (5)	C (6)
		B	C	C (3)	C (4)	D (4)
		C	C	C	C	C
50,000	1500	B (3)	B (4)	C (4)	D (5)	E (6)
		B	C	C (3)	C (4)	D (4)
		C	C	C	C	C

Table 7. LOS for Mixed and Separated Flows (2% Grade Terrain, 10% Enter/Exit).

AADTT	Truck Peak Hr. Volume[1]	Total ADT and Peak Hour Volume[2]				
		60,000	90,000	120,000	150,000	180,000
		3000	4500	6000	7500	9000
10,000	300	C	C (3)	D (3)	D (4)	C (6)
		C	D	D (3)	D (4)	D (4)
		A	A	A	A	A
20,000	600	C	C (3)	C (4)	D (4)	C (6)
		C	D	D (3)	D (4)	D (4)
		A	A	A	A	A
30,000	900	C	C (3)	C (4)	E (4)	C (6)
		B	D	D (3)	C (4)	D (4)
		B	B	B	B	B
40,000	1200	C	C (3)	C (4)	C (5)	C (6)
		B	C	C (3)	C (4)	D (4)
		C	C	C	C	C
50,000	1500	C	C (3)	C (4)	C (5)	C (6)
		B	C	C (3)	C (4)	D (4)
		C	C	C	C	C

[1] Conversion from AADTT to peak hour using a 50 percent directional split and a 6 percent peak hour factor.
[2] Conversion from ADT to peak hour using a 50 percent directional split and a 10 percent peak hour factor.

Where (in each cell): Numbers in parentheses = no. lanes (2 lanes if no parentheses).

☐ = LOS of the entire vehicle stream (trucks and cars) on a mixed-flow freeway facility
☐ = LOS of the vehicle stream (with no trucks) on an otherwise mixed-flow freeway facility
----- = LOS of trucks on a two-lane exclusive truck freeway facility

Table 8. LOS for Mixed and Separated Flows (2% Grade Terrain, 20% Enter/Exit).

AADTT	Truck Peak Hr. Volume[1]	Total ADT and Peak Hour Volume[2]				
		60,000	90,000	120,000	150,000	180,000
		3000	4500	6000	7500	9000
10,000	300	C	C (3)	C (4)	D (4)	D (5)
		C	D	D (3)	D (4)	E (4)
		A	A	A	A	A
20,000	600	C	C (3)	C (4)	D (4)	D (5)
		C	D	D (3)	D (4)	E (4)
		A	A	A	A	A
30,000	900	C	C	C (4)	C (5)	C (6)
		B	D	D (3)	C (4)	D (4)
		B	B	B	B	B
40,000	1200	C	C (3)	C (4)	C (5)	C (6)
		B	C	C (3)	C (4)	D (4)
		C	C	C	C	C
50,000	1500	B (3)	C (3)	C (5)	C (5)	C (6)
		B	C	C (3)	C (4)	D (4)
		C	C	C	C	C

Table 9. LOS for Mixed and Separated Flows (2% Grade Terrain, 30% Enter/Exit).

AADTT	Truck Peak Hr. Volume[1]	Total ADT and Peak Hour Volume[2]				
		60,000	90,000	1200,000	150,000	180,000
		3000	4500	6000	7500	9000
10,000	300	C	C (3)	C (4)	C (5)	C (6)
		C	D	D (3)	D (4)	D (5)
		A	A	A	A	A
20,000	600	C	C (3)	C (4)	C (5)	C (6)
		C	D	D (3)	D (4)	D (5)
		A	A	A	A	A
30,000	900	C	C (3)	C (4)	C (5)	C (6)
		B	D	D (3)	C (4)	E (4)
		B	B	B	B	B
40,000	1200	B (3)	B (4)	C (4)	C (5)	C (6)
		B	C	C (3)	C (4)	D (4)
		C	C	C	C	C
50,000	1500	B (3)	B (4)	C (5)	C (5)	C (6)
		B	C	C (3)	C (4)	C (5)
		C	C	C	C	C

[1] Conversion from AADTT to peak hour using a 50 percent directional split and a 6 percent peak hour factor.
[2] Conversion from ADT to peak hour using a 50 percent directional split and a 10 percent peak hour factor.

Where (in each cell): Numbers in parentheses = no. lanes (2 lanes if no parentheses).
  = LOS of the entire vehicle stream (trucks and cars) on a mixed-flow freeway facility
  = LOS of the vehicle stream (with no trucks) on an otherwise mixed-flow freeway facility
  - - - - = LOS of trucks on a two-lane exclusive truck freeway facility

Table 10. LOS for Mixed and Separated Flows (4% Grade Terrain, 10% Enter/Exit).

AADTT	Truck Peak Hr. Volume[1]	Total ADT and Peak Hour Volume[2]				
		60,000	90,000	120,000	150,000	180,000
		3000	4500	6000	7500	9000
10,000	300	C	C (3)	C (4)	C (5)	C (6)
		C	D	D (3)	D (4)	D (4)
		A	A	A	A	A
20,000	600	C	C (3)	C (4)	C (5)	C (6)
		C	D	D (3)	D (4)	D (4)
		A	A	A	A	A
30,000	900	C	C (3)	C (4)	C (5)	C (6)
		B	D	D (3)	C (4)	D (4)
		B	B	B	B	B
40,000	1200	C	C (3)	C (4)	C (5)	C (6)
		B	C	C (3)	C (4)	D (4)
		C	C	C	C	C
50,000	1500	C	C (3)	C (4)	C (5)	C (6)
		B	C	C (3)	C (4)	D (4)
		C	C	C	C	C

Table 11. LOS for Mixed and Separated Flows (4% Grade Terrain, 20% Enter/Exit).

AADTT	Truck Peak Hr. Volume[1]	Total ADT and Peak Hour Volume[2]				
		60,000	90,000	120,000	150,000	180,000
		3000	4500	6000	7500	9000
10,000	300	C	C (3)	C (4)	C (5)	D (5)
		C	D	D (3)	D (4)	E (4)
		A	A	A	A	A
20,000	600	C	C (3)	C (4)	C (5)	C (6)
		C	D	D (3)	D (4)	E (4)
		A	A	A	A	A
30,000	900	C	C (3)	C (4)	C (5)	C (6)
		B	D	D (3)	C (4)	D (4)
		B	B	B	B	B
40,000	1200	B (3)	B (4)	C (4)	D (5)	C (6)
		B	C	C (3)	C (4)	D (4)
		B	C	C	C	C
50,000	1500	B (3)	B (4)	C (5)	E (5)	C (6)
		B	C	C (3)	C (4)	D (4)
		C	C	C	C	C

[1] Conversion from AADTT to peak hour using a 50 percent directional split and a 6 percent peak hour factor.
[2] Conversion from ADT to peak hour using a 50 percent directional split and a 10 percent peak hour factor.

Where (in each cell): Numbers in parentheses = no. lanes (2 lanes if no parentheses).
☐ = LOS of the entire vehicle stream (trucks and cars) on a mixed-flow freeway facility
☐ = LOS of the vehicle stream (with no trucks) on an otherwise mixed-flow freeway facility
- - - - - = LOS of trucks on a two-lane exclusive truck freeway facility

Table 12. LOS for Mixed and Separated Flows (4% Grade Terrain, 30% Enter/Exit).

AADTT	Truck Peak Hr. Volume[1]	Total ADT and Peak Hour Volume[2]				
		60,000	90,000	120,000	150,000	180,000
		3000	4500	6000	7500	9000
10,000	300	C	C (3)	C (4)	C (5)	C (6)
		C	D	D	D (4)	D (5)
		A	A	A	A	A
20,000	600	B (3)	C (3)	C (4)	D (5)	D (6)
		C	D	D (3)	D (4)	D (5)
		A	A	A	A	A
30,000	900	B (3)	B (4)	C (4)	E (5)	C (6)
		B	D	D (3)	C (4)	E (4)
		B	B	B	B	B
40,000	1200	B (3)	B (4)	C (4)	C (6)	C (6)
		B	C	C (3)	C (4)	D (4)
		C	C	C	C	C
50,000	1500	B (3)	B (4)	C (5)	C (6)	C (6)
		B	C	C (3)	C (4)	D (4)
		C	C	C	C	C

[1] Conversion from AADTT to peak hour using a 50 percent directional split and a 6 percent peak hour factor.
[2] Conversion from ADT to peak hour using a 50 percent directional split and a 10 percent peak hour factor.

Where (in each cell): Numbers in parentheses = no. lanes (2 lanes if no parentheses).

☐ = LOS of the entire vehicle stream (trucks and cars) on a mixed-flow freeway facility
☐ = LOS of the vehicle stream (with no trucks) on an otherwise mixed-flow freeway facility
┅ = LOS of trucks on a two-lane exclusive truck freeway facility

5.3.5 Acquire Crash Data and Estimate Crash Costs

Determine truck-car crash history for the corridor. Historical data do not exist for this purpose, but estimates might use some percentage reduction in truck-car crashes currently being experienced on the mixed-flow freeway. Use TxDOT's latest accident cost calculations to estimate cost of crash reductions. TxDOT uses $854,000 as a combined average cost for fatal and incapacitating injury accident costs, $41,500 for the combined average non-incapacitating injury accident and possible injury accident costs, and $1400 for property damage only accident costs. Where hazardous material spills are involved, the costs may increase significantly.

5.3.6 Determine Initial Construction Cost

The initial construction cost in 2004 dollars for a four-lane truck roadway (two lanes each direction) is about $11 million per mile. Table 13 provides a comparison of the initial costs of a variety of mixed-flow and separated flow roadways. This cost includes two 13-ft lanes, a 12-ft right shoulder, a 6-ft left shoulder, and 14 inches of continuously reinforced concrete pavement. Table 14 provides the annualized costs of the same configurations using a 5 percent rate of return and converting the incremental cost to annualized cost per mile. The cost of the mixed-flow

scenario is its initial cost converted to an annualized basis, whereas in all of the separated scenarios, the table values are the incremental costs for building two-lane truck roadways. All costs are for both directions even though the number of lanes shown in all cases is for one direction. Continuing the example begun on page 7 and using Table 10, the demand volume indicates that either a six-lane mixed traffic roadway or a four-lane non-truck facility combined with a two-lane truck facility would adequately serve the forecast traffic needs. Table 14 indicates that the annualized cost of a six-lane mixed freeway would be $1,325,411 compared to a "2 + 4" at $415,784 plus $1,325,411, or $1,741,195.

Table 13. Initial Two-Way Cost/Mile for Mixed Roadways versus Separated Roadways.

Lanes by Direction	Cost Mixed	Separated Scenario	Cost Separated	Separated Scenario	Cost Separated	Separated Scenario	Cost Separated
2	$5,964,429	2+2	$16,964,429	N/A	N/A	N/A	N/A
3	$8,767,232	2+2	$16,964,429	2+3	$19,767,232	2+4	$21,699,845
4	$10,699,845	2+2	$16,964,429	2+3	$19,767,232	2+4	$21,699,845
5	$16,018,968	2+3 [a]	$19,767,232	2+4	$21,699,845	2+5	$27,018,968
6	$16,518,089	2+4	$21,699,845	2+5	$27,018,968	2+6	$27,518,089
7	$19,069,090	2+5	$27,018,968	2+6	$27,518,089	2+7	$30,069,090

[a] 2+3 is two truck lanes and 3 non-truck lanes by direction.

Table 14. Initial and Incremental Cost/Mile Converted to Annualized Cost/Mile.

Lanes by Direction	Annualized Cost Mixed	Separated Scenario	Annualized Payment Separated	Separated Scenario	Annualized Payment Separated	Separated Scenario	Annualized Payment Separated
2	$478,585	2+2	$882,640	N/A	N/A	N/A	N/A
3	$703,482	2+2	$657,743	2+3	$882,640	2+4	$1,037,712
4	$858,555	2+2	$502,670	2+3	$727,567	2+4	$882,640
5	$1,285,361	2+3 [a]	$300,760	2+4	$455,833	2+5	$882,640
6	$1,325,411	2+4	$415,784	2+5	$842,590	2+6	$882,640
7	$1,530,103	2+5	$637,898	2+6	$677,947	2+7	$882,640

[a] 2+3 is two truck lanes and 3 non-truck lanes by direction.

5.3.7 Determine Costs of Delay and Fuel Consumption

Evaluate the overall benefits and costs of each truck roadway being considered in minimum lengths of 10 to 20 miles. Shorter lengths will probably not be feasible and would not be very attractive to motor carriers. One exception might be a connector from an interstate roadway to a very large truck distribution center or port which generated large numbers of truck trips. The best source of delay and fuel consumption results is simulation programs such as CORSIM or VISSIM, or possibly TxDOT's Statewide Analysis Model. Appendix C tabulates output from VISSIM corresponding to the level of service tables (Tables 4 through 12), providing an easy comparison of results for separated and mixed flows.

5.3.8 Determine User Perspectives and Public Satisfaction Measures

Factors to consider include toll versus non-toll, size/weight incentives, speed incentives, alternative routes and their congestion levels, environmental issues, and general public perception. Like HOV lanes, if truck roadways are not reasonably utilized, there will likely be negative feedback from the public. Ways to get input from the public and from users is to hold public meetings where citizens can speak out for or against a proposal and to interview the appropriate elements of the public. For truck roadways to be successful, interviews with truck drivers and other motor carrier representatives are a must. Since there is no cost associated with this criterion, it may figure as a "tie breaker" or otherwise serve as a qualitative measure with less precision than other inputs.

5.3.9 Total All Benefits and Costs

Tables 15, 16, and 17 provide the calculated benefit/cost (B/C) values for the same conditions of truck and total volume presented earlier in this document. The most significant unknown remains the effects of crashes when trucks are separated from cars. This analysis used a constant annual benefit of $700,000 per mile for all volume levels. The crash reductions are thought to be greater at higher volume levels so this value probably underestimates crash cost reduction in some cases. The total number of B/C values in these three tabular summaries which are 2.0 or greater are 72 out of 75 possible scenarios for flat grades and 4 percent grades, and 73 out of 75 for 2 percent grades.

Table 15. Benefit/Cost Summary for Flat Grades.

Grade	% Enter	Total Hourly Volume	Truck Hourly Volume				
			300	600	900	1200	1500
0	10	3000	2.37	2.57	2.41	2.70	6.66
		4500	2.30	4.69	3.12	3.22	7.98
		6000	2.44	5.17	3.12	3.49	4.99
		7500	3.20	4.55	4.28	5.12	5.60
		9000	1.09	4.07	2.48	8.10	5.57
Grade	% Enter	Total Hourly Volume	Truck Hourly Volume				
			300	600	900	1200	1500
0	20	3000	2.35	2.50	3.09	2.66	6.38
		4500	3.44	4.72	4.40	3.60	6.47
		6000	2.76	4.00	6.32	10.43	17.23
		7500	3.08	5.56	6.33	11.71	15.22
		9000	(0.65)	1.86	2.19	8.98	19.66
Grade	% Enter	Total Hourly Volume	Truck Hourly Volume				
			300	600	900	1200	1500
0	30	3000	2.53	4.18	5.44	5.77	3.45
		4500	3.13	5.13	6.07	8.95	4.36
		6000	2.19	4.28	5.17	16.72	16.49
		7500	3.56	3.33	6.65	20.39	27.68
		9000	3.37	7.05	5.80	17.22	20.65

Table 16. Benefit/Cost Summary for 2 Percent Grades.

			Truck Hourly Volume				
Grade	**% Enter**	**Total Hourly Volume**	**300**	**600**	**900**	**1200**	**1500**
2	**10**	**3000**	2.48	3.88	2.60	2.25	17.01
		4500	3.70	4.78	4.34	3.62	5.00
		6000	3.12	4.45	4.19	4.21	8.31
		7500	5.00	6.68	6.22	7.14	10.97
		9000	(0.16)	1.44	3.42	4.75	11.95
			Truck Hourly Volume				
Grade	**% Enter**	**Total Hourly Volume**	**300**	**600**	**900**	**1200**	**1500**
2	**20**	**3000**	2.52	4.98	3.84	5.54	6.07
		4500	2.93	5.28	6.55	5.78	6.85
		6000	2.73	4.45	6.76	10.57	7.03
		7500	4.68	8.42	6.45	11.72	14.04
		9000	3.06	2.95	5.65	8.66	15.56
			Truck Hourly Volume				
Grade	**% Enter**	**Total Hourly Volume**	**300**	**600**	**900**	**1200**	**1500**
2	**30**	**3000**	2.72	4.80	4.87	4.99	2.87
		4500	3.20	6.06	6.46	5.83	2.36
		6000	3.08	5.31	7.51	10.83	6.98
		7500	2.03	7.01	7.72	18.41	21.12
		9000	3.35	7.41	13.44	9.23	8.60

Table 17. Benefit/Cost Summary for 4 Percent Grades.

Grade	% Enter	Total Hourly Volume	Truck Hourly Volume				
			300	**600**	**900**	**1200**	**1500**
4	**10**	**3000**	2.40	3.86	3.34	4.66	4.12
		4500	3.67	4.96	4.06	7.86	6.55
		6000	2.84	4.86	4.05	7.40	5.70
		7500	3.67	4.46	5.21	5.67	15.99
		9000	0.61	4.00	3.78	6.42	16.13

Grade	% Enter	Total Hourly Volume	Truck Hourly Volume				
			300	**600**	**900**	**1200**	**1500**
4	**20**	**3000**	3.92	6.19	5.11	3.67	6.07
		4500	4.62	7.30	6.05	6.15	4.75
		6000	2.58	5.77	4.13	3.75	5.85
		7500	4.18	5.92	7.82	8.65	7.47
		9000	6.57	11.08	7.46	11.57	11.87

Grade	% Enter	Total Hourly Volume	Truck Hourly Volume				
			300	**600**	**900**	**1200**	**1500**
4	**30**	**3000**	3.71	4.06	3.87	5.45	1.81
		4500	4.50	5.84	4.31	7.08	1.73
		6000	3.72	11.05	8.88	9.94	7.62
		7500	8.40	14.10	9.17	11.33	10.15
		9000	5.96	8.80	3.13	9.98	16.27

6.0 DEMONSTRATION OF TRUCK FACILITY ANALYSIS TOOLS

This research evaluated three sites to demonstrate the use of the truck facility analysis tools. One of the three is a segment of I-45 near Huntsville, and it is included in Appendix E to meet the need for product P2, "Training Procedures for Truck Facility Analysis Tools."

7.0 CALIBRATION OF CORSIM FOR TRUCK ROADWAYS

The primary purpose of this Guidebook – taking the findings from the research and creating a method by which candidate primary roadway corridors can be evaluated for truck roadway potential – is filled by the application of the tables and figures relating to operations impacts (delay and fuel consumption), crash impacts, and design and construction cost impacts. In a generic sense, these tables can be applied to segments of freeway in mostly rural conditions that are many miles in length. The unit costs from the tables are simply multiplied by the length of roadway segment containing a roughly consistent cross section and the overall operations, crash and design and construction costs are produced. In more detailed and complicated freeway sections, however, a more rigorous analytical process may be desirable.

Where weaving sections exist, and in portions of freeway corridors where ramps and interchanges are frequent, the unit cost impact tables will not be sufficiently flexible to estimate the realistic field impacts of truck roadway operations. In these situations, and up to the discretion of the analyst, it may be desirable to perform more detailed modeling of truck roadway operations. In these instances, the least cost and most readily available tool for performing these analyses is CORSIM. As described in the research report *(5)*, researchers used CORSIM side-by-side with another model, VISSIM, to establish basic capacities for truck roadways. It has demonstrated capabilities for modeling trucks and truck roadways. Appendix F has the necessary guidance for using CORSIM to evaluate a truck roadway.

LIST OF REFERENCES

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2. Cothron, A.S., S.E. Ranft, C.H. Walters, D.W. Fenno, and D. Lord. *Safety Evaluation of HOV Lane Design Elements*, Research Report 0-4434-S, Texas Transportation Institute, College Station, TX, April 2005.
3. Email from Robert W. Poole, Reason Foundation, "Surface Transportation Innovations," Subtitle: "New Safety Problem for HOV and Maybe HOT Lanes" June 30, 2005.
4. *Highway Capacity Manual,* Transportation Research Board, National Research Council, Washington D.C., 2000.
5. Middleton, D., S. Venglar, C. Quiroga, D. Lord, and D. Jasek. *Strategies for Separating Trucks from Passenger Vehicles: Final Report,* Report FHWA/TX-06/0-4663-2, Texas Transportation Institute, College Station, TX, October 2006.

APPENDIX A

State Transportation Code for Lane Restrictions

Sec. 545.0651.   RESTRICTION ON USE OF HIGHWAY.   (a)   In this section:

    (1)   "Commission" means the Texas Transportation Commission.

    (1-a)   "Department" means the Texas Department of Transportation.

    (2)   "Highway" means a public highway that:

        (A)   is in the designated state highway system;

        (B)   is designated a controlled access facility; and

        (C)   has a minimum of three travel lanes, excluding access or frontage roads, in each direction of traffic that may be part of a single roadway or may be separate roadways that are constructed as an upper and lower deck.

    (b)   The commission by order may restrict, by class of vehicle, through traffic to two or more designated lanes of a highway. If the lanes to be restricted by the commission are located within a municipality, the commission shall consult with the municipality before adopting an order under this section. A municipality by ordinance may restrict, by class of vehicle, through traffic to two or more designated lanes of a highway in the municipality.

    (c)   An order or ordinance under Subsection (b) must allow a restricted vehicle to use any lane of the highway to pass another vehicle and to enter and exit the highway.

    (d)   Before adopting an ordinance, a municipality shall submit to the department a description of the proposed restriction. The municipality may not enforce the restrictions unless the department's executive director or the executive director's designee has approved the restrictions.

    (e)   Department approval under Subsection (d) must:

    (1)   be based on a traffic study performed by the department to evaluate the effect of the proposed restriction; and

    (2)   to the greatest extent practicable, ensure a systems approach to preclude the designation of inconsistent lane restrictions among adjacent municipalities.

    (f)   The department's executive director or the executive director's designee may suspend or rescind approval of any restrictions approved under Subsection (d) for one or more of the following reasons:

        (1)   a change in pavement conditions;

        (2)   a change in traffic conditions;

        (3)   a geometric change in roadway configuration;

        (4)   construction or maintenance activity; or

        (5)   emergency or incident management.

    (g)   The department shall erect and maintain official traffic control devices necessary to implement and enforce an order adopted or an ordinance adopted and approved under this section. A restriction approved under this section may not be enforced until the appropriate traffic control devices are in place.

Added by Acts 1997, 75th Leg., ch. 384, Sec. 1, eff. May 28, 1997. Amended by Acts 2003, 78th Leg., ch. 1049, Sec. 9, eff. June 20, 2003.

Figure 4. State Transportation Code – Restriction on Use of Highway.

Sec. 545.0652.   COUNTY RESTRICTION ON USE OF HIGHWAY.   (a)   In this section:

(1)   "Department" means the Texas Department of Transportation.

(2)   "Highway" means a public roadway that:

(A)   is in the designated state highway system;

(B)   is designated a controlled access facility; and

(C)   has a minimum of three travel lanes, excluding access or frontage roads, in each direction of traffic.

(b)   A county commissioner's court by order may restrict, by class of vehicle, through traffic to two or more designated lanes of a highway located in the county and outside the jurisdiction of a municipality.

(c)   An order under Subsection (b) must allow a restricted vehicle to use any lane of the highway to pass another vehicle and to enter and exit the highway.

(d)   Before issuing an order under this section, the commissioner's court shall submit to the department a description of the proposed restriction. The commissioners court may not enforce the restrictions unless:

(1)   the department's executive director or the executive director's designee has approved the restrictions; and

(2)   the appropriate traffic-control devices are in place.

(e)   Department approval under Subsection (d) must to the greatest extent practicable ensure a systems approach to preclude the designation of inconsistent lane restrictions among adjacent counties or municipalities.

(f)   The department's executive director or the executive director's designee may suspend or rescind approval under this section for one or more of the following reasons:

(1)   a change in pavement conditions;

(2)   a change in traffic conditions;

(3)   a geometric change in roadway configuration;

(4)   construction or maintenance activity; or

(5)   emergency or incident management.

(g)   The department shall erect and maintain official traffic-control devices necessary to implement and enforce an order issued and approved under this section.

Added by Acts 2003, 78th Leg., ch. 846, Sec. 1, eff. Sept. 1, 2003.

Figure 5. State Transportation Code – County Restriction on Use of Highway.

APPENDIX B

Level of Service Graphical Results

Figure 6. Freeway Design Based on LOS for Flat Grades, 10% Enter/Exit.

Figure 7. Freeway Design Based on LOS for Flat Grades, 20% Enter/Exit.

Figure 8. Freeway Design Based on LOS for Flat Grades, 30% Enter/Exit.

Figure 9. Freeway Design Based on LOS for 2% Grades, 10% Enter/Exit.

Figure 10. Freeway Design Based on LOS for 2% Grades, 20% Enter/Exit.

Figure 11. Freeway Design Based on LOS for 2% Grades, 30% Enter/Exit.
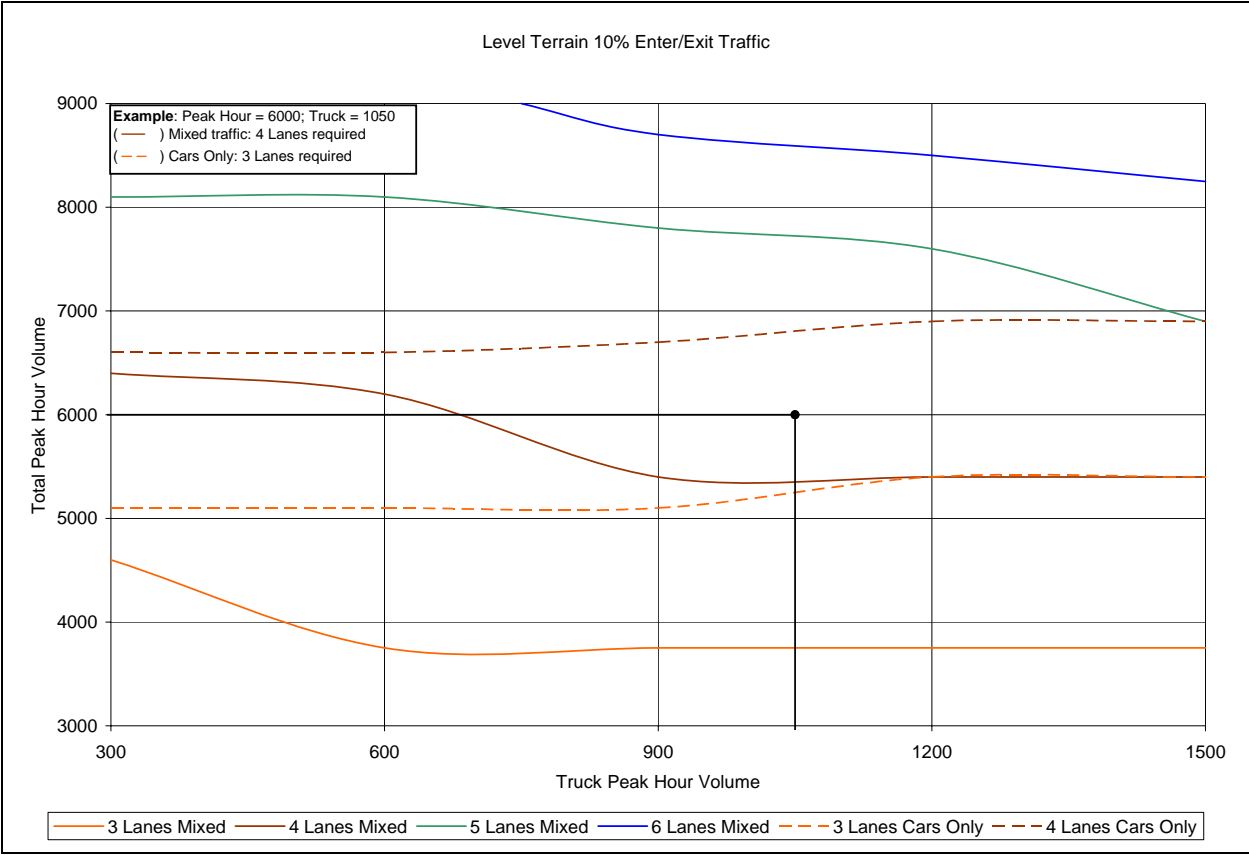
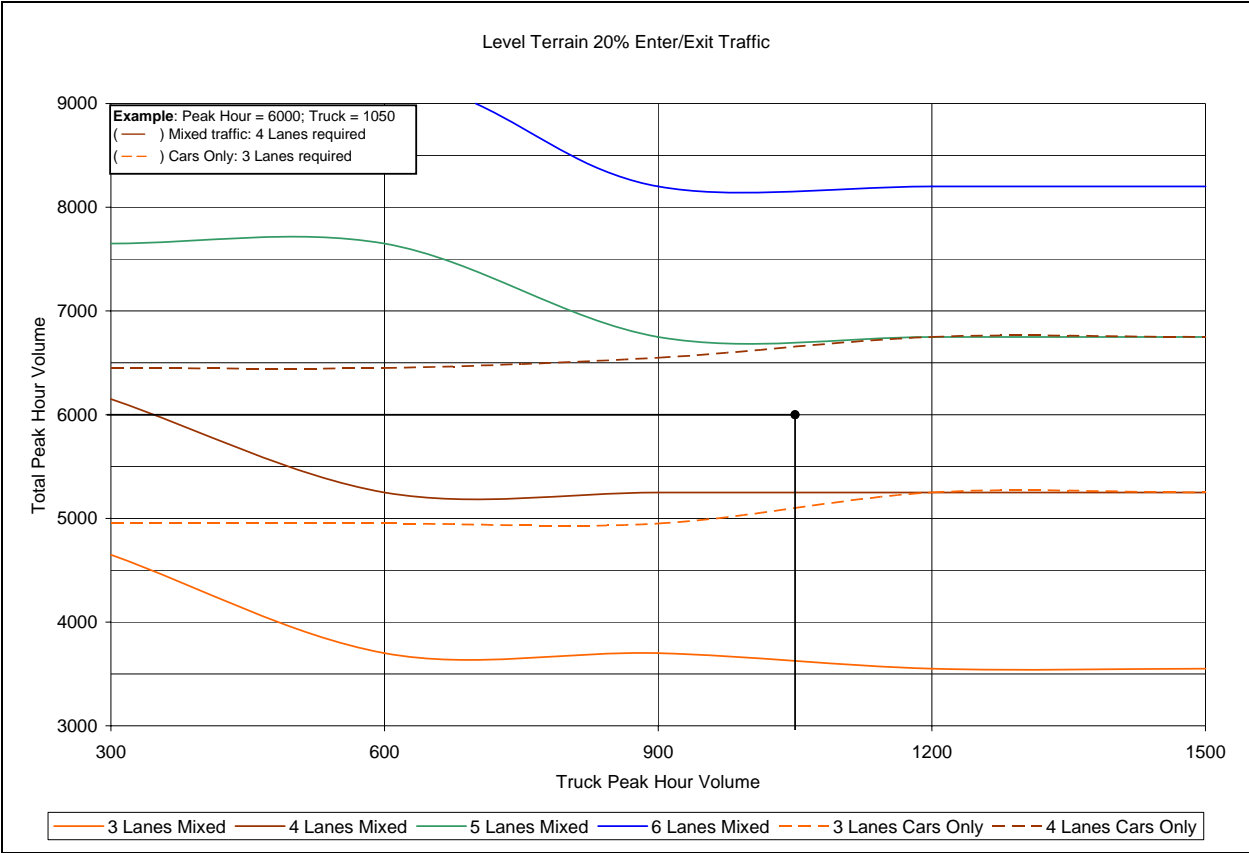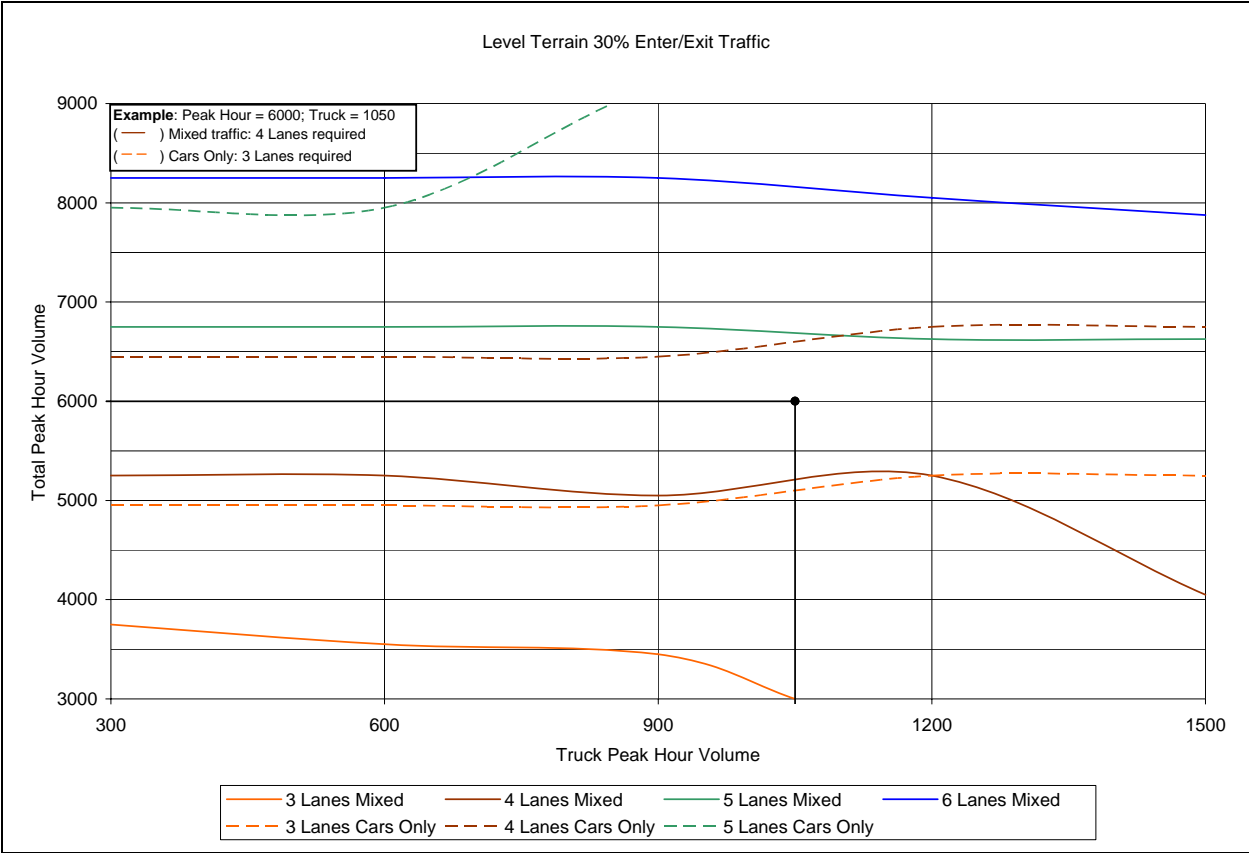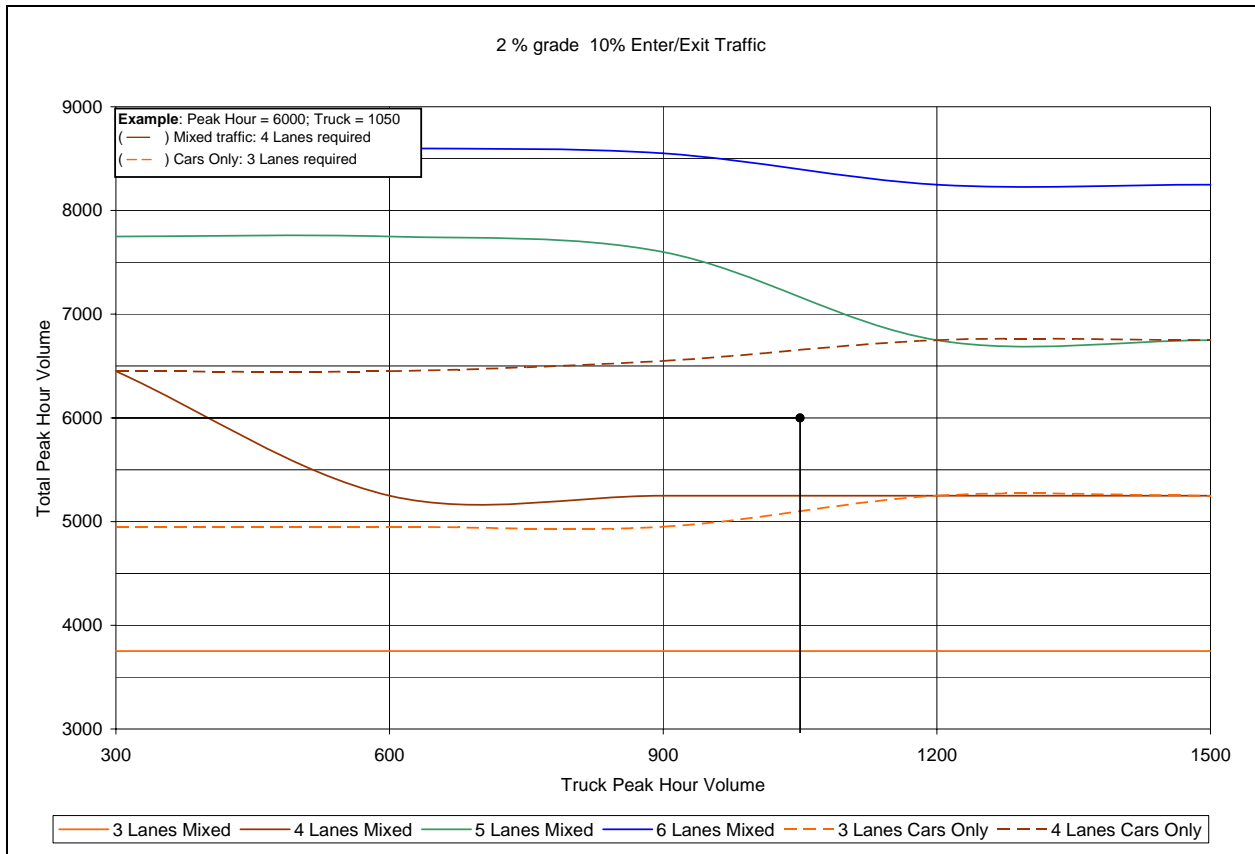**Figure 12. Freeway Design Based on LOS for 4% Grades, 10% Enter/Exit.**

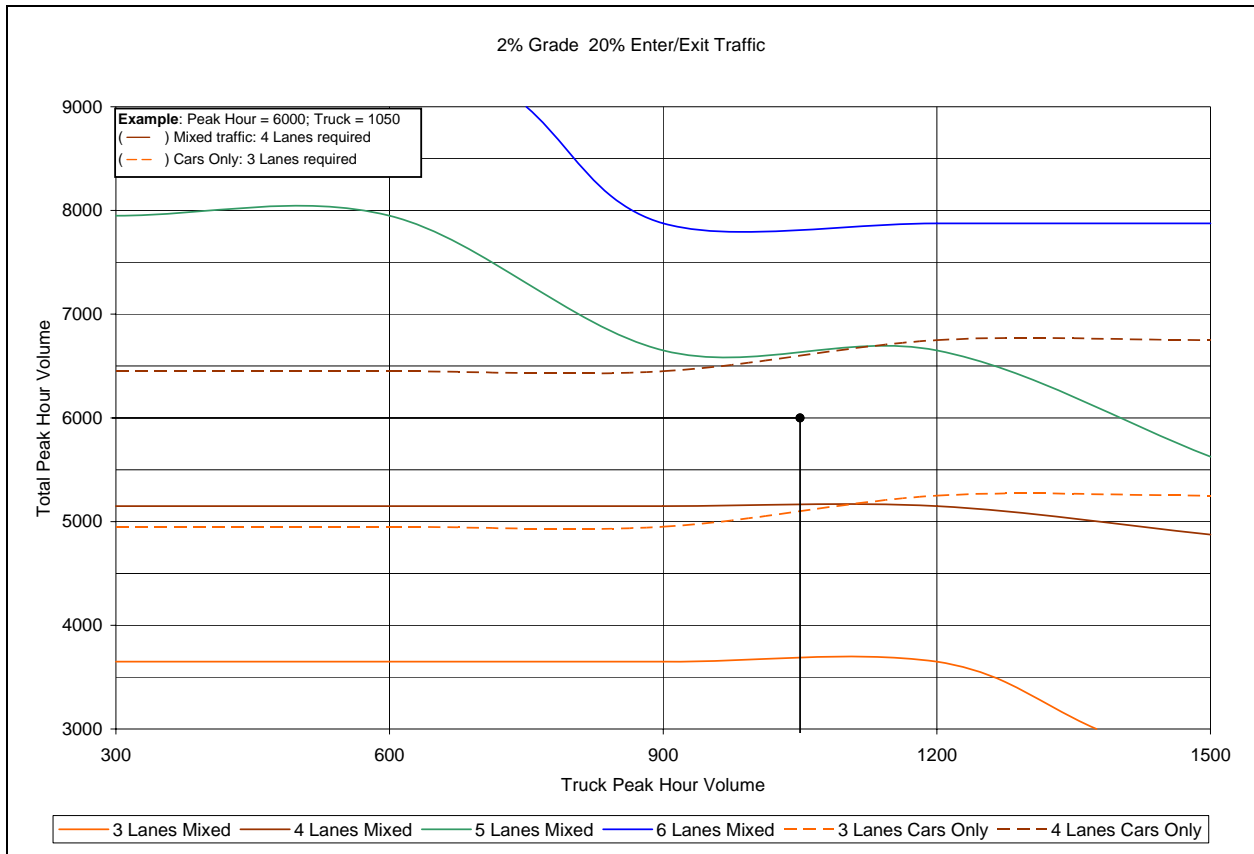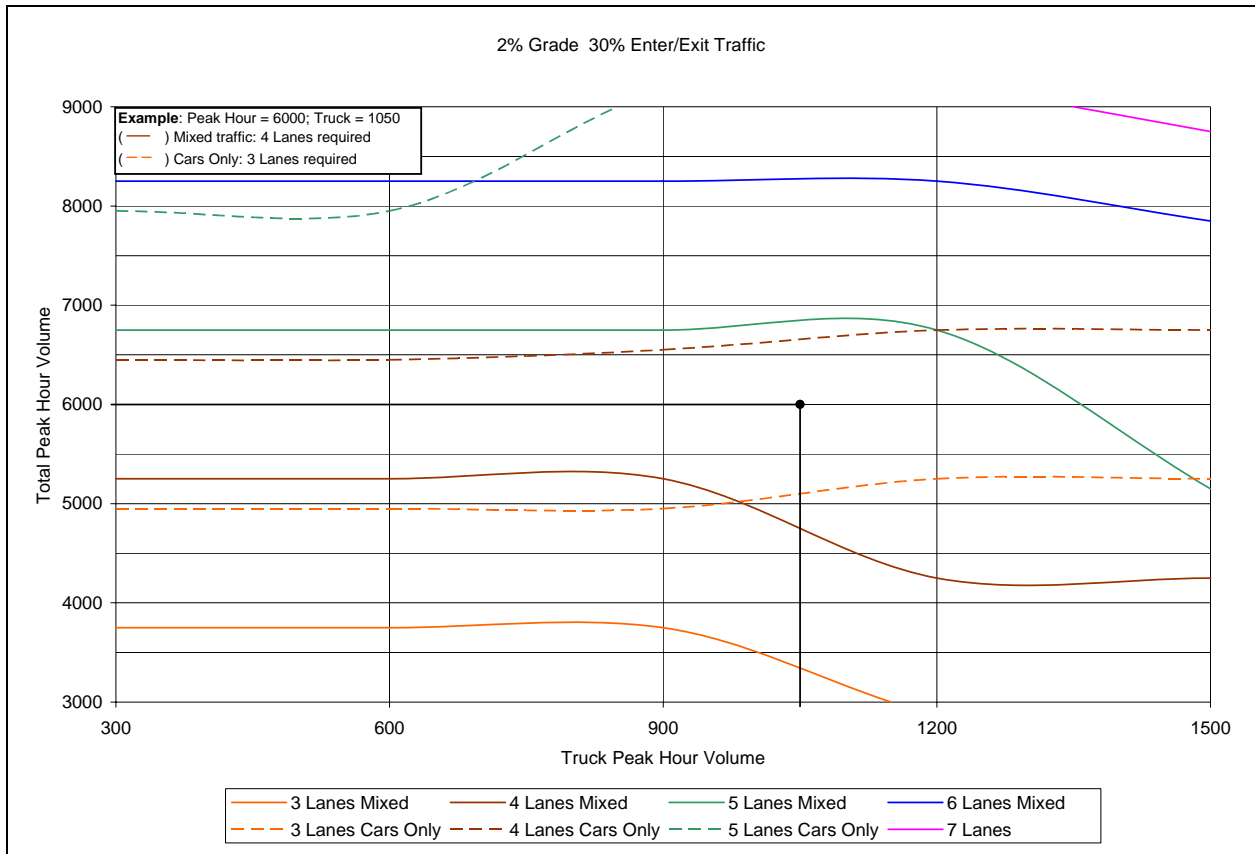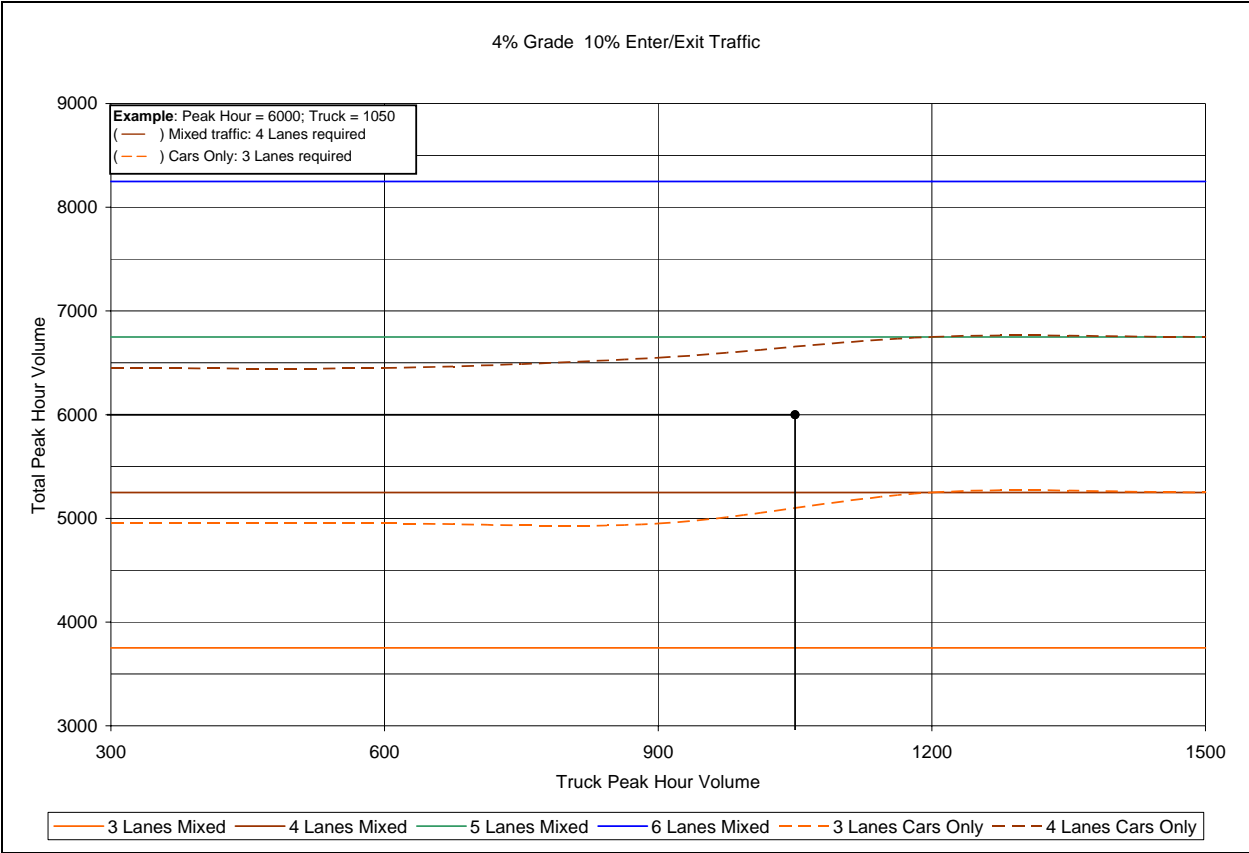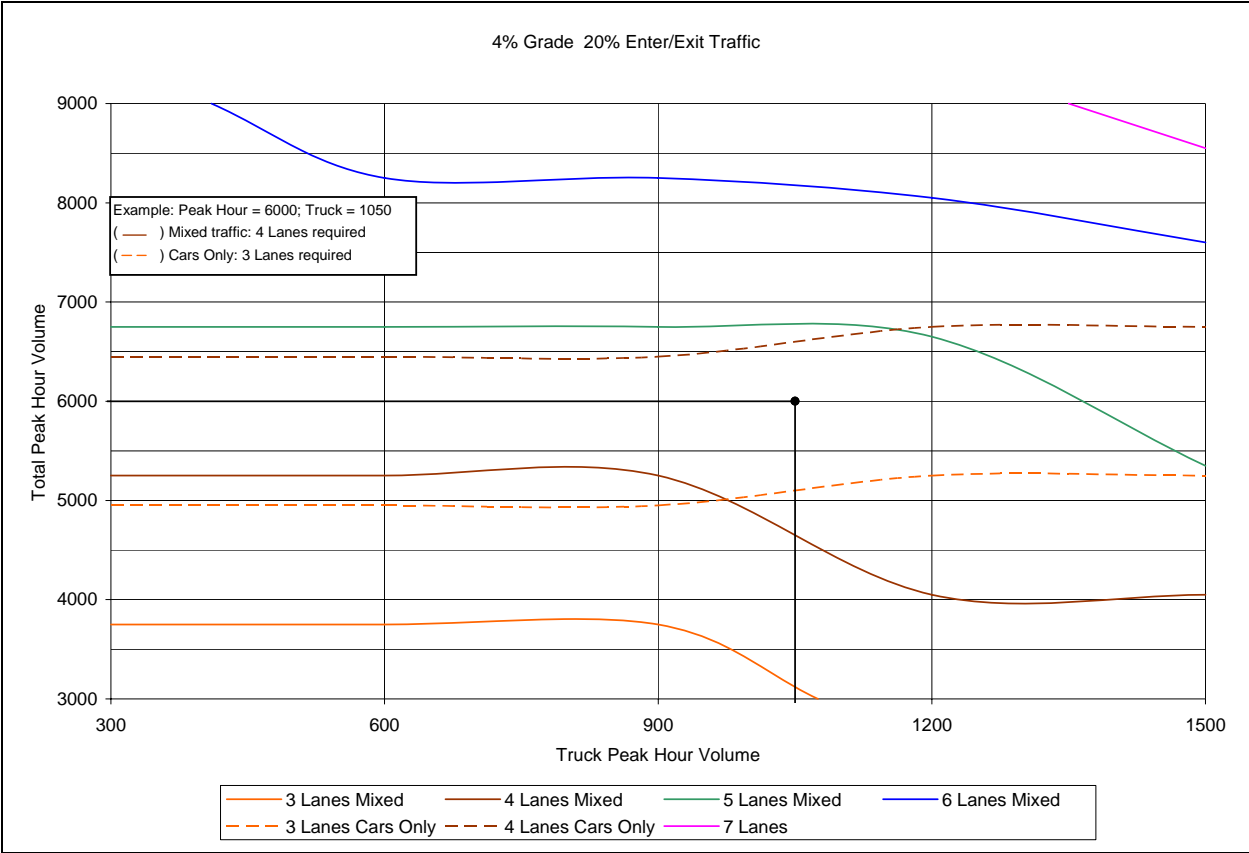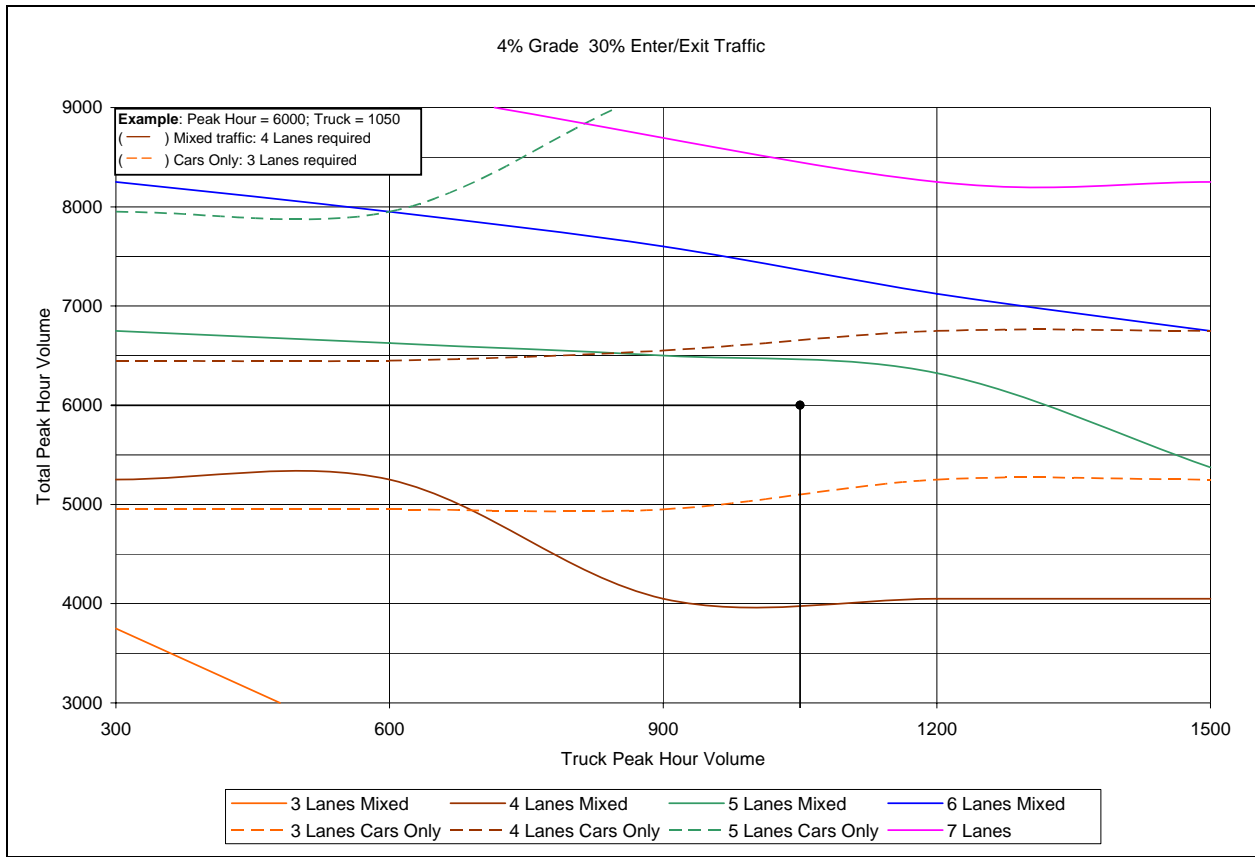**Figure 13. Freeway Design Based on LOS for 4% Grades, 20% Enter/Exit.**

Figure 14. Freeway Design Based on LOS for 4% Grades, 30% Enter/Exit.

APPENDIX C

Cost of Delay and Fuel Consumption

Table 18. Delay and Fuel Consumption Cost Summary (Flat Terrain, 10% Enter/Exit).

Grade	% Enter	Total Hourly Volume	Cost Element	Truck Hourly Volume				
				300	600	900	1200	1500
0	10	3000	Time	$33.74	$56.84	$52.94	$84.32	$198.63
			Fuel	$22.01	$13.05	$5.67	($5.27)	($66.76)
			Total	**$55.74**	**$69.89**	**$58.61**	**$79.05**	**$131.87**
		4500	Time	$656.72	$114.22	$92.28	$103.24	$143.51
			Fuel	($13.95)	$21.63	$16.63	$13.06	$36.81
			Total	**$642.77**	**$135.85**	**$108.91**	**$116.30**	**$180.31**
		6000	Time	$283.99	$755.90	$113.10	$147.26	$219.80
			Fuel	($21.12)	$37.15	($4.06)	($12.14)	$22.49
			Total	**$262.87**	**$793.04**	**$109.04**	**$135.12**	**$242.29**
		7500	Time	$128.34	$222.74	$1,059.80	$4,115.87	$258.32
			Fuel	($13.68)	$37.71	($18.54)	$31.02	$26.89
			Total	**$114.65**	**$260.45**	**$1,041.26**	**$4,146.89**	**$285.21**
		9000	Time	$16.72	$197.68	$114.39	$225.68	$312.33
			Fuel	($51.82)	($26.61)	($50.60)	($41.01)	($28.62)
			Total	**($35.10)**	**$171.07**	**$63.78**	**$184.67**	**$283.71**

Table 19. Delay and Fuel Consumption Cost Summary (Flat Terrain, 20% Enter/Exit).

Grade	% Enter	Total Hourly Volume	Cost Element	Truck Hourly Volume				
				300	600	900	1200	1500
0	20	3000	Time	$33.91	$55.22	$64.35	$375.08	$116.47
			Fuel	$20.74	$10.02	$42.96	($3.03)	$5.11
			Total	**$54.65**	**$65.24**	**$107.30**	**$372.05**	**$121.58**
		4500	Time	$1,250.46	$125.24	$133.88	$122.12	$126.92
			Fuel	$28.36	$12.17	$11.28	$21.43	($1.93)
			Total	**$1,278.82**	**$137.41**	**$145.17**	**$143.55**	**$124.99**
		6000	Time	$740.99	$119.87	$258.31	$218.94	$410.61
			Fuel	$127.09	($20.87)	($0.43)	$51.29	$53.89
			Total	**$868.08**	**$99.00**	**$257.88**	**$270.23**	**$464.50**
		7500	Time	$405.29	$1,117.84	$262.42	$261.94	$333.59
			Fuel	($2.86)	$31.21	($3.85)	$55.42	$63.47
			Total	**$402.43**	**$1,149.05**	**$258.57**	**$317.36**	**$397.06**
		9000	Time	($994.95)	($222.70)	$66.39	$153.51	$463.46
			Fuel	($82.37)	$85.49	($51.07)	$63.52	$82.58
			Total	**($1,077.32)**	**($137.21)**	**$15.32**	**$217.03**	**$546.04**

Table 20. Delay and Fuel Consumption Cost Summary (Flat Terrain, 30% Enter/Exit).

Grade	% Enter	Total Hourly Volume	Cost Element	Truck Hourly Volume				
				300	600	900	1200	1500
0	30	3000	Time	$39.97	$115.68	$308.49	$105.01	$121.54
			Fuel	$27.37	$66.06	($0.67)	($5.85)	($0.31)
			Total	**$67.33**	**$181.74**	**$307.82**	**$99.16**	**$121.22**
		4500	Time	$76.59	$141.60	$454.11	$214.88	$189.15
			Fuel	$33.23	$17.69	$73.19	$1.05	($5.99)
			Total	**$109.82**	**$159.29**	**$527.30**	**$215.92**	**$183.15**
		6000	Time	$57.85	$133.79	$179.80	$546.81	$401.59
			Fuel	($14.90)	($19.55)	$10.23	$69.34	$38.07
			Total	**$42.95**	**$114.24**	**$190.03**	**$616.15**	**$439.66**
		7500	Time	$92.55	$113.27	$282.75	$588.69	$775.49
			Fuel	$2.67	($49.73)	($5.40)	$47.55	$38.99
			Total	**$95.21**	**$63.54**	**$277.35**	**$636.24**	**$814.48**
		9000	Time	$90.50	$218.85	($448.43)	$320.93	$2,714.00
			Fuel	($24.59)	($46.27)	($43.19)	$103.63	$45.10
			Total	**$65.91**	**$172.58**	**($491.62)**	**$424.56**	**$2,759.10**

Table 21. Delay and Fuel Consumption Cost Summary (2% Terrain, 10% Enter/Exit).

Grade	% Enter	Total Hourly Volume	Cost Element	Truck Hourly Volume				
				300	600	900	1200	1500
2	10	3000	Time	$35.60	$76.40	$65.72	$74.56	$527.76
			Fuel	$28.20	$16.31	$6.10	$14.92	($70.73)
			Total	**$63.80**	**$92.70**	**$71.83**	**$89.48**	**$457.02**
		4500	Time	$106.15	$112.31	$106.27	$138.69	$87.35
			Fuel	$44.05	$28.37	$35.26	$29.65	($32.70)
			Total	**$150.20**	**$140.68**	**$141.53**	**$168.34**	**$54.65**
		6000	Time	$71.92	$132.40	$134.08	$144.18	$145.02
			Fuel	$194.78	($9.58)	($1.38)	$42.44	$20.71
			Total	**$266.70**	**$122.83**	**$132.70**	**$186.62**	**$165.73**
		7500	Time	$248.06	$188.26	$3,210.42	$162.33	$220.84
			Fuel	$111.53	$53.13	$52.24	($12.87)	$33.92
			Total	**$359.59**	**$241.39**	**$3,262.65**	**$149.46**	**$254.76**
		9000	Time	($82.76)	$19.63	$131.98	$89.29	$247.74
			Fuel	($41.51)	($56.30)	($44.47)	($27.54)	$39.90
			Total	**($124.26)**	**($36.67)**	**$87.50**	**$61.76**	**$287.63**

Table 22. Delay and Fuel Consumption Cost Summary (2% Terrain, 20% Enter/Exit).

Grade	% Enter	Total Hourly Volume	Cost Element	Truck Hourly Volume				
				300	600	900	1200	1500
2	20	3000	Time	$40.71	$139.69	$97.29	$300.25	$96.73
			Fuel	$25.84	$11.29	$45.37	($18.92)	$13.27
			Total	**$66.55**	**$150.98**	**$142.65**	**$281.33**	**$109.99**
		4500	Time	$61.06	$152.12	$220.15	$286.73	$172.38
			Fuel	$34.56	$15.10	$51.11	$11.67	($33.75)
			Total	**$95.62**	**$167.23**	**$271.26**	**$298.40**	**$138.63**
		6000	Time	$96.19	$137.45	$224.24	$226.38	$130.73
			Fuel	($14.70)	($14.59)	$59.32	$49.25	($8.17)
			Total	**$81.50**	**$122.86**	**$283.56**	**$275.63**	**$122.57**
		7500	Time	$176.08	$328.78	$266.60	$249.17	$316.29
			Fuel	$177.17	$4.93	($1.39)	$68.45	$41.18
			Total	**$353.25**	**$333.72**	**$265.20**	**$317.63**	**$357.48**
		9000	Time	($643.27)	($48.94)	$138.88	$243.17	$321.80
			Fuel	$153.46	$104.99	($44.12)	($37.96)	$86.74
			Total	**($489.81)**	**$56.04**	**$94.76**	**$205.21**	**$408.54**

Table 23. Delay and Fuel Consumption Cost Summary (2% Terrain, 30% Enter/Exit).

Grade	% Enter	Total Hourly Volume	Cost Element	Truck Hourly Volume				
				300	600	900	1200	1500
2	30	3000	Time	$48.88	$117.94	$171.46	$75.56	$77.34
			Fuel	$31.60	$23.64	$1.10	($4.91)	$4.38
			Total	**$80.48**	**$141.58**	**$172.56**	**$70.64**	**$81.72**
		4500	Time	$74.10	$141.95	$215.23	$86.85	$52.90
			Fuel	$40.70	$66.45	$50.51	$14.31	($5.21)
			Total	**$114.80**	**$208.40**	**$265.73**	**$101.15**	**$47.69**
		6000	Time	$116.50	$179.24	$254.99	$331.60	$122.55
			Fuel	($10.26)	($10.66)	$87.88	$46.75	($1.46)
			Total	**$106.24**	**$168.58**	**$342.87**	**$378.35**	**$121.09**
		7500	Time	$1.29	$155.76	$315.56	$654.11	$478.75
			Fuel	($6.30)	$15.37	$24.26	$127.50	$115.93
			Total	**($5.01)**	**$171.13**	**$339.82**	**$781.62**	**$594.68**
		9000	Time	$78.45	$200.82	($332.70)	$125.46	$217.37
			Fuel	($13.65)	($13.50)	$134.36	$182.01	($42.04)
			Total	**$64.79**	**$187.32**	**($198.33)**	**$307.48**	**$175.33**

Table 24. Delay and Fuel Consumption Cost Summary (4% Terrain, 10% Enter/Exit).

Grade	% Enter	Total Hourly Volume	Cost Element	Truck Hourly Volume				
				300	600	900	1200	1500
4	10	3000	Time	$52.04	$124.70	$167.04	$68.72	($20.13)
			Fuel	$56.74	($33.18)	($84.26)	($10.20)	$45.20
			Total	**$108.78**	**$91.52**	**$82.78**	**$58.52**	**$25.07**
		4500	Time	$106.15	$149.29	$180.67	$265.62	$187.70
			Fuel	$44.05	$64.25	$5.45	($72.68)	($83.81)
			Total	**$150.20**	**$213.53**	**$186.12**	**$192.94**	**$103.89**
		6000	Time	$98.93	$135.28	$137.75	$154.92	$102.39
			Fuel	($9.89)	$9.26	($13.29)	$4.23	($24.37)
			Total	**$89.05**	**$144.54**	**$124.46**	**$159.15**	**$78.02**
		7500	Time	$117.82	$114.85	$181.54	$136.35	$230.08
			Fuel	$30.19	$37.55	$83.21	($40.77)	$192.89
			Total	**$148.01**	**$152.40**	**$264.75**	**$95.58**	**$422.97**
		9000	Time	($29.93)	$149.76	$99.40	$150.66	$190.62
			Fuel	($39.49)	($50.52)	$200.72	($27.53)	$236.91
			Total	**($69.42)**	**$99.24**	**$300.12**	**$123.13**	**$427.53**

Table 25. Delay and Fuel Consumption Cost Summary (4% Terrain, 20% Enter/Exit).

Grade	% Enter	Total Hourly Volume	Cost Element	Truck Hourly Volume				
				300	600	900	1200	1500
4	20	3000	Time	$58.58	$140.53	$288.43	$26.50	$96.73
			Fuel	$107.61	$2.92	($73.58)	($4.41)	$13.49
			Total	**$166.19**	**$143.45**	**$214.85**	**$22.09**	**$110.21**
		4500	Time	$91.29	$181.79	$216.94	$73.94	($53.12)
			Fuel	$124.17	$67.95	($51.80)	$39.05	$99.39
			Total	**$215.46**	**$249.73**	**$165.15**	**$112.99**	**$46.26**
		6000	Time	$91.60	$188.93	$282.03	$248.84	($27.91)
			Fuel	($21.14)	$180.72	($2.07)	($66.42)	$111.23
			Total	**$70.46**	**$369.65**	**$279.96**	**$182.42**	**$83.32**
		7500	Time	$113.99	$171.61	$244.66	$515.56	$1,943.46
			Fuel	($5.50)	($54.79)	$324.37	$58.65	$80.23
			Total	**$108.48**	**$116.82**	**$569.04**	**$574.21**	**$2,023.68**
		9000	Time	($643.27)	($370.21)	$151.40	$194.75	$53.50
			Fuel	$155.84	$271.15	$82.26	($19.42)	$231.35
			Total	**($487.42)**	**($99.06)**	**$233.65**	**$175.33**	**$284.85**

Table 26. Delay and Fuel Consumption Cost Summary (4% Terrain, 30% Enter/Exit).

Grade	% Enter	Total Hourly Volume	Cost Element	Truck Hourly Volume				
				300	600	900	1200	1500
4	30	3000	Time	$74.52	$92.78	$119.45	$79.25	($37.93)
			Fuel	$119.23	$9.79	($5.48)	$8.04	$47.79
			Total	**$193.75**	**$102.57**	**$113.97**	**$87.28**	**$9.87**
		4500	Time	$89.05	$156.20	$126.26	$104.64	($41.74)
			Fuel	$36.65	$40.48	$13.42	$65.16	$46.25
			Total	**$125.70**	**$196.67**	**$139.68**	**$169.80**	**$4.51**
		6000	Time	$92.46	$198.95	$325.99	$516.43	($6.65)
			Fuel	($8.03)	$232.23	$81.85	($53.66)	$149.16
			Total	**$84.43**	**$431.18**	**$407.84**	**$462.77**	**$142.52**
		7500	Time	$51.33	$331.70	$1,787.49	$190.18	$47.05
			Fuel	$349.06	$338.47	$220.37	$23.72	$180.32
			Total	**$400.39**	**$670.17**	**$2,007.86**	**$213.90**	**$227.37**
		9000	Time	$100.12	$681.36	($262.45)	($2.45)	$240.22
			Fuel	($14.45)	$397.19	($59.26)	$148.05	$192.01
			Total	**$85.67**	**$1,078.55**	**($321.71)**	**$145.60**	**$432.23**

APPENDIX D

Crash Summary for I-45 Near Huntsville for 1999, 2000, and 2001

Table 27. Huntsville I-45 Section 1 Crashes of Type: INCAPACITATING.

ACC_YR	CRASHES	FATAL	INCINJ	NONINC	POSSINJ	NONINJ
2000	1	0	1	1	1	0

Table 28. Huntsville I-45 Section 1 Crashes of Type: NONINCAPACIT.

ACC_YR	CRASHES	FATAL	INCINJ	NONINC	POSSINJ	NONINJ
1999	1	0	0	1	0	1
2000	1	0	0	2	0	0
SEVERITY	**2**	**0**	**0**	**3**	**0**	**1**

Table 29. Huntsville I-45 Section 1 Crashes of Type: POSSIBLE INJURY.

ACC_YR	CRASHES	FATAL	INCINJ	NONINC	POSSINJ	NONINJ
1999	5	0	0	0	7	4
2000	2	0	0	0	2	2
2001	4	0	0	0	5	5
SEVERITY	**11**	**0**	**0**	**0**	**14**	**11**

Table 30. Huntsville I-45 Section 1 Crashes of Type: FATAL.

ACC_YR	CRASHES	FATAL	INCINJ	NONINC	POSSINJ	NONINJ
1999	1	1	0	0	0	1
2000	1	1	0	0	2	1
SEVERITY	**2**	**2**	**0**	**0**	**2**	**2**

Table 31. Huntsville I-45 Section 1 Crashes of Type: NON-INJURY.

ACC_YR	CRASHES	FATAL	INCINJ	NONINC	POSSINJ	NONINJ
1999	3	0	0	0	0	6
2000	3	0	0	0	0	5
2001	4	0	0	0	0	8
SEVERITY	**10**	**0**	**0**	**0**	**0**	**19**
CONTSEC1	**26**	**2**	**1**	**4**	**17**	**33**

Table 32. Huntsville I-45 Section 2 Crashes of Type: INCAPACITATING.

ACC_YR	CRASHES	FATAL	INCINJ	NONINC	POSSINJ	NONINJ
2000	1	0	1	0	3	0

Table 33. Huntsville I-45 Section 2 Crashes of Type: NONINCAPACIT.

ACC_YR	CRASHES	FATAL	INCINJ	NONINC	POSSINJ	NONINJ
1999	7	0	0	10	3	8
2000	7	0	0	7	4	4
2001	3	0	0	4	1	1
SEVERITY	**17**	**0**	**0**	**21**	**8**	**13**

Table 34. Huntsville I-45 Section 2 Crashes of Type: POSSIBLE INJURY.

ACC_YR	CRASHES	FATAL	INCINJ	NONINC	POSSINJ	NONINJ
1999	7	0	0	0	16	5
2000	8	0	0	0	16	5
2001	8	0	0	0	11	10
SEVERITY	**23**	**0**	**0**	**0**	**43**	**20**

Table 35. Huntsville I-45 Section 2 Crashes of Type: FATAL.

ACC_YR	CRASHES	FATAL	INCINJ	NONINC	POSSINJ	NONINJ
1999	1	2	0	0	0	1
2001	1	1	1	0	0	1
SEVERITY	**2**	**3**	**1**	**0**	**0**	**2**

Table 36. Huntsville I-45 Section 2 Crashes of Type: NON-INJURY.

ACC_YR	CRASHES	FATAL	INCINJ	NONINC	POSSINJ	NONINJ
1999	11	0	0	0	0	18
2000	4	0	0	0	0	9
2001	8	0	0	0	0	14
SEVERITY	**23**	**0**	**0**	**0**	**0**	**41**
CONTSEC1	**66**	**3**	**2**	**21**	**54**	**76**
	737	**11**	**43**	**164**	**626**	**1000**

Appendix E

Truck Roadway Training Procedures

DEMONSTRATION OF ANALYSIS TOOLS

TTI applied the analysis tools developed in previous tasks to the following three corridor segments in order to evaluate the utility of the truck-segregated concept:

- I-35 between U.S. 83 and Loop 20 (near Laredo),

- I-10 east in Houston (near ship channel), and

- I-45 near Huntsville.

The Project Management Committee provided the input for identifying these candidate corridors at its May 5, 2005, meeting. For each of the selected corridors, the research team used the modeling environment developed earlier and evaluated traffic flow conditions under existing and future truck and non-truck volumes, and treatments of truck segregation. Results for all three are available in Research Report 0-4663-1. The Huntsville I-45 case study provided the best example, so this appendix provides the step-by-step procedures to assist users in learning how to evaluate corridors for truck roadways.

Case Study of I-45 near Huntsville

This case study follows the same eight-step process outlined at the beginning of this document. The selected freeway segment for this case study is near Huntsville on I-45; it has 12 sub-segments and is 8.87 miles in length.

Step 1: Acquire truck and non-truck volume: Request the latest classification counts from TPP(T) in Austin. Locations of major truck traffic generators along with national and international trends are also critical for accurate predictions pertaining to long design periods. Each segment of freeway evaluated will have a different traffic volume, different mix of vehicles, and potentially different growth rates, so the analyst must decide which sub-element, if any, best represents the overall segment and for which a roadway can feasibly be built. Choosing the highest value may not always be feasible.

Step 2: Predict truck and non-truck volume: If several years of data are available, establish a growth pattern by fitting a line to the earliest and most recent year's data points (using as many relevant years as TPP can provide). Calculate an equivalent constant annual growth rate using the following equation:

$$i = \left[\frac{AADTT_e}{AADTT_s} \right]^{\frac{1}{n-1}}$$

where,

i = equivalent constant annual growth rate,
$AADTT_s$ = AADTT for starting year,

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AADTT$_e$ = AADTT for ending year, and

n = number of years between starting year and ending year.

Table 37 summarizes traffic growth on the selected freeway segment on I-45, which is 8.87 miles in length. The tabulated values indicate the results from four count stations and the variation in traffic along the segment. The ADT and AADTT values shown in bold are the maximum values along the selected segment of freeway of about 100,000 vehicles per day and about 45,000 trucks per day, respectively. The use of a value lower than the maximum may be feasible in some cases.

Table 37. 2022 AADT and AADTT Summary for I-45 near Huntsville.

Minimum ADT	Maximum ADT	AADT	Minimum ADTT (90%)	Maximum ADTT (90%)	AADTT (90%)
26,580	41,020	31,790	7,074	9,005	8,344
37,976	58,607	45,420	12,526	17,142	15,005
45,393	70,053	54,291	16,668	23,652	20,133
64,855	**100,089**	77,567	29,513	**45,026**	36,285

Step 3: Determine desired level of service: The desired LOS in this case is LOS C, and ramp volumes on the truck roadway are expected to be 20 percent of the mainline traffic volume. The terrain is level. Choose the appropriate table and values from Tables 4 through 12 (use Table 5).

Step 4: Determine number of lanes: Enter Table 5 with the ADT and AADTT to find a scenario which best represents the predicted traffic in the design year. For ramp volumes in the 20 percent range, the mixed scenario will operate at LOS C or slightly worse on three lanes (using the 90,000 vpd column), and the separated scenario will require two lanes for cars and two lanes for trucks, both operating at or near LOS C.

Step 5: Acquire crash data and estimate crash costs: Table 38 is a summary of the crashes that occurred on this segment of I-45 near Huntsville for the three years 1999, 2000, and 2001, with more detail on each severity category provided in Appendix D. The total cost of these crashes for all three years was $10,968,600, so the average annual cost would be $3,656,200. Assuming that 75 percent of these costs could be saved by separating trucks from cars, the resulting benefit would be $2,742,150 per year. Dividing by the 8.87-mile length of this segment would give an approximate reduction in cost per mile of $309,149. The crash database does not provide information on whether hazardous materials involvement could have increased this value even more.

Table 38. Huntsville I-45 Crash Summary.

Crash Type	Combined Fatal and Incap. Injury	Non-Incap. Injury/ Possible Injury	Non-Injury
No. Crashes	8	96	109
Cost by Type	$854,000 [a]	$41,500 [a]	$1,400 [a]
Subtotal	$6,832,000	$3,984,000	$152,600

[a] *Source:* TxDOT.

Step 6: Determine initial construction cost: Having a "2 + 2" cross-section in each direction instead of a three-lane by direction mixed roadway adds an incremental annual cost of $657,743 per mile (from Table 16), assuming a 5 percent rate of return.

Step 7: Determine costs of delay and fuel consumption: Savings due to reduced delay and fuel consumption at these volumes would be $125 per hour per mile of roadway (rounded, based on 1500 trucks per hour and 4500 total hourly vehicles) based on the peak hour. Appendix C contains values matched to Tables 4 through 12. In this case, use the Appendix table, which corresponds to Table 5. To convert the hourly value to an annual value, multiply by a value, which is representative for the full day. Based on TPP count data from seven high-volume sites, the percent of total daily traffic which occurs each hour varies in a linear fashion from 6 percent during the highest hour to 2.5 percent for the lowest hour. For this analysis, use a value midway between, which is 4.25 percent. To consider the daily fluctuations, reduce the savings of $125 per hour per mile by an averaging factor determined by dividing 4.25 percent by 6.0 percent. This hourly value would become $89. The annual savings would be found by multiplying 8760 hours per year by $89 or $197,249.

Step 8: Determine user perspectives and other measures of acceptability: The best means of determining user perspectives is to contact motor carriers or their representative organizations. In Texas, the Texas Motor Transport Association (TMTA) represents a variety of carriers and is a good source of information regarding roadway treatments that potentially affect their members. Public meetings are a good means of getting information from the general public. The Trans Texas Corridor initiative has resulted in a large number of public meetings along the I-35 corridor, and their findings can be requested from the Texas Turnpike Authority Division of TxDOT.

Step 9: Total all benefits and costs: Steps 5, 6, and 7, and to a lesser degree Step 8 will lead to several values that, when totaled, can yield a Benefit/Cost ratio. In cases in which perfect data contribute to the final answer, a B/C greater than 1.0 (indicating benefits exceed costs) would probably suffice for decision-makers. However, most data has some uncertainty, so many decision-makers increase the B/C threshold to a more "comfortable" level to account for this uncertainty. This document uses a value of 2.0. The final calculation of all benefits and costs places any savings in delays, fuel consumption, and crash reduction costs in the numerator and the additional cost associated with separated truck roadways in the denominator. For the I-45 example, benefits accrue based on crash improvements of $309,149 per mile and improvements in delay and fuel consumption of $197,249. The additional annual cost for a 2+2 roadway versus

a three-lane roadway (per direction) would be $657,743. The benefit/cost value would be the sum of $309,149 plus $197,249 divided by $657,743, for a B/C of 0.77. This result indicates that building a two-lane truck roadway would not be cost-effective.

APPENDIX F

Truck Roadway User Guide for CORSIM Analysis

Simulating Texas Trucks in CORSIM

Within CORSIM, a submodel known as FRESIM contains all freeway simulation details; another submodel known as NETSIM handles surface street operations. Interface nodes between FRESIM and NETSIM create a CORSIM network, which then contains all desired surface and freeway roadway features, vehicles, and controls. Since truck roadways are conceptualized as freeway facilities within this research investigation, we will only present the details for using FRESIM to simulate truck roadways. However, we will use the all-inclusive term CORSIM to refer to the model and all of its components.

Several calibration changes must be made within an input file to ensure that CORSIM creates the most appropriate representation of truck types and characteristics for Texas conditions. By default, CORSIM features four generic truck types for freeway operations simulation. Table 39 presents these types, their default percentages in the traffic stream, and their general classification (refer to Table 40, Truck Classification Schemes, for more detail). Within CORSIM, all trucks feature a headway factor of 120, a jerk value of 7.0 ft/s^2, an emergency deceleration of 15.0 ft/s^2, and a maximum deceleration under normal conditions of 8.0 ft/s^2. The headway factor indicates that truck drivers generally allow greater spacing between vehicles than automobile drivers, and the jerk and acceleration values govern the acceleration and braking performance limits of heavy vehicles. These values were found to be reasonably consistent with truck performance data described earlier in this report.

The "Performance Index" value shown for each CORSIM truck type shown in Table 39 affects the fuel consumption and emissions outputs from the model. Such differentiation is necessary so that larger and more heavily loaded trucks are correctly shown to be more demanding consumers of fuel and produce more emissions than smaller trucks.

Table 39. CORSIM Default Truck Types for Freeway Simulation.

CORSIM Truck Type	Length (Feet)	Performance Index	Performance Description	Texas 6 Classification	Percent of Truck Population
FRESIM 3	35	3	Single Unit	Class 5,6	31
FRESIM 4	53	4	Semi-Trailer – Medium Load	Class 7,8,9,10	36
FRESIM 5	53	5	Semi-Trailer – Full Load	Class 7,8,9,10	24
FRESIM 6	64	6	Double-Bottom Trailer	Class 11,12,13	9

As indicated by Table 39, CORSIM has a limited number of truck types available for inclusion in the model. In addition, it uses one "truck type" to differentiate between trucks of the same type with different load levels, or weights. While at first appearing rather constrained, especially since the Texas 6 truck classification scheme features nine different truck types and the FHWA truck classification scheme includes eight different truck types, the number of truck types available in CORSIM is appropriate for the simulation of Texas' truck distribution (see Table 40 for more detail). By combining the truck population found in Texas into broad

Table 40. Truck Classification Schemes.
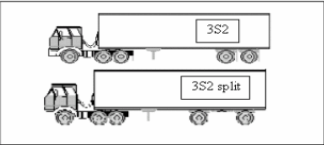
Typical Vehicle Type	Texas 6 Classification	FHWA Classification
	Class 5: 3 axles, single unit	**Class 6**: 3 axles, single unit
	Class 6: 4 or more axles, single unit	**Class 7**: 4 or more axles, single unit
2S1 2S2 3S1	**Class 7**: 3 axles, single trailer **Class 8**: 4 axles, single trailer	**Class 8**: 3 to 4 axles, single trailer
3S2 3S2 split	**Class 9**: 5 axles, single trailer	**Class 9**: 5 axles, single trailer
3S3 3S4	**Class 10**: 6 or more axles, single trailer	**Class 10**: 6 or more axles, single trailer
2S1-2	**Class 11**: 5 or less axles multi-trailers	**Class 11**: 5 or less axles, multi-trailers
2S2-2 3S1-2	**Class 12**: 7 or more axles multi-trailers	**Class 12**: 6 axles, multi-trailers
3S2-2	**Class 13**: 6 axles, multi-trailers	**Class 13**: 7 or more axles, multi-trailers

Table 41. Truck Type Distribution for Rural Texas Conditions.

Truck Class	ATR Station 13D (40% Weight) (Daily Volume)	ATR Station 198 (60% Weight) (Daily Volume)	Final Distribution (Percent)
5	345	546	8.2
6	48	53	0.9
7	6	6	0.1
8	180	62	1.9
9	3169	5817	83.5
10	49	20	0.6
11	135	285	3.9
12	36	60	0.9
13	0	1	0.0

categories for single unit, semi-trailer and double-bottom trucks, and using the default load distribution for semi-trailers represented by CORSIM truck types FRESIM 4 and FRESIM 5, the distribution of trucks in Texas, represented in CORSIM, becomes that shown in Table 42. The new lengths shown for each truck type are weighted averages based on each truck's length within the Texas 6 classification scheme and its relative proportion within the appropriate CORSIM truck type.

Coding the Model

The data from Table 39 is incorporated into CORSIM by editing network properties. Once the user has created a TRAFED (CORSIM input file graphical editor) file and is within CORSIM's TRAFED editor, simply click on **Network** from the main menu bar and then select **Properties** from the pull-down menu. Once within the Properties pop-up window, select the tab for **Vehicle Types**; the window should look exactly like the one shown in Figure 15. At the top of this window you see a pull-down box titled "Select a Vehicle Type to edit." By clicking the pull-down arrow the user is able to edit FRESIM vehicle types 3, 4, 5, and 6 (i.e., the FRESIM truck types) to contain the values shown in Table 41. Upon completing each FRESIM vehicle (truck) type edit, the window should look like the window images shown in Figure 16. Red highlighting circles have been added to the images to show where values have been changed from the CORSIM default values.

Once the truck population for Texas has been entered into CORSIM, the model can be coded for the unique situation being analyzed. Once the links have been correctly coded into CORSIM for the freeway mainlane sections and any ramps included within the geometric boundaries of the analysis, volume input details are coded. When specifying input volumes, ensure that the correct truck percentage of traffic is coded. For truck roadways as considered in this research, the truck percentage would be 100 percent. Figure 17 shows an example of a CORSIM entry node volume input window for a 100 percent truck allocation. When using the

Texas truck percentage in CORSIM for a mixed-flow facility, simply indicating the known percent trucks for that freeway segment's entry nodes and ramps will cause CORSIM to create trucks of the right type, in the right proportion (using the vehicle type data entered from Figure 16) and of the correct proportion in the overall traffic stream.

Table 42. CORSIM Distribution/Representation of Texas Rural Truck Population.

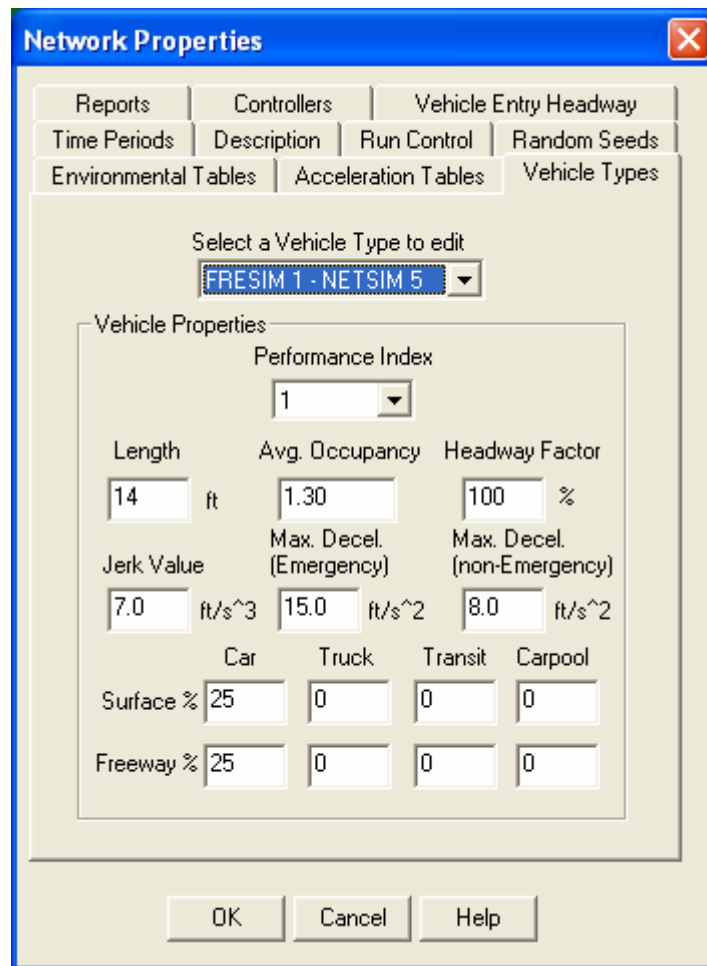| CORSIM Truck Type	Length (Feet)	Performance Index	Performance Description	Texas 6 Classification	Percent of Truck Population
FRESIM 3	35	3	Single Unit	Class 5,6	9
FRESIM 4	68	4	Semi-Trailer – Medium Load	Class 7,8,9,10	52
FRESIM 5	68	5	Semi-Trailer – Full Load	Class 7,8,9,10	34
FRESIM 6	73	6	Double-Bottom Trailer	Class 11,12,13	5

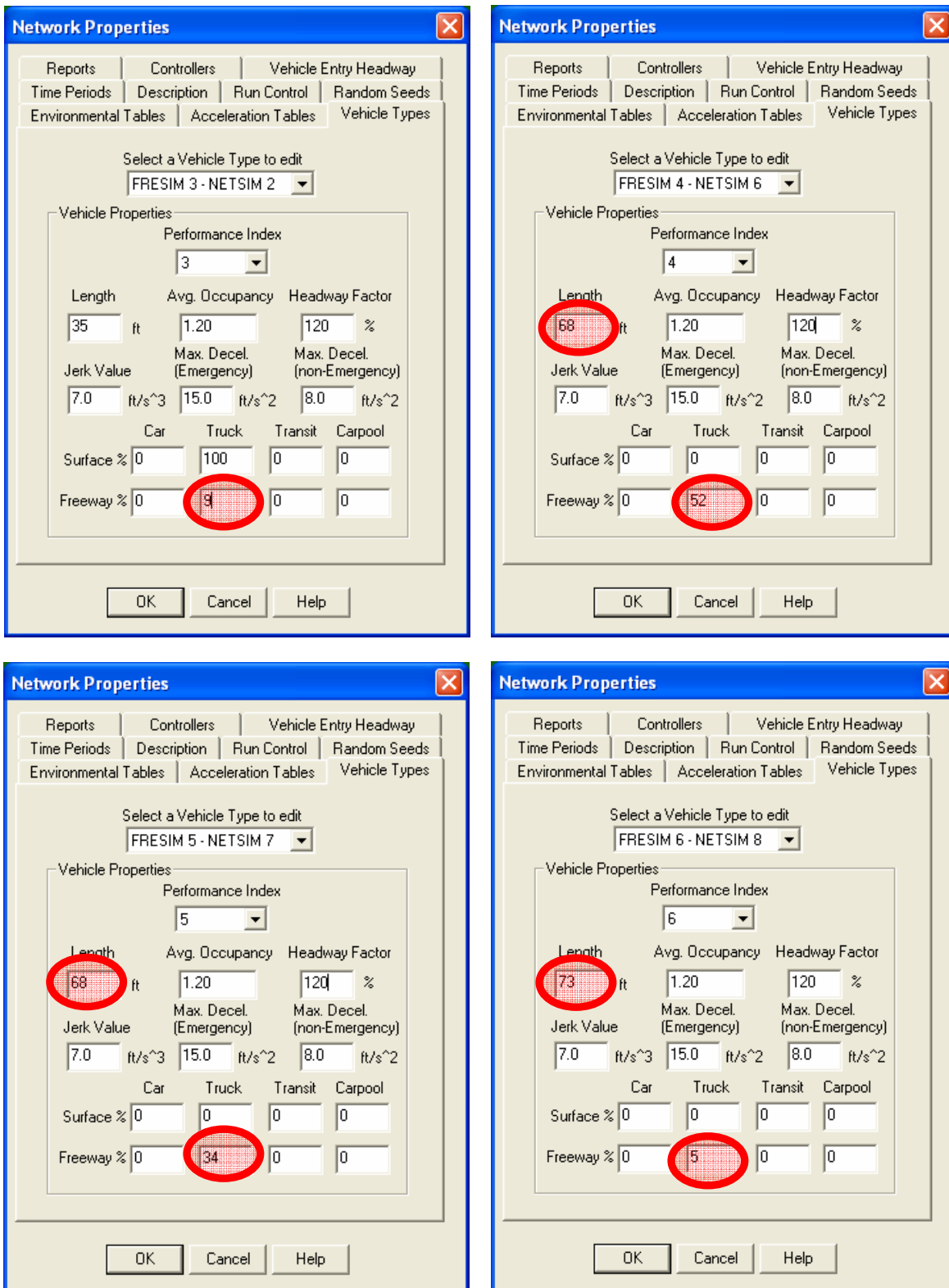**Figure 15. CORSIM Network Properties/Vehicle Types Window.**

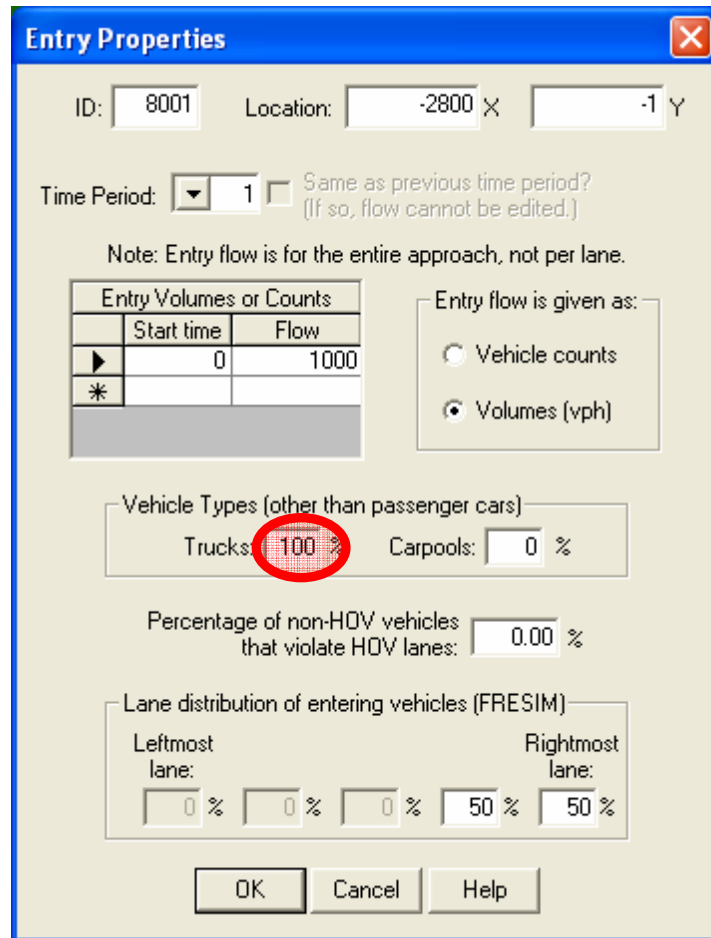**Figure 16. CORSIM Vehicle Types Edited for Texas Truck Population.**

Figure 17. CORSIM Volume Data Entry Window.

       If one of the truck treatment alternatives being investigated is truck lane restrictions, CORSIM includes a feature that allows you to either bias trucks to certain lanes of the freeway or to fully restrict trucks so that they only use certain lanes. To use this feature, simply double-click on a freeway link where you wish to add the restriction. A freeway link pop-up window will appear that allows you to edit the geometric properties of the link. Upon viewing this window, click on the **Trucks** tab (see Figure 18). The user has the option of letting trucks use all lanes, biasing trucks to a select number of left or rightmost lanes on the freeway, or restricting trucks to a select number of left- or rightmost lanes on the freeway. In a common situation associated with truck lane restrictions, where trucks are not allowed to use the leftmost lane of the freeway, you would simply code the freeway links to restrict trucks to the rightmost two (2) through lanes (assuming a three-lane freeway).
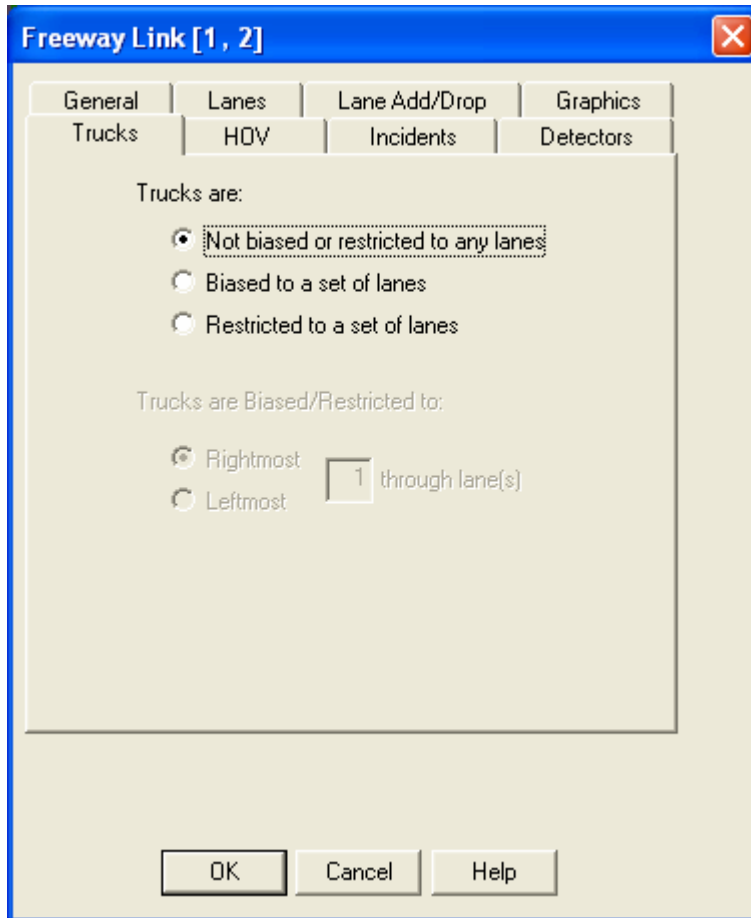
Figure 18. CORSIM (FRESIM) Truck Restriction Settings.

Creating a number of CORSIM input files for truck roadway simulation analysis requires creating a new TRAFED input file and re-entering the truck type distribution data shown in Figure 16. There is no way within CORSIM to alter the vehicle type distributions and save those settings for later use.