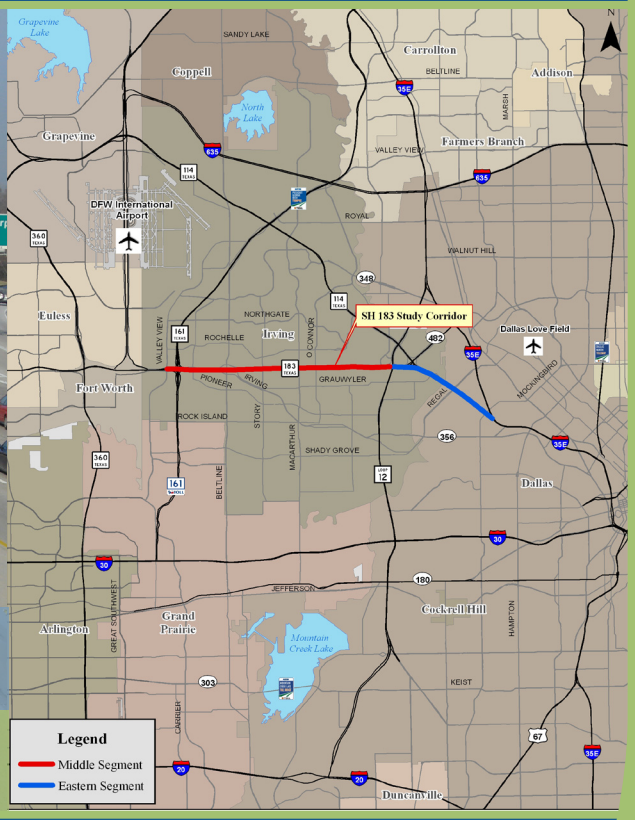
# Level 2 Traffic and Toll Revenue Study

## SH 183 Managed Lanes between Valley View Lane and IH 35E




**Prepared for:** *Texas Department of Transportation*

DRAFT

*March* **2010**

# Level 2 Traffic and Toll Revenue Study

## SH 183 Managed Lanes between Valley View Lane and IH 35E

Prepared for:

Texas Department of Transportation

Prepared by:

WilburSmith Associates

DRAFT

March 2010

March 31, 2010

Mr. Doug Woodall, P.E.
Director of Planning and Development
Texas Turnpike Authority Division of TxDOT
125 East 11th Street
Austin, TX 78071

**Re: SH 183 Managed Lanes Intermediate Level 2 Traffic and Toll Revenue Study**

Dear Mr. Woodall:

Wilbur Smith Associates (WSA) is pleased to submit this report of our traffic and toll revenue study for the proposed SH 183 Managed Lanes project located in Dallas County. The report summarizes the findings of the study, which included development of traffic and toll revenue estimates for a 52-year period.

This study builds upon previous study prepared by WSA and the extensive data collected as part of this study and enhanced the travel demand model with updated information. The study describes the methodologies implemented to collect new data within the corridor and the enhancements undertaken as part of the model development to forecast the traffic and toll revenue that the managed lane project will generate under defined alternatives.

Our project team, including Xiaojin (Jerry) Ji, Ram S. Maddali, Mustafa Kamal, Ting Yi, Lin Zhou, Kristin McLeod, Naveen Mokkapati and others, gratefully acknowledge the assistance and cooperation received from TxDOT as well as others contacted during the course of the study. WSA sincerely appreciates the opportunity to have participated in this important project.

Respectfully submitted,

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*WSA has made qualitative judgments related to several key variables within the analysis used to develop the traffic and revenue forecasts that must be considered as a whole; therefore selecting portions of any individual results without consideration of the intent of the whole may create a misleading or incomplete view of the results and the underling methodologies used to obtain the results. WSA gives no opinion as to the value or merit to partial information extracted from the report.*

*All estimates and projections reported herein are based on WSA' experience and judgment and on a review of independent third party projections and information obtained from multiple state and local agencies including TxDOT. These estimates and projections may not be indicative of actual or future values, and are therefore subject to substantial uncertainty. Future developments cannot be predicted with certainty, and may affect the estimates or projections expressed in the report, such that WSA does not specifically guarantee or warrant any estimate or projections contained within this report While WSA believes that some of the projections or other forward-looking statements contained within the report are based on reasonable assumptions as of the date in the report, such forward looking statements involve risks and uncertainties that may cause actual results to differ materially from the results predicted. WSA take no responsibility or obligation to advise of changes that may in any matter affect the assumptions contained within the report, following the date of this report as they pertain to: socioeconomic and demographic forecasts, proposed residential or commercial land use development projects and/or potential improvements to the regional transportation network.*

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# EXECUTIVE SUMMARY

Wilbur Smith Associates (WSA) was retained by the Texas Turnpike Authority (TTA) division of the Texas Department of Transportation (TxDOT) to conduct an Intermediate Level 2 Traffic and Toll Revenue study for the proposed SH 183 Managed Lanes between Valley View Lane (west of SH 161) and IH 35E Stemmons Freeway East/Trinity Parkway in Dallas County. This study is part of TxDOT's ongoing planning effort to evaluate the toll feasibility and revenue generating potential of operating the SH 183 as managed lane facility with toll pricing.

## PROJECT DESCRIPTION

The SH 183 corridor connects the cities of Dallas and Fort Worth, located directly to the south of the DFW airport, and provides one of the primary connections between the two central business districts of both cities. The proposed 9.5 mile long SH 183 corridor segment evaluated under this Level 2 study is located entirely within Dallas County and extends from Valley View Lane just west of SH 161 at the western termini to IH 35E/Trinity Parkway at the eastern termini. The majority of the SH 183 study corridor traverses the city of Irving and part of the city of Dallas at the eastern terminus where SH 183 merges with IH 35E.

The ultimate configuration of the proposed SH 183 study corridor includes approximate eight general purpose lanes to the west of SH 114 and ten general purpose lanes east of SH 114. Two concurrent tolled managed lanes in each direction running from Valley View Lane up to the intersection of SH 114 will be constructed with three concurrent managed lanes in each direction beyond SH 114 to IH 35E. The study corridor will connect to the North Tarrant Express Segment 2E at its west end, which will have three managed lanes in each direction extending until IH 820. The proposed SH 183 managed

lanes are expected to connect at the east termini of the project to a 2-lane reversible lane facility along IH 35E. Direct connections will ultimately be constructed to connect the SH 183 managed lanes to the proposed Trinity Parkway and the SH 114 managed lanes based on expected opening dates provided by TxDOT staff. The corridor was evaluated as two segments to facilitate anticipated project development phasing scenarios as defined below and shown in **Figure ES-1**:

- Middle Segment: A 6.3 mile concurrent managed lane facility with two lanes in each direction, from Valley View Lane west of SH 161 to Loop 12; and
- East Segment: A 3.2 mile concurrent managed lane facility with three lanes in each direction, from Loop 12 to IH 35E.

## PROJECT ALTERNATIVES DESCRIPTION

Five project alternatives were identified and evaluated as part of this study to reflect the different combinations and phasing of the various corridor segments. The toll operation and pricing policies followed the guidelines defined by the Regional Transportation Council (RTC) managed lane policy. Under this policy, the single occupant vehicles (SOVs) will pay the full toll rate, while the high occupant vehicles with two or more passengers (HOV 2+) will receive a 50 percent discount during the peak periods but pay the full toll rate during the off-peak periods until 2025 after which no further discounts will be provided to all markets. Four of the alternatives as described below assumed the RTC policy while the duration of the discounted toll for the HOV traffic is assumed to extend until 2030 for Alternative 5. The five alternatives reflect early or delayed opening dates for the full build-out of the project corridor and combinations of the phased opening of east segment and middle segments outlined below and summarized in **Table ES-1**:

*Alternative 1 (Early Combined)* – Both the middle and east segments will be constructed and open to traffic by 2015 and reflects the most optimistic construction plan of the five project alternatives;

*Alternative 2 (East only)* – East segment will be constructed and open to traffic by 2019 with the middle segment opening by 2030;

*Alternative 3 (Middle Only)* – Middle segment will be constructed and open to traffic by 2019 with the east segment opening by 2030;

*Alternative 4 (MTP Combined)* – Both the middle and east segments will be constructed and open to traffic by 2019, which is consistent with the latest NCTCOG's 2030 Mobility Plan – 2009 Amendment;

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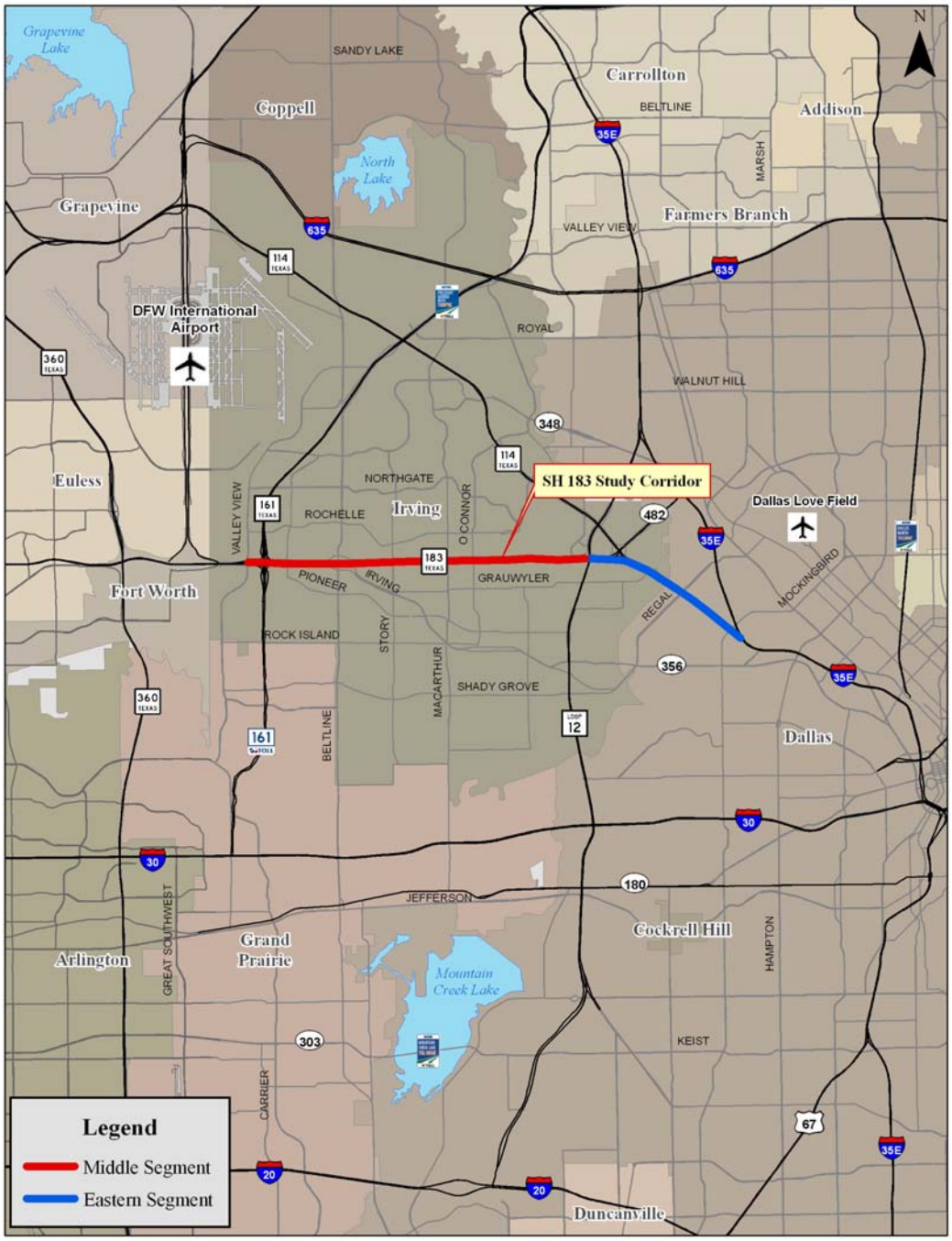


**Figure ES-1. SH 183 Managed Lane Project Location and Segments**

*Alternative 5 (Delayed Combined)* – Both middle and east segments are assumed to be constructed and open to traffic by 2025, which reflects a 6-year deferral from the current NCTCOG's 2030 Mobility Plan – 2009 Amendment. Under this alternative, the HOV2+ discount is also assumed to extend until 2030.

**Table ES-1**
**SH 183 Managed Lane Project Alternatives**

| Alternatives | Items | Middle Segment<br>From Valley View Lane to Loop 12 | East Segment<br>From Loop 12 to IH 35E |
|---|---|---|---|
| 1 - Early Combined | Opening | Open by 2015 | Open by 2015 |
| | Pricing | HOV2+ pay discounted price till 2025 | HOV2+ pay discounted price till 2025 |
| 2 - East Only | Opening | Open by 2030 | Open by 2019 |
| | Pricing | HOV2+ pay discounted price till 2025 | HOV2+ pay discounted price till 2025 |
| 3 - Middle Only | Opening | Open by 2019 | Open by 2030 |
| | Pricing | HOV2+ pay discounted price till 2025 | HOV2+ pay discounted price till 2025 |
| 4 - MTP Combined | Opening | Open by 2019 | Open by 2019 |
| | Pricing | HOV2+ pay discounted price till 2025 | HOV2+ pay discounted price till 2025 |
| 5 - Delayed Combined | Opening | Open by 2025 | Open by 2025 |
| | Pricing | HOV2+ pay discounted price till 2030 | HOV2+ pay discounted price till 2030 |

## TRAFFIC AND REVENUE SUMMARY

The 52-year traffic and toll revenue estimates for the five alternatives were calculated based on the project configuration described in Chapter 1, the corridor growth discussed in Chapter 4, and the following additional basic assumptions:

- The SH 183 managed lanes would run from Valley View Lane just west of SH 161 to IH 35E Stemmons Freeway East/Trinity Parkway. The managed lane segments will open to traffic in various years and phases depending on the defined alternative. The collection of tolls begins at the opening of the various project segments for purposes of analyzing the revenue generation potential of the corridor;
- The tolls will be collected using electronic toll collection (ETC) with revenue-neutral video tolling based on distance traveled and no cash will be accepted.

The ETC operations are assumed to be actively monitored and strictly enforced to minimize the potential revenue loss due to toll evasion. *No toll evasion adjustments were made to the toll revenue estimates included in this report*;

- Transportation improvements as detailed in NCTCOG's Mobility Plan 2030: 2009 Amendment will be implemented; no other competing routes or capacity improvements will be constructed within the forecast period and no additional general purpose lane capacity besides those proposed in the MTP will be implemented within the SH 183 corridor;
- Commercial vehicles/trucks with more than two-axles will have access to the managed lanes and will be charged 2.8 times the normal toll rate as derived from the average truck axle distribution along the corridor;
- Estimates of annual toll revenue included in this report have been adjusted to reflect "ramp-up" during the first three years of operation. The ramp-up volume was assumed to be 80 percent of the model estimate in the opening year, 90 percent in the following year, and 100 percent for all subsequent years;
- The HOV2+ vehicles will receive a 50 percent discount during the AM and PM peak periods until 2025, to conform with the current Regional Transportation Council (RTC) managed lane policy, with the exception of Alternative 5 which assumes the extension of the HOV2+ discount until 2030;
- The value-of-time was increased at an average rate of 2.75 percent per year for the forecast period based on an economic analysis of the region;
- Weekend traffic is assumed to be approximately 20 percent of weekday managed lane traffic, which correspond to the annual days of 275 for annual transaction calculation. Weekend revenue is calculated using reduced weekday toll rates;
- Traffic during the night time (7:30 p.m. - 6:30 a.m.) was not directly modeled in the travel demand model. Instead, the potential revenue generation during the night time was assumed to be 2 percent of the total daily revenue;

The baseline annual toll revenue estimates for the proposed SH 183 managed lane project are summarized in **Table ES-2** for the five alternatives evaluated. Alternative 1 represents the most optimistic full build-out of the entire corridor and is expected in the 2015 opening year to generate revenues of approximately $4.50 million and is estimated to grow to $16.3 million by 2030. Alternatives 2 and 3 are both open in 2019 and expected to generate $1.5 million and $5.3 million respectively with the consideration of project ramp up. All five alternatives assume that the entire corridor will ultimately be built by 2030. The ramp up factors applied to Alternatives 2 and 3 result in slight

variations in the revenue among alternatives with Alternatives 2 and 3 close $15 million and the other Alternatives over $16 million.

**Table ES-2**
**Estimated Baseline Annual Revenue (in thousands)**

| Year | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5 |
|---|---|---|---|---|---|
| 2015 | $4,500 | | | | |
| 2019 | $9,300 | $1,500 | $5,300 | $7,400 | |
| 2025 | $11,700 | $3,400 | $6,900 | $11,700 | $8,800 |
| 2030 | $16,300 | $14,600 | $14,800 | $16,300 | $16,300 |
| 2040 | $26,500 | $26,500 | $26,500 | $26,500 | $26,500 |
| 2050 | $40,300 | $40,300 | $40,300 | $40,300 | $40,300 |

In addition to the baseline assumptions, a risk assessment was undertaken to examine the impact of the level of uncertainty associated with multiple key variables upon which travel demand is dependent. The key variables evaluated as part of the risk assessment of this study included the ramp-up factor truck toll factor, annual traffic factor, socioeconomic forecasts, values of time, and toll diversion. The risk assessment was performed for both the midline and modified scenarios with the modified case reflecting the more aggressive of the revenue growth assumptions. The estimated annual toll revenues of the modified case are summarized in **Table ES-3** and **ES-4** for the five alternatives along with the baseline toll revenue.

The managed lanes are expected to generate $4.5 million in toll revenue for Alternative 1 in the opening year of 2015 under the baseline assumptions, while approximately $12.9 million in revenue is expected under the modified scenario assumptions, reflecting an approximate 2.9 factor increase over the baseline revenues. The toll revenue is estimated to grow to $16.3 million by 2030 for the baseline case, and $54.5 for the modified case, reflecting an approximate 3.3 factor over the baseline revenues. As is expected, the uncertainty for managed lanes revenue forecast may be significantly higher than the traditional toll road given some unique operating characteristics of managed lanes that include the parallel competing alternatives, and more specifically the congestion pricing that needs to be implemented to effectively manage the demand along the managed facilities.

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**Table ES-3**
**Estimated Risk Analysis Annual Toll Revenue for Alternatives 1, 2 and 3 (in Thousands)**

| Year | Alternative 1 | | Alternative 2 | | Alternative 3 | |
|---|---|---|---|---|---|---|
| | Baseline | Modified | Baseline | Modified | Baseline | Modified |
| 2015 | $4,500 | $12,900 | | | | |
| 2019 | $9,300 | $19,600 | $1,500 | $4,700 | $5,300 | $10,200 |
| 2025 | $11,700 | $35,500 | $3,400 | $13,800 | $6,900 | $15,200 |
| 2030 | $16,300 | $54,500 | $14,600 | $49,700 | $14,800 | $51,500 |
| 2040 | $26,500 | $101,700 | $26,500 | $101,700 | $26,500 | $101,700 |
| 2050 | $40,300 | $160,700 | $40,300 | $160,700 | $40,300 | $160,700 |

**Table ES-4**
**Estimated Risk Analysis Annual Toll Revenue for Alternatives 4,and 5 (in Thousands)**

| Year | Alternative 4 | | Alternative 5 | |
|---|---|---|---|---|
| | Baseline | Modified | Baseline | Modified |
| 2019 | $7,400 | $17,700 | | |
| 2025 | $11,700 | $35,500 | $8,800 | $28,600 |
| 2030 | $16,300 | $54,500 | $16,300 | $54,500 |
| 2040 | $26,500 | $101,700 | $26,500 | $101,700 |
| 2050 | $40,300 | $160,700 | $40,300 | $160,700 |

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# CHAPTER 1
# INTRODUCTION

Wilbur Smith Associates (WSA) was retained by the Texas Turnpike Authority (TTA) division of the Texas Department of Transportation (TxDOT) to conduct an Intermediate Level 2 Traffic and Toll Revenue study for the proposed SH 183 Managed Lanes between Valley View Lane (west of SH 161) and IH 35E Stemmons Freeway East/Trinity Parkway in Dallas County. This study is part of TxDOT's ongoing planning effort to evaluate the toll feasibility and revenue generating potential of operating the SH 183 as managed lane facility with toll pricing.

## OBJECTIVE AND SCOPE OF STUDY

A Preliminary Traffic and Revenue study was conducted for this corridor as a managed lane facility by WSA in 2002. The project studied in 2002 extends from SH 360 to IH 35E as a reversible manage lane with two or three lanes along the project. Two major tolling concepts were evaluated as part of the 2002 study that include HOV2+ traveling free, single occupant vehicle (SOV) tolled and HOV3+ free, SOV and HOV2 tolled. The managed lane concept evolves and new managed lane tolling policy was applied by regional transportation commission (RTC) since then. The reversible managed lane configuration of SH 183 was later changed to the concurrent managed lane with 2-lane each direction. The current RTC managed lane policy requires that HOV2+ vehicles pay discount toll rate. In order to support the TxDOT procurement of this project, a sketch level study was conducted by WSA in 2008 with the new configuration and tolling policy.

This Intermediate Level 2 Study is the continuation of a more detailed traffic and toll revenue study to develop 52-year annual revenue forecasts for various proposed project alternatives using more detailed and recently collected data within the corridor. The study is not intended for use in financing, however, it provides a significant amount of

additional information beyond that provided previously. The extensive data collected that was used to calibrate the travel demand model and enhance the model included:

- Traffic counts along SH 183 and several screenlines, and speed and delay information to establish a current baseline of traffic patterns in the study area, for purposes of base travel demand model calibration;
- Origin-destination surveys to capture the trip characteristics along the SH 183 corridor for use in evaluating and enhancing the trip tables obtained from North Texas Council of Government (NCTCOG);
- Stated-preference survey efforts to investigate the willingness-to-pay characteristics in the study area and capture other preferences affecting the use of the proposed managed lanes. This information is also critical in developing and enhancing the toll diversion characteristics in the corridor.

The study provides a detailed analysis of the existing trends and characteristics of traffic within the SH 183 study corridor, as shown in **Figure 1-1**, and investigates the toll feasibility of the corridor under a number of potential project alternatives in support of the TxDOT procurement process. The modeling of the corridor demand was performed for multiple future years, and annual revenue forecasts were then developed for different project scenarios as defined and requested by TxDOT staff. The latest travel demand model databases, including the updated network and trip tables, and the economic forecasts from the NCTCOG 2030 Mobility Plan-2009 Amendment were used as part of the analysis.

The scope of work for this study includes a review of background material, traffic data collection, an analysis of the regional economic growth, model calibration and development, and estimates of traffic and revenue for the corridor segments. In addition, traffic and revenue risk analyses were performed to evaluate the potential range of revenue likely to be generated from the managed lane project.

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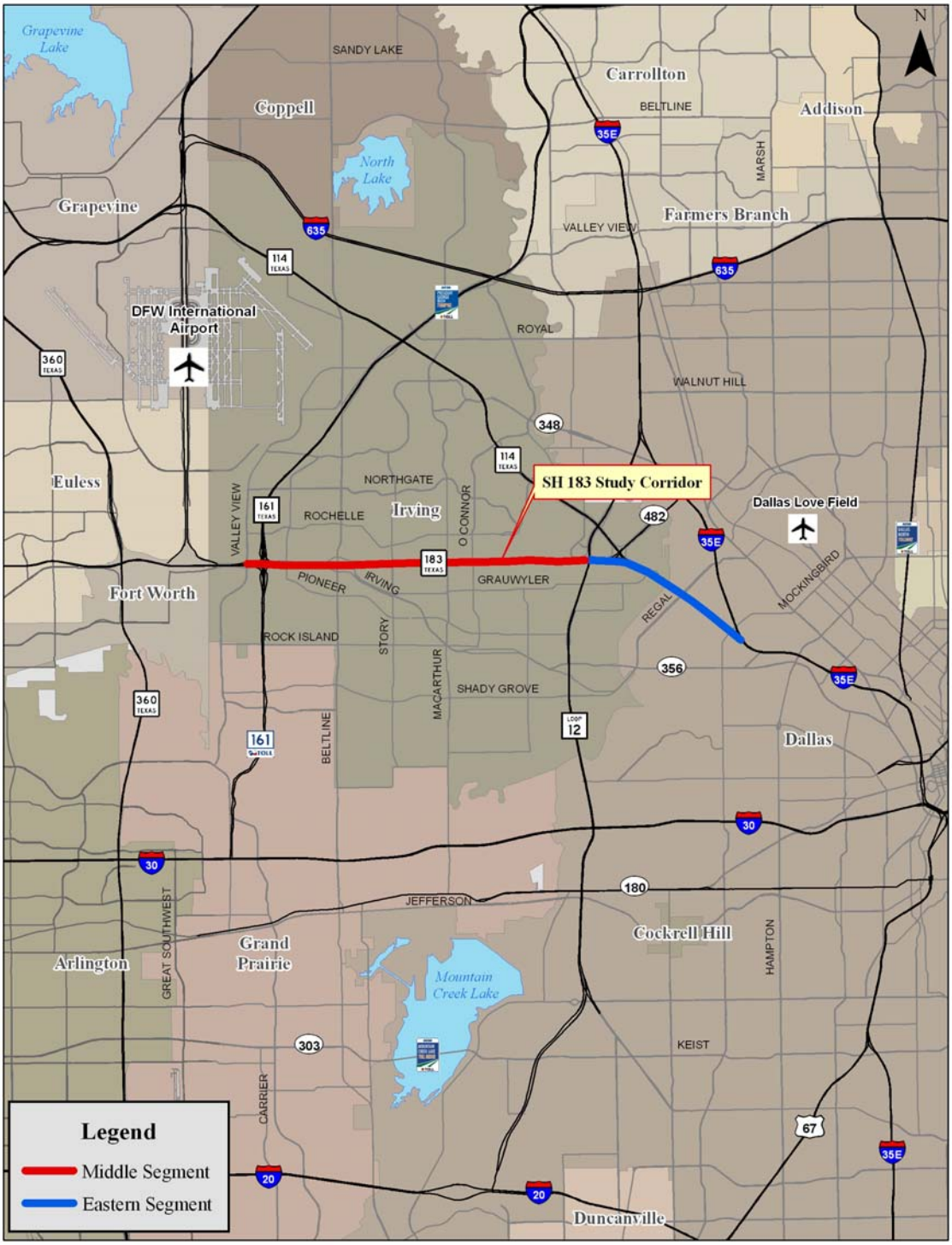


**Figure 1-1. SH 183 Managed Lane Project Location and Segments**

## EXISTING CORRIDOR DESCRIPTION

The SH 183 corridor is one of the three east-west limited access travel corridors connecting the cities of Dallas and Fort Worth. The other two corridors are IH 30 and IH 20. This corridor also provides the primary connection from the Dallas Fort Worth International Airport (DFW airport) to the two central business districts of both cities. The proposed SH 183 corridor evaluated under this Level 2 study is approximately 9.5 miles and extends from Valley View Lane (just west of SH 161) at the western termini to IH 35E/Trinity Parkway at the eastern termini. This section of the SH 183 corridor traverses the cities of Irving and Dallas and is located entirely within Dallas County. A majority of the SH 183 study corridor is located within the city of Irving, with the exception for the last several miles at the eastern terminus where SH 183 merges with IH 35E, which is located in the city of Dallas, as shown in **Figure 1-1**. The Dallas Love Field Airport is also located just to the north of the eastern terminus of the SH 183 study area.

Two segments along this corridor are defined to facilitate the project phase development. The limits of each segment are provided below:

- Middle Segment: A 6.3 mile concurrent managed lane facility with two lanes in each direction, from Valley View Lane (west of SH 161) to Loop 12;
- East Segment: A 3.2 mile concurrent managed lane facility with three lanes in each direction, from Loop 12 to IH 35E.

Middle Segment, approximately 6.3 miles between Valley View Lane and Loop 12 also known as Airport Freeway, currently has six lanes with parallel frontage roads. The frontage roads, however, are discontinuous in the eastbound direction at the Beltline Road interchange and in the westbound direction between SH 114 and Loop 12. The commercial and retail developments adjacent to the roadway along this segment are extensive and reflect a relatively mature build-out. **Figure 1-2** shows the existing configuration and number of lanes of SH 183 study corridor. East Segment, between Loop 12 and IH 35E, is known as John W. Carpenter Freeway. This section has six and eight lane segments and crosses the Elm Fork of the Trinity River, which forms the boundary between the city of Irving and the city of Dallas. In general, the peak travel demand is demonstrated in the eastbound direction in the morning towards the employment centers in Dallas with reversed peak movement in the westbound direction in the evening.

## SH 183 MANAGED LANE PROJECT DESCRIPTION

The ultimate proposed configuration of the SH 183 study corridor will include an eight general purpose lane facility (the number of lanes varies with or without auxiliary lanes)

with two concurrent tolled managed lanes in each direction up to the intersection of SH 114, and three concurrent tolled managed lanes in each direction beyond SH 114 to IH 35 E as shown in **Figure 1-3**. The study corridor connects to the North Tarrant Express Segment 2E at its west end, which has three-lane each direction extending until IH 820. The proposed SH 183 managed lanes connects to the 2-lane reversible lanes along the IH 35E at the east termini. Direct connections will be constructed to connect the SH 183 managed lanes to the proposed Trinity Parkway and also the SH 114 managed lanes. Another pair of the access/egress ramps is located between Carl Road and O'Conner Road with the direct access to/from frontage road.

The managed lane ramps at SH 356 provide access/exit to both frontage road and general purpose lanes. Direct connections are also designed for movements from eastbound managed lane to northbound SH 161 and southbound SH 161 to westbound SH 183 managed lane. Various managed lane ramps will be constructed International Parkway and SH 360 to access frontage road and general purpose lanes. The full build-out of the entire project consists of the widening of general purpose lanes to four/five lanes from the existing three lanes each direction.

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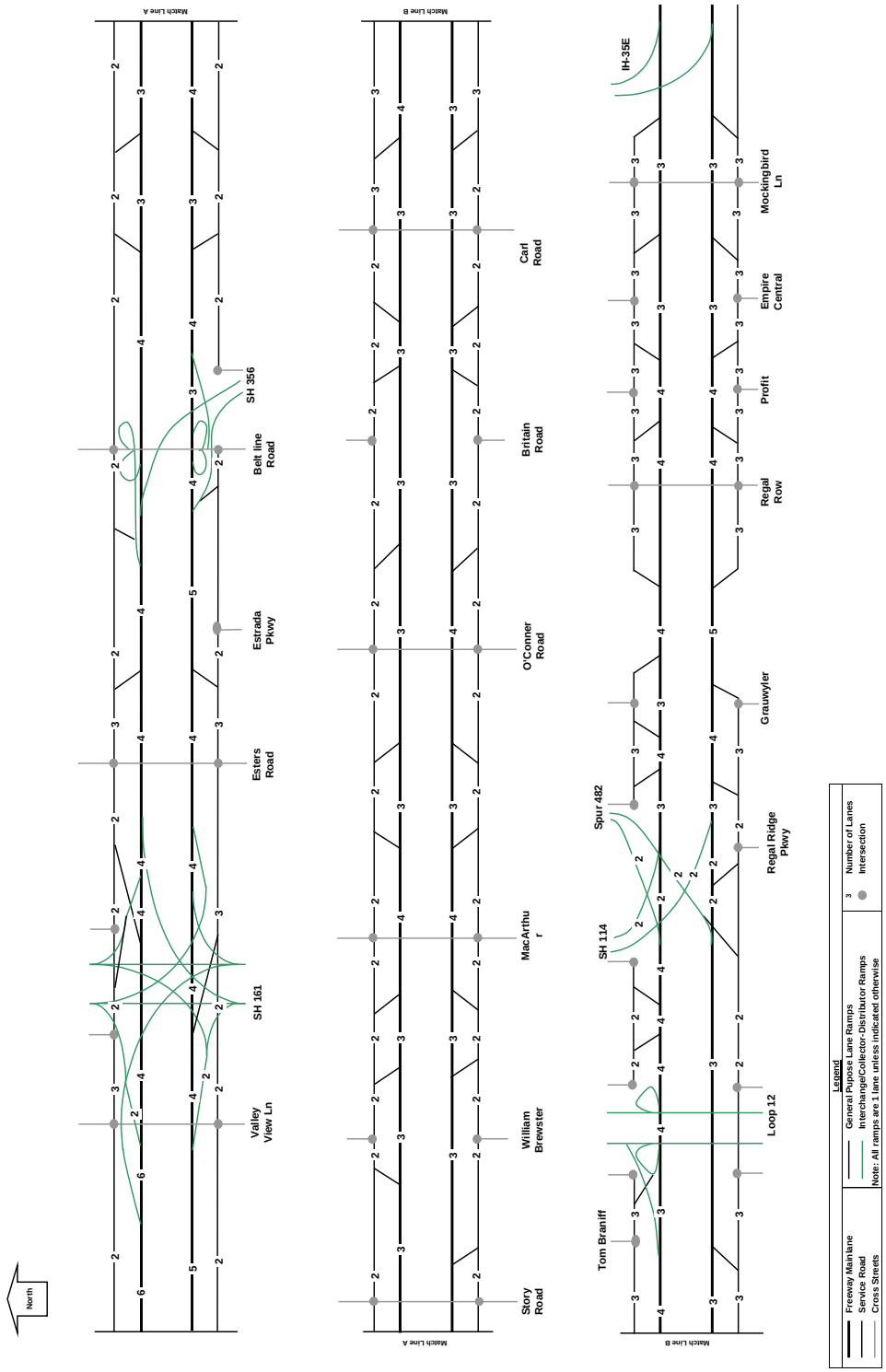


**Figure 1-2 SH 183 Existing Configuration**

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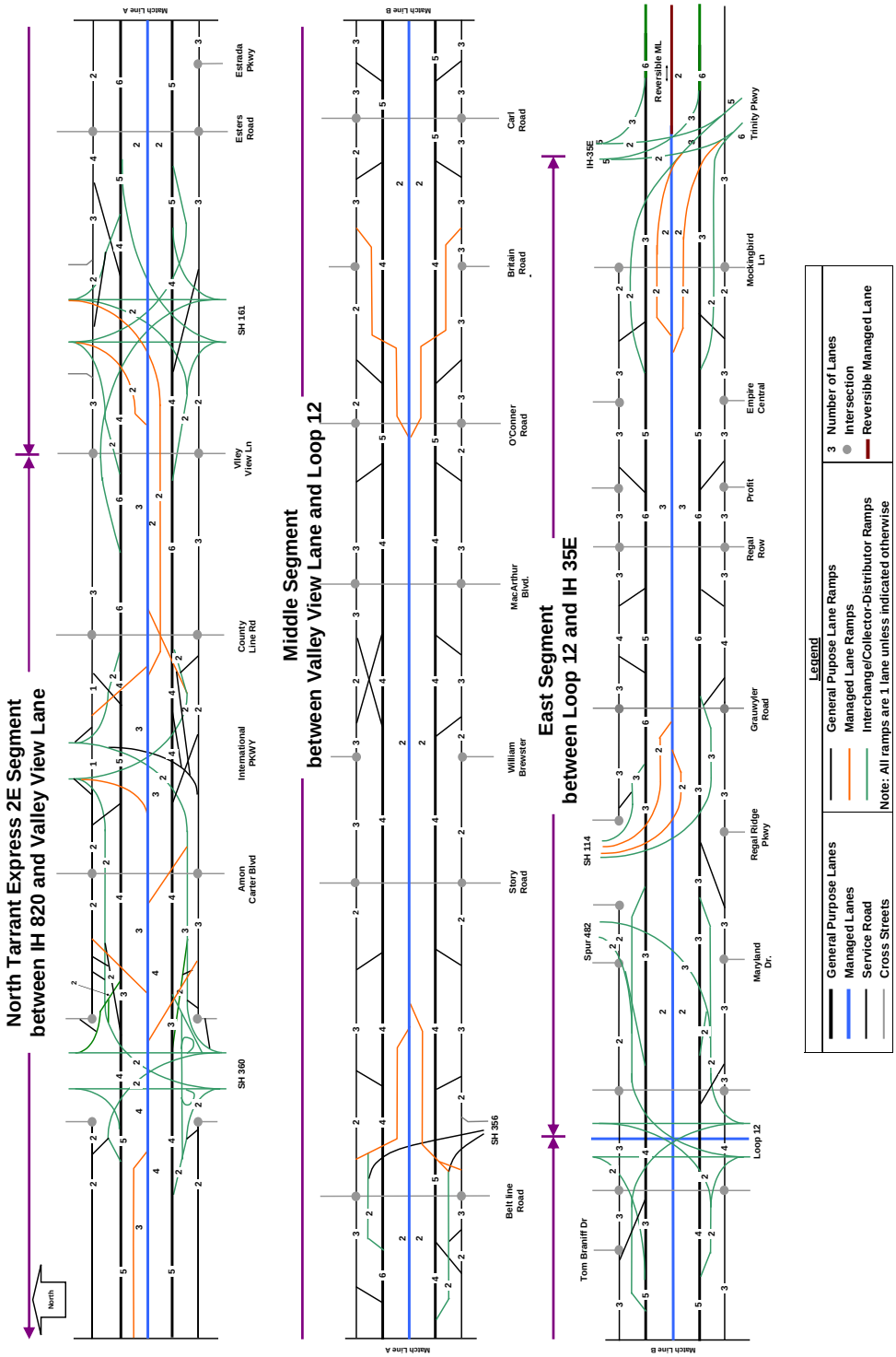


**Figure 1-3. Configuration of SH 183 Managed Lane Project**

## PROJECT ALTERNATIVES DESCRIPTION

Five managed lane project alternatives were evaluated as part of this study and reflect various combinations of the corridor segments along with differing phasing of the segments. The toll operation and pricing policies follow the guidelines defined by the Regional Transportation Council (RTC) managed lane policy and incorporates the TxDOT staff directives regarding the analysis of each of the alternatives. Under the baseline policy, the single occupant vehicles (SOVs) pay a full toll rate, and the high occupant vehicles with two or more passengers (HOV 2+) receive a 50 percent discount during the peak periods but pay a full toll rate during the off-peak periods. This HOV discount toll policy will be provided until 2025 according to RTC policy for all the project alternatives, with the exception of Alternative 5, which extends the discount toll until 2030 and reflect its delayed opening year assumption of SH 183 managed lane. Trucks are allowed to travel on the managed lane but pay a higher toll rate calculated based on the SOV toll rate and takes into account the number of axles. The five scenarios evaluated under this Intermediate Level 2 study are as described below and as shown in **Table 1-1**:

*Alternative 1* – Early combined, both middle segment and east segment will be constructed and open by 2015, which reflects the most optimistic construction plan of the five project alternatives;

*Alternative 2* – East only, East segment will be constructed and open by 2019 and middle segment open by 2030;

*Alternative 3* – Middle only, Middle segment will be constructed and open by 2019 and east segment open by 2030;

*Alternative 4* – MTP combined, both middle segment and east segment will be constructed and open by 2019, which is consistent with the project plan included in NCTCOG's latest 2030 Mobility Plan – 2009 Amendment;

*Alternative 5* – Delayed combined, both middle segment and east segment are assumed to be constructed and open by 2025, which represents the 6-year deferral from the Alternative 4. The HOV2+ discount toll payment is also assumed to extend to 2030.

**Table 1-1**
**SH 183 Managed Lane Project Alternatives**

| Alternatives | Items | Middle Segment<br>From Valley View Lane to Loop 12 | East Segment<br>From Loop 12 to IH 35E |
|---|---|---|---|
| 1 - Early Combined | Opening | Open by 2015 | Open by 2015 |
| | Pricing | HOV2+ pay discounted price till 2025 | HOV2+ pay discounted price till 2025 |
| 2 - East Only | Opening | Open by 2030 | Open by 2019 |
| | Pricing | HOV2+ pay discounted price till 2025 | HOV2+ pay discounted price till 2025 |
| 3 - Middle Only | Opening | Open by 2019 | Open by 2030 |
| | Pricing | HOV2+ pay discounted price till 2025 | HOV2+ pay discounted price till 2025 |
| 4 - MTP Combined | Opening | Open by 2019 | Open by 2019 |
| | Pricing | HOV2+ pay discounted price till 2025 | HOV2+ pay discounted price till 2025 |
| 5 - Delayed Combined | Opening | Open by 2025 | Open by 2025 |
| | Pricing | HOV2+ pay discounted price till 2030 | HOV2+ pay discounted price till 2030 |

## REPORT STRUCTURE

The report is divided into several chapters that refer to major work elements undertaken as part of the study.

- **Chapter 1 – Introduction**: Provides an introduction to the project and describes the objective and purpose of the study, outlines the project configuration, segmentation and project alternatives, and summarizes the report structure.

- **Chapter 2 – Existing Traffic Trends and Characteristics**: The extensive traffic data collected as part of this study is described and summarized in this chapter. Data collection efforts that were undertaken included a comprehensive traffic count collection program, speed and delay runs, an origin-destination survey, and a stated-preference survey. The methodologies implemented for each of these efforts and their respective results are detailed and summarized.

- **Chapter 3 – Dallas-Fort Worth Area Transportation Characteristics**: The existing and future transportation characteristics of the Dallas-Fort Worth Metropolitan Area (DFWMA) are briefly summarized in this section of the report based on the North Central Texas Council of Government's (NCTCOG) "Mobility Transportation Plan 2030 (MTP)" and its most recent 2009 Amendment.

- **Chapter 4 – Economic Growth Analysis:** This chapter reviews the historical demographic growth trends in the Dallas-Fort Worth region and the expected future growth. This review focused on an evaluation of the socioeconomic variables that feed into the travel demand forecasting process as specifically used by NCTCOG. These variables include population, households, employment, and major employment establishments and other proposed developments which may have an impact on facility demand. The review of the demographics begins with an assessment at the region-wide and county level demographics, followed by the review of the cities located along the study corridor, and finally evaluates the Traffic Analysis Zones (TAZ) 5-miles around the corridor.

- **Chapter 5 – Modeling Approach:** This section describes the travel demand modeling process used in the traffic and revenue forecast for this project. The calibration of the base-year travel demand model is described and other major elements in the modeling process are discussed to include global demand estimates, travel time simulation modeling, and market share analysis using developed micro-models.

- **Chapter 6 – Traffic and Toll Revenue Estimates:** The key assumptions and estimated traffic and toll revenue for the proposed IH 35E managed lane project are presented in this chapter, and the toll collection configuration, toll revenue sensitivity analysis, and the final forecasted baseline traffic and revenue characteristics are outlined and summarized.

- **Chapter 7 – Toll Revenue Risk Assessment:** The key parameters of traffic and revenue estimates used in the risk assessment process are outlined and discussed. The toll revenue risk assessments for the six defined project scenarios are then described and summarized under moderate and aggressive risk assumptions.

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# CHAPTER 2

# EXISTING CORRIDOR SYSTEM TRENDS AND CHARACTERISTICS

This chapter provides a summary of the historical traffic trends and characteristics along the existing highway infrastructure in and around the proposed SH 183 corridor, located within Dallas County. A comprehensive traffic count program was undertaken in the SH 183 corridor with automatic traffic recorder (ATR) counts collected at all of the ramps and direct connectors entering and exiting SH 183 between Valley View Lane and IH 35E and at six screenline locations. The traffic and operational data summarized in this chapter were used as inputs to the model calibration process in order to enhance the travel demand model that was used for the traffic and revenue estimates of the proposed SH 183 corridor.

## DESCRIPTION OF EXISTING CORRIDOR FACILITIES

The SH 183 corridor is the northernmost of three east-west highways that exist between the cities of Dallas and Fort Worth. The approximately 9.5 mile long SH 183 study corridor between Valley View Lane and IH 35E is located entirely within Dallas County to the northwest of the city of Dallas, as shown in **Figure 2-1**. The majority of the SH 183 study area is located within the city of Irving, with the exception of the last several miles at the eastern terminus located in the city of Dallas where SH 183 merges with IH 35E. This corridor also provides the primary connection from the Dallas Fort Worth International Airport (DFW airport) to the two central business districts of both cities. The Dallas Love Field Airport is another major airport to the region and is also located just north of the eastern terminus of the SH 183 study area.

The study corridor comprises of two major sections that were established to highlight the different geometric and traffic characteristics. The peak travel demand along both segments is demonstrated in the eastbound direction in the morning towards the employment centers in Dallas and this reverses to the westbound direction in the evening.

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The majority of the study corridor is contained within the first section that stretches seven miles through the city of Irving, between SH 161 and Loop 12 to the east. This section is also known as Airport Freeway, and currently has six lanes with parallel frontage roads. These frontage roads are discontinuous in the eastbound direction at the Beltline Road interchange and in the westbound direction between SH 114 and Loop 12. The extensive commercial and retail developments adjacent to the roadway along this section reflect a mature build-out. The second section between Loop 12 and IH 35E is known as John W. Carpenter Freeway and consists of six to eight lane segments that crosses the Elm Fork of the Trinity River boundary between the city of Irving and the city of Dallas.

The numerous highways converging within the SH 183 study area currently services diverse markets from all directions and includes both local and wide variety of intercity traveler markets. These facilities include Loop 12, IH 35E and SH 114 in the east and SH 161/SH 161 toll in the west.

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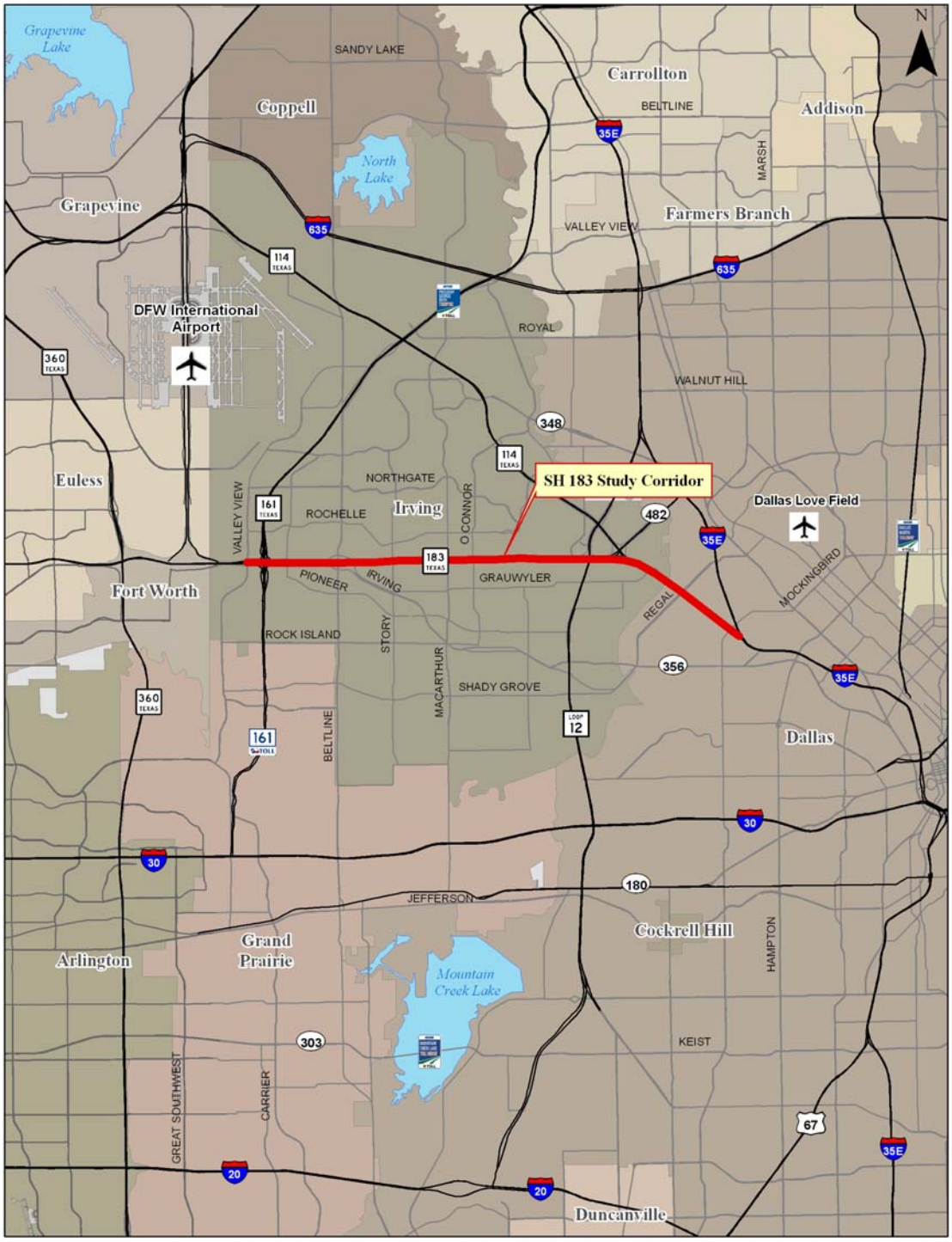


**Figure 2-1. SH 183 Proposed Corridor Alignment**

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## HISTORICAL TRAFFIC GROWTH TRENDS

The Texas Department of Transportation (TxDOT) records the annual average daily traffic (AADT) volumes at a number of locations along state roadways in Texas. Xl kd45 2008 volumes from the district and county maps were the most up-to-date data that was readily available for use as part of this study. The traffic trends along several kds ey highways adjacent to the SH 183 corridor between 1990 and 2008 were obtained and are summarized in **Table 2-1**. The average annual growth in AADT ranged from a high of 7.6 percent per year (SH 161 north of SH 183), to a low of -3.0 percent per year (SH 356, east of Mockingbird Lane), between 2003 and 2008 in the project region. The negative growth along SH 183 between 2003 and 2008 is to some extent a result of the opening of the SH 161 connection to the north of the SH 183 that diverted traffic away from the corridor in 2006. The recent economic turmoil and recession resulted in most of the routes within the project region exhibiting a negative growth trend between 2007 and 2008, with the exception of SH 183 and Loop 12 where positive growth was observed. **Figure 2-2** illustrates the some key count locations within the SH 183 corridor evaluated as part of this analysis, and **Figure 2-3** summarizes the historical traffic growth trends between 1990 and 2008 at several of the respective count locations.

The historical traffic along the existing SH 183 showed diverse variations in the average annual growth rates that ranged between -0.2 and 1.6 percent over the last fifteen years. The historical trends within the SH 183 corridor have been greatly affected by the improvements to the transportation system in and around the area, such as the 2006 opening of the SH 161 mainlanes between SH 183 and IH 35E at the western end of the proposed corridor, which caused some redistribution of traffic through the proposed corridor. The growth of traffic along SH 183 to the west of SH 161 has been shown to grow at an average annual rate of between -0.9 to 2.0 percent between the years of 2003 and 2008, with the historical trends ranging between 1.7 and 10.9 percent between 1998 and 2003. For the SH 183 traffic to the east of SH 161, the average annual growth trends were shown to range between 1.0 and 3.6 percent between 1998 and 2003, but declined at an average annual rate of -2.6 to -0.5 percent between 2003 and 2008 as a result of the traffic redistribution from the opening of the SH 161 connection. With the exception of one location along SH 183, east of SH 360, the traffic continued to grow along SH 183 between 2007 and 2008 at all of the observed locations.

The traffic along IH 35E to the south of SH 183 has grown at a slower rate between 2003 and 2008 as compared to the historical trend for the last fifteen years. Between 2007 and 2008 all locations along IH 35E within the project region showed negative growth rates. The traffic along Loop 12 showed average annual growth rates in the range of -2.6 to 2.9 percent between 2003 and 2008, although the growth has ranged between -0.5 to 2.5 percent for the historical fifteen year timeframe. For the most part, locations along Loop 12 continued to show positive growth between 2007 and 2008.

State Highway 356, also known as Irving Boulevard, demonstrated a positive growth rate between 2003 and 2008 at the location just south of Pioneer Road, however prior years between 1998 and 2003 showed some negative growth traffic trends at several locations. The traffic growth along SH 114, west of Loop 12 exhibited an average annual growth rate of 0.5 percent between 2003 and 2008 compared to the lower growth rate of -0.9 percent during the prior period between 1998 and 2003. Consistent with most other locations, the traffic between 2007 and 2008 showed a negative growth rate of -3.3 percent.

The traffic on SH 161, north of SH 183, demonstrated an average annual growth rate of 8.6 percent between 1993 and 2008 and an average annual growth rate of 7.6 percent between 2003 and 2008; however, more recently this growth has been showing signs of slowing to 4.3 percent between 2007 and 2008. The traffic growth along SH 360, north of SH 183, showed annual growth rate of 7.0 percent between 1993 and 2008 and demonstrated the high growth of traffic along key facilities that provided accessibility to the SH 183 corridor. Between 2007 and 2008 at this same location along SH 360, the traffic has remained flat. The International Parkway, north of SH 183, provides a connection from SH 183 to the Dallas Forth Worth Airport, and showed an average annual growth rate of about 2.9 percent between 1998 and 2003, and a negative growth rate of -1.2 percent between 2007 and 2008.

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**Table 2 -1**
**Trend in Annual Average Daily Traffic**

| | 1993 | 1998 | 2003 | 2007 | 2008 | Average Annual Percentage Change | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | AADT | AADT | AADT | AADT | AADT | 1993-1998 | 1998-2003 | 2003-2008 | 1993-2008 | 2007-2008 |
| **IH 35E** | | | | | | | | | | |
| North of Mockingbird Lane | 116,000 | 156,000 | 131,000 | 137,000 | 129,000 | 6.1% | -3.4% | -0.3% | 0.7% | -5.8% |
| North of Regal Row | 116,000 | 156,000 | 134,000 | 142,000 | 139,000 | 6.1% | -3.0% | 0.7% | 1.2% | -2.1% |
| North of SPUR 482 | 98,000 | 136,000 | 113,000 | 121,000 | 115,000 | 6.8% | -3.6% | 0.4% | 1.1% | -5.0% |
| North of Loop 12 | 98,000 | 133,000 | 108,000 | 117,000 | 115,000 | 6.3% | -4.1% | 1.3% | 1.1% | -1.7% |
| | | | | | | | | | | |
| **SH 183** | | | | | | | | | | |
| West of SH 360 | 121,000 | 123,000 | 134,000 | 145,000 | 146,000 | 0.3% | 1.7% | 2.0% | 1.3% | 0.7% |
| East of SH 360 | 168,000 | 116,000 | 195,000 | 200,000 | 199,000 | -7.1% | 10.9% | 0.6% | 1.1% | -0.5% |
| East of International Parkway | 141,000 | 158,000 | 186,000 | 174,000 | 178,000 | 2.3% | 3.3% | -0.9% | 1.6% | 2.3% |
| East of SH 161 | 147,000 | 165,000 | 173,000 | 154,000 | 157,000 | 2.3% | 1.0% | -1.9% | 0.4% | 1.9% |
| East of Beltline Road | 153,000 | 161,000 | 171,000 | 145,000 | 153,000 | 1.0% | 1.2% | -2.2% | 0.0% | 5.5% |
| East of Story Road | 166,000 | 156,000 | 185,000 | 162,000 | 168,000 | -1.2% | 3.5% | -1.9% | 0.1% | 3.7% |
| West of Loop 12 | 156,000 | 150,000 | 177,000 | 149,000 | 155,000 | -0.8% | 3.4% | -2.6% | 0.0% | 4.0% |
| East of SPUR 482 | 120,000 | 125,000 | 149,000 | 135,000 | 145,000 | 0.8% | 3.6% | -0.5% | 1.3% | 7.4% |
| | | | | | | | | | | |
| **SH 356** | | | | | | | | | | |
| North of Grauwyler Road | 18,500 | 19,200 | 18,300 | 17,500 | 17,700 | 0.7% | -1.0% | -0.7% | -0.3% | 1.1% |
| South of Pioneer Road | 16,700 | 18,000 | 14,900 | 17,000 | 16,700 | 1.5% | -3.7% | 2.3% | 0.0% | -1.8% |
| East of Nursery Drive | 24,000 | 27,000 | 25,000 | 27,000 | 25,000 | 2.4% | -1.5% | 0.0% | 0.3% | -7.4% |
| West of Regal Row | 26,000 | 26,000 | 24,000 | 26,000 | 22,000 | 0.0% | -1.6% | -1.7% | -1.1% | -15.4% |
| East of Mockingbird Lane | 27,000 | 26,000 | 28,000 | 25,000 | 24,000 | -0.8% | 1.5% | -3.0% | -0.8% | -4.0% |
| East of IH 35E | 12,400 | 13,100 | 11,200 | 11,600 | 12,000 | 1.1% | -3.1% | 1.4% | -0.2% | 3.4% |
| | | | | | | | | | | |
| **Loop 12** | | | | | | | | | | |
| South of Shady Grove Road | 100,000 | 123,000 | 138,000 | 141,000 | 145,000 | 4.2% | 2.3% | 1.0% | 2.5% | 2.8% |
| North of SH 356 | 99,000 | 116,000 | 130,000 | 130,000 | 134,000 | 3.2% | 2.3% | 0.6% | 2.0% | 3.1% |
| South of SH 114 | 102,000 | 122,000 | 136,000 | 137,000 | 140,000 | 3.6% | 2.2% | 0.6% | 2.1% | 2.2% |
| North of SH 114 | 104,000 | 120,000 | 130,000 | 126,000 | 123,000 | 2.9% | 1.6% | -1.1% | 1.1% | -2.4% |
| East of IH 35E | 38,000 | 44,000 | 46,000 | 52,000 | 53,000 | 3.0% | 0.9% | 2.9% | 2.2% | 1.9% |
| West of Harry Hines Blvd | 34,000 | 34,000 | 36,000 | 33,000 | 33,000 | 0.0% | 1.1% | -1.7% | -0.2% | 0.0% |
| West of Denton Dr | 53,000 | 53,000 | 56,000 | 49,000 | 49,000 | 0.0% | 1.1% | -2.6% | -0.5% | 0.0% |
| East of Marsh Lane | 38,000 | 42,000 | 38,000 | 39,000 | 36,000 | 2.0% | -2.0% | -1.1% | -0.4% | -7.7% |
| | | | | | | | | | | |
| **Other Locations** | | | | | | | | | | |
| SH 114 West of Loop 12 | 65,000 | 90,000 | 86,000 | 91,000 | 88,000 | 6.7% | -0.9% | 0.5% | 2.0% | -3.3% |
| SH 161 North of SH 183 | 21,000 | 23,000 | 50,000 | 69,000 | 72,000 | 1.8% | 16.8% | 7.6% | 8.6% | 4.3% |
| SH 360 North of SH 183 | 25,000 | 51,000 | 52,000 | 69,000 | 69,000 | 15.3% | 0.4% | 5.8% | 7.0% | 0.0% |
| Harry Hines Blvd North of Loop 12 | 36,000 | 31,000 | 34,000 | 34,000 | 32,000 | -2.9% | 1.9% | -1.2% | -0.8% | -5.9% |
| International Parkway North of SH 183 | 70,000 | 65,000 | 75,000 | 84,000 | 83,000 | -1.5% | 2.9% | 2.0% | 1.1% | -1.2% |
| SH 348 East of Loop 12 | -- | -- | 125,000 | 125,000 | 121,000 | -- | -- | -0.6% | N/A | -3.2% |
| SH 482 North of SH 114 | 36,000 | 42,000 | N/A | 51,000 | 47,000 | 3.1% | N/A | N/A | 1.8% | -7.8% |

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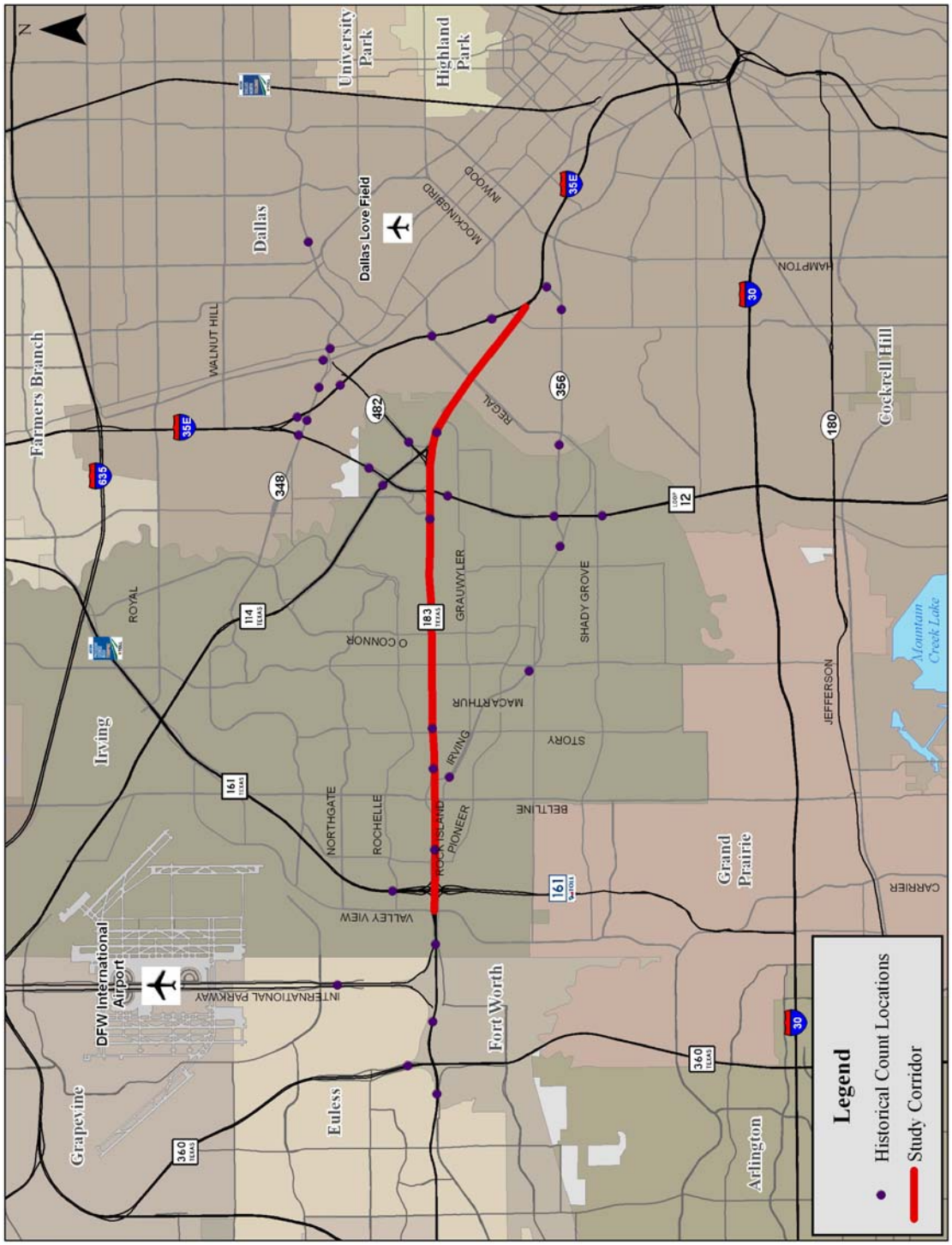


**Figure 2-2. Historical Traffic Count Locations**

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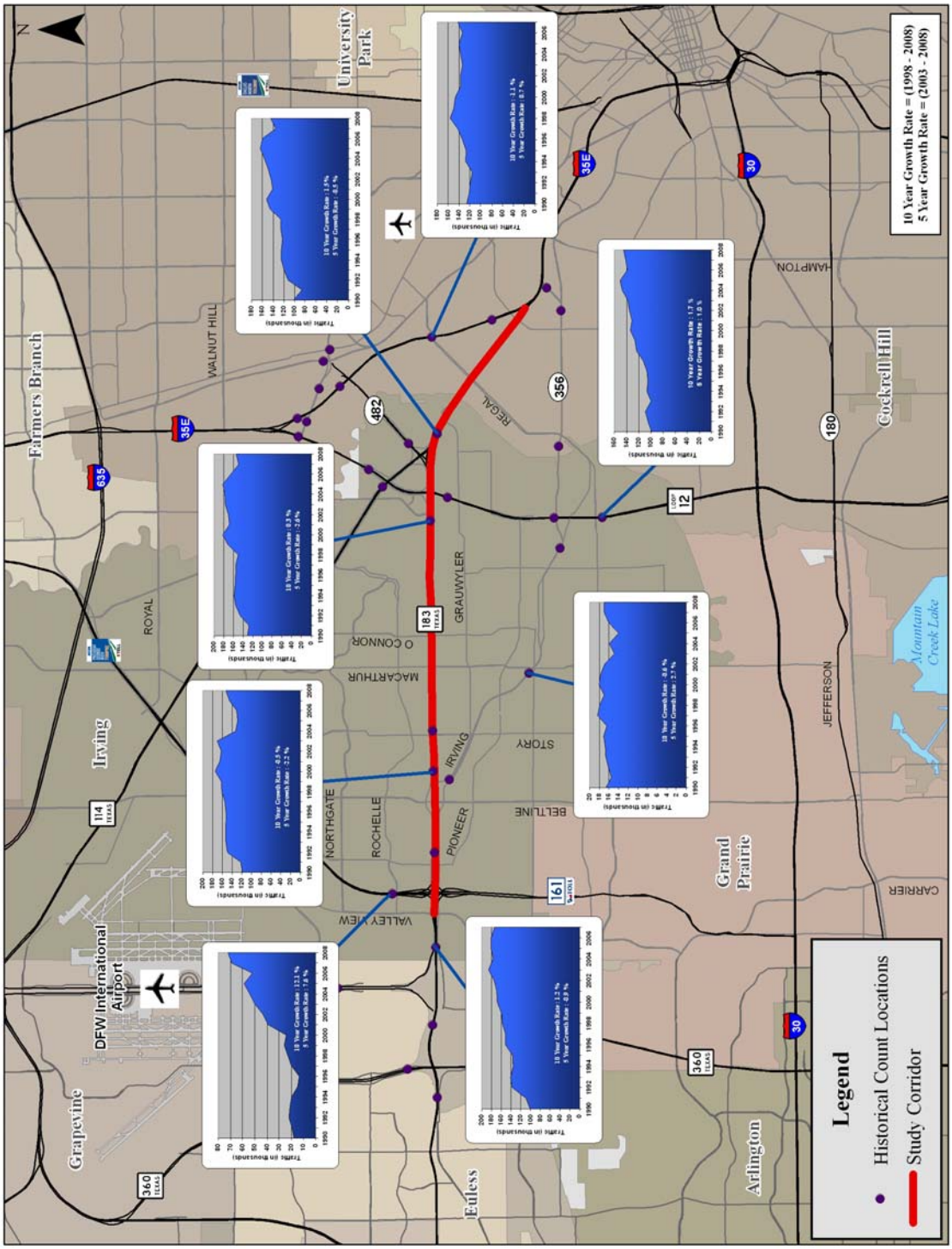


**Figure 2-3. SH 183 Corridor Historical Traffic Volumes**

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## SEASONAL VARIATION TRENDS

The Texas Department of Transportation (TxDOT) has several permanent traffic counters along the state roadways throughout Texas that continuously record the average daily traffic volumes each year. The traffic data since 2004 was obtained for the permanent count location along IH 35E (southeast of SH 356) to gauge the monthly/seasonal variation of traffic compared to the overall yearly average. **Figure 2-4** and **Figure 2-5** show the summarized seasonal indices between 2004 and 2009. The traffic varies in the same year during different months. The peak months typically occur during March, April, June, August, and October. The data collection for this project was undertaken in September of 2009, which was close to the average daily traffic during the year. These seasonal variations were taken into consideration as part of the model calibration to compare the collected average annual daily traffic (AADT) to those produced within the travel demand model.

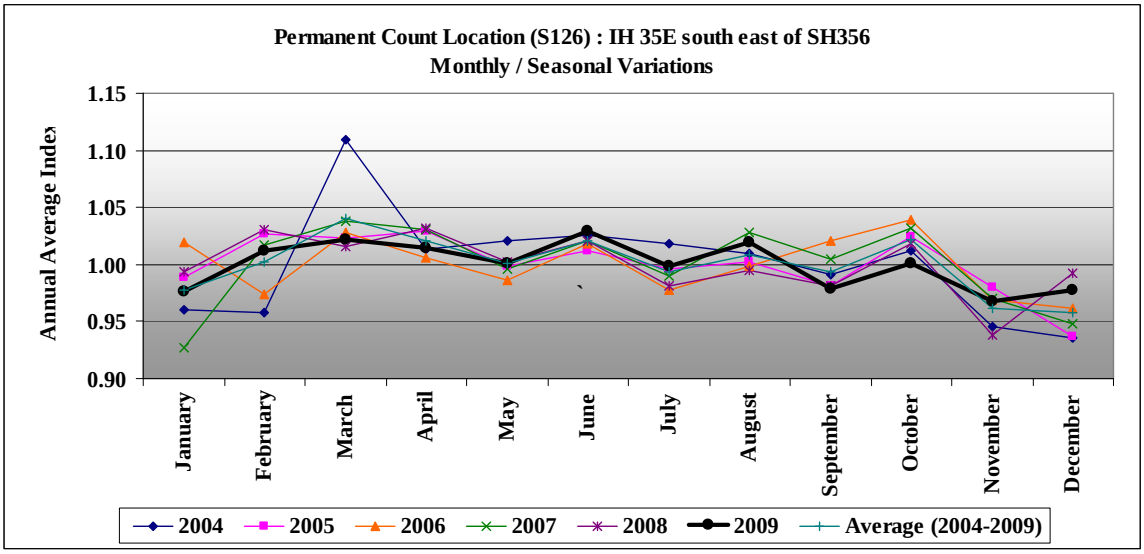


**Figure 2-4. Monthly/Seasonal Variations for IH 35E**

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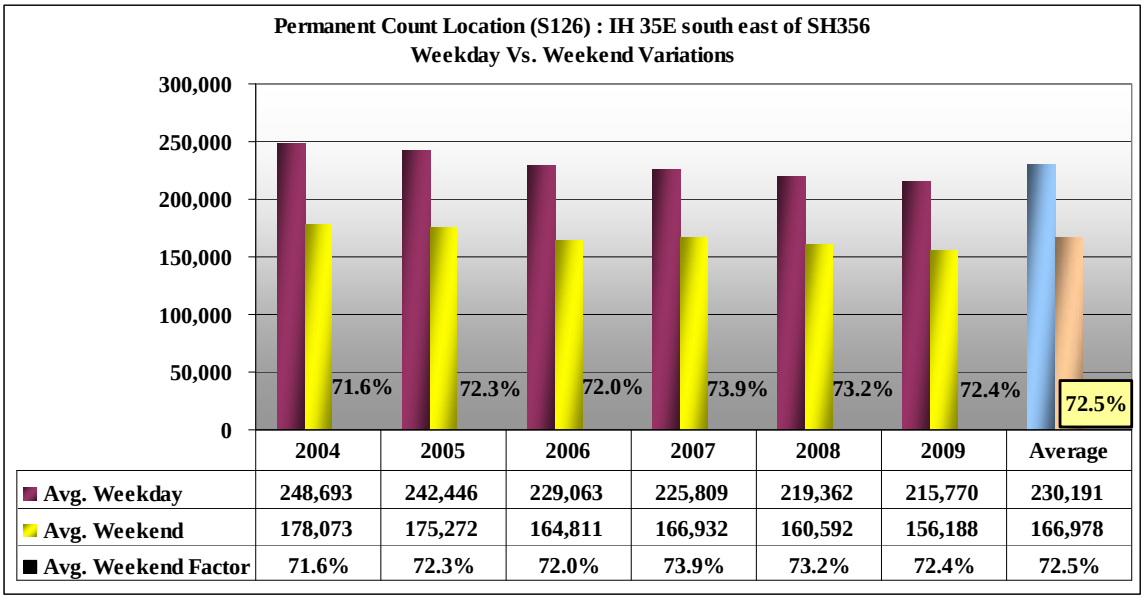


| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | Average |
|---|---|---|---|---|---|---|---|
| Avg. Weekday | 248,693 | 242,446 | 229,063 | 225,809 | 219,362 | 215,770 | 230,191 |
| Avg. Weekend | 178,073 | 175,272 | 164,811 | 166,932 | 160,592 | 156,188 | 166,978 |
| Avg. Weekend Factor | 71.6% | 72.3% | 72.0% | 73.9% | 73.2% | 72.4% | 72.5% |

**Figure 2-5. Average Weekday vs. Weekend Distribution**

**Figure 2-5** summarizes the yearly average weekday vs. weekend factors which showed average weekend traffic to be 72.5 percent of average weekday traffic.

## TRAFFIC COUNT PROGRAM

Traffic counts were recorded throughout the SH 183 study corridor at several highway locations for a continuous 48-hour period on September 15 and 16, 2009 to evaluate the current traffic volumes in the region. All screenline counts were collected on the following week with a few locations requiring recounting in the subsequent weeks following initial review. The traffic count program included vehicle classification counts at six locations along several north-south and east-west facilities, as shown in **Figure 2-6**. In addition, the variation of traffic throughout the week was obtained by performing continuous seven-day period counts at ten main lane locations along SH 183 and the intersecting freeways. The traffic count program captured a total of 133 count locations as part of the study as shown in **Table 2-2**. Manual vehicle occupancy counts were conducted at two locations in each direction along the SH 183 main lanes to capture the current distribution share of high-occupancy vehicles traversing the corridor.

A total of 69 ramp and direct connector (DC) count locations were identified along the SH 183 corridor, as listed in **Table 2-2**. Each count location was assigned a unique number and the start date for the traffic counts at each location is also shown in the table. All the ramp and direct connection counts were collected as 48-hour traffic volume counts with the exception of the direct connectors to/from SH 114, where vehicle classification counts were captured.

The data obtained from the traffic count program was then used to calibrate the models to reflect existing trends and was used to extract other calibration traffic statistics such as the truck percentages, axle distributions etc.

### AUTOMATIC TRAFFIC COUNTS

The count identification numbers and their corresponding locations are shown in **Figure 2-**6. The traffic counts collected along the major facilities provided information pertaining to the current average weekday traffic volumes, and the morning, evening and off-peak period traffic demands currently exhibited within the proposed SH 183 corridor. The counts collected were initially evaluated for consistency with historical trends, seasonal variations and overall reasonableness. The final reviewed daily traffic volumes were then used to calibrate the base travel demand models for purposes of evaluating the future SH 183 corridor demand potential.

Screenlines were developed to cross all the major roads which intersect the existing SH 183 corridor, as shown in **Figure 2-6**. **Table 2-3** summarizes the 2009 average daily traffic (ADT) volume and total percentage share of the corridor demand along several east-west and north-south screenlines used as part of the model calibration. Among all the major roads, the SH 183 was shown to carry more than 30 percent of the traffic share at most of the identified screenlines. The traffic share along SH 183 at the western and eastern termini were shown to be in excess of 70 percent while the SH 183 mainlane shares within the study corridor were shown to range from over half on the western end and 30 percent towards the eastern end before Loop 12. The highest 24-hour traffic volume count locations were shown to be along the SH 183 mainlanes with 141,000 average daily traffic (ADT) captured just west of River Bridge, 130,000 average daily vehicles just east of Story Road; and 124,000 average daily traffic just west of SH 161.

**Figure 2-7** shows the hourly distribution of traffic at several locations along SH 183 where freeway mainlane counts were made. Significant directional traffic is observed west Loop 12 with morning peak at eastbound and morning peak at westbound. Traffic east of SH 114 exhibits dual peaks in both morning and afternoon.

The data collected in 2009 was compared with previous counts collected in 2005. The comparison with previous counts showed that the 2009 traffic at many of the count locations have declined due to the economy recession that began in late 2007. This reduction in traffic appears to be consistent across many of the count locations and follows a similar pattern to the historical trends at the TxDOT count locations.

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**Table 2-2**
**Traffic Count Locations**

| Count Location Number | Facility Type | Location Description | Count Type |
|---|---|---|---|
| 1 | Arterial (2 Way) | Northgate Drive East of Valley View Lane | 48-hour |
| 2 | Arterial (2 Way) | Rochelle Road East of Valley View Lane | 48-hour |
| 3 | Frontage (1 Way) | SH 183 Frontage Road WB East of Valley View Lane | 48-hour |
| 4 | Main Lane | SH 183 WB East of Valley View Lane | SD |
| 5 | Main Lane | SH 183 EB East of Valley View Lane | SD |
| 6 | Frontage (1 Way) | SH 183 Frontage Road EB East of Valley View Lane | 48-hour |
| 7 | Arterial (2 Way) | Shady Grove Road East of Roy Orr Boulevard | 48-hour |
| 8 | Arterial (2 Way) | Trinity Boulevard: East of Roy Orr Boulevard | 48-hour |
| 9 | Arterial (2 Way) | Walnut Hill Lane East of Story Road | 48-hour |
| 10 | Arterial (2 Way) | Northgate Drive East of Story Road | 48-hour |
| 11 | Arterial (2 Way) | Rochelle Boulevard East of Story Road | 48-hour |
| 12 | Frontage (1 Way) | SH 183 Frontage Road WB East of Story Road | 48-hour |
| 13 | Main Lane | SH 183 WB East of Story Road | 48-hour, VC |
| 14 | Main Lane | SH 183 EB East of Story Road | 48-hour, VC |
| 15 | Frontage (1 Way) | SH 183 Frontage Road EB East of Story Road | 48-hour |
| 16 | Arterial (2 Way) | Grauwyler Road East of Story Road | 48-hour |
| 17 | Arterial (2 Way) | Irving Blvd - SH 356 East of Story Road | 48-hour |
| 18 | Arterial (2 Way) | Pioneer Road East of Story Road | 48-hour |
| 19 | Arterial (2 Way) | Shady Grove Road East of Story Road | 48-hour |
| 20 | Arterial (2 Way) | Spur 348 Northwest Hwy West of Loop 12 | 48-hour |
| 21 | Frontage (1 Way) | SH 114 Frontage Road WB West of Loop 12 | 48-hour |
| 22 | Main Lane | SH 114 WB West of Loop 12 | SD |
| 23 | Main Lane | SH 114 EB West of Loop 12 | SD |
| 24 | Frontage (1 Way) | SH 114 Frontage Road EB West of Loop 12 | 48-hour |
| 25 | Frontage (1 Way) | SH 183 Frontage Road WB West of Loop 12 | 48-hour |
| 26 | Main Lane | SH 183 WB West of Loop 12 | 48-hour |
| 27 | Main Lane | SH 183 EB West of Loop 12 | 48-hour |
| 28 | Frontage (1 Way) | SH 183 Frontage Road EB West of Loop 12 | 48-hour |
| 29 | Arterial (2 Way) | Grauwyler Road West of Loop 12 | 48-hour |
| 30 | Arterial (2 Way) | Union Bower Road West of Loop 12 | 48-hour |
| 31 | Arterial (2 Way) | Pioneer Road West of Loop 12 | 48-hour |
| 32 | Arterial (2 Way) | SH 356 West of Loop 12 | 48-hour |
| 33 | Arterial (2 Way) | Irving Boulevard West of Loop 12 | 48-hour |
| 34 | Arterial (2 Way) | Shady Grove Road West of Loop 12 | 48-hour |
| 35 | Arterial (2 Way) | Storey Lane (Spur 482) west of river bridge | 48-hour |
| 36 | Main Lane | SH 183 WB mainlanes west of river bridge | SD |
| 37 | Main Lane | SH 183 EB mainlanes west of river bridge | SD |
| 38 | Arterial (2 Way) | SH 356 Irving Blvd east of Regal Row | 48-hour |
| 39 | Arterial (2 Way) | Valley View Lane North of SH 183 | 48-hour |
| 40 | Frontage (1 Way) | SH 161 Frontage Road SB North of SH 183 | 48-hour |
| 41 | Main Lane | SH 161 SB North of SH 183 | SD |
| 42 | Main Lane | SH 161 NB North of SH 183 | SD |
| 43 | Frontage (1 Way) | SH 161 Frontage Road NB North of SH 183 | 48-hour |
| 44 | Arterial (2 Way) | Esters Road North of SH 183 | 48-hour |
| 45 | Arterial (2 Way) | Beltline Road North of SH 183 | 48-hour |
| 46 | Arterial (2 Way) | Story Road North of SH 183 | 48-hour |
| 47 | Arterial (2 Way) | MacArthur Boulevard North of SH 183 | 48-hour |
| 48 | Arterial (2 Way) | O'Connor Road North of SH 183 | 48-hour |
| 49 | Main Lane | Loop 12 SB North of SH 183 | 48-hour |
| 50 | Main Lane | Loop 12 NB North of SH 183 | 48-hour |
| 51 | Arterial (2 Way) | Valley View Lane North of Trinity Railway Express | 48-hour |
| 52 | Arterial (2 Way) | Beltline Road North of Trinity Railway Express | 48-hour |
| 53 | Arterial (2 Way) | Story Road North of Trinity Railway Express | 48-hour |
| 54 | Arterial (2 Way) | Irving Boulevard North of Trinity Railway Express | 48-hour |
| 55 | Arterial (2 Way) | MacArthur Boulevard North of Trinity Railway Express | 48-hour |
| 56 | Arterial (2 Way) | O'Connor Road North of Trinity Railway Express | 48-hour |
| 57 | Arterial (2 Way) | Nursery Road North of Trinity Railway Express | 48-hour |
| 58 | Main Lane | Loop 12 SB North of Trinity Railway Express | SD |
| 59 | Main Lane | Loop 12 NB North of Trinity Railway Express | SD |
| 60 | Main Lane | SH 183 WB East of Mockingbird Lane | 48-hour, VC |
| 61 | Main Lane | SH 183 EB East of Mockingbird Lane | 48-hour, VC |
| 62 | Frontage (1 Way) | SH 183 Frontage Road EB East of Mockingbird Lane | 48-hour |
| 63 | Ramp | SH 183 WB Off Ramp to SB SH 360 | 48-hour |
| 64 | Ramp | SH 183 WB Off Ramp to NB SH 360 | 48-hour |
| 65 | Direct Connector | SH 161 NB to SH 183 WB | 48-hour |
| 66 | Direct Connector | SH 161 SB to SH 183 WB | 48-hour |
| 67 | Direct Connector | SH 183 EB to SH 161 NB | 48-hour |

VC = Vehicle Classification; SD = Seven Day

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**Table 2-2 (Continued)**
**Traffic Count Locations**

| Count Location Number | Facility Type | Location Description | Count Type |
|---|---|---|---|
| 68 | Direct Connector | SH 183 EB to SH 161 SB | 48-hour |
| 69 | Ramp | SH 183: EB Off Ramp to Esters Road | 48-hour |
| 70 | Ramp | SH 183: WB Off Ramp to Valley View Lane | 48-hour |
| 71 | Direct Connector | SH 183 WB to SH 161 NB | 48-hour |
| 72 | Direct Connector | SH 183 WB to SH 161 SB | 48-hour |
| 73 | Direct Connector | SH 161 NB to SH 183 EB | 48-hour |
| 74 | Direct Connector | SH 161 SB to SH 183 EB | 48-hour |
| 75 | Ramp | SH 183: WB On Ramp from Esters Road | 48-hour |
| 76 | Ramp | SH 183: EB On Ramp from Esters Road | 48-hour |
| 77 | Ramp | SH 183: WB Off Ramp to Esters Road | 48-hour |
| 78 | Ramp | SH 183: EB Off Ramp to Belt Line Road | 48-hour |
| 79 | Ramp | SH 183: EB Off Ramp to Spur 356 | 48-hour |
| 80 | Ramp | SH 183: WB On Ramp from Belt Line Road | 48-hour |
| 81 | Ramp | SH 183: WB On Ramp DC from NB Belt Line Road | 48-hour |
| 82 | Ramp | SH 183: EB Off Ramp DC to Belt Line NB | 48-hour |
| 83 | Ramp | SH 183: EB On Ramp DC from Belt Line SB | 48-hour |
| 84 | Ramp | SH 183: WB On Ramp from Irving Boulevard | 48-hour |
| 85 | Ramp | SH 183: EB On Ramp from Belt Line Road | 48-hour |
| 86 | Ramp | SH 183: WB Off Ramp DC to Belt Line SB | 48-hour |
| 87 | Ramp | SH 183: EB Off Ramp to Story Road | 48-hour |
| 88 | Ramp | SH 183: WB On Ramp from Story Road | 48-hour |
| 89 | Ramp | SH 183: EB On Ramp from Frontage Road | 48-hour |
| 90 | Ramp | SH 183: WB Off Ramp to Belt Line Road | 48-hour |
| 91 | Ramp | SH 183: EB Off Ramp to Frontage Road (William Brewster) | 48-hour |
| 92 | Ramp | SH 183: WB On Ramp from MacArthur Boulevard | 48-hour |
| 93 | Ramp | SH 183: EB Off Ramp to MacArthur Boulevard | 48-hour |
| 94 | Ramp | SH 183: WB Off Ramp to Story Road | 48-hour |
| 95 | Ramp | SH 183: EB On Ramp from Story Road | 48-hour |
| 96 | Ramp | SH 183: WB Off Ramp to Frontage Road (William Brewster) | 48-hour |
| 97 | Ramp | SH 183: EB Off Ramp to O'Connor Road | 48-hour |
| 98 | Ramp | SH 183: WB On Ramp from O'Connor Road | 48-hour |
| 99 | Ramp | SH 183: EB On Ramp from MacArthur Boulevard | 48-hour |
| 100 | Ramp | SH 183: WB Off Ramp to MacArthur Boulevard | 48-hour |
| 101 | Ramp | SH 183: EB Off Ramp to Frontage Road (Britain Road) | 48-hour |
| 102 | Ramp | SH 183: WB Off Ramp to O'Connor Road | 48-hour |
| 103 | Ramp | SH 183: EB On Ramp from O'Connor Road | 48-hour |
| 104 | Ramp | SH 183: WB Off Ramp to Frontage Road (Wingren Road) | 48-hour |
| 105 | Ramp | SH 183: EB Off Ramp to Carl Road | 48-hour |
| 106 | Ramp | SH 183: WB On Ramp from Carl Road | 48-hour |
| 107 | Ramp | SH 183: EB Off Ramp to Loop 12 | 48-hour |
| 108 | Ramp | SH 183: WB Off Ramp to Carl Road | 48-hour |
| 109 | Direct Connector | SH 183: WB On Ramp from Loop 12 SB | 48-hour |
| 110 | Ramp | SH 183: EB On Ramp from Carl Road | 48-hour |
| 111 | Ramp | SH 183: WB Off Ramp to Tom Braniff Drive | 48-hour |
| 112 | Direct Connector | SH 183: WB Off Ramp to SB Loop 12 - loop ramp | 48-hour |
| 113 | Direct Connector | SH 183: WB On Ramp from NB Loop 12 - loop ramp | 48-hour |
| 114 | Direct Connector | SH 183: WB On Ramp from Spur 482 | 48-hour |
| 115 | Direct Connector | SH 183: EB Off Ramp to Spur 482 | 48-hour |
| 116 | Ramp | SH 183: EB Off Ramp to Grauwyler Road | 48-hour |
| 117 | Direct Connector | SH 183: EB On Ramp from SH 114 | 48-hour, VC |
| 118 | Direct Connector | SH 183: WB Off Ramp to SH 114 | 48-hour, VC |
| 119 | Ramp | SH 183: EB On Ramp from Frontage Road / NB Loop 12 | 48-hour |
| 120 | Ramp | SH 183: WB Off Ramp to Frontage Road / NB Spur 482 | 48-hour |
| 121 | Ramp | SH 183: WB On Ramp from Grauwyler Road | 48-hour |
| 122 | Ramp | SH 183: EB On Ramp from Grauwyler Road | 48-hour |
| 123 | Ramp | SH 183: WB Off Ramp to Grauwyler Road | 48-hour |
| 124 | Ramp | SH 183: EB Off Ramp to Regal Row | 48-hour |
| 125 | Ramp | SH 183: WB On Ramp from Regal Row | 48-hour |
| 126 | Ramp | SH 183: EB On Ramp from Regal Row | 48-hour |
| 127 | Ramp | SH 183: WB Off Ramp to Regal Row | 48-hour |
| 128 | Ramp | SH 183: EB Off Ramp to Mockingbird Lane | 48-hour |
| 129 | Ramp | SH 183: WB On Ramp from Mockingbird Lane | 48-hour |
| 130 | Ramp | SH 183: EB On Ramp from Dividend Drive | 48-hour |
| 131 | Ramp | SH 183: WB Off Ramp to Empire Central | 48-hour |
| 132 | Ramp | SH 183: EB On Ramp from Mockingbird Lane | 48-hour |
| 133 | Ramp | SH 183: WB Off Ramp to Mockingbird Lane | 48-hour |

VC = Vehicle Classification; SD = Seven Day

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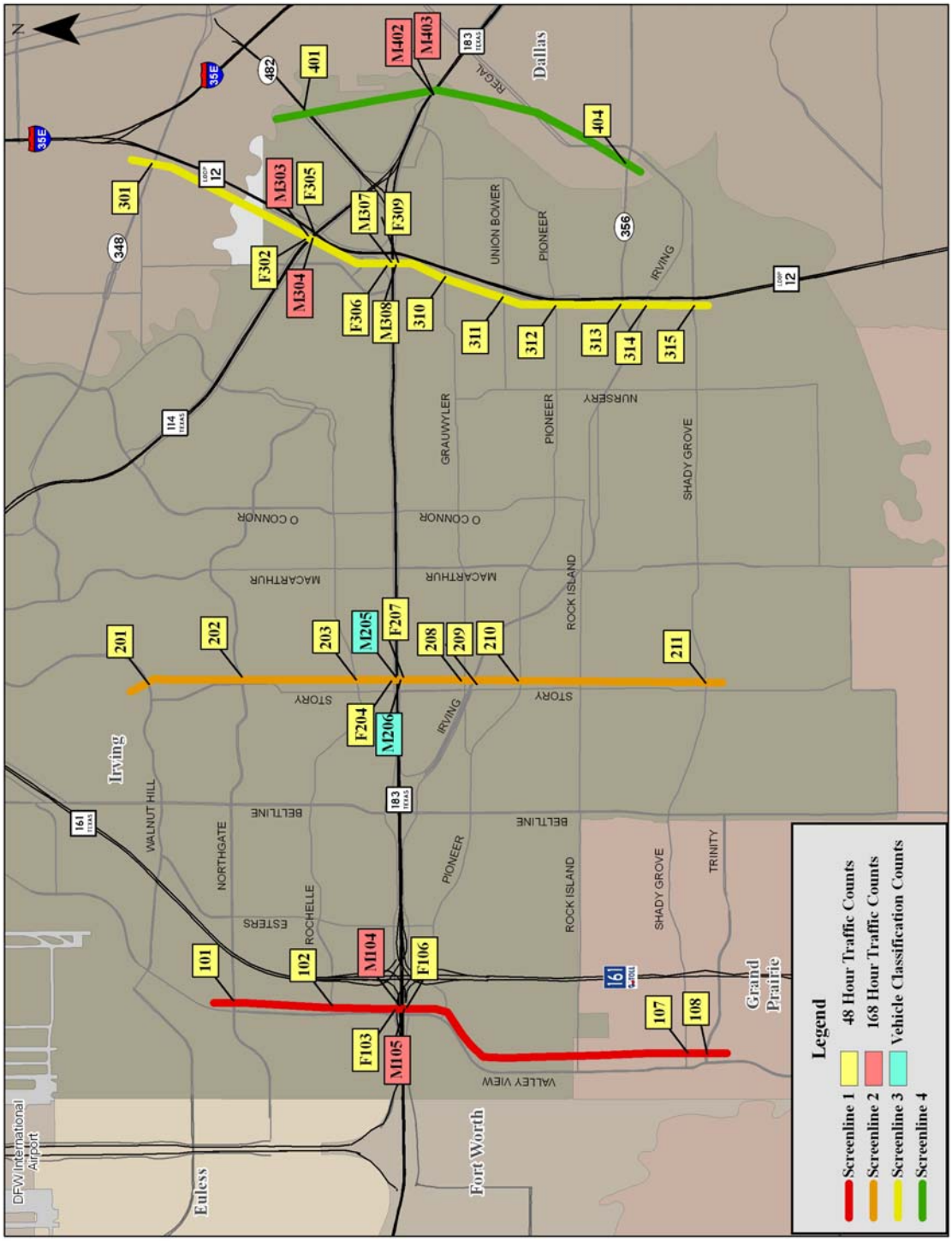


**Figure 2-6. Screenline Locations and Count Locations**

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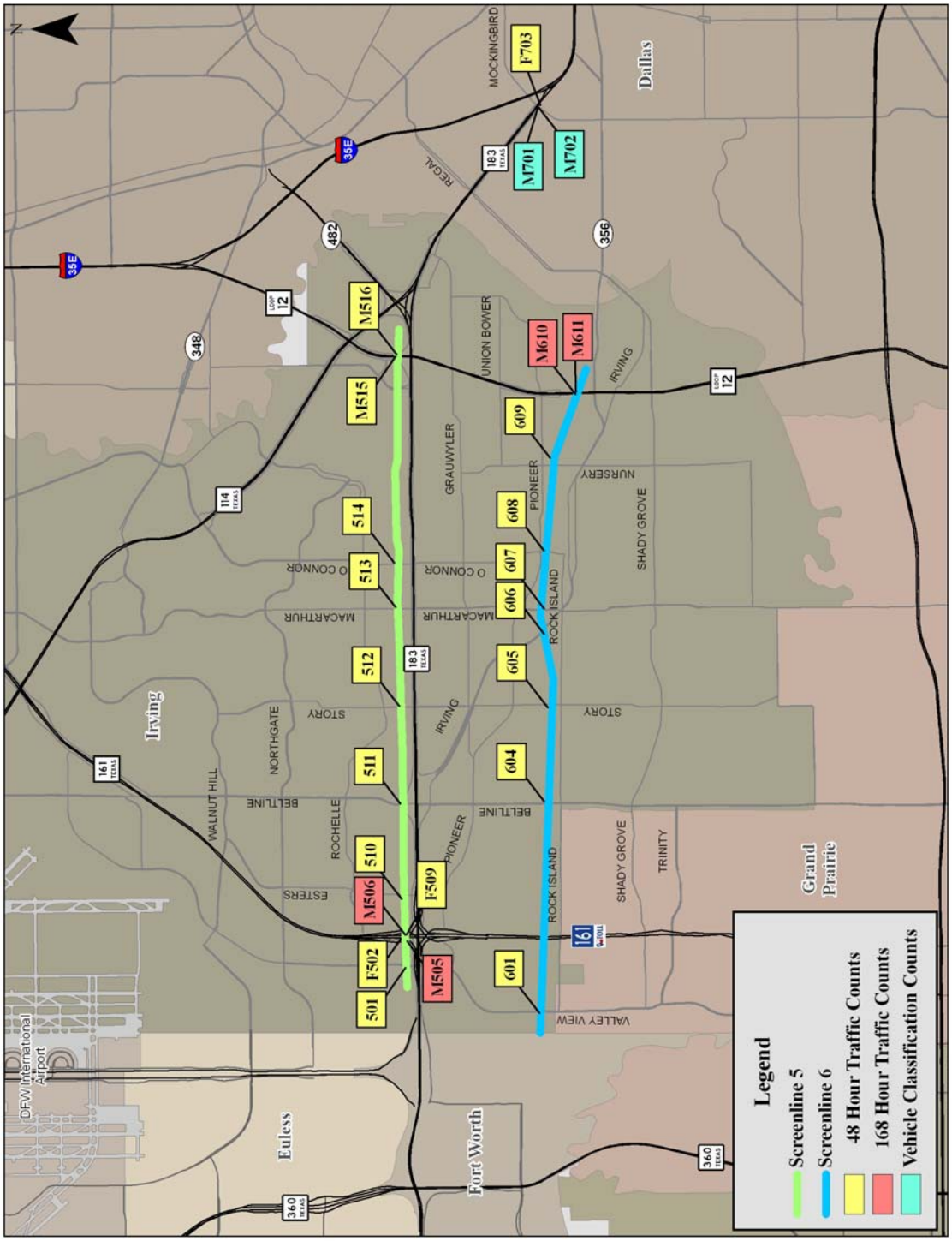


**Figure 2-6. Screenline Locations and Count Locations (continued)**

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**Table 2-3**
**Total Share of Corridor Demand**

| **Location: Screenline 1 (W. of SH 161)** | **ADT*** | **% Share** |
|---|---|---|
| Northgate Drive | 10,531 | 6.4% |
| Rochelle Road | 2,382 | 1.4% |
| SH 183 Frontage Road | 14,996 | 9.1% |
| SH 183 Mainlanes | 124,721 | 75.9% |
| Shady Grove Road | 2,909 | 1.8% |
| Trinity Boulevard | 8,802 | 5.4% |
| | | |
| **Location: Screenline 2 (E. of Story Road)** | **ADT*** | **% Share** |
| Walnut Hill Lane | 18,727 | 7.7% |
| Northgate Drive | 11,497 | 4.7% |
| Rochelle Road | 11,763 | 4.8% |
| SH 183 Frontage Road | 22,253 | 9.1% |
| SH 183 Mainlanes | 130,722 | 53.6% |
| Gauwyler Road | 5,458 | 2.2% |
| Irving Blvd | 17,972 | 7.4% |
| Pioneer Road | 10,882 | 4.5% |
| Shady Grove Road | 14,478 | 5.9% |
| | | |
| **Location: Screenline 3 (W. of Loop 12)** | **ADT*** | **% Share** |
| SP 348 | 39,621 | 11.7% |
| SH 114 Frontage Road | 21,803 | 6.5% |
| SH 114 Mainlanes | 64,462 | 19.1% |
| SH 183 Frontage Road | 47,011 | 13.9% |
| SH 183 Mainlanes | 103,997 | 30.8% |
| Gauwyler Road | 7,884 | 2.3% |
| Union Bower Road | 4,005 | 1.2% |
| Pioneer Road | 3,439 | 1.0% |
| SH 356 | 21,891 | 6.5% |
| Irving Boulevard | 5,453 | 1.6% |
| Shady Grove Road | 17,810 | 5.3% |
| | | |
| **Location: Screenline 4 (W. of River Bridge)** | **ADT*** | **% Share** |
| Storey Lane (Spur 482) | 34,449 | 17.2% |
| SH 183 Mainlanes | 141,032 | 70.6% |
| SH 356 Irving Boulevard | 24,289 | 12.2% |
| | | |

* 2009 Traffic Count

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**Table 2-3 (Continued)**
**Total Share of Corridor Demand**

| **Location: Screenline 5 (N. of SH 183)** | **ADT*** | **% Share** |
|---|---|---|
| Valley View Lane | 9,902 | 3.7% |
| SH 161 Frontage Road | 2,936 | 1.1% |
| SH 161 Mainlanes | 16,457 | 6.2% |
| Esters Road | 16,057 | 6.0% |
| Belt Line Rd | 40,484 | 15.2% |
| Story Road | 26,263 | 9.9% |
| MacArthur Boulevard | 30,892 | 11.6% |
| O'Connor Road | 16,681 | 6.3% |
| Loop 12 | 106,212 | 39.9% |
| | | |
| **Location: Screenline 6 (N. of Rock Island Road)** | **ADT*** | **% Share** |
| Valley View Lane | 12,353 | 5.2% |
| Belt Line Rd | 30,353 | 12.9% |
| Story Road | 16,904 | 7.2% |
| Irving Boulevard | 15,237 | 6.5% |
| MacArthur Boulevard | 17,125 | 7.3% |
| O'Connor Road | 11,783 | 5.0% |
| Nursery Road | 9,284 | 3.9% |
| Loop 12 | 122,330 | 52.0% |
| | | |

* 2009 Traffic Count

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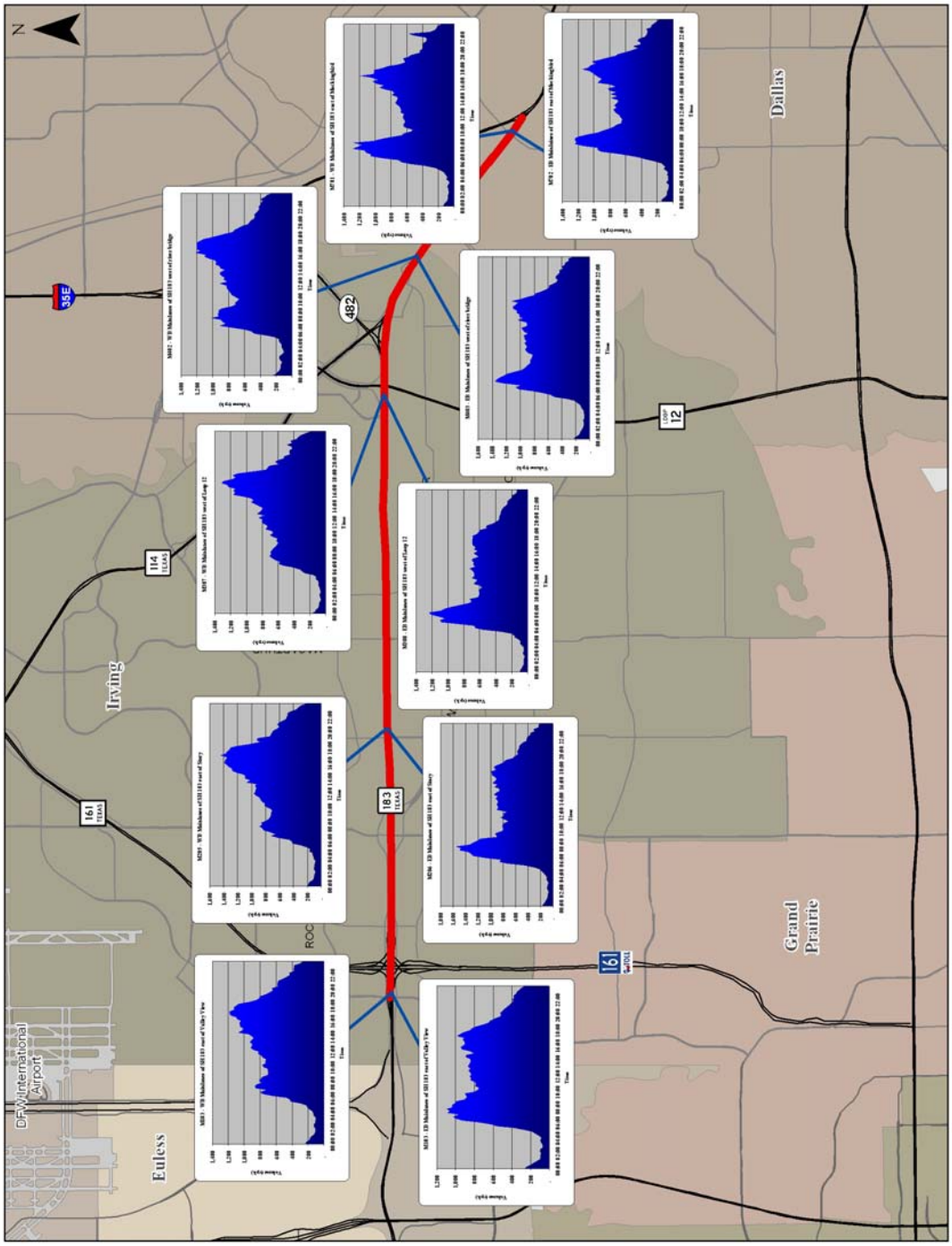


**Figure 2-7. SH 183 Traffic Temporal Distribution**

**Time-of-Day Traffic Distribution**

The 15-minute interval volume data collected from the traffic count program were used to evaluate the time-of-day distributions to determine the directional peaking characteristics of the major facilities within the study corridor area. For modeling purposes, seven time periods were used to capture the peak (AM and PM) and off peak (Midday and Night) travel patterns as defined below:

- AM1 Peak Period – 6:30 AM to 8:00 AM
- AM2 Peak Period – 8:00 AM to 9:00 AM
- Midday Period – 9:00 AM to 3:00 PM
- PM1 Peak Period – 3:00 PM to 4:30 PM
- PM2 Peak Period – 4:30 PM to 6:30 PM
- PM3 Peak Period – 6:30 PM to 7:30 PM
- Night Period – 7:30 PM to 6:30 AM

**Figures 2-8** and **2-9** summarizes the peaking characteristics by direction of travel for the average weekday and weekend traffic along SH 183, east of Valley View Lane and **Figures 2-10** and **2-11** illustrate peaking characteristics along SH 183, west of River Bridge. The east of Valley View Lane location, showed that higher traffic in the AM and PM peak periods occurs in both the eastbound and westbound direction for the average weekday traffic, which accounted for approximately 30 percent of the daily traffic. The afternoon peak occurs in the westbound direction and accounted for approximately 28.5 percent of the daily traffic. The weekend traffic also demonstrated similar distribution of traffic with slightly less traffic in occurring in the morning and more occurring in the remaining periods.

The location west of River Bridge, as shown in **Figures 2-10** and **2-11,** illustrated a similar traffic distribution profile to the east of Valley View Lane location. The weekend traffic at this location, however, exhibited significantly less traffic within the morning period and more traffic occurring during the midday and night time periods.

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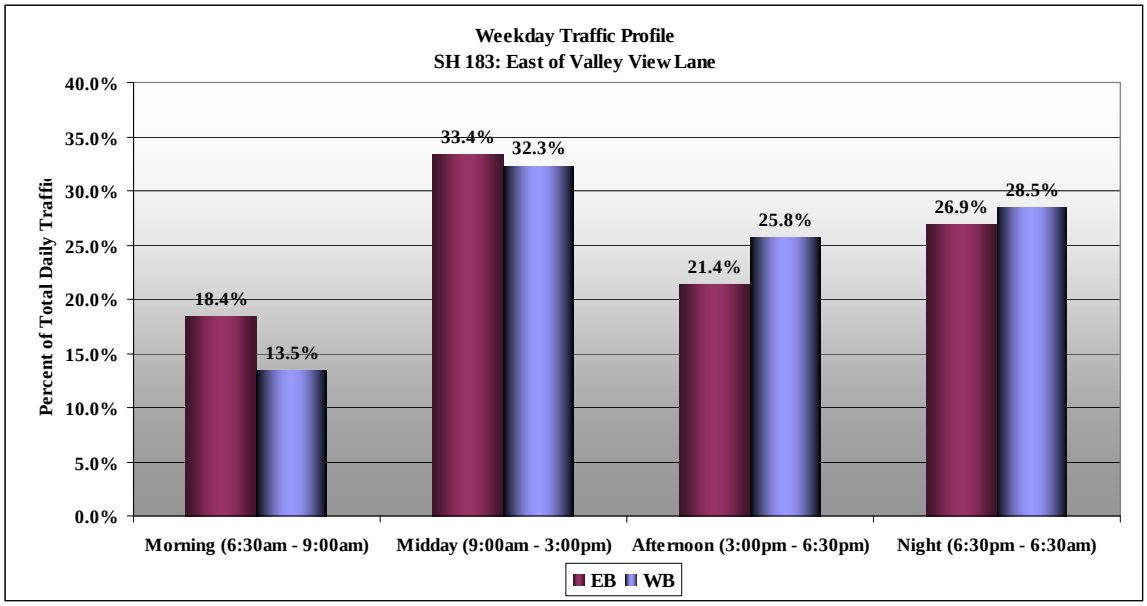


**Figure 2-8. Weekday Traffic Profile (SH 183: East of Valley View Lane)**

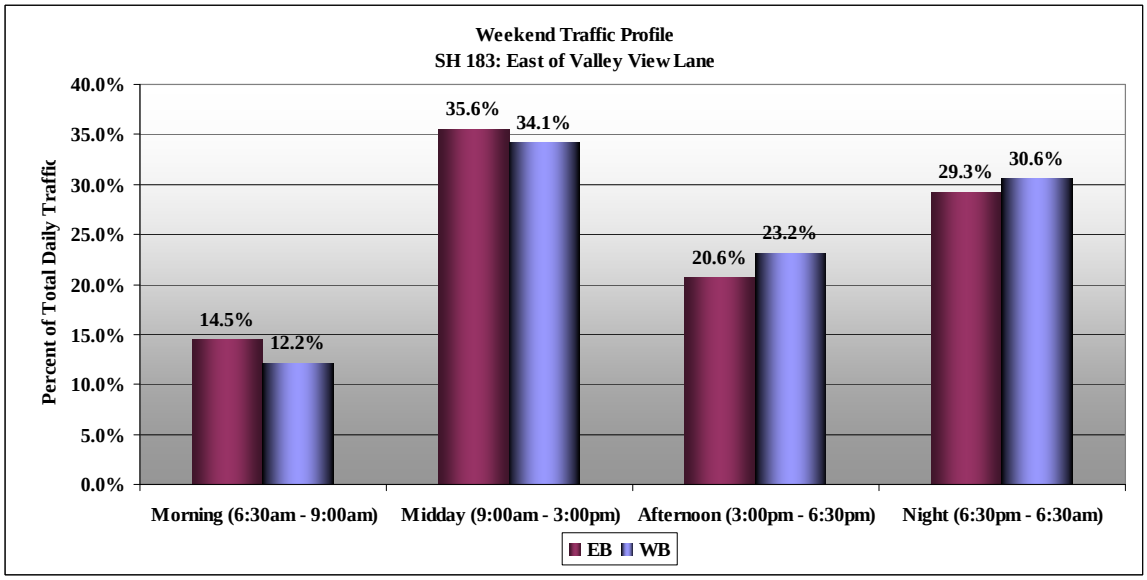


**Figure 2-9. Weekend Traffic Profile (SH 183: East of Valley View Lane)**

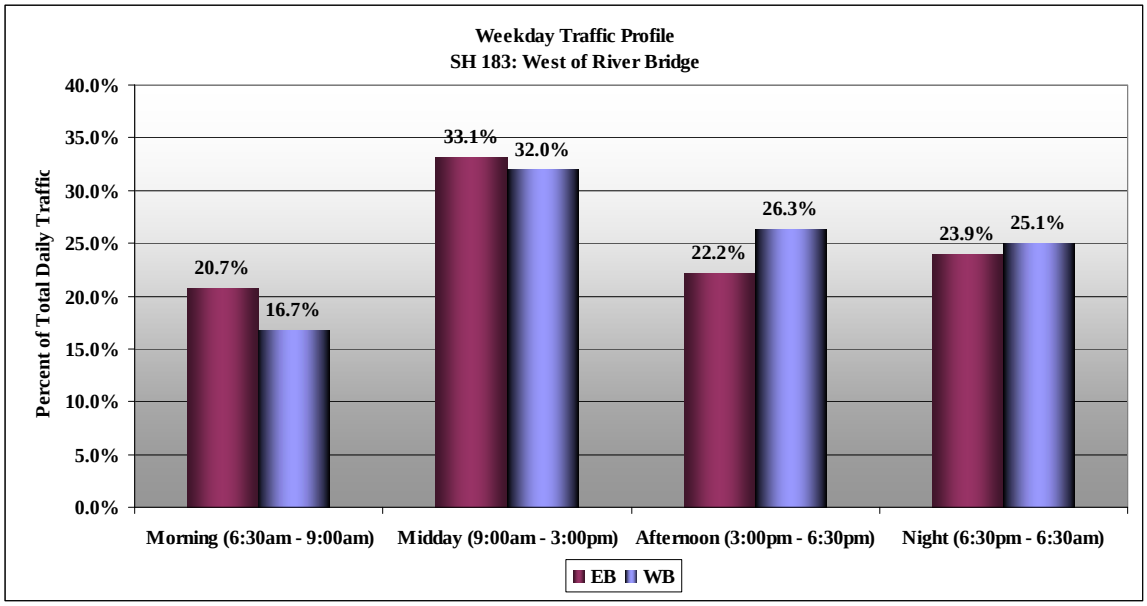


**Figure 2-10. Weekday Traffic Profile (SH 183: West of River Bridge)**

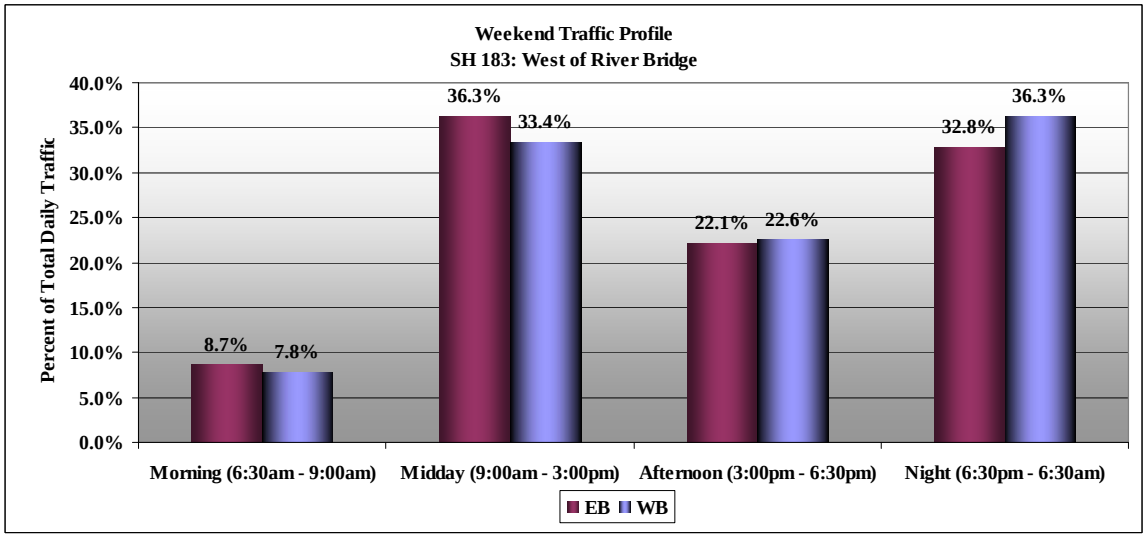


**Figure 2-11. Weekend Traffic Profile (SH 183: West of River Bridge)**

**Table 2-4** summarizes the directional split (portion of traffic in each direction) by time period along the SH 183 study corridor. These temporal directional split percentages were important to assess the period distributions of the period trip tables as further described in the model development Chapter 5. The traffic counts collected at locations along SH 183 showed that the westbound to eastbound daily traffic split, east of Valley View Lane was approximately 51/49 percent, with more traffic traveling in the

westbound direction. A review of average daily volumes along SH 183, west of River Bridge showed the westbound to eastbound daily traffic split of approximately 52/48 percent, with slightly more traffic traveling in the eastbound direction.

**Table 2-4**
**Directional Split by Peak Period**

| Location | Direction | AM | MD | PM | NT | Total Daily |
|---|---|---|---|---|---|---|
| SH 183: East of Valley View | **EB** | 57% | 50% | 45% | 48% | 49% |
| | **WB** | 43% | 50% | 55% | 52% | 51% |
| SH 183: West of River Bridge | **EB** | 57% | 52% | 47% | 50% | 52% |
| | **WB** | 43% | 48% | 53% | 50% | 48% |

### DAY-OF-WEEK TRAFFIC DISTRIBUTION

Seven-day traffic counts were collected along SH 183 to capture the variations of traffic demand during the weekday and weekend. The weekend factor, defined as a ratio between the magnitude of average daily weekend traffic compared to the average weekday traffic, was calculated from the collected data. These factors gauge differences between the weekday commuter markets and the weekend recreational markets that may potentially use the SH 183 corridor. The overall weekend-to-weekday traffic conditions provided a gauge of the potential reduction in traffic anticipated along the corridor during the weekends. This ratio, combined with the distribution of hourly traffic, is used to estimate the number of revenue days which impacts the revenue generation potential of the proposed SH 183 project.

Analysis of the daily traffic patterns from the seven-day traffic counts along SH 183, east of Valley View Lane, showed that the average weekend traffic was approximately 89 percent of the average weekday daily traffic, as presented in **Table 2-5**. Traffic along SH 183, west of River Bridge, demonstrated that the average weekend traffic was approximately 63 percent of the average weekday daily traffic. This indicates there is significant weekend traffic within the region – most likely a result of the through/ intercity/ recreational traffic in the area that is passing through the SH 183 region from multiple directions.

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**Table 2-5**
**Weekend Traffic Factors**

| Location | Period | WB | EB | Total |
|---|---|---|---|---|
| SH 183: East of Valley View | AM | 0.80 | 0.70 | 0.74 |
| | MD | 0.94 | 0.94 | 0.94 |
| | PM | 0.80 | 0.85 | 0.82 |
| | NT | 0.95 | 0.96 | 0.96 |
| | **Daily** | **0.89** | **0.88** | **0.89** |
| SH 183: West of River Bridge | AM | 0.30 | 0.26 | 0.28 |
| | MD | 0.67 | 0.68 | 0.68 |
| | PM | 0.56 | 0.61 | 0.58 |
| | NT | 0.93 | 0.85 | 0.89 |
| | **Daily** | **0.65** | **0.62** | **0.63** |

### CORRIDOR HOURLY TRAFFIC PROFILES

An analysis of the temporal distribution of the traffic counts illustrated that the PM peak hourly traffic in the westbound direction carried the highest traffic volumes, while AM peak hourly traffic was the highest in the eastbound direction, as shown in **Figure 2-12** and **2-13**. The hourly peak volumes of close to 5,000 vehicles was demonstrated throughout most of the corridor in the westbound direction during the PM peak period while in the AM peak period the volumes between Regency and Regal ROW were shown to reach slightly higher than 6,000 but then fell to about 4,500 thereafter. The eastbound direction AM period was shown to carry the highest hourly volumes throughout most of the corridor with the exception of the segment between Loop 12 and SH 114. The PM peak in the eastbound direction followed a similar pattern to the AM period traffic and carried close to 4,000 hourly vehicles through most of the segments.

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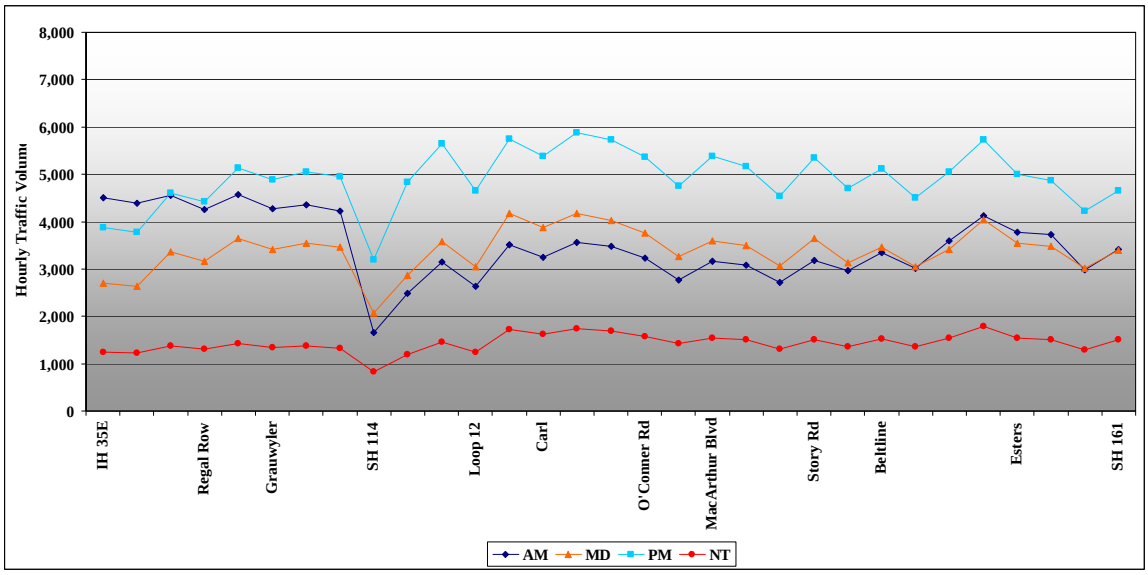


**Figure 2-12. SH 183 Westbound Hourly Traffic Volumes**

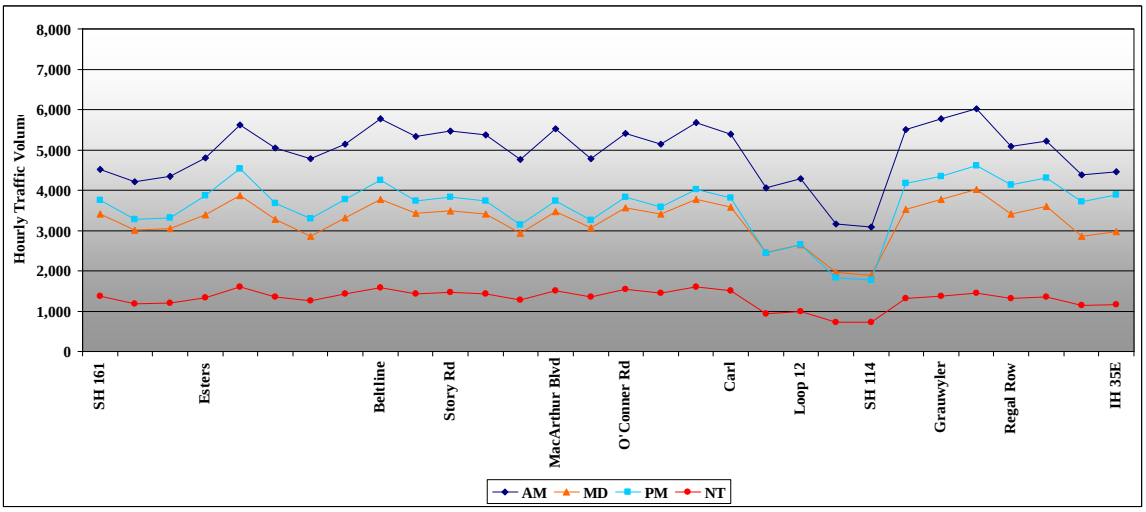


**Figure 2-13. SH 183 Eastbound Hourly Traffic Volumes**

## RAMP COUNTS

The ramp counts along the SH 183 were collected as part of the data collection to gauge the extent of ramp traffic exiting and entering the facility from the various cross-streets within the corridor, as shown in **Figure 2-14**. Aside from the major cross-streets and freeways along the corridor, Empire Central/Dividend Drive and Ester Road were also shown to generate significant traffic to the SH 183 mainlanes.

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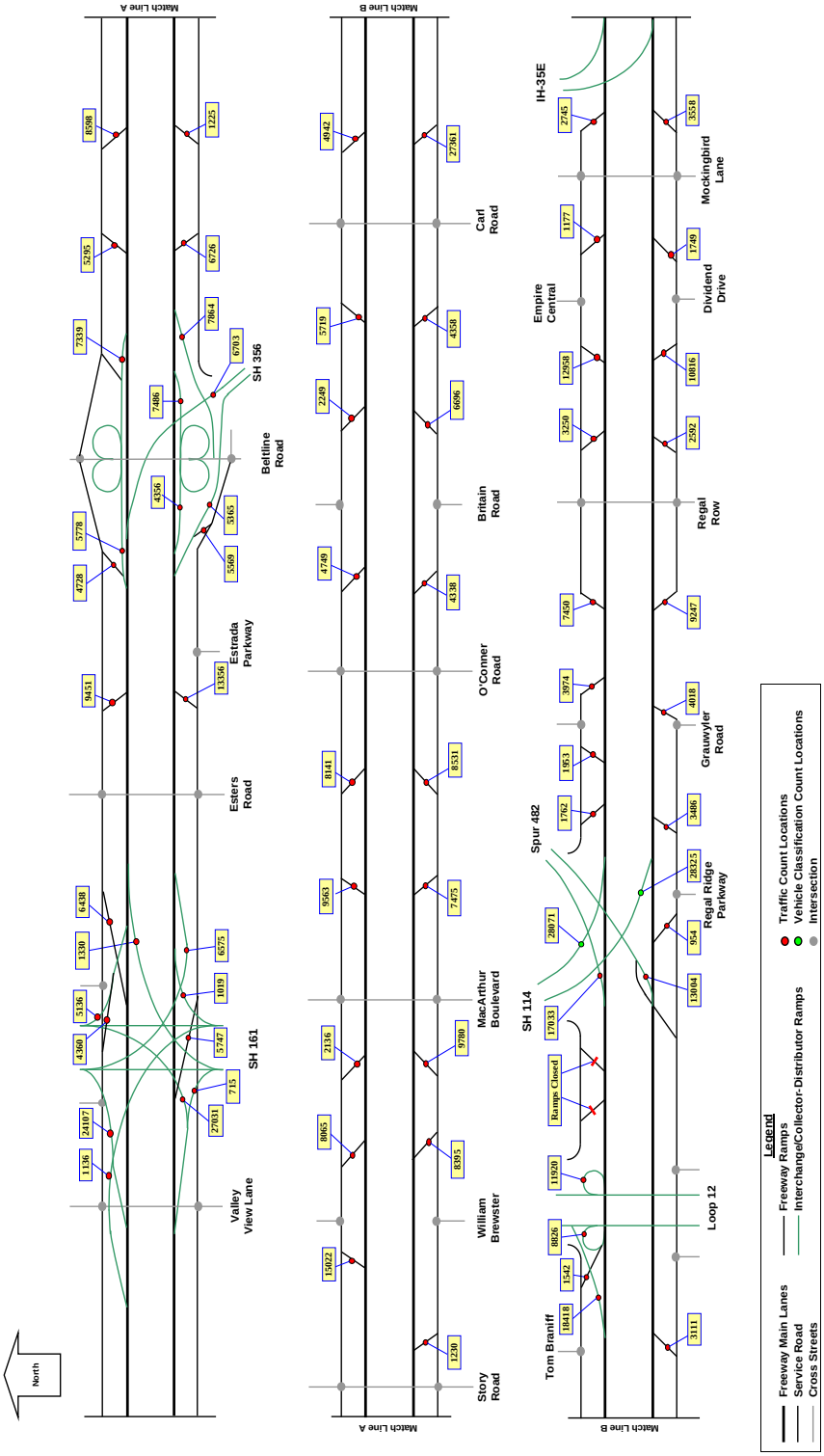


**Figure 2-14. SH 183 Ramp Volumes**

### VEHICLE CLASSIFICATION COUNTS

The vehicle classification counts were conducted at several traffic count locations in both directions within the SH 183 study corridor. The counts were conducted to evaluate the axle distribution characteristics of vehicles using the existing routes within the SH 183 region.

The considerable proportion of trucks within the region, as compared to the passenger vehicle demand, is an important consideration in evaluating the possible capture of the SH 183. The magnitude of truck participation within the region also has a significant impact on the revenue potential of the proposed SH 183 managed lanes, since these vehicles typically have much higher toll rates than the passenger vehicle markets.

**Figures 2-15** and **2-16** summarize the current truck axle distributions along SH 183, east of Story Road and along the off-ramp direct connector from/to SH 114. The SH 183 (east of Story Road) showed that the truck traffic was approximately 5.8 percent of total traffic with the five-axle truck market accounting for over 57 percent of total truck traffic.

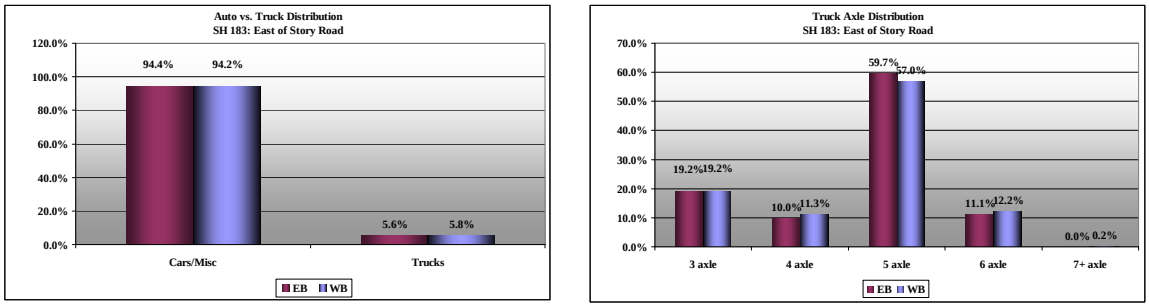


**Figure 2-15. Vehicle Classification SH 183 East of Story Road**

The SH 183 off-ramp direct connector from/to SH 114 showed that the combined four-axle and five-axle truck market was approximately 60 percent of total truck traffic. The truck percentage at this location was approximately 9.5 percent of the total volumes.

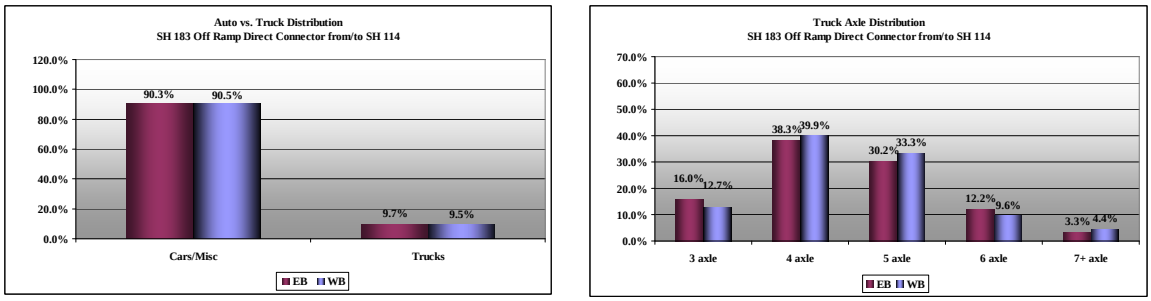


**Figure 2-16. Vehicle Classification Direct Connector to/from SH 114**

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### TRUCK DISTRIBUTION

The historical truck volume and growth trends between 2001 and 2008 at several key locations were investigated within the SH 183 study area, as summarized in **Figure 2-17**. The SH 114 (northwest of SH 161) showed the highest average annual growth in overall traffic between 2001 and 2008 of 5.7 percent and carried approximately 4,594 daily truck trips in 2008. On the other hand, the lowest average annual growth of -3.73 percent for overall truck traffic was seen along SH 183 (west of Loop 12), with approximately 5,118 daily truck trips in 2008. The Loop 12 (south of IH 30), with an annual growth rate of -0.66 percent between 2001 and 2008, carried approximately 6,800 daily trucks in 2008, and was shown to be the facility that carried the highest overall daily truck traffic. The existing facilities radiating from the SH 183 corridor were carrying approximately 4,437 (on SH 360 north of IH 30) to 6,800 daily trucks in 2008.

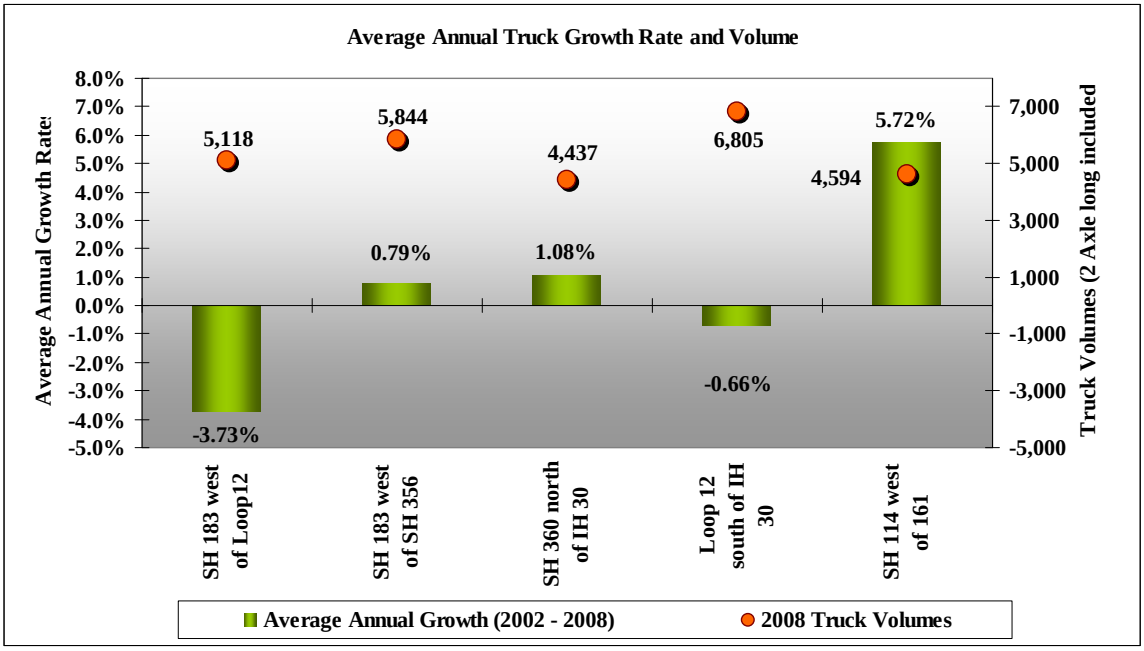


**Figure 2-17. Annual Average Truck Growth Rate and Volume**

**Figure 2-18** illustrates the 2008 truck percentage shares, including and excluding the two-axle long vehicles. The Loop 12 (south of IH 30) showed the highest percentage share of trucks in 2008 (approximately 7.8 percent and 5.2 percent for the without and with the two-axle vehicles definitions).

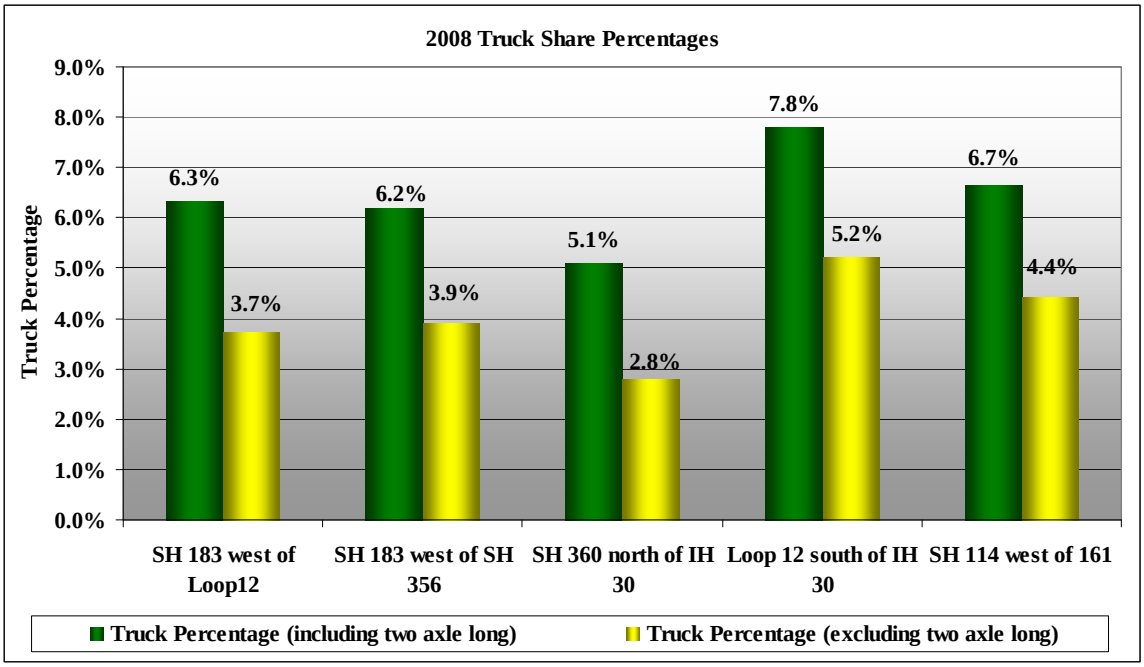


**Figure 2-18. 2008 Truck Share Percentages**

MANUAL OCCUPANCY COUNTS

Several manual vehicle occupancy counts were also conducted along SH 183 to complement the ATR count data. The manual counts were collected by observing traffic from the side of the roadway and recording the existing carpooling characteristics within the corridor. All the counts were conducted during the daylight hours from 7:00 AM to 7:00 PM on a mid-weekday in both directions of the SH 183 corridor. Each occupancy count was reviewed to ensure that the counts were of good quality and the results from this effort are summarized in **Table 2-6**.

The highest vehicle occupancy rate of 1.22 was observed east of Story Road during the PM peak. The lowest occupancy rate of 1.05 was observed west of Mockingbird Lane during the AM peak.

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**Table 2-6**
**Manual Vehicle Occupancy Counts**
**SH 183: East of Story Road - Eastbound**

| Period | SOV | HOV2 | HOV 3+ | Total vehicles | % of HOVs | Total Occupants | Occupancy Rate |
|---|---|---|---|---|---|---|---|
| AM | 8,819 | 1,195 | 246 | 10,260 | 14.0% | 11,947 | 1.16 |
| MD | 17,722 | 3,252 | 558 | 21,532 | 17.7% | 25,900 | 1.20 |
| PM | 11,814 | 2,375 | 425 | 14,614 | 19.2% | 17,839 | 1.22 |

**Manual Vehicle Occupancy Counts**
**SH 183: East of Story Road - Westbound**

| Period | SOV | HOV2 | HOV 3+ | Total vehicles | % of HOVs | Total Occupants | Occupancy Rate |
|---|---|---|---|---|---|---|---|
| AM | 5,443 | 517 | 33 | 5,993 | 9.2% | 6,576 | 1.10 |
| MD | 19,493 | 2,430 | 215 | 22,138 | 11.9% | 24,998 | 1.13 |
| PM | 17,347 | 3,014 | 196 | 20,557 | 15.6% | 23,963 | 1.17 |

**Manual Vehicle Occupancy Counts**
**SH 183: West of Mockingbird Lane - Eastbound**

| Period | SOV | HOV2 | HOV 3+ | Total vehicles | % of HOVs | Total Occupants | Occupancy Rate |
|---|---|---|---|---|---|---|---|
| AM | 8,685 | 280 | 73 | 9,038 | 3.9% | 9,464 | 1.05 |
| MD | 15,436 | 1,266 | 123 | 16,825 | 8.3% | 18,337 | 1.09 |
| PM | 12,862 | 842 | 67 | 13,771 | 6.6% | 14,747 | 1.07 |

**Manual Vehicle Occupancy Counts**
**SH 183: West of Mockingbird Lane - Westbound**

| Period | SOV | HOV2 | HOV 3+ | Total vehicles | % of HOVs | Total Occupants | Occupancy Rate |
|---|---|---|---|---|---|---|---|
| AM | 6,944 | 415 | 70 | 7,429 | 6.5% | 7,984 | 1.07 |
| MD | 14,868 | 1,520 | 162 | 16,550 | 10.2% | 18,394 | 1.11 |
| PM | 14,598 | 1,356 | 156 | 16,110 | 9.4% | 17,778 | 1.10 |

## SPEED AND DELAY CHARACTERISTICS

The collection of the speed and delay characteristic along key routes within the SH 183 corridor provided a description of the existing congestion experienced along several key facilities throughout the day. The speed and delay data was gathered in the field using Global Position System (GPS) technology during the peak and off-peak periods. The time and position data was gathered from the GPS device every one-twentieth of a mile to derive the average operating speeds along the respective routes chosen for this study. The speed and delay information was collected for two days along each alternate major arterial street.

### ROUTE SELECTION

A single driver was used along each route with the exception of the SH 183 main lanes where two drivers were used to perform the speed and delay data collection. The speed and delay runs were undertaken along each route during both morning and afternoon peak periods, and during the midday off-peak period.

The routes driven as part of this study included:

- Route 1: Rental Car and Northgate Drive between 26th Avenue and Tom Braniff Drive
- Route 2: Rochelle Boulevard between Valley View Lane and SH 114
- Route 3: SH 183 between Euless Main Street and Commonwealth Drive
- Route 4: Pioneer Drive and Grauwyler Road between Esters Road and Recognition Point Drive
- Route 5: Irving Boulevard between Beltline Road and Commonwealth Drive
- Route 6: Shady Grove Road between Roy Orr Boulevard and SH 183
- Route 7: SH 114 between Beltline Road and Grauwyler Road
- Route 8: Loop 12 between Walnut Hill Lane and Jefferson Boulevard
- Route 9: IH 35E between IH 635 and Commonwealth Drive

Routes 1, 2, 4, 5, and 6 capture the alternative routes to the SH 183 study corridor, while the last three routes capture the freeways/cross-streets to the SH 183 study corridor. Drivers of the GPS-equipped vehicles were instructed to travel along the corridor beginning at designated starting points of a specific route during a specified time period. The driver then drove the route following the natural trend of traffic and returned along the route in the opposite direction. The driver attempted to keep pace with the overall flow of traffic usually by passing the same number of vehicles that would pass their vehicle. The route was repeated for as many times as was allowable within the specified time period. The time periods driven in the morning peak were from 6:00 AM to 9:00 AM, the midday or off-peak were from 11:00 AM to 2:00 PM and the evening peak were from 4:00 PM to 7:00 PM.

Data collected by the GPS was downloaded, compiled, and formatted for analysis using customized spreadsheet applications. The operating speed along each route was then calculated along with the speed profiles on each facility that included the average speed for the full length of the facility. These speed profiles were developed to help identify bottlenecks or other traffic operational deficiencies along the identified routes and to assist in the calibration of the simulation models.

The maximum possible number of runs were made during each time period for every route, and travel speeds were recorded every one-twentieth (0.05) of a mile using a global

position system (GPS), thus providing detailed information regarding peak period average travel speeds along the respective routes. The speed and delay runs were carried out the week of September 14, 2009 along the nine routes shown in **Figure 2-19**. The average speed along the nine routes for the AM, Midday and PM peak periods are summarized in **Figures 2-20** thru **Figure 2-22**. The travel information on the existing conditions of the respective roadway facilities was used during the calibration process to verify the output speeds derived from the travel demand model.

The speed and delay run summaries for the morning peak period showed varied traffic conditions along the nine routes, as illustrated in **Figure 2-20**. The majority of SH 183 showed little congestion in the morning peak period in both directions, with speeds ranging between 54 to 60 miles per hour (mph). The slowest speeds observed along SH 183 were on the western segments between SH 360 and SH 161 in the eastbound direction. Route 1 follows Rental Car and Northgate Drive between 26$^{th}$ Avenue and Tom Braniff Drive and showed high levels of congestion between Beltline Road and MacArthur Boulevard in both directions. Route 2 along Rochelle Boulevard between Valley View Lane and SH 114, exhibited slow speeds in the morning peak in both directions and further degradation in speeds occurring in the westbound direction. Route 4 along Pioneer Drive and Grauwyler Road between Esters Road and Recognition Point Drive, Route 5 along Irving Boulevard between Beltline Road and Commonwealth Drive, and Route 6 along Shady Grove Road between Roy Orr Boulevard and SH 183 showed slower speeds in both directions during the morning peak period which in part reflects the signalized intersections throughout these corridors. Route 7 along SH 114 between Beltline Road and Grauwyler Road showed slightly faster speed in both direction during the peak periods. For the most part, Route 8 along Loop 12 between Walnut Hill Lane and Jefferson Boulevard did not show any significant congestion with the exception of a small segment in the northbound direction. Route 9 along IH 35E between IH 635 and Commonwealth Drive demonstrated very little degradation of speeds during the morning period in both travel directions.

The midday off-peak speed and delay runs are shown in **Figure 2-21**. The speeds observed on SH 183 during the mid-day period showed little congestion within the corridor. All the routes that run parallel to SH 183 showed slower speeds and again reflect the signalized intersections along the routes and the feeder routes that provide access to SH 183 demonstrated no significant speed deterioration during the midday time period.

The speed and delay runs summarized in **Figure 2-22** show the afternoon peak period variations in traffic congestion patterns along the nine routes. The speeds observed on SH 183 in the afternoon peak were similar to the morning conditions. Some speed degradation in the northbound direction along IH 35E was evident from the field survey data. The congestion patterns along the parallel routes in the afternoon followed similar

patterns to the morning and midday. No unusual occurrences were noted during the course of the speed and delay data collection.

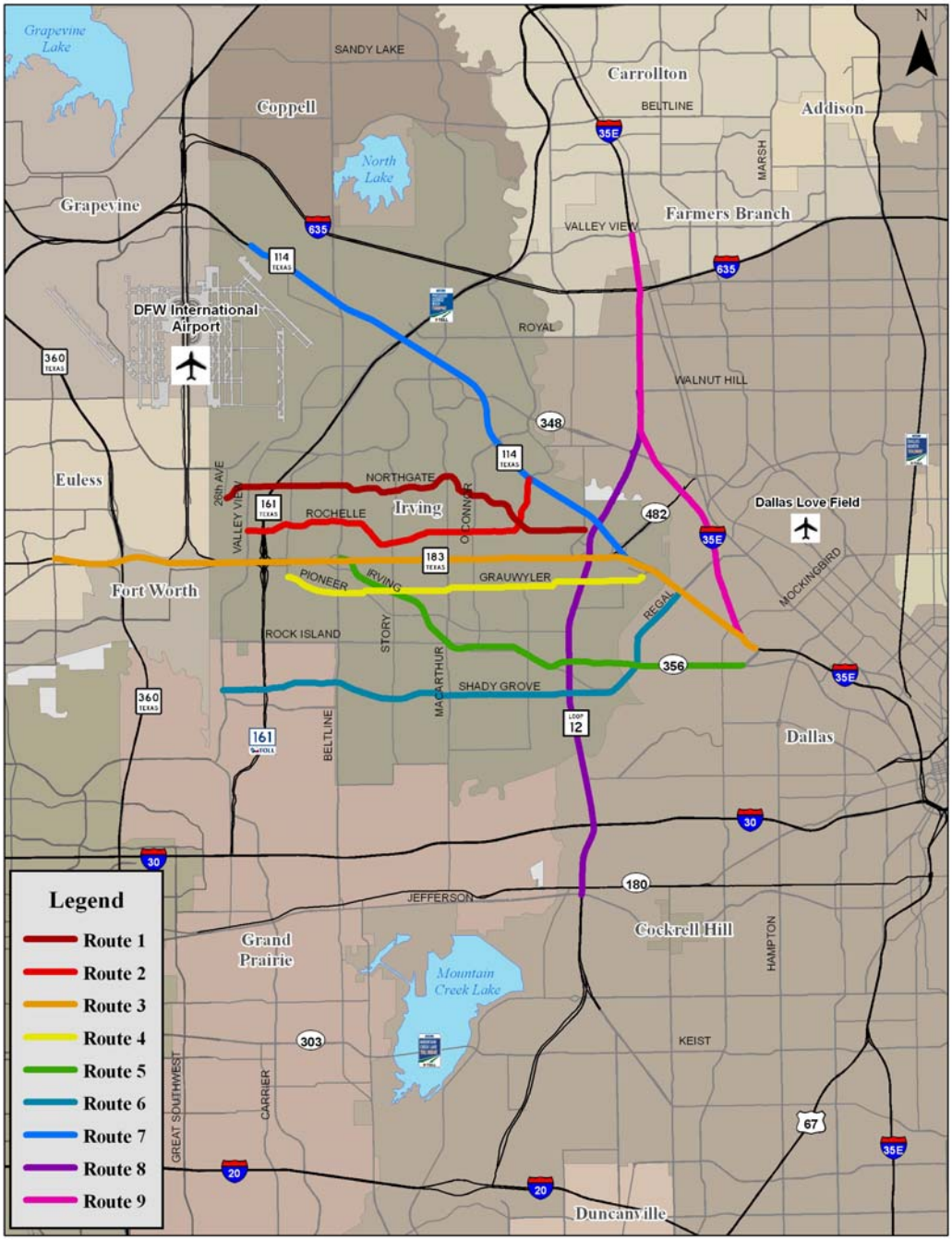


**Figure 2-19. Speed and Delay Routes**

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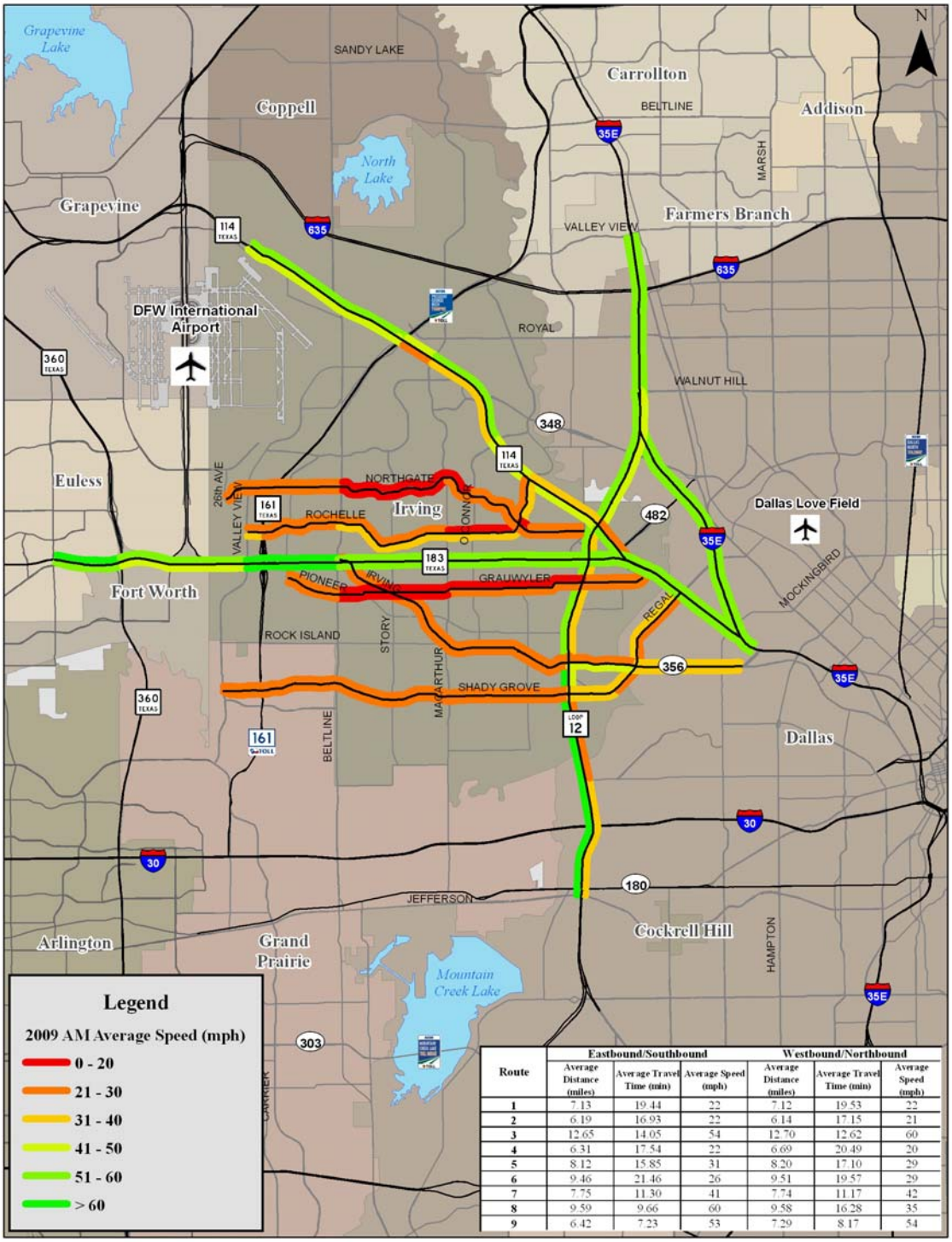


| Route | Eastbound/Southbound | | | Westbound/Northbound | | |
|---|---|---|---|---|---|---|
| | Average Distance (miles) | Average Travel Time (min) | Average Speed (mph) | Average Distance (miles) | Average Travel Time (min) | Average Speed (mph) |
| 1 | 7.13 | 19.44 | 22 | 7.12 | 19.53 | 22 |
| 2 | 6.19 | 16.93 | 22 | 6.14 | 17.15 | 21 |
| 3 | 12.65 | 14.05 | 54 | 12.70 | 12.62 | 60 |
| 4 | 6.31 | 17.54 | 22 | 6.69 | 20.49 | 20 |
| 5 | 8.12 | 15.85 | 31 | 8.20 | 17.10 | 29 |
| 6 | 9.46 | 21.46 | 26 | 9.51 | 19.57 | 29 |
| 7 | 7.75 | 11.30 | 41 | 7.74 | 11.17 | 42 |
| 8 | 9.59 | 9.66 | 60 | 9.58 | 16.28 | 35 |
| 9 | 6.42 | 7.23 | 53 | 7.29 | 8.17 | 54 |

**Figure 2-20. AM Peak Average Speeds**

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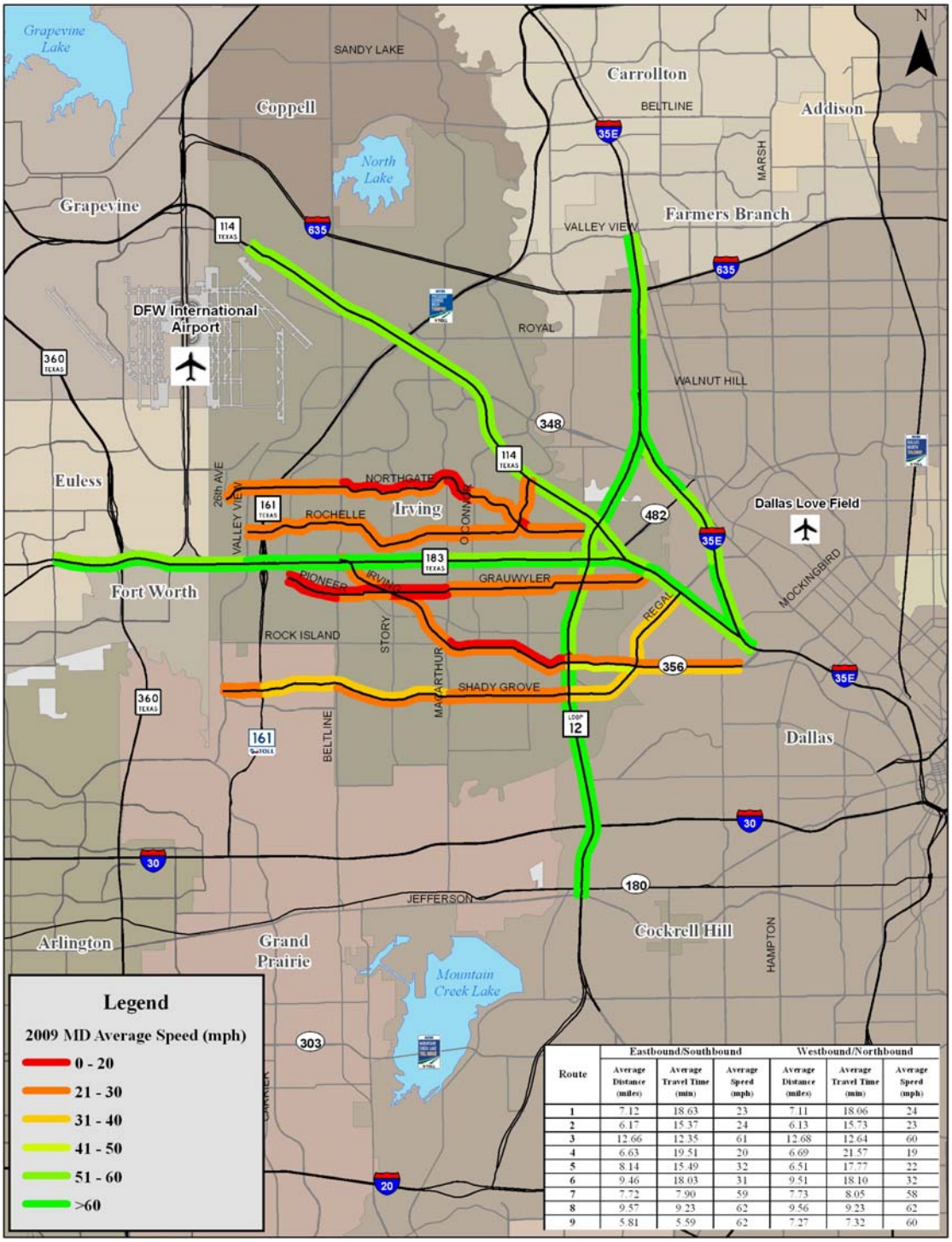


| Route | Eastbound/Southbound | | | Westbound/Northbound | | |
|---|---|---|---|---|---|---|
| | Average Distance (miles) | Average Travel Time (min) | Average Speed (mph) | Average Distance (miles) | Average Travel Time (min) | Average Speed (mph) |
| 1 | 7.12 | 18.63 | 23 | 7.11 | 18.06 | 24 |
| 2 | 6.17 | 15.37 | 24 | 6.13 | 15.73 | 23 |
| 3 | 12.66 | 12.35 | 61 | 12.68 | 12.64 | 60 |
| 4 | 6.63 | 19.51 | 20 | 6.69 | 21.57 | 19 |
| 5 | 8.14 | 15.49 | 32 | 6.51 | 17.77 | 22 |
| 6 | 9.46 | 18.03 | 31 | 9.51 | 18.10 | 32 |
| 7 | 7.72 | 7.90 | 59 | 7.73 | 8.05 | 58 |
| 8 | 9.57 | 9.23 | 62 | 9.56 | 9.23 | 62 |
| 9 | 5.81 | 5.59 | 62 | 7.27 | 7.32 | 60 |

**Figure 2-21. Midday Off-Peak Average Speeds**

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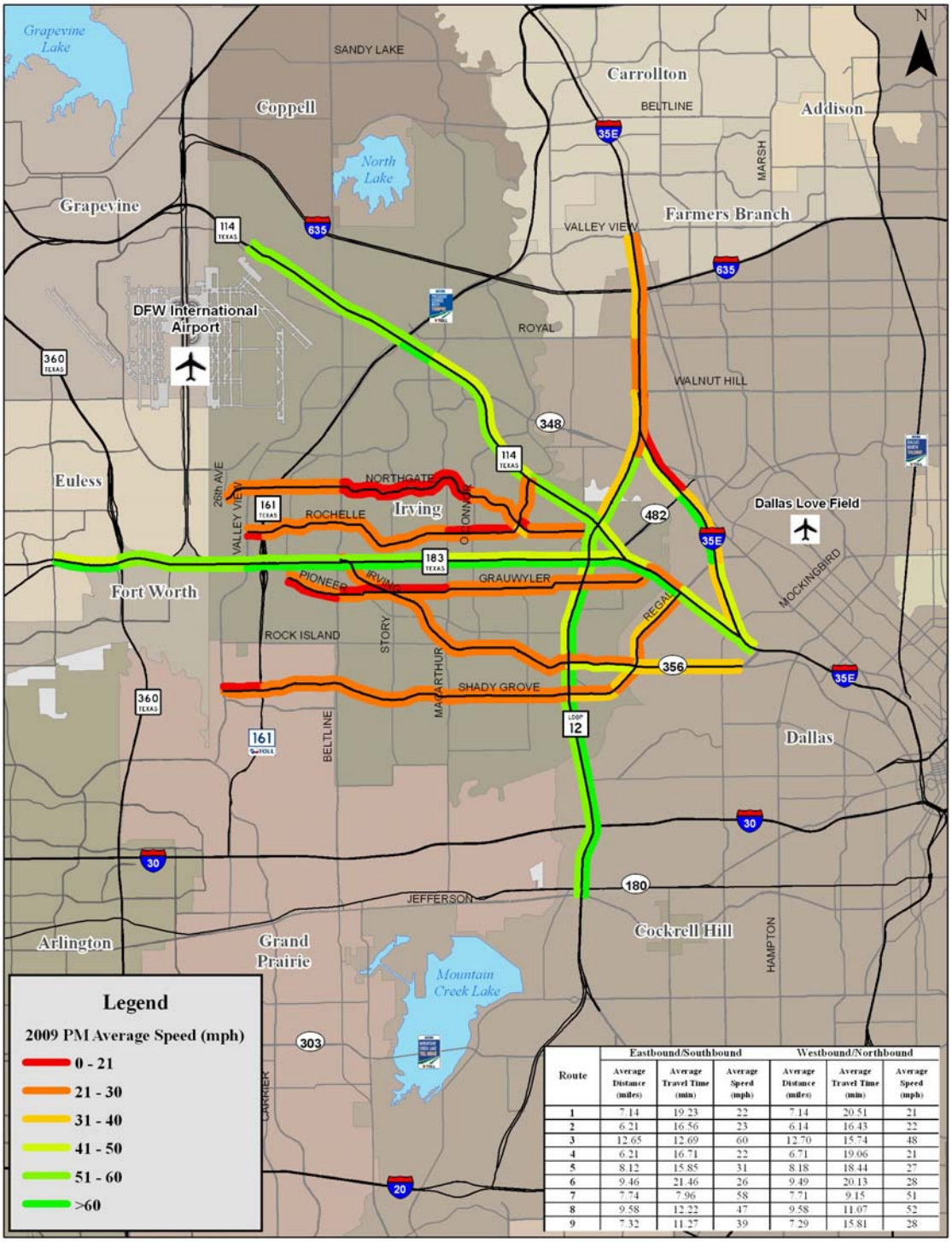


| Route | Eastbound/Southbound | | | Westbound/Northbound | | |
|---|---|---|---|---|---|---|
| | Average Distance (miles) | Average Travel Time (min) | Average Speed (mph) | Average Distance (miles) | Average Travel Time (min) | Average Speed (mph) |
| 1 | 7.14 | 19.23 | 22 | 7.14 | 20.51 | 21 |
| 2 | 6.21 | 16.56 | 23 | 6.14 | 16.43 | 22 |
| 3 | 12.65 | 12.69 | 60 | 12.70 | 15.74 | 48 |
| 4 | 6.21 | 16.71 | 22 | 6.71 | 19.06 | 21 |
| 5 | 8.12 | 15.85 | 31 | 8.18 | 18.44 | 27 |
| 6 | 9.46 | 21.46 | 26 | 9.49 | 20.13 | 28 |
| 7 | 7.74 | 7.96 | 58 | 7.71 | 9.15 | 51 |
| 8 | 9.58 | 12.22 | 47 | 9.58 | 11.07 | 52 |
| 9 | 7.32 | 11.27 | 39 | 7.29 | 15.81 | 28 |

**Figure 2-22. PM Peak Average Speeds**

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## ORIGIN/DESTINATION SURVEY

An origin-destination (OD) survey is generally performed to validate trip making patterns within the study corridor and identify the main characteristics of the traveling markets. The survey was conducted using a mail-out survey technique. Travelers along the SH 183 corridor were surveyed by capturing their license plate numbers while driving along the SH 183 corridor. These license plate numbers were used to identify motorists' addresses using an anonymous process and the mail-back surveys were then distributed. The survey effort was undertaken to provide some insight into the existing travel patterns of the motorists within the study corridor.

### LICENSE PLATE DATA COLLECTION

The locations for the license plate capture sites were determined taking into account location feasibility, visibility, and the maximum potential for traffic video capture rates. Eight survey locations were selected along the SH 183 corridor in order to obtain a representative sample of the traffic using the entire facility. The license plate information was collected in both directions along the corridor to allow for both a license plate matching and mail-back capture of the origin-destination patterns through the corridor.

The following eight locations were identified for the license plate data collection and are outlined in **Figure 2-23**:

- Site 1: Westbound SH 183 at the southbound lanes of IH 35E;
- Site 2: Southbound Spur 482 connection to westbound SH 183;
- Site 3: Southbound Loop 12 connection to westbound SH 183;
- Site 4: Westbound SH 183 at the southbound lanes of SH 161;
- Site 5: Westbound SH 183 connection to northbound SH 360;
- Site 6: Westbound SH 183 connection to southbound SH 360;
- Site 7: Eastbound SH 183 at northbound SH 356; and
- Site 8: Eastbound SH 183 at the Northbound Spur 482 connection.

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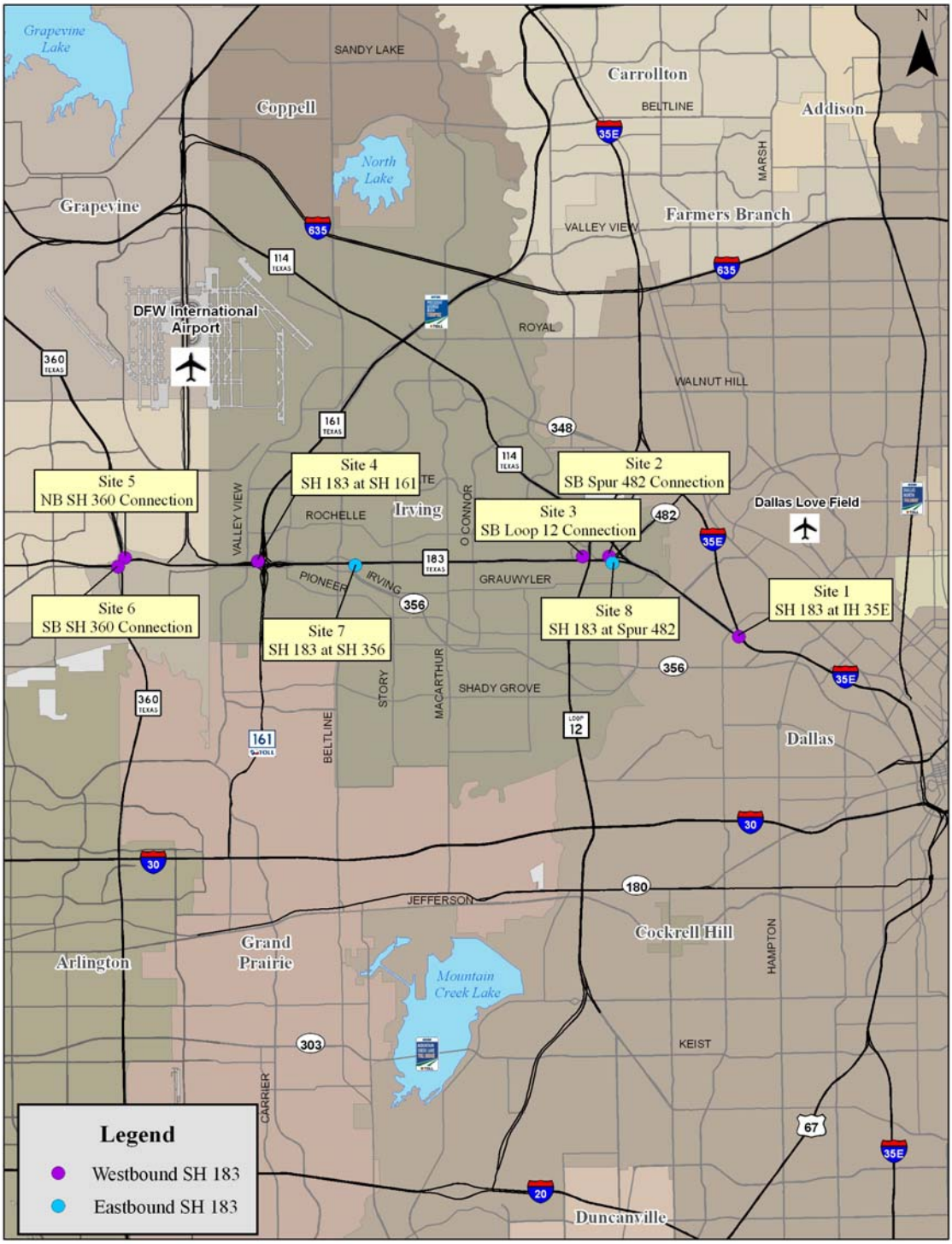


**Figure 2-23. OD Survey License Plate Capture Sites**

GRAM Traffic Counting Inc (GRAM) undertook the license plate data capture on September 23, 2009 (Wednesday). The license plate recording was conducted during daylight hours between 7:30 AM and 7:30 PM. Traffic counts were collected along the SH 183 mainlanes and the direct connections for validation and confirmation of captured data. The license plate numbers were read manually from the recorded video. The license plate data collected was then used to create a database of license plate records. A series of post-processing steps were undertaken to clean the database, and remove the incomplete and duplicate plates. **Table 2-6** shows the number of plates recorded from the video capture and the number of vehicles captured at each location from the traffic count collection efforts.

**Table 2-7**
**License Plate Collection**

| Site | License Plate Capture | | Traffic Count | | Capture Rate* | |
|---|---|---|---|---|---|---|
| | Total Records | Unread | Daily Traffic | 12-Hour Traffic Volume | Total | Useable |
| 1 | 38,364 | 2,696 | 58,653 | 42,204 | 91% | 85% |
| 2 | 12,662 | 424 | 17,033 | 12,865 | 98% | 95% |
| 3 | 12,005 | 532 | 18,418 | 12,842 | 93% | 89% |
| 4 | 37,825 | 2,730 | 63,299 | 45,424 | 83% | 77% |
| 5 | 5,267 | 712 | 7,212 | 5,271 | 100% | 86% |
| 6 | 16,416 | 2,922 | 25,001 | 17,339 | 95% | 78% |
| 7 | 45,764 | 4,116 | 68,821 | 49,626 | 92% | 84% |
| 8 | 33,589 | 2,759 | 47,815 | 34,774 | 97% | 89% |
| **Total** | **201,892** | **16,891** | **306,252** | **220,345** | **92%** | **84%** |

** Capture rates are calculated out of the 12-hour day time (7:30am - 7:30pm) traffic volume.*
*The useable capture rate is calculated by removing the unreadable license plates.*

The capture rate shown in the table illustrates the percentage of vehicles whose license plate was recorded. The "unread" license plates were a result of one or more characters on the plate being obscured, missing license plates, or as a result of vehicles following too closely. The total capture rate of the eight license plate capture sites was approximately 92 percent and 84 percent of the license plates were shown to be usable records.

The license plate data collected was then used to create a database of license plate records. Duplicate plates occurring from the same vehicle passing through two or more data collection locations along with out-of-state plates were excluded from the database for extraction of unique addresses for use in the mail-out survey efforts. This filtering resulted in a unique plate database to prevent the survey from being mailed to the same motorist multiple times.

The license plate records at four identified locations (note: the remaining locations were identified primarily for license plate matching purposes) were first supplied to the Department of Transportation (TTA division) for cross-referencing with the Department of Public Safety master file to obtain the names and addresses of the registered vehicle owners. A total of 91,635 addresses were obtained from the license plates database for use as part of the mail-out survey. An additional filtering of these addresses was undertaken to remove those addresses found to belong to rental car agencies, leasing companies, car dealerships, and duplicated addresses. This resulted in 74,803 final records which were used for the OD survey mail-out following the removal of 16,832 addresses. These final addresses were provided to a mailing house to distribute the final OD survey instrument. The first round of surveys was distributed on October 14, 2009. The initial response rate of the first wave of mail-out surveys was relatively low. As such, the license plate records from the other two license plate capture locations were also processed and provided to TTA for further address extraction. A total of 21,363 addresses were obtained from TTA and these addresses were then processed to remove 10,312 addresses, for use as part of the second round of mail-out.

### ORIGIN-DESTINATION SURVEY INSTRUMENT

The development and design of the survey instrument/questionnaire that was mailed to the motorists incorporated similar efforts undertaken for projects in the DFW area and was modified as needed to account for unique SH 183 corridor characteristics. Motorists were queried as to their trip origin and destination, trip purpose, frequency, and vehicle occupancy. The questionnaire was designed to permit anonymous responses thus removing any linkage between responses and the name and address of the motorists. Allcraft Printing, Inc. was responsible for the printing and distribution of the surveys.

As mentioned above, two distributions of the mail-out survey were made. The first went to 74,536 addresses on October 14, 2009, and the second distribution to 10,275 addresses was made on November 30, 2009. The responses were collected in a P.O. Box rented specifically for this OD survey effort and within two weeks of the initial mail-out, over 2,600 surveys had been returned. The processing of the survey responses was closed on January 4, 2010.

**Figure 2-24** shows the main body of the survey questionnaire design used for this study along with the return mail address provided on the back of the questionnaire. **Figure 2-25** provides the portion of the survey that contained a brief explanation of the purpose of the survey and a map showing the SH 183 corridor and could be separated from the return portion of the questionnaire.

The returned surveys were collected and given to Paul Data Processing, Inc., a data entry service team, for input into a database format. The information from a total of 4,010 valid returned survey questionnaires was entered into a single database file.

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**A**

Dear Motorist:
As stated, you have been selected to participate in this important survey. Please answer the following questions about your most recent weekday trip that used SH 183 as part of your travel route. Please provide information regarding only one direction of this specific trip. Thank you.

A. Please indicate the time period in which this one-way trip was made. (Circle one)
1. 6:00am to 9:00am 2. 9:00am to 3:00pm 3. 3:00pm to 7:00pm 4. 7:00pm to 6:00am

B. In which direction were you traveling when making this one-way trip? (Circle one)
1. Westbound 2. Eastbound

C. Please refer to the map included in this survey and indicate the area number (1 to 99) that corresponds to your starting and ending locations for this trip. (If locations fall outside of the map, please indicate the closest area.)
Starting Location Number _____ Ending Location Number _____

D. Where did you start this trip (in this direction)? Please be as specific as possible. (If you do not know the street address please, identify the nearest intersection, airport, shopping center, etc.)
_____
Street Address or Nearest Intersection
_____
City State Zip Code

E. Where did you end this trip (in this direction)? Please be as specific as possible. (If you do not know the street address, please identify the nearest intersection, airport, shopping center, etc.) This should not be the same as answer to Question D.
_____
Street Address or Nearest Intersection
_____
City State Zip Code

F. What was the purpose of this particular trip? (Circle one)
1. To / From Work 3. Company Business 5. School 7. Recreation
2. To / From Airport 4. Personal Business 6. Shopping 8. Social

G. How often do you make this trip in this direction? Choose one.

H. Including yourself, how many people were in your vehicle? Please include children. (Circle one)
1 2 3 4 5 6 or more

I. Please indicate the nearest street that you used to enter SH 183:
_____

J. Please indicate the nearest street that you used to exit from SH 183:
_____

K. If you use an alternative route to avoid congestion on SH 183, please let us know which route you use:

L. Do you currently have a 1. TollTag 2. TxTag 3. EZ Tag 4. None?

M. If you would like to participate in the supplemental follow-up internet survey, please provide your e-mail address.
E-mail address (Optional) _____

Station Number [ ][ ][ ] October 2009

**Figure 2-24. Origin Destination Mail-out Survey**

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# TRAVEL PATTERN SURVEY - 2009

Dear Motorist:

The Texas Department of Transportation (TxDOT) is embarking on important transportation initiatives aimed at improving mobility along SH 183. A key element of the planning process is to obtain information regarding travel patterns and trip characteristics of motorists using SH 183.

To accomplish this effort, TxDOT is undertaking this important travel pattern and trip characteristic survey. TxDOT is soliciting your assistance by requesting information on one of your trips to effectively plan these transportation initiatives.

You have been selected to participate in this important survey. TxDOT is requesting information regarding recent weekday trips made on SH 183 between Valley View Ln. and IH 35E as part of the travel route. If you have not recently used SH 183, please disregard this survey.

When you detach the survey form, there will be no way to associate your answers with your name and address. Your answers will be anonymous and used for planning purposes only. Please take a few minutes to answer the questions, detach the survey form and return it. No postage is necessary.

We will also be conducting a supplemental internet-based survey of transportation options. If you are interested in participating in this follow-up survey, please provide your e-mail address in the space provided on the questionnaire. Your participation in the follow-up internet survey is optional but would be greatly appreciated.

If you have any questions about this survey, please call 214-320-4485 on weekdays. Thank you for your participation.

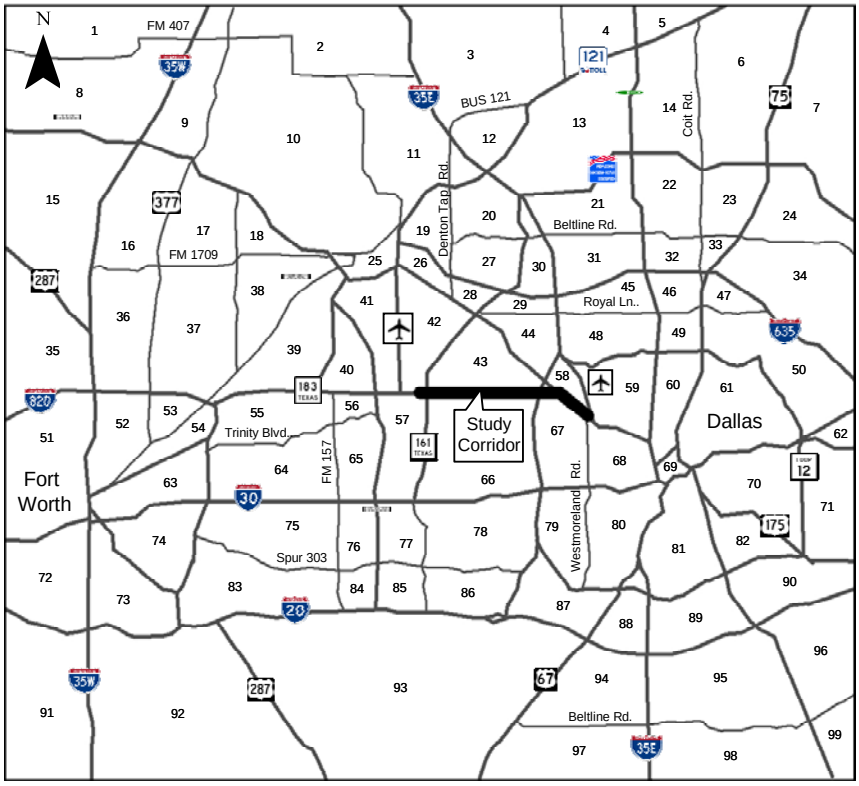


**Figure 2-25. Origin Destination Mail-out Survey Back of Address Page**

### SUMMARY OF TRIP DISTRIBUTIONS

The origin and destination distribution summarized from the processed OD survey data is presented in **Figure 26A** through **Figure 26F** separately for origin and destination and by time periods. As shown, traffic mainly originates from west of SH 183 study corridor during morning peak with some large origination zones along SH 183 between SH 161 and Loop 12 where large residential development is located. AM peak traffic destinations spread along SH 183 east of SH 114 and IH 35E south of Loop 12, where a number of major employment centers are located. As expected, midday traffic spreads relatively evenly along the corridor especially destination distribution. PM traffic represents the reverse patterns of AM peak traffic with origins mainly at the east side of the corridor and destinations at the middle and west side of the corridor.

### SUMMARY OF TRIP CHARACTERISTICS

A summary of the trip characteristics obtained from about 3,800 mail-back surveys are shown in **Figure 2-27**. The mail-back survey showed that the majority of the respondents were headed in the eastbound direction during peak and off-peak hours and predominantly to and from work during peak and off-peak hours. Over half (58 percent) of surveyed motorists indicated that they made the same trip five times per week in the peak period while 43 percent made less than one trip per week in the off-peak period. The majority of the vehicles were single occupant. The split between vehicles with any kind of electronic tags vs. vehicles without any tags was even and was around 50 percent in each case.

The data obtained from the origin-destination surveys were used to modify the original mobility transportation plan trip tables and to calibrate for any deficiencies in origin-destination patterns and distributions as described in Chapter 5.

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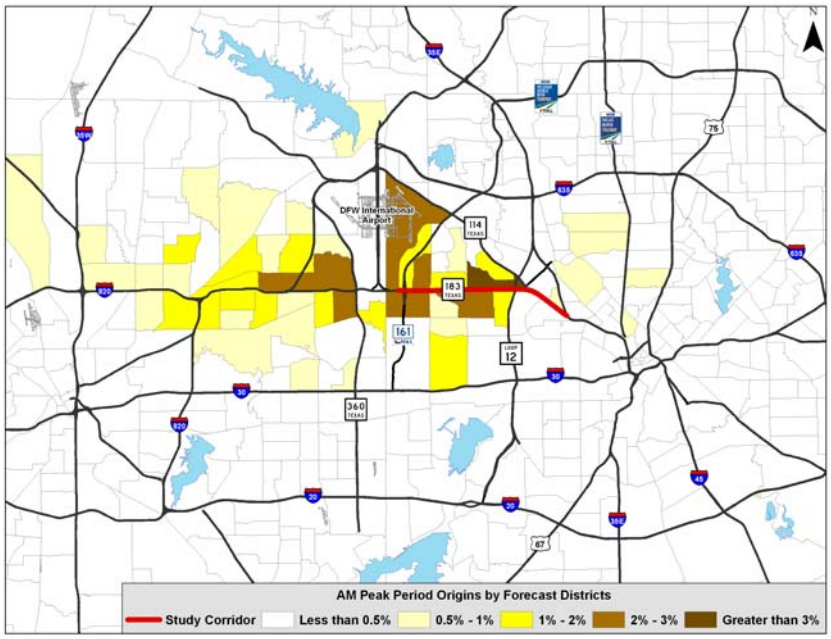


**Figure 2-26A. AM Peak Period Origins Summary**

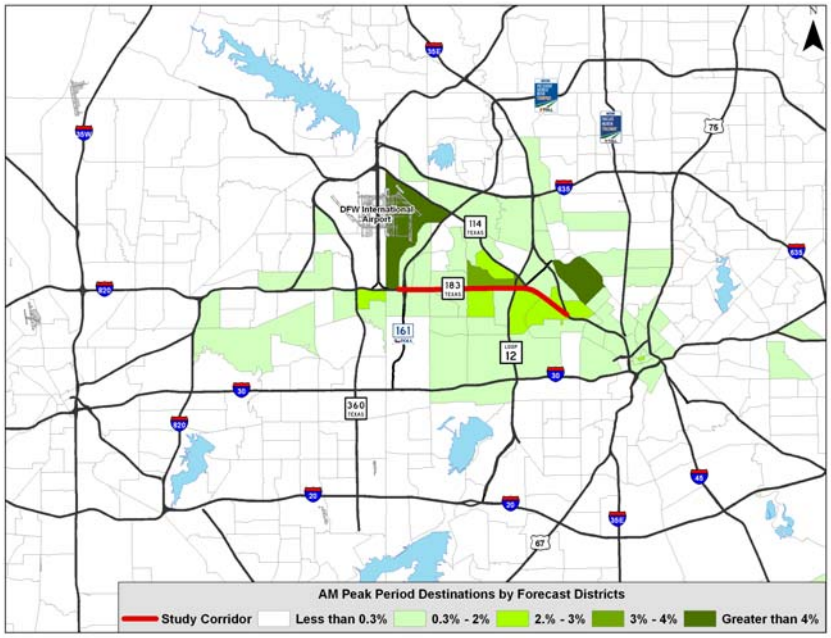


**Figure 2-26B. AM Peak Period Destinations Summary**

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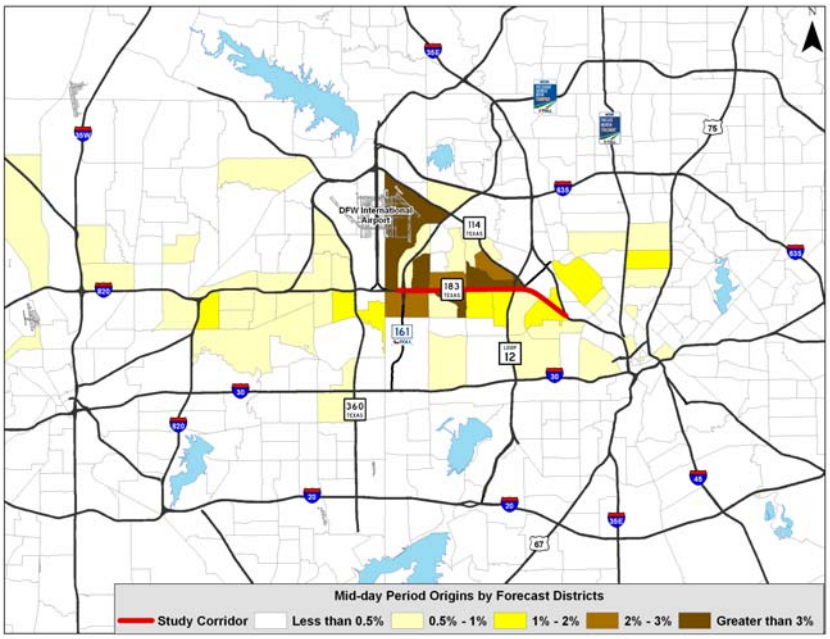


**Figure 2-26C. Midday Period Origins Summary**

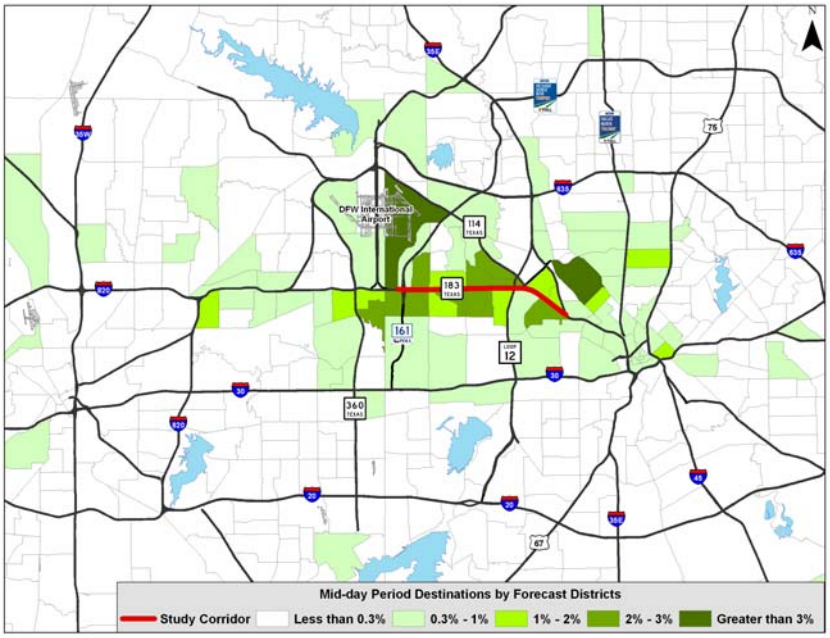


**Figure 2-26D. Midday Period Destinations Summary**

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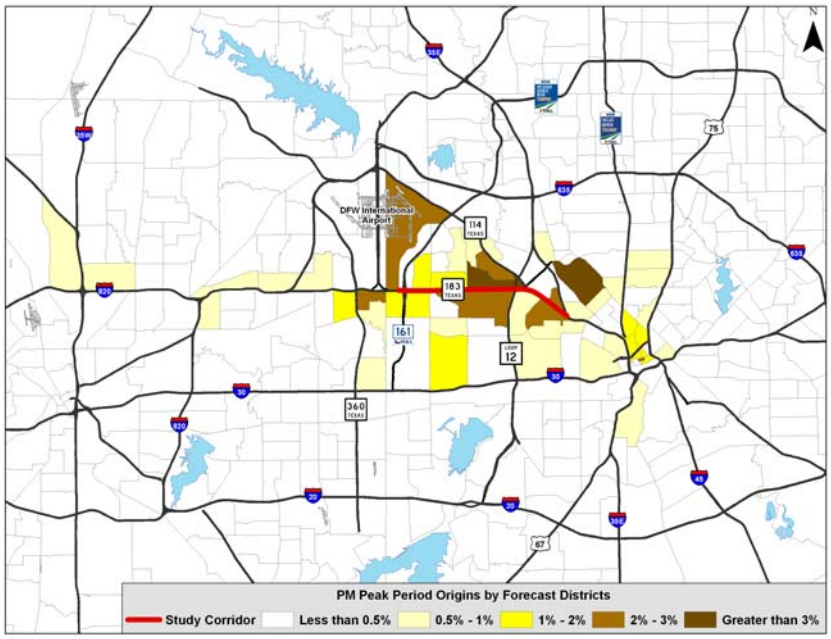


**Figure 2-26E. PM Peak Period Origins Summary**

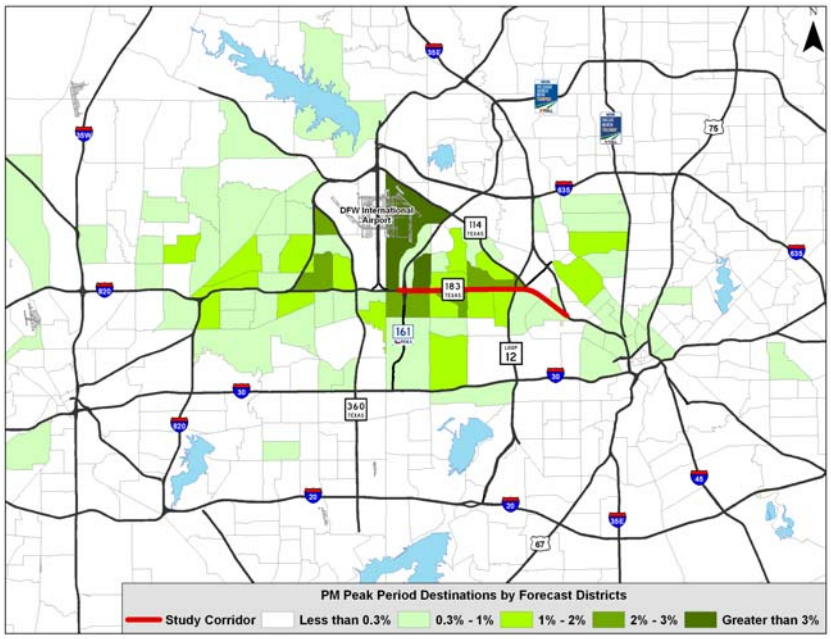


**Figure 2-26F. PM Peak Period Destinations Summary**

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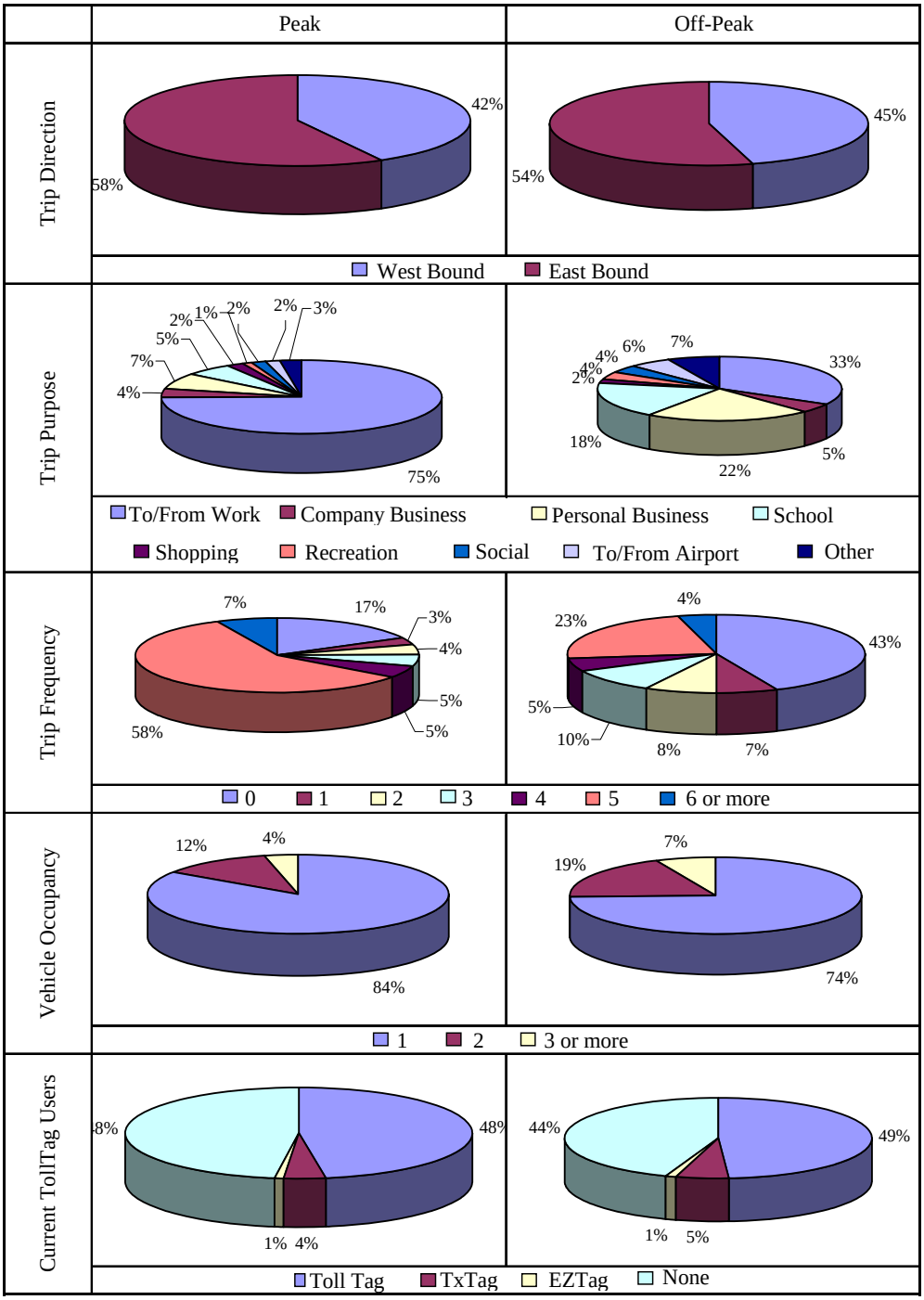


**Figure 2-27. O/D Trip Characteristics**

## STATED PREFERENCE SURVEY

Resource Systems Group (RSG) was tasked to develop and implement the stated preference survey for this data collection project. The stated preference survey was implemented through a multiple-method sampling approach that consisted of field intercept surveys using stand-alone laptop computers as well as over the internet via e-mail distribution to identified targeted audiences. A total of 302 surveys were completed through a purchased sample of Dallas area residents of which 100 were part of the pre-test of the survey questionnaire. Another 604 surveys were completed in the field at various activity centers. An additional 1,098 responses were collected from the internet survey (which included 448 from the origin-destination survey sample and 650 from the business recruiting efforts) for a total sample of 2,004 respondents. The number of useable records was reduced to 1,593 after performing data checks and removing outliers during the value-of-time estimation process.

Two stated preference questionnaires – one for passenger vehicles and one for commercial vehicle users – were developed that allowed the estimation of the VOT for travelers in the region. These questions were followed with stated preference "experiments" that represented a set of trade-off questions that were presented to each respondent in which characteristics of the corridor travel alternatives – travel times and tolls – were systematically varied. The stated preference survey instrument was customized for each respondent by presenting adaptive questions based on respondents' previous answers. These dynamic survey features provided an accurate and efficient means of data collection and allowed presentation of realistic future conditions that corresponded with the respondents' reported experiences. The passenger vehicle respondents were asked multiple questions within which they had to choose between the non-tolled and tolled alternatives. Commercial vehicle respondents were also asked multiple questions within which they chose between non-tolled and tolled alternatives. Both questionnaires also included sufficient demographic details (or, in the case of the commercial vehicle survey, questions about the load, vehicle and type of operator) to allow the data to be segmented into market groups of similar characteristics and the VOT outputs from statistical modeling to be applied to the full population of users.

Statistical estimation, specification testing, and discrete choice model estimation were carried out using the collected stated preference survey samples and used a conventional maximum likelihood procedure that estimated a set of coefficients for six identified market segments. The coefficients provide information about the relative importance of travel time and toll cost that can be used to infer travelers' values-of-time (VOT). The detailed description of the survey design, implementation, survey results, and the model estimation is presented in the report provided by RSG and included as **Appendix A** in this report.

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# CHAPTER 3

# DALLAS–FORT WORTH AREA TRANSPORTATION CHARACTERISTICS

The following chapter provides some background on the existing and forecasted transportation characteristics surrounding the SH 183 corridor in the Dallas-Fort Worth Metropolitan Area (DFWMA). The information described herein draws from the Mobility Transportation Plan (MTP) 2030 and its 2009 Amendment developed by the North Central Texas Council of Governments (NCTCOG), the metropolitan planning organization for the DFWMA. NCTCOG is primarily responsible for conducting the multimodal long-range regional planning process for transportation within the DFWMA region.

The MTP is a comprehensive, multimodal transportation strategy that is developed by NCTCOG to address the mobility needs of the DFWMA. It serves as a guideline for the region's planned investment in the transportation infrastructure and services over the next two decades. As indicated, the MTP is financially constrained and balanced to the region's anticipated revenue streams over this period. Building upon the previous MTPs, the 2030 MTP was approved in January 2007 by the Regional Transportation Council (RTC) of NCTCOG. The 2009 Amendment to the 2030 MTP was adopted in April 2009 to reflect changes to the financially constrained projects and their respective opening dates and configurations. The 2030 MTP and the 2009 Amendment outlines nearly $71 billion expenditure through 2030 for transportation infrastructure investment in freeway, tollway, transit, bicycle and pedestrian facilities, congestion mitigation strategies, HOV lanes, and many other mobility projects.

The DFWMA is the fourth largest metropolitan area in the country with a population of over 6 million according to the latest Population Estimates from the U.S. Census in July 2009. The region's population is forecasted by NCTCOG to grow to 9 million by 2030. Total employment is also expected to increase from 3.1 million in 2000 to 5.4 million by 2030.

## TRAFFIC CONGESTION TRENDS

The continuing growth of population in the DFWMA will place a great strain on the existing transportation infrastructure and is expected to cause severe traffic congestion along many facilities within the region in the future. **Figure 3-1**, adapted from the 2030 MTP report, provides an illustration of the areas that experienced congested traffic conditions during the peak periods in 2007, and the expected congestion levels in 2030 taking into account the recommended fiscally constrained transportation infrastructure improvements. As shown, the proposed SH 183 managed lanes project is located within an area that in 2007 had overall moderate traffic congestion levels, while congestion along SH 183 study corridor gets improved by 2030, which might be attributed to the capacity improvement planned along SH 183 on both general purpose lanes and the construction of managed lanes by 2030.

The 2030 MTP estimated that the region-wide cost of congestion during 2007 was approximately $4.2 billion and will likely reach $6.6 billion by 2030. This is an increase of more than 50 percent from the 2007 levels in spite of the $71 billion in infrastructure investment anticipated over the next 20 years.

## FREEWAY AND TOLLWAY SYSTEM

Several new freeway and tollway facilities were identified in the MTP to be constructed in the next 20 years. **Figure 3-2** highlights the funded roadway recommendations in the DFWMA, which include the proposed SH 183 managed lane project, and several competing and complementary projects within the study area. The identification of these facilities is very important to this study because additional freeway and arterial improvements may materially impact the traffic and toll revenue on the proposed managed lane facility.

New or expanded facilities providing improved accessibility to the proposed managed lane corridor may provide positive impacts while competing alternative routes have the potential to dampen the demand for the managed lanes facilities. Capacity improvements to existing highways and arterials, along with new freeway facilities that may affect the traffic and toll revenue potential of the proposed 183 managed lane facility are shown in **Figure 3-2** and include:

- SH 161 tolled facility expansion between SH 183 and IH 20;
- North Tarrant Express (NTE) managed lanes along SH 183, IH 820 and IH 35W;
- DFW Connector SH 114/SH 121 (Grapevine Funnel);
- Project PEGASUS;
- Trinity Parkway toll road extending from the SH 183/IH 35E juncture to US 175/Spur 310;

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- IH 30 corridor improvements;

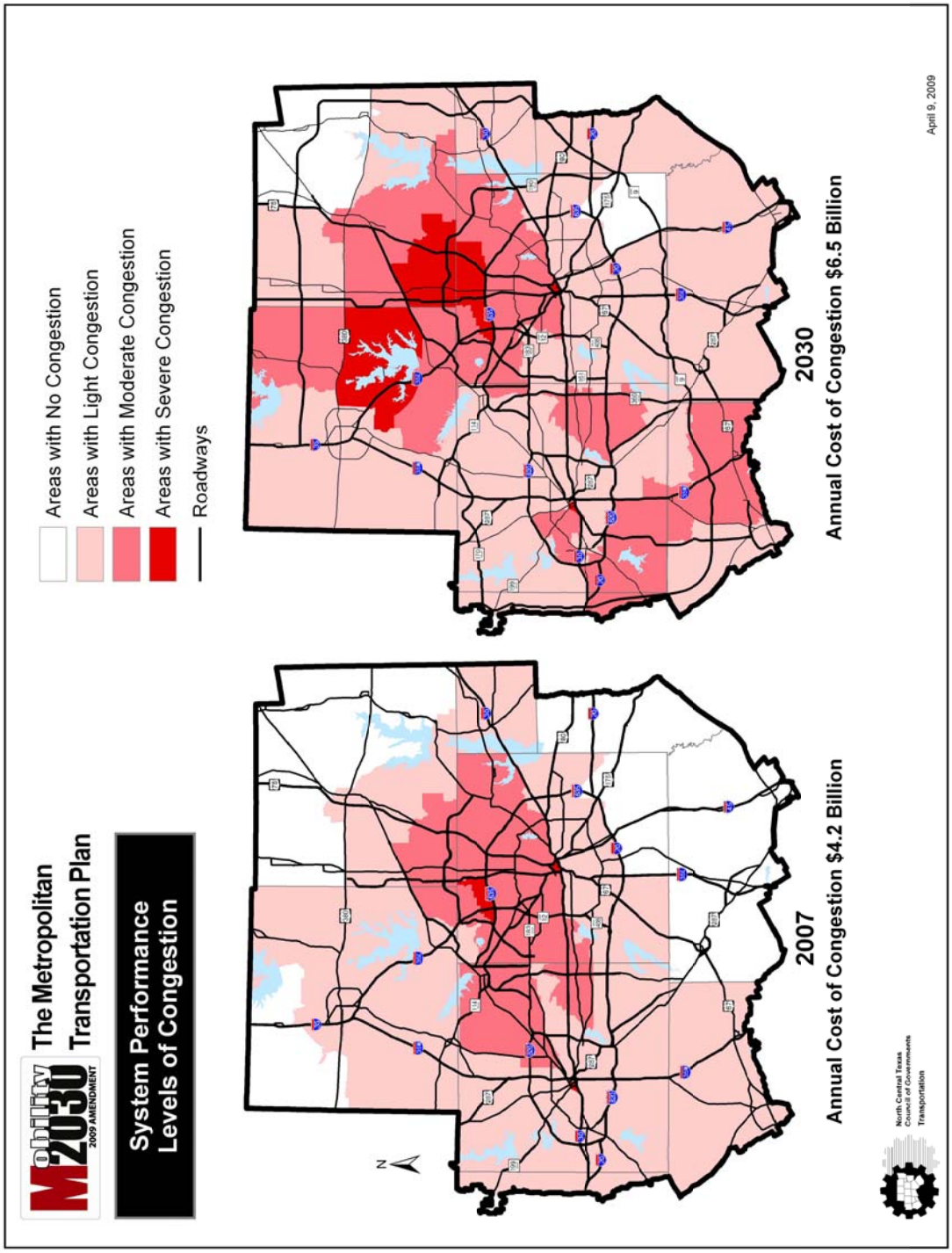


**Figure 3-1. Traffic Congestion Level of 2007 and 2030**
Source: North Central Texas Council of Governments

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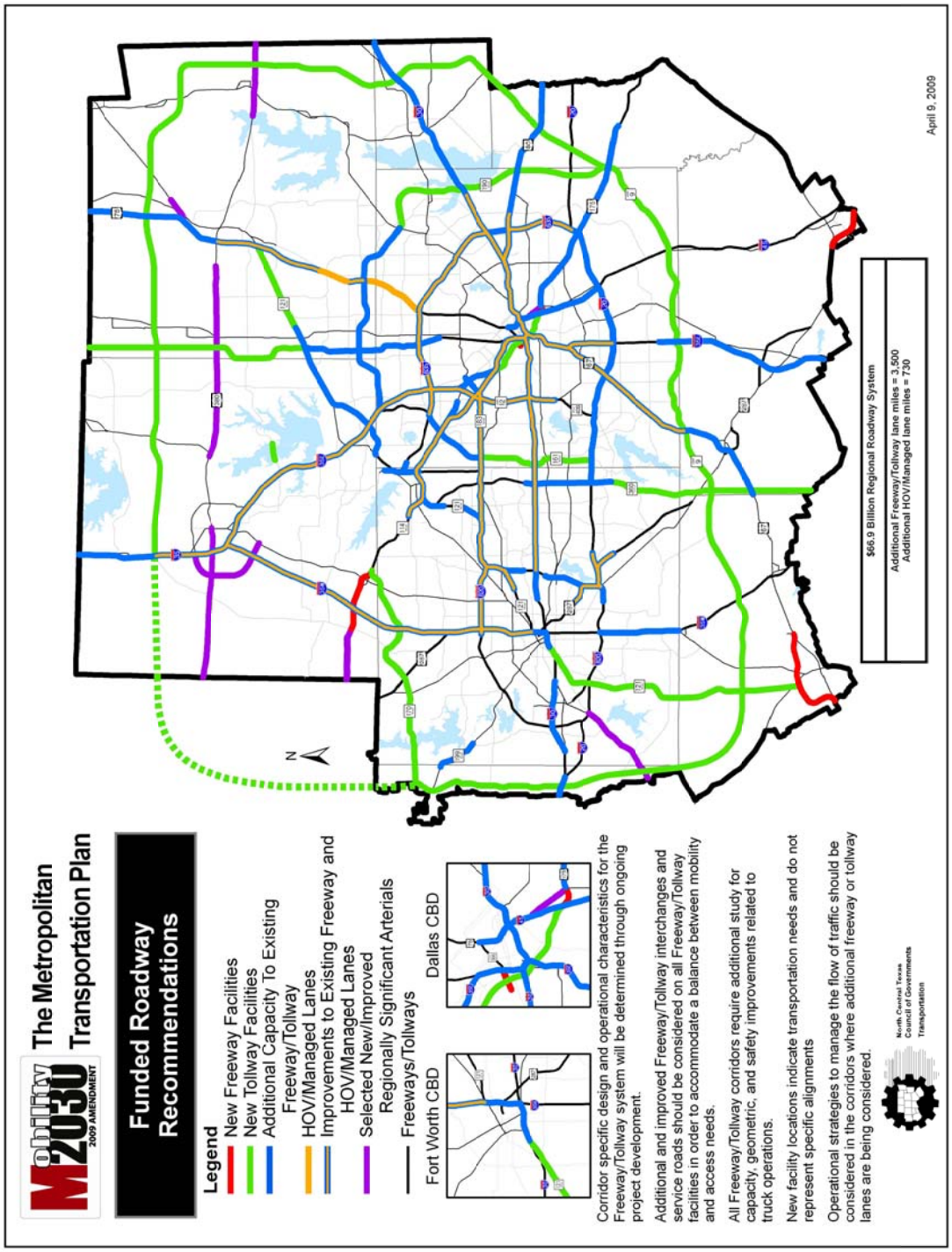


**Figure 3-2. Funded Roadway Recommendations in 2030 MTP 2009 Amendment**

Source: North Central Texas Council of Governments

- IH 35E Managed Lanes;
- SH 114 and Loop 12 corridor – from International Parkway to SH 183, and from IH 35E to Spur 408 respectively under a managed lane configuration;
- SRT (SH 121) Tollway capacity Improvement
- PGBT capacity Improvement
- IH 635 Managed Lane and general purpose lane expansion
- IH 20 corridor improvement
- SH 360 Tollway between IH 20 and IH 30

**Figure 3-3** highlights general limits of these projects along with their planned opening years that assumed in the travel demand modeling. Some of the projects are currently under study or design by TxDOT and the opening year assumption was made per TxDOT staff's instruction, which might be different from what is shown in NCTCOG's MTP. The scopes of several of these projects are described in more detail below:

**SH 161:** The SH 161, a tolled facility, is a natural extension to the President George Bush Turnpike (PGBT) which provides circumferential accessibility for travelers in the Dallas northern region and is comprised of two segments. The northern segment, from President George Bush Turnpike/Belt Line Road to SH 183, will consist of 8 general purpose non-tolled lanes. The southern segment, from SH 183 to IH 20, will consist of 4 to 6 general purpose tolled lanes and three discontinuous frontage lanes in each direction. Several sections of the southern segment are currently open to traffic while others are currently being built. The ultimate configuration of the project will include major interchanges with flyover ramp connections at SH 183 (at the northern termini), IH 30 (in the middle), and IH 20 (at the southern termini). The initial segments that are already built and open to traffic includes the Phase 1 segment with the main lane interchange at SH 183 and service roads from North Carrier Parkway to IH 20, and the Phase 2 segment that includes two main lanes in each direction from SH 183 to Egyptian Way. The Phase 3 segment is anticipated to open to traffic by fourth quarter 2010 and will include the service roads and a third main lane in each direction from Conflans Road to North Carrier Parkway. The Phase 4 segment is expected to be in place by end of 2012 and will include the construction of the main lanes in each direction from North Carrier Parkway to IH 20 and interchanges at IH 30 and IH 20 and Union Pacific Railroad (UPRR) railroad crossing at West Main Street and Jefferson Road.

N**orth Tarrant Express IH 35W/SH 183/IH 820 (NTE):** The 13-mile NTE project consists of a series of critical highways improvements along IH 820 and SH 121/SH 183 between IH 35W and Industrial Boulevard just beyond the SH 121/SH 183 split in North Tarrant County. The NTE Mobility Partners were awarded the project through the Texas Department of Transportation (TxDOT) comprehensive development agreement (CDA) procurement (equivalent to a public private partnership (PPP) program). The consortium

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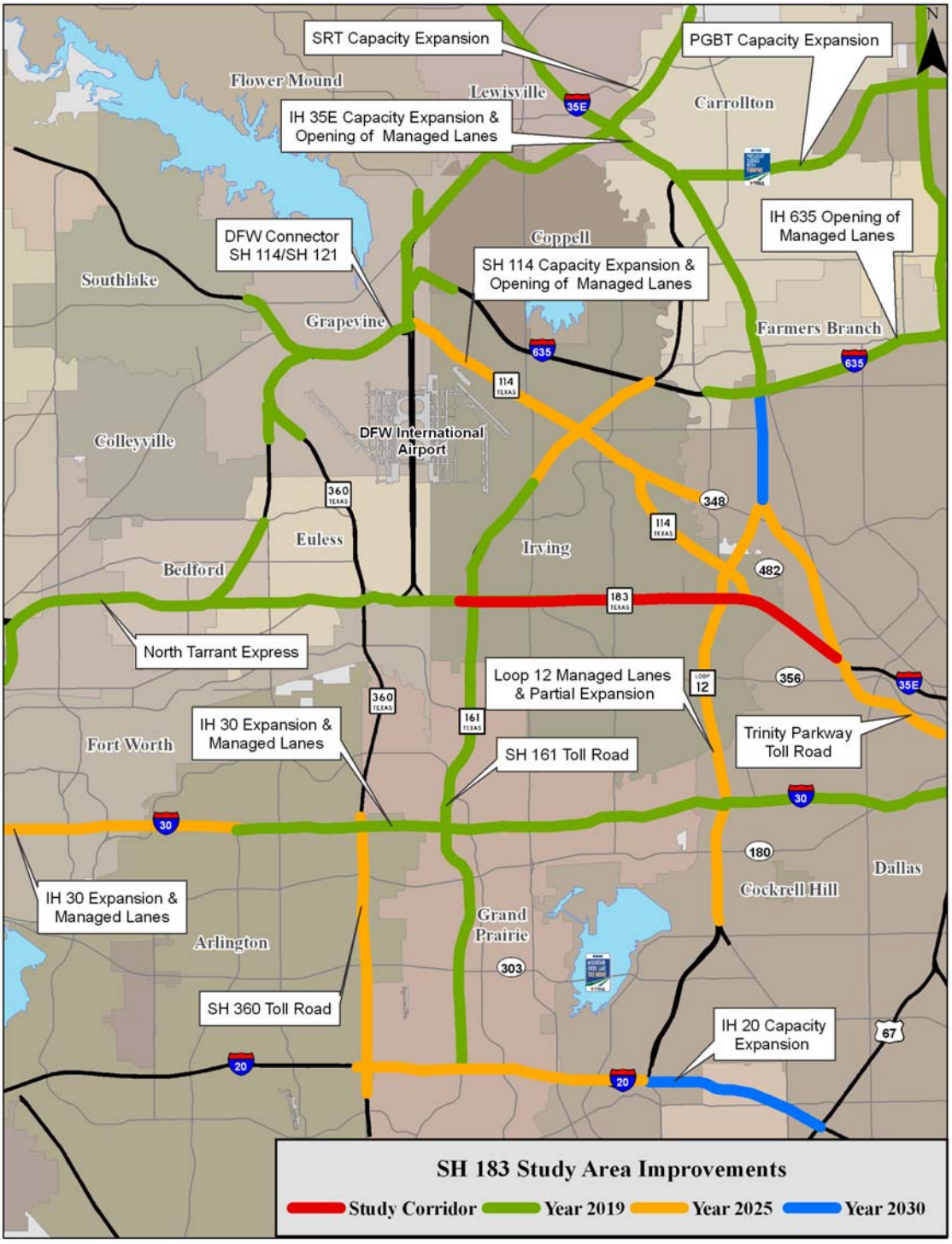


**Figure 3-3. Future Highway Projects around SH 183**

recently reached financial close for the construction and operation of two initial segments of the North Tarrant Express, that will provide a natural extension of the proposed SH 183 managed lanes to the western termini of the proposed study corridor. Construction of these initial segments is expected to start in late 2010 and will be completed and open to traffic by 2015.

**DFW Connector SH 114/SH 121 (Grapevine Funnel):** This 14.4-mile project consists of several expressways directly to the north of Dallas Fort Worth International Airport, and will include enhancements to connections from SH 114 to SH 121 and SH 360 in the south, and connections to SH 121 and IH 635 in the east. Groundbreaking for a 8.4-mile section of the ultimate project occurred in February 2010 and the managed lanes are expected to be open by 2014. The schedule and funding for the remaining project portions had not yet been identified at the time of this study.

**Project PEGASUS (IH 30/IH 35E Interchange):** TxDOT is planning improvements to the IH 30/IH 35E interchange at the western edge of downtown Dallas, the depressed portion of IH 30 to south of downtown Dallas, and the portion of IH 35E from the IH 30/IH 35E to SH 183 (also referred to as 'Lower Stemmons'). The improvements under this PEGASUS project are expected to be constructed in phases and take 5 to 10 years to complete. This project is currently in the Planning, Design and Environmental stage.

**Trinity Parkway:** The North Texas Tollway Authority (NTTA) is planning a proposed 9-mile toll road extending from the SH 183/IH 35E junction to US 175/Spur 310. The project will initially be built as a four lanes facility with the option to expand it ultimately to six lanes. When complete, the Trinity Parkway will offer a tolled bypass around downtown Dallas, which will provide traffic relief for the IH 30 and IH 35E corridors. The construction of the Trinity Parkway is expected to take 5 to 10 years to complete. This project is currently undergoing an environmental review.

**IH 30 Corridor Improvements:** The IH 30 Corridor project limits extend from Oakland Boulevard in Fort Worth to SH 161 in Grand Prairie. The proposed improvements to this facility include widening to 8 lanes between Oakland Boulevard and IH 820, reconstructing to 10 general purpose lanes plus reversible HOV/managed lanes between IH 820 and SH 161, and a fully-directional interchange with flyover ramps at SH 360. Construction between Cooper Street and Ballpark Way is scheduled to be completed in fall of 2010.

**IH 35E Managed Lanes:** This project is proposed to be a tolled managed lane facility with an ultimate two lane to four lanes running along side the existing general purpose lanes. The facility is divided into three segment to facilitate design and other studies, North Segment from US 380 to FM 2181, Middle Segment from FM 2181 to President George Bush Turnpike, and the South Segment: from President George Bush Turnpike to IH 635 (LBJ). The study of this managed lane project is currently underway. For the

purpose of travel demand model of this study, the IH 35E managed lane is assumed to be constructed only with South and Middle Segment, per the instruction of TxDOT staff.

**SH 114 and Loop 12 corridor:** – The SH 114 from International Parkway to SH 183 will include general purpose lanes with two to three concurrent tolled managed lanes in each direction The SH 114 facility is expected to open to traffic by 2025 according to 2030 MTP-2009 Amendment. The Loop 12 project from IH 35E to Spur 408 will include general purpose lanes with two reversible tolled managed lanes, open in the peak direction. The Loop 12 facility will be segmented to open in phases: with the SH 114/SH 183 and Loop 12 Interchange (open in 2015); the segment from IH 30 to IH 35E (open in 2025).

In the future NCTCOG, in cooperation with local decision makers, may designate additional freeway facilities in the region which may have an impact on the traffic and toll revenue of the proposed SH 183 managed lanes. **Figure 3-4** highlights the planned future toll facilities and future HOV/managed facilities in blue and orange respectively. In addition to the Lewisville Lake Toll Bridge that was opened to traffic on August 1, 2009 as a tolled facility, several other HOV/managed lane facilities have been proposed within the SH 183 managed lane study area to provide an extensive system of HOV/managed lane facilities. Most of these will improve the accessibility to the proposed SH 183 managed lane and include:

- Managed lanes along SH 114 between SH 121/International Parkway and Loop 12 and SH 183 HOV/managed lane between SH 161 and IH 35E which will provide linkages for a planned HOV/managed lane network system and help funnel traffic to the proposed SH 183 managed lane facility;
- Loop 12/IH 35E HOV/managed lane corridor which will encompass the portion from IH 635 to Loop 12 as well as the Loop 12 from IH 35E to Spur 408. This corridor directly connects to the IH 35E corridor at the south terminus to IH 635 and brings traffic from further south of the corridor;
- IH 30 Managed lane runs parallel to SH 183 managed lane and connects the city of Dallas and Fort Worth. The IH 30 corridor improvement competes with IH 183 to some extent; and
- The North Tarrant Express along IH 820 connects SH 183 managed at its west termini and feed traffic from the west side of the project.

## RAIL TRANSIT SYSTEM

Transit service in the DFWMA is provided by Dallas Area Rapid Transit (DART), the Fort Worth Transportation Authority (The T) and the Denton County Transportation Authority.

The high socioeconomic growth warrants that alternative modes of transportation be incorporated as part of the overall regional transportation plan. **Figure 3-5** illustrates the future proposed rail system as developed by NCTCOG in cooperation with the transit agencies in the region as part of the 2009 Amendment. Approximately 500 miles of rail were identified in these recommendations, of which, 83 miles are currently in service, 128 miles are programmed projects or projects currently under development. An additional 38 miles consist of projects identified within the transit authority planning studies, and the remaining 251 miles consisting of projects that may utilize funding identified through the Rail North Texas efforts. Of particular interest to the SH 183 managed lane project is the 14 mile Orange Line extension to the DFW Airport also known as the "third phase" scheduled to be open by 2013. The Orange Line will run parallel with the Green Line through downtown Dallas to Bachman Station in Northwest Dallas. From Bachman Station, the Orange Line will head northwest to the Las Colinas Urban Center and eventually to the DFW Airport. The construction of the first two sections of the Orange Line, from the future Bachman Station in northwest Dallas to Las Colinas and then to Belt Line Station, began in 2009.

The transportation system defined in the 2009 Amendment of 2030 MTP and described above is reflected in the NCTCOG networks and trip tables used as the baseline databases in the development of the models used to estimate the traffic and toll revenue for the proposed SH 183 managed lanes project. The trip tables and networks were obtained from NCTCOG and reflect all the planned transportation infrastructural development over the next 20 years.

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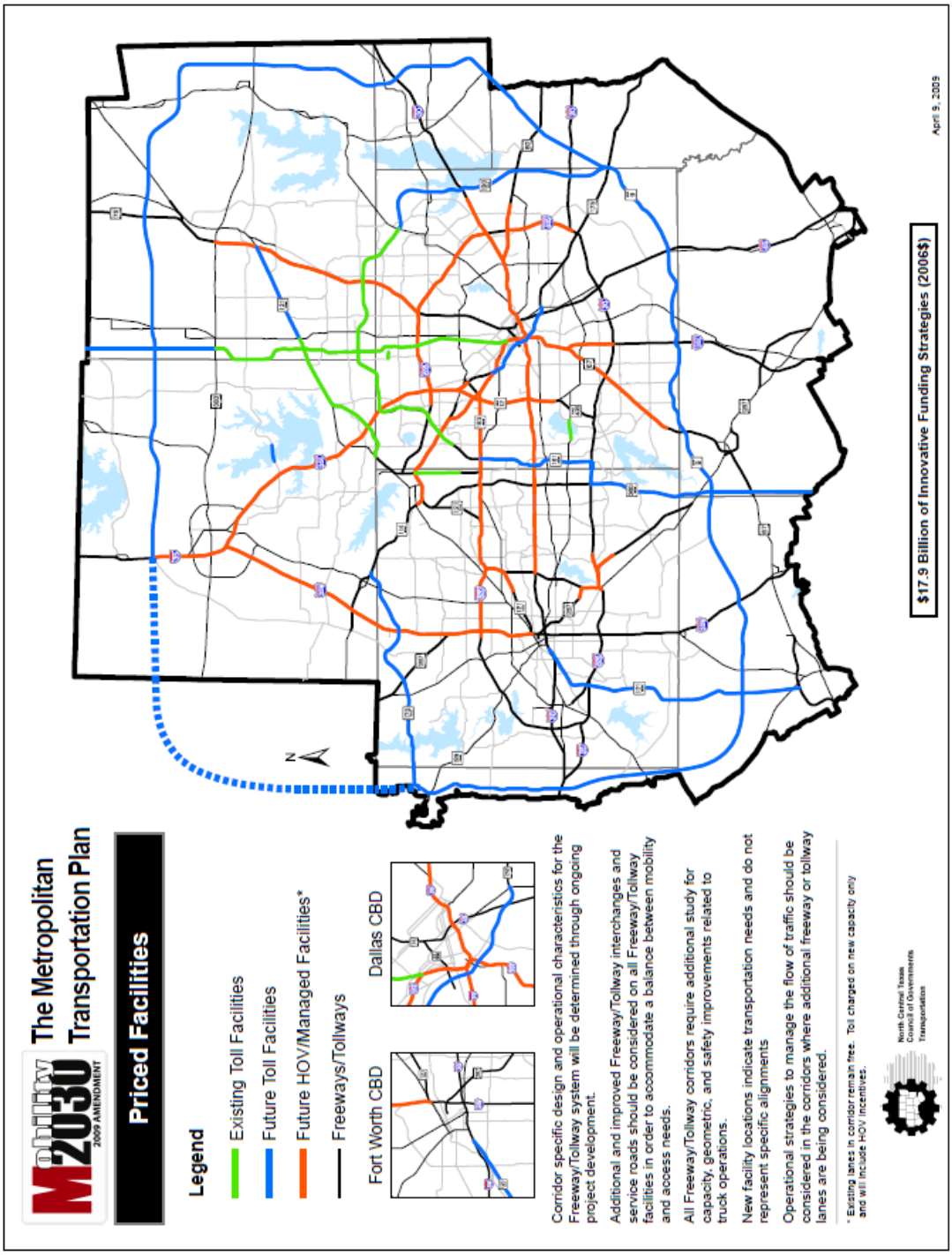


**Figure 3-4. Priced Facilities Planned in 2030 MTP 2009 Amendment**
Source: North Central Texas Council of Governments

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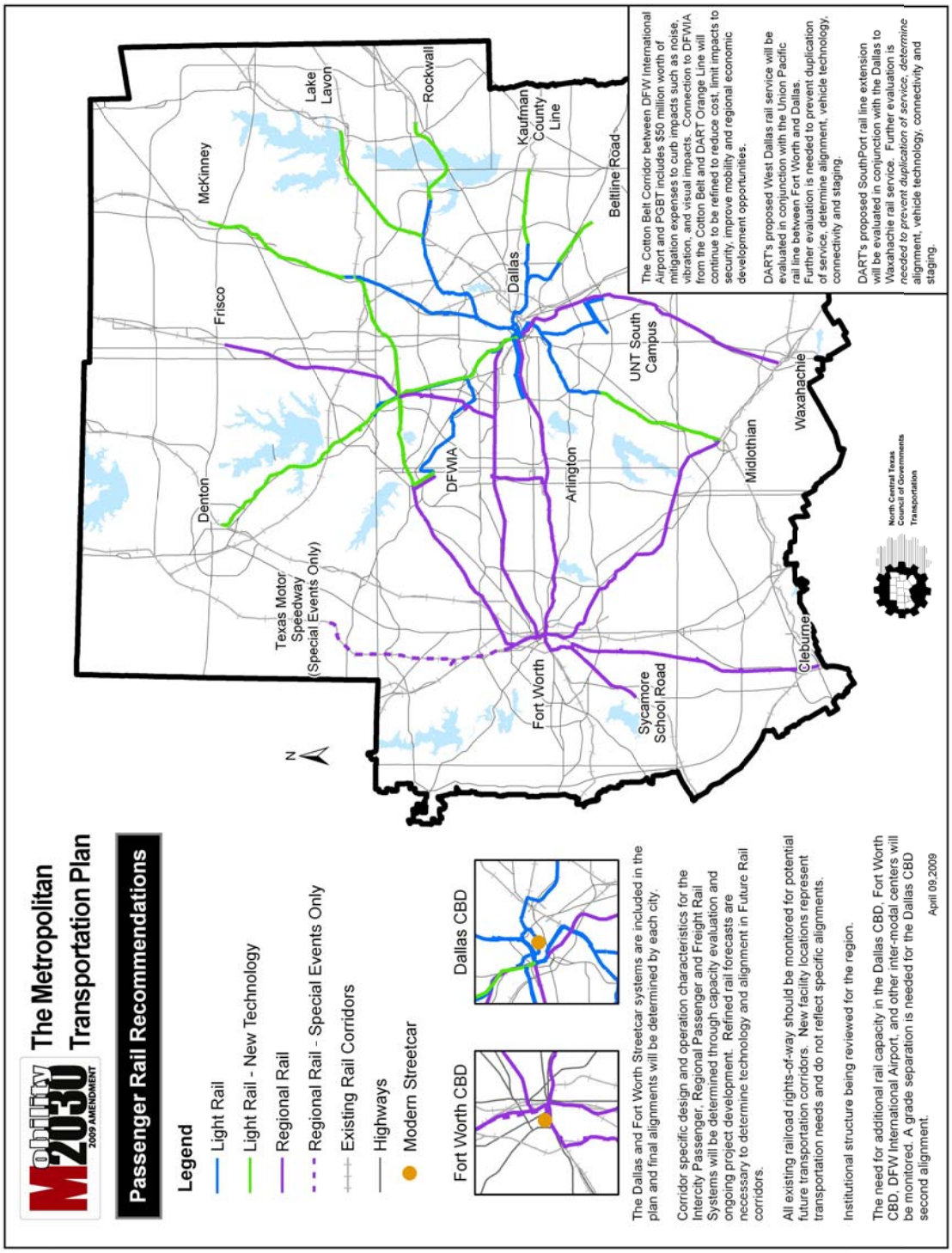


**Figure 3-5. Passenger Rail Recommendations**
Source: North Central Texas Council of Governments

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# CHAPTER 4

# ECONOMIC GROWTH ANALYSIS

A review of the historical and projected demographic characteristics used by the North Central Texas Council of Governments (NCTCOG) to develop its traffic modeling trip tables was thoroughly reviewed along with other sources such as the Texas State Data Center, and U.S Census Bureau. This chapter describes the major socioeconomic characteristics of the Dallas-Fort Worth Metropolitan Area (DFWMA) including both the regional and corridor specific trends within the SH 183 managed lanes study area. The current official NCTCOG forecasted regional demographics were approved by its Executive Board in April 2003 and have not changed since this time. This database was used by NCTCOG as the baseline to generate future trip patterns in the DFWMA. The 2009 Amendment approved in April 2009, for the ten counties that comprise the DFWMA: Dallas, Tarrant, Collin, Denton, Johnson, Ellis, Kaufman, Rockwall, Parker and Wise addressed changes to the financially constrained project list but made no further modifications to the underlying demographics.

The first section of this chapter describes the NCTCOG forecast process used to generate the base official demographics. The second section provides details of the regional historical and future growth patterns within the ten-county area. The historical and future growth trends in the key individual municipalities within the study corridor are then described in the third section of the chapter. The final section describes the corridor-level demographic characteristics specifically within the SH 183 managed lane study area.

The demographic data included in this chapter ranges from the macroscopic level (the region) to the corridor-level (five-mile buffer along each side of SH 183). This demographic information was used by the trip generation model to estimate total trips allocated within the travel demand model and serves as the foundation to forecast demand within the study area.

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## NCTCOG FORECAST PROCESS

As required by federal legislation, NCTCOG periodically develops future demographics based on county and region control totals created by the Texas State Data Center (TSDC) and other independent consultants. The TSDC is part of the State Data Center System, with a national network of 52 centers (all 50 states, Puerto Rico and the Virgin Islands) in charge of disseminating demographic information (www.txsdc.utsa.edu). The demographics adopted by NCTCOG are considered official demographics that support the metropolitan planning process and travel demand modeling.

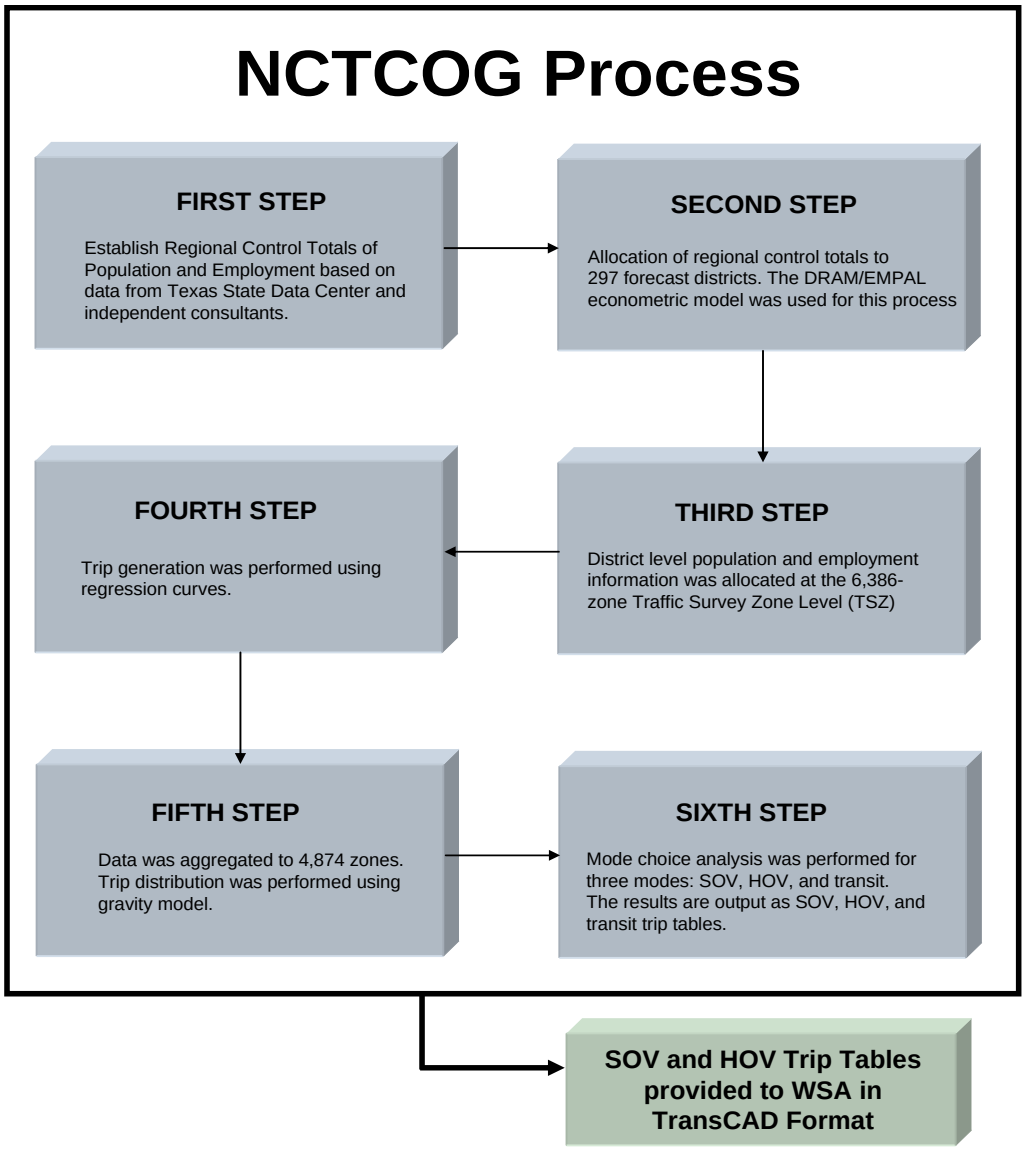


**Figure 4-1. NCTCOG Forecast Process**

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The demographic forecast process and methodologies used in the development of trip tables implemented by NCTCOG comprise of six main steps as illustrated in **Figure 4-1**. In the first step, the regional control totals of population and employment are developed in five-year increments from a base year (2000) through the forecast year (2030). These regional totals originated from the TSDC and were complemented with forecasts developed by the Perryman Group, an independent local economist firm. A task force of local officials from city, county, and transportation entities acted as a governing body for the 2030 MTP process and endorses the approval of demographic forecasts.

The TSDC population forecast process includes the rate of regional migration as a key element. Three scenarios with different rates of migration are usually developed. **Table 4-1** shows the control totals that were considered during the forecasting process. The 2030 population forecasts range from 6.2 million under the zero percent migration scenario, to 12.1 million under the 1.0 percent migration scenario. The 2000-2004 and 2000-2007 scenarios are currently available, which show the changes during the respective periods that are extrapolated into the future. The population control totals adopted by NCTCOG for the region are shown in bold in **Table 4-1**. They reflect similar trends to those developed by the Perryman Group, and fall between the 0.5 and 1.0 migration scenarios from the TDSC, and represent a middle ground.

**Table 4-1**
**Population Control Totals**

| | 2000 | 2010 | 2020 | 2030 | Actual Growth (2000 -2030) | Average Annual Growth Rate |
|---|---|---|---|---|---|---|
| **TSDS Scenario 0.0** | 5,079,621 | 5,595,967 | 5,960,035 | 6,215,270 | 22.4% | 0.7% |
| **TSDC Scenario 0.5** | 5,079,621 | 6,100,370 | 7,226,513 | 8,519,177 | 67.7% | 1.7% |
| **TSDC Scenario 1.0** | 5,079,621 | 6,699,732 | 9,016,610 | 12,335,333 | 142.8% | 3.0% |
| **TSDC Scenario (2000 - 2004)** | 5,079,621 | 6,474,322 | 8,453,575 | 11,264,452 | 121.8% | 2.7% |
| **TSDC Scenario (2000 - 2007)** | 5,079,621 | 6,511,420 | 8,477,765 | 11,151,038 | 119.5% | 2.7% |
| **The Perryman Group** | 5,079,600 | 6,336,947 | 7,728,399 | 9,216,601 | 81.4% | 2.0% |
| **NCTCOG Adopted Forecast** | **5,067,400** | **6,328,200** | **7,646,600** | **9,107,900** | **79.7%** | **2.0%** |

Source: North Central Texas Council of Governments, Texas State Data Center, The Perryman Group

The employment control totals were generated by NCTCOG with input from its Employment Estimates program, which monitors non-construction job counts by place-of-work for municipalities within the North Central Texas Metropolitan Planning Area. The employment control totals in **Table 4-2** show that the total employment in the ten-county area are expected to increase from 3.2 million in 2000 to 5.4 million by 2030.

**Table 4-2**
**Employment Control Totals**

| | 2000 | 2010 | 2020 | 2030 | Actual Growth (2000 -2030) | Average Annual Growth Rate |
|---|---|---|---|---|---|---|
| **NCTCOG Adopted Forecast** | **3,158,200** | **3,897,000** | **4,658,700** | **5,416,700** | **71.5%** | **1.8%** |

Source: North Central Texas Council of Governments, Research and Information Services.

The second step of the forecasting process involved allocating the regional control totals to 297 forecast districts for each five-year interval. The Desegregated Residential Allocation (DRAM)/ Employment Allocation Model (EMPAL) econometric model, the most widely accepted model by metropolitan planning organizations in the country, was used for this process. Key variables for the DRAM/EMPAL model include current employment locations by sector, household locations by income quartile, land use inventories, travel time matrices, and number of workers per household.

In the third step, the district level information was disaggregated to the Traffic Survey Zone (TSZ) level (6,386 TSZs in the ten-county area) which is the smallest zone size used in the travel demand process. There were 4,874 TSZs in the 2030 MTP NCTCOG model. The critical variables used in this process were: district level household change, acres of vacant land, density of future residential development, and proximity to transportation infrastructure. Output from this process was closely reviewed by the member cities and approved by the Regional Demographic Task Force before being presented and approved by the NCTCOG Executive Board in 2003.

The fourth step involves performing trip generation using calibrate regional regression curves. This process estimates the total number of trips generated and attracted for each TSZ. In the fifth step, the data was aggregated into 4,874 zones and the trip distribution is then performed using the gravity model. In the sixth and final step, mode choice analysis is performed to create trip tables for single occupant vehicles (SOVs), high occupancy vehicles (HOVs), and transit modes.

### Recent NCTCOG Changes to Demographic Forecasts

The NCTCOG is currently in the process of developing its next demographic forecasts that will include the addition of two more counties (Hood and Hunt). The total number of TSZ's will increase from 6,386 to 6,672. The exact timing of the release of these new forecasts was still unknown at the time of this study; therefore, the 2030 MTP 2009 Amended Plan was the only readily available database and was deemed sufficient for purposes of the traffic and revenue analysis.

## HISTORICAL AND FUTURE REGIONAL GROWTH

The DFWMA wholly encompasses Collin, Dallas, Denton, Rockwall and Tarrant Counties and portions of Ellis, Johnson, Kaufman, Parker, and Wise Counties. The analysis of historical and future demographic growth from a regional perspective is based on county-level information pertaining to population, employment, and income.

### Historical Regional Population Trends

**Table 4-3** shows the historical population trends for counties in the DFWMA, Texas and the United States, and **Figure 4-2** illustrates the spatial relationship of each county encompassed within the DFWMA. The total population in the ten-county area has

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increased by an annual rate of 2.6 percent from 1970 to 2000, equivalent to 2.7 million additional residents. This population growth trend exceeded the state and national growth trends between 1970 and 2000, which were 2.1 percent and 1.1 percent per year, respectively.

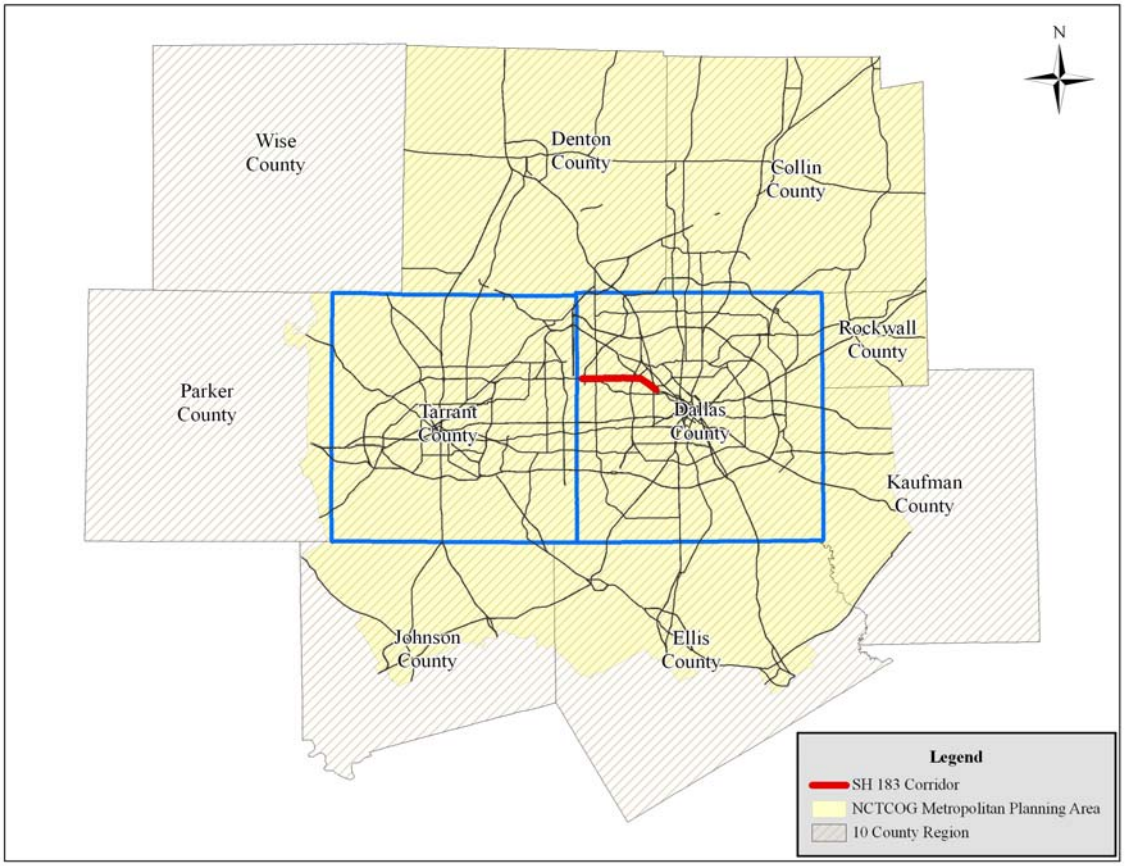


**Figure 4-2. Ten-County Area Location**

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**Table 4-3**
**Countywide Population Trends and Projections**

| County | Year 1970 | Year 1980 | Year 1990 | Year 2000 | Year 2030 | Annual Percent Growth (1970-2000) | Annual Percent Growth (2000-2030) | Percent Population Distribution By County | | Percentage of New Residents Between 2000 and 2030 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 2000 | 2030 | |
| Collin | 66,920 | 144,576 | 264,036 | 491,675 | 1,166,645 | 6.9% | 2.9% | 9.7% | 12.8% | 16.8% |
| **Dallas** | **1,327,696** | **1,556,419** | **1,852,810** | **2,218,899** | **2,817,191** | **1.7%** | **0.8%** | **43.7%** | **30.9%** | **14.9%** |
| Denton | 75,633 | 143,126 | 273,525 | 432,976 | 1,085,343 | 6.0% | 3.1% | 8.5% | 11.9% | 16.2% |
| Ellis | 46,638 | 59,743 | 85,167 | 111,360 | 448,588 | 2.9% | 4.8% | 2.2% | 4.9% | 8.4% |
| Johnson | 45,769 | 67,649 | 97,165 | 127,793 | 444,151 | 3.5% | 4.2% | 2.5% | 4.9% | 7.9% |
| Kaufman | 32,392 | 39,015 | 52,220 | 71,313 | 277,745 | 2.7% | 4.6% | 1.4% | 3.0% | 5.1% |
| Parker | 33,888 | 44,609 | 64,785 | 88,495 | 328,418 | 3.3% | 4.5% | 1.7% | 3.6% | 6.0% |
| Rockwall | 7,046 | 14,528 | 25,604 | 43,080 | 144,976 | 6.2% | 4.1% | 0.8% | 1.6% | 2.5% |
| **Tarrant** | **715,587** | **860,880** | **1,170,103** | **1,446,219** | **2,291,723** | **2.4%** | **1.5%** | **28.5%** | **25.2%** | **21.0%** |
| Wise | 19,687 | 26,575 | 34,679 | 48,793 | 102,449 | 3.1% | 2.5% | 1.0% | 1.1% | 1.3% |
| Ten-County Area | 2,371,256 | 2,957,120 | 3,920,094 | 5,080,603 | 9,107,229 | 2.6% | 2.0% | 100.0% | 100.0% | 100.0% |
| State of Texas | 11,256,480 | 14,337,820 | 16,986,510 | 20,851,820 | 31,830,579 | 2.1% | 1.4% | N/A | N/A | N/A |
| United States | 203,982,310 | 227,225,620 | 248,709,873 | 281,421,906 | 362,880,000 | 1.1% | 0.9% | N/A | N/A | N/A |

Dallas County has the largest population in the ten-county area, with a growth from 1.3 million to 2.2 million (891,203 additional residents) between 1970 and 2000 at an average annual growth rate of 1.7 percent. Given the maturity of population growth in this county, this annual growth rate was lower than the rate of expansion experienced by the combined ten-county area during the same period, which grew at an average annual rate of 2.6 percent.

Tarrant County is the second largest county in the DFWMA. The population of Tarrant County increased at an average annual rate of 2.4 percent between 1970 and 2000, adding a total of 730,632 new residents to yield 1.4 million residents by 2000. The rate of population growth experienced in Tarrant County between 1970 and 2000 was slightly higher than the population growth seen in Texas and significantly higher than the nationwide population growth experienced during that same period.

The majority of the existing population in the DFWMA is concentrated within four counties. By 2000, Collin, Dallas, Denton and Tarrant Counties accounted for over 90 percent of the total population within the ten-county area, as demonstrated in **Table 4-3**. Dallas and Tarrant Counties combined comprised of approximately 72.2 percent of the total population within the ten-county area (43.7 percent plus 28.5 percent).

The long-term historical population data for the ten counties within the region is shown in **Table 4-4.** Dallas and Tarrant Counties have been the fastest growing counties in the region over the last century. More recent countywide population data is presented in **Table 4-5.** These values reflect results from the U.S. Census Bureau's annual population estimates program. It is evident that population growth as a percentage has slowed some in Dallas and Tarrant Counties in recent years as more people move into the surrounding counties.

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**Table 4-4**
**Historical Countywide Population Trends**

| County | Year 1900 | Year 1950 | Year 2000 | Average Annual Growth (1900 - 1950) | Average Annual Growth (1950 - 2000) | Average Annual Growth (1900 - 2000) |
|---|---|---|---|---|---|---|
| Collin | 50,087 | 41,692 | 491,675 | -0.4% | 5.1% | 2.3% |
| **Dallas** | **82,726** | **614,799** | **2,218,899** | **4.1%** | **2.6%** | **3.3%** |
| Denton | 28,318 | 41,365 | 432,976 | 0.8% | 4.8% | 2.8% |
| Ellis | 50,059 | 45,645 | 111,360 | -0.2% | 1.8% | 0.8% |
| Johnson | 33,819 | 31,390 | 126,811 | -0.1% | 2.8% | 1.3% |
| Kaufman | 33,376 | 31,170 | 71,313 | -0.1% | 1.7% | 0.8% |
| Parker | 25,823 | 21,528 | 88,495 | -0.4% | 2.9% | 1.2% |
| Rockwall | 8,531 | 6,156 | 43,080 | -0.7% | 4.0% | 1.6% |
| **Tarrant** | **52,376** | **361,253** | **1,446,219** | **3.9%** | **2.8%** | **3.4%** |
| Wise | 27,116 | 16,141 | 48,793 | -1.0% | 2.2% | 0.6% |

Source: U.S. Census Bureau Decennial Census

**Table 4-5**
**U.S. Census Population Estimates**

| City/County | July 1, 2000 | July 1, 2001 | July 1, 2002 | July 1, 2003 | July 1, 2004 | July 1, 2005 | July 1, 2006 | July 1, 2007 | July 1, 2008 | Average Annual Growth Rate |
|---|---|---|---|---|---|---|---|---|---|---|
| Collin County | 500,198 | 537,904 | 568,990 | 596,839 | 628,010 | 660,124 | 697,611 | 730,906 | 762,010 | 5.4% |
| **Dallas County** | **2,225,448** | **2,267,698** | **2,280,650** | **2,287,406** | **2,297,946** | **2,317,174** | **2,355,200** | **2,383,179** | **2,412,827** | 1.0% |
| Denton County | 438,967 | 464,792 | 489,394 | 512,081 | 533,151 | 557,829 | 588,081 | 613,660 | 636,557 | 4.8% |
| Ellis County | 112,382 | 115,704 | 119,500 | 123,704 | 127,216 | 131,834 | 137,476 | 142,998 | 148,186 | 3.5% |
| Johnson County | 127,967 | 131,675 | 134,853 | 138,218 | 141,398 | 143,843 | 145,914 | 149,364 | 153,630 | 2.3% |
| Kaufman County | 72,082 | 75,169 | 77,744 | 81,490 | 84,566 | 87,868 | 91,854 | 96,458 | 100,527 | 4.2% |
| Parker County | 89,237 | 91,640 | 93,941 | 96,713 | 98,877 | 101,292 | 104,543 | 108,433 | 111,776 | 2.9% |
| Rockwall County | 43,880 | 47,103 | 50,795 | 54,434 | 57,916 | 62,235 | 68,317 | 73,693 | 77,633 | 7.4% |
| **Tarrant County** | **1,454,431** | **1,488,537** | **1,523,445** | **1,552,481** | **1,580,804** | **1,612,869** | **1,662,215** | **1,709,249** | **1,750,091** | 2.3% |
| Wise County | 49,400 | 50,981 | 52,449 | 53,753 | 54,592 | 55,720 | 56,678 | 57,461 | 58,506 | 2.1% |

Source: U.S. Census Bureau, Population Estimates Program

### FUTURE REGIONAL POPULATION GROWTH

The future 2030 population estimates developed by NCTCOG are also included in **Table 4-3**. Population in the ten-county area is currently expected to increase from 5.1 million in 2000 to 9.1 million by 2030, corresponding to an annual growth rate of 2.0 percent. This annual growth rate for the DFWMA is anticipated to be higher than the annual growth rate for both the state and the nation, which are expected to be 1.4 and 0.9 percent, respectively.

Tarrant County's population is expected to grow by an average annual rate of 1.5 percent between 2000 and 2030, from 1.4 million in 2000 to 2.3 million by 2030. The additional 845,504 residents expected in Tarrant County by 2030 would represent the highest number of additional residents (21.0 percent) for any county in the ten-county area followed by Collin (16.8 percent), Denton (16.2 percent), and Dallas (14.9 percent) during that period.

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Recent (2000) and future year (2030) population distributions for each of the counties within the ten-county area are also presented in **Table 4-3**. As indicated, Tarrant and Dallas Counties will continue to comprise the largest population centers in the ten-county area. However, their overall shares are expected to decline as neighboring counties continue to grow at faster rates and absorb the majority of the new resident growth.

**Figures 4-3 and 4-4** illustrate the future population by county and their annual historical and expected future percentage growth, respectively. A significant portion of the total area population resides in Dallas and Tarrant Counties as demonstrated in **Figure 4-3**.

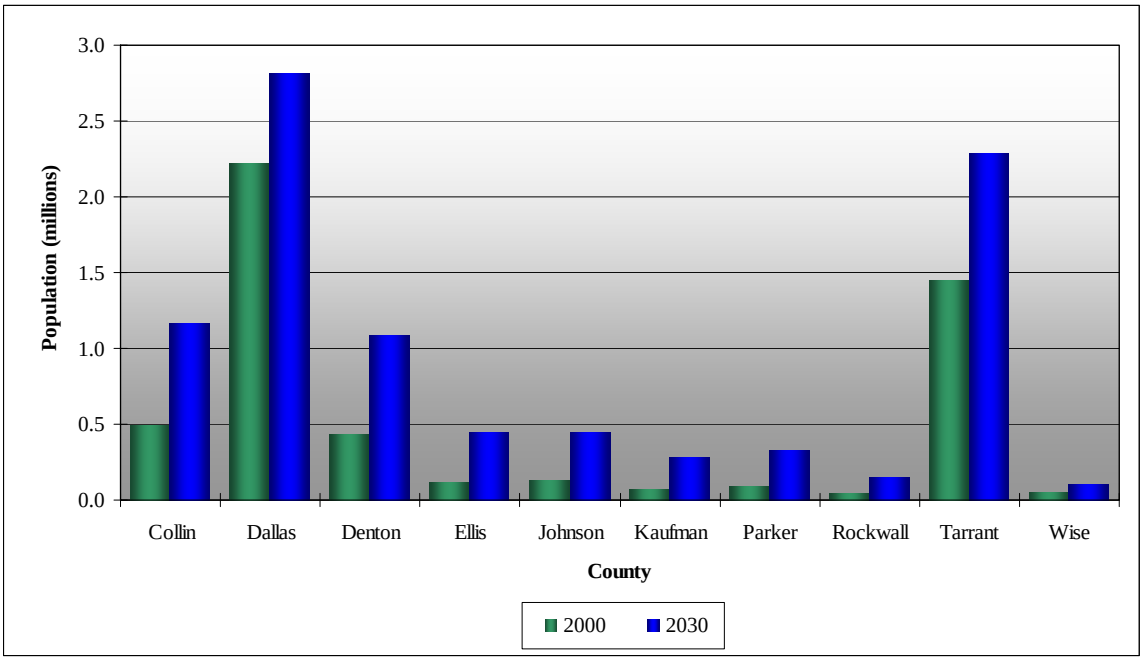


**Figure 4-3. 2000 and 2030 Population**

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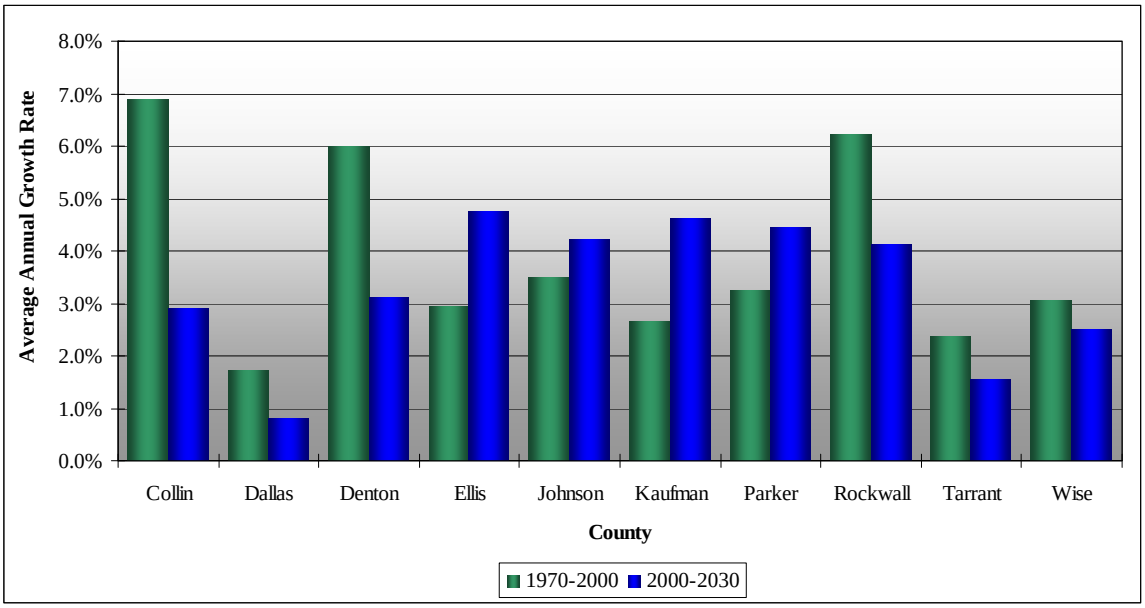


**Figure 4-4. Population Annual Growth Rate**

### HISTORICAL REGIONAL EMPLOYMENT TRENDS

Employment statistics are another indication of the relative trip attractions to regions within the study area. Intense employment growth in an area generally indicates potential increased demand for transportation infrastructure, especially if the level of employment is high relative to levels of population in the same area. The countywide historical employment trends for the DFWMA are shown in **Table 4-6**. Between 1990 and 2000, employment in the ten-county area increased at an annual rate of 4.1 percent, which was higher than the employment growth rate of both the state and nation.

Dallas County continues to be the major employment center in the region, with employment in 2000 comprising 55.3 percent of the ten-county area's total employment, and increased from 1.3 million in 1990 to 1.7 million by 2000. Tarrant County held 27.4 percent of the region's employment in 2000. From 1990 to 2000, employment in Tarrant County grew from 0.6 million to 0.9 million (278,302 additional employment) at an average annual rate of 4.0 percent.

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**Table 4-6**
**Countywide Employment Trends and Projections**

| County | Year 1990 | Year 2000 | Year 2030 | Woods & Poole 2030 | Annual Percent Growth (1990-2000) | Annual Percent Growth (2000-2030) | Percent Employment Distribution By County | | Percentage of New Employees Between 2000 and 2030 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 2000 | 2030 | |
| Collin | 93,729 | 204,057 | 517,264 | 736,914 | 8.1% | 3.1% | 6.5% | 9.5% | 13.8% |
| **Dallas** | **1,254,974** | **1,745,109** | **2,529,371** | **2,337,377** | **3.4%** | **1.2%** | **55.3%** | **46.7%** | **34.7%** |
| Denton | 75,817 | 152,818 | 413,453 | 371,921 | 7.3% | 3.4% | 4.8% | 7.6% | 11.5% |
| Ellis | 27,789 | 49,071 | 162,769 | 80,803 | 5.9% | 4.1% | 1.6% | 3.0% | 5.0% |
| Johnson | 26,214 | 45,071 | 142,544 | 99,699 | 5.6% | 3.9% | 1.4% | 2.6% | 4.3% |
| Kaufman | 17,174 | 31,027 | 82,078 | 55,753 | 6.1% | 3.3% | 1.0% | 1.5% | 2.3% |
| Parker | 16,173 | 29,816 | 94,703 | 76,580 | 6.3% | 3.9% | 0.9% | 1.7% | 2.9% |
| Rockwall | 7,492 | 17,025 | 48,466 | 53,539 | 8.6% | 3.5% | 0.5% | 0.9% | 1.4% |
| **Tarrant** | **586,058** | **864,360** | **1,388,247** | **1,343,600** | **4.0%** | **1.6%** | **27.4%** | **25.6%** | **23.1%** |
| Wise | N/A | 19,848 | 37,823 | 46,830 | N/A | 2.2% | 0.6% | 0.7% | 1.0% |
| Ten-County Area | 2,105,420 | 3,158,202 | 5,416,718 | 5,203,016 | 4.1% | 1.8% | 100.0% | 100.0% | 100.0% |
| State of Texas | 6,983,170 | 9,289,286 | 16,743,000 | 19,568 | 2.9% | 2.0% | N/A | N/A | N/A |
| United States | 108,657,200 | 129,877,063 | 202,431,000 | 228,283,967 | 1.8% | 1.5% | N/A | N/A | N/A |

Souce: NCTCOG, Texas State Data Center, U.S. Census Bureau, Woods & Poole

Collin, Denton and Rockwall Counties experienced the highest average annual growth rates in employment from 1990 to 2000, at rates of 8.1 percent, 7.3 percent, and 8.6 percent, respectively. This brought nearly 200,000 new jobs to the region over the ten year period.

Employment distributions by county are summarized in **Table 4-6**. Dallas and Tarrant Counties account for the bulk of the employment centers within the ten-county area, and encompassed 82.7 percent of the region's total employment in 2000 (55.3 percent plus 27.4 percent). Employment in Dallas County in 2000 accounted for over half of the total ten-county area employment.

### FUTURE REGIONAL EMPLOYMENT GROWTH

**Table 4-4** also shows the adopted NCTCOG employment estimates for 2030. Dallas County employment is expected to increase from 1.7 million in 2000 to 2.5 million by 2030, reflecting an annual growth rate of 1.2 percent. The 784,262 new jobs in Dallas County will represent 34.7 percent of the total additional jobs in the ten-county area.

Tarrant County employment is projected to grow at an average annual rate of 1.6 percent from 2000 to 2030. The growth from 0.9 million to 1.4 million would bring 523,887 new jobs to the study area and would represent 23.1 percent of the total new employment to the ten-county area.

Between 2000 and 2030, 2.3 million additional jobs are expected to be added in the ten-county area, at an annual average growth rate of 1.8 percent. Employment in Texas and in the nation is expected to grow at an annual rate of 2.0 percent and 1.5 percent from 2000 to 2030, respectively.

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**Table 4-6** also illustrates the 2000 and 2030 employment distributions for the ten-county area. The major employment concentrations are expected to continue to be located in Dallas and Tarrant. However, the projections anticipate much stronger job growth within suburban activity centers compared to the established central city activity centers throughout the DFWMA.

**Figure 4-5** illustrates future employment by county. The historical and expected future annual growth rates for each county are shown in **Figure 4-6**. Similar to the population trends, the employment trends show that the majority of employment will continue to be in Dallas and Tarrant Counties (**Figure 4-6**), however, employment growth rates are expected to be higher in the peripheral counties.

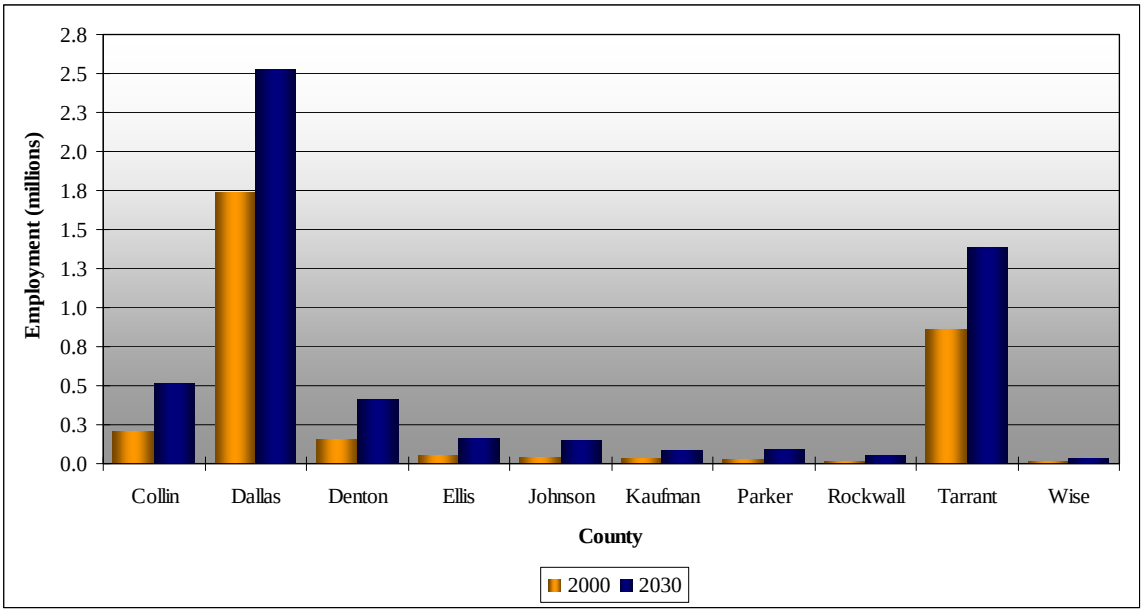


**Figure 4-5. 2000 and 2030 Employment**

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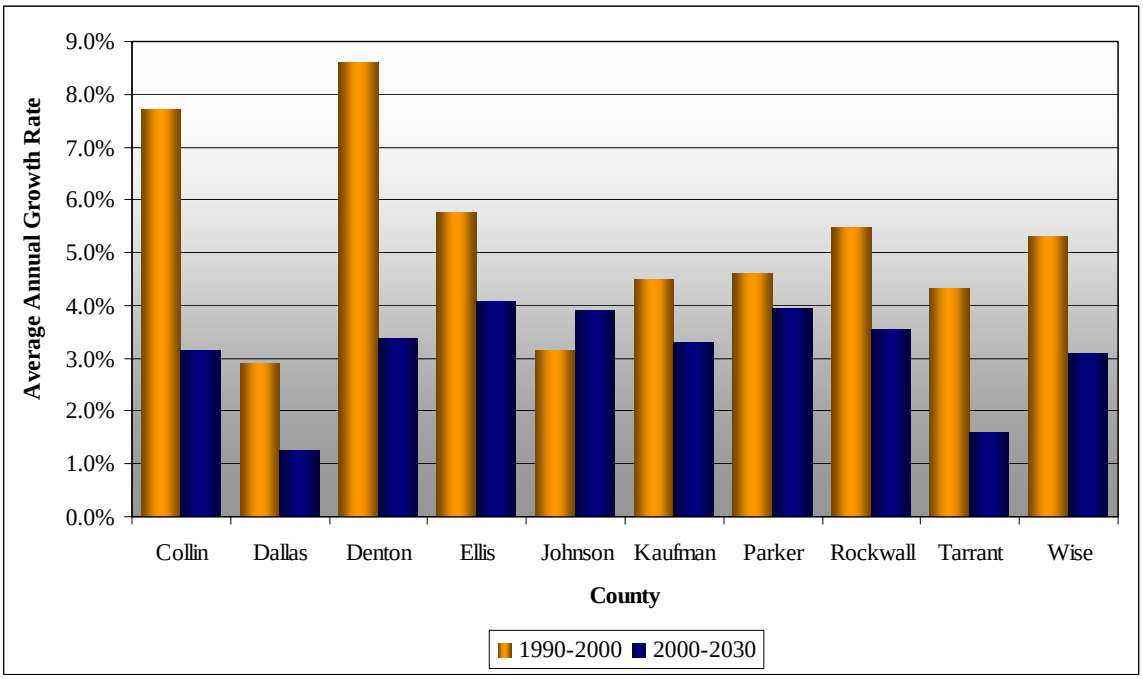


**Figure 4-6. Employment Annual Growth Rate**

The unemployment rates between 1990 and 2009 for Dallas County, Texas and the United States are shown in **Table 4-7** and illustrated in **Figure 4-7**. The unemployment rates for Dallas County stayed continually lower than the Texas statewide unemployment rates prior to 2000. However, following 2000, the Dallas County unemployment rates have trended higher than the Texas statewide rates but have still remained lower than the national unemployment rate trends. Between 2008 and 2009, the number increased from 5.4 to 8.0 percent as a result of recent economic downturn, which was in line with the U.S. trends that showed an increase in the unemployment rate to 9.3 percent.

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**Table 4-7**
**Dallas County Employment and Unemployment**

| Year | Labor Force | Employment | Unemployment | Unemployment Rate | | |
|---|---|---|---|---|---|---|
| | | | | Dallas County | Texas | United States |
| 1990 | 1,069,971 | 1,012,686 | 57,285 | 5.4 | 6.4 | 5.6 |
| 1991 | 1,079,188 | 1,008,924 | 70,264 | 6.5 | 7.0 | 6.8 |
| 1992 | 1,094,780 | 1,014,402 | 80,378 | 7.3 | 7.6 | 7.5 |
| 1993 | 1,105,107 | 1,032,680 | 72,427 | 6.6 | 7.2 | 6.9 |
| 1994 | 1,120,332 | 1,056,262 | 64,070 | 5.7 | 6.6 | 6.1 |
| 1995 | 1,136,117 | 1,077,244 | 58,873 | 5.2 | 6.1 | 5.6 |
| 1996 | 1,153,680 | 1,100,861 | 52,819 | 4.6 | 5.8 | 5.4 |
| 1997 | 1,184,606 | 1,135,125 | 49,481 | 4.2 | 5.4 | 4.9 |
| 1998 | 1,194,096 | 1,149,009 | 45,087 | 3.8 | 4.9 | 4.5 |
| 1999 | 1,209,198 | 1,165,628 | 43,570 | 3.6 | 4.7 | 4.2 |
| 2000 | 1,184,393 | 1,138,299 | 46,094 | 3.9 | 4.4 | 4.0 |
| 2001 | 1,191,134 | 1,127,641 | 63,493 | 5.3 | 5.0 | 4.7 |
| 2002 | 1,187,091 | 1,099,268 | 87,823 | 7.4 | 6.4 | 5.8 |
| 2003 | 1,163,867 | 1,077,393 | 86,474 | 7.4 | 6.7 | 6.0 |
| 2004 | 1,153,563 | 1,077,373 | 76,190 | 6.6 | 6.0 | 5.5 |
| 2005 | 1,147,202 | 1,082,487 | 64,715 | 5.6 | 5.4 | 5.1 |
| 2006 | 1,148,767 | 1,089,351 | 59,416 | 5.2 | 4.9 | 4.6 |
| 2007 | 1,141,461 | 1,088,478 | 52,983 | 4.6 | 4.4 | 4.6 |
| 2008 | 1,158,504 | 1,096,099 | 62,405 | 5.4 | 4.9 | 5.8 |
| 2009 | 1,177,446 | 1,083,115 | 94,331 | 8.0 | 7.6 | 9.3 |

Source: U.S. Bureau of Labor Statistics

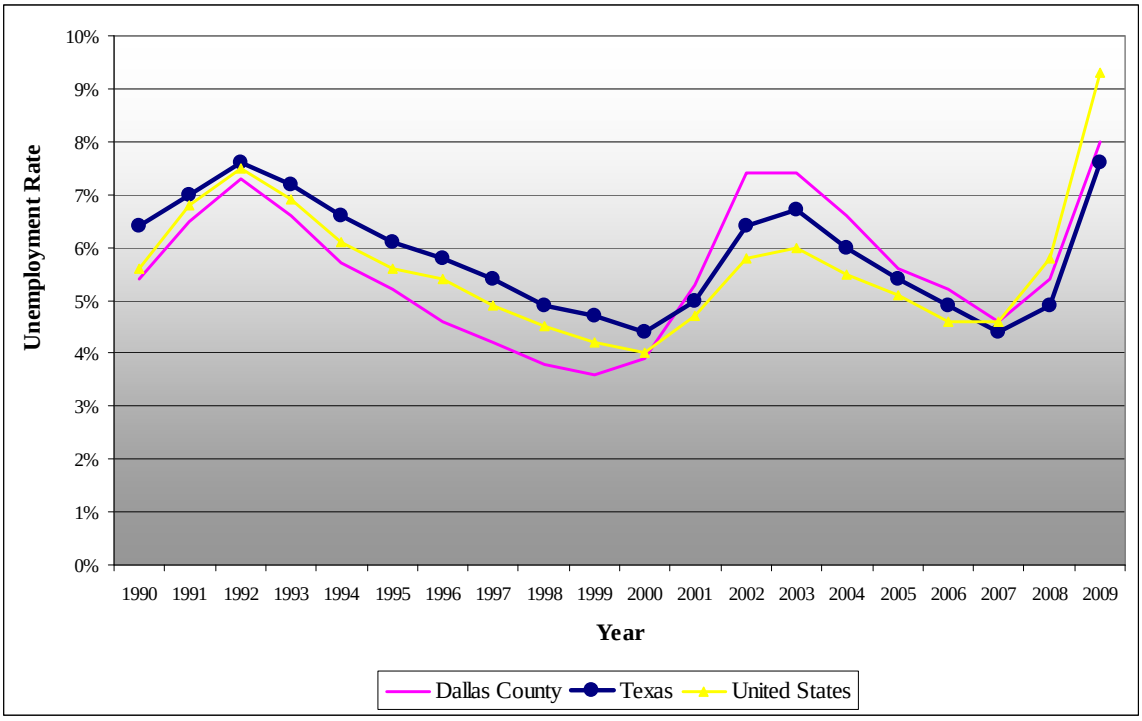


**Figure 4-7. Unemployment Rate Historical Trend**

### REGIONAL MEDIAN HOUSEHOLD INCOME TRENDS

Travel demand, and more specifically demand for toll roads, is sensitive to the amount of disposable income available within a household. A reliable indicator of a household's propensity for trip-making, or a motorist's willingness-to-pay a toll, is median household income. Generally, households with higher incomes tend to make more trips than those with lower incomes due to their higher disposable incomes. The value-of-time is a key factor that defines motorists willingness-to-pay tolls, and this also tends to be higher in households with higher incomes.

A comparison of the nominal and real median household incomes for the ten-county area, the state, and nation is provided in **Table 4-8**. The most recent median household income data from the 2008 American Community Survey was not available for Wise County but is provided for all the other counties. The median household income data presented in **Table 4-8** indicates that when reported in real 2008 dollars, income in the region, the state, and the nation grew considerably between 1989 and 1999, but had declined somewhat by 2008. The 1999 median household incomes in Collin, Denton and Tarrant Counties were higher than those of the state and nation. Though Dallas County has an income similar to the statewide average, it includes a diverse range of sub-areas, with large distributional variations in the very high income and much lower income areas.

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**Table 4-8**
**Median Household Income**

| Politcal Division | Nominal | | | Average Annual Growth Rate (1989 - 2008) | Average Annual Growth Rate (1999 - 2008) | Real (adjusted to 2008 dollars using CPI) | | | Average Annual Growth Rate (1989 - 2008) | Average Annual Growth Rate (1999 - 2008) |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1989 | 1999 | 2008 | | | 1989 | 1999 | 2008 | | |
| Collin County | $46,020 | $70,835 | $81,395 | 3.0% | 1.6% | $77,714 | $90,472 | $81,395 | 0.2% | -1.2% |
| **Dallas County** | **$31,605** | **$43,324** | **$47,085** | **2.1%** | **0.9%** | **$53,371** | **$55,334** | **$47,085** | **-0.7%** | **-1.8%** |
| Denton County | $36,914 | $58,216 | $73,544 | 3.7% | 2.6% | $62,337 | $74,354 | $73,544 | 0.9% | -0.1% |
| Ellis County | $30,553 | $50,350 | $65,574 | 4.1% | 3.0% | $51,595 | $64,308 | $65,574 | 1.3% | 0.2% |
| Johnson County | $30,612 | $44,621 | $53,244 | 3.0% | 2.0% | $51,695 | $56,991 | $53,244 | 0.2% | -0.8% |
| Kaufman County | $27,280 | $44,783 | $59,317 | 4.2% | 3.2% | $46,068 | $57,198 | $59,317 | 1.3% | 0.4% |
| Parker County | $30,592 | $45,487 | $61,455 | 3.7% | 3.4% | $51,661 | $58,097 | $61,455 | 0.9% | 0.6% |
| Rockwall County | $42,417 | $65,164 | $77,184 | 3.2% | 1.9% | $71,630 | $83,228 | $77,184 | 0.4% | -0.8% |
| **Tarrant County** | **$32,335** | **$46,179** | **$56,251** | **3.0%** | **2.2%** | **$54,604** | **$58,981** | **$56,251** | **0.2%** | **-0.5%** |
| Wise County | $25,885 | $41,933 | *** | *** | *** | $43,712 | $53,557 | *** | *** | *** |
| State of Texas | $27,016 | $39,927 | $50,043 | 3.3% | 2.5% | $45,622 | $50,995 | $50,043 | 0.5% | -0.2% |
| United States | $30,056 | $41,994 | $52,029 | 2.9% | 2.4% | $50,756 | $53,635 | $52,029 | 0.1% | -0.3% |

Sources: 1990 and 2000 Decennial Census, 2008 American Community Survey, U.S. Census Bureau.

The 2008 estimates of median household income were published in the 2008 American Community Survey by the U.S. Census Bureau. The 2008 median household income estimates for Collin, Denton and Tarrant Counties are higher than the state and the nation median household income estimates. Dallas County has lower income areas in the southern areas of the city, while the north Dallas regions, where the corridor will serve, has much higher income areas than the overall average for the county. **Figure 4-8** illustrates the median household income distribution among ten-county area counties, the State of Texas and the United States for 1989, 1999, and 2008.

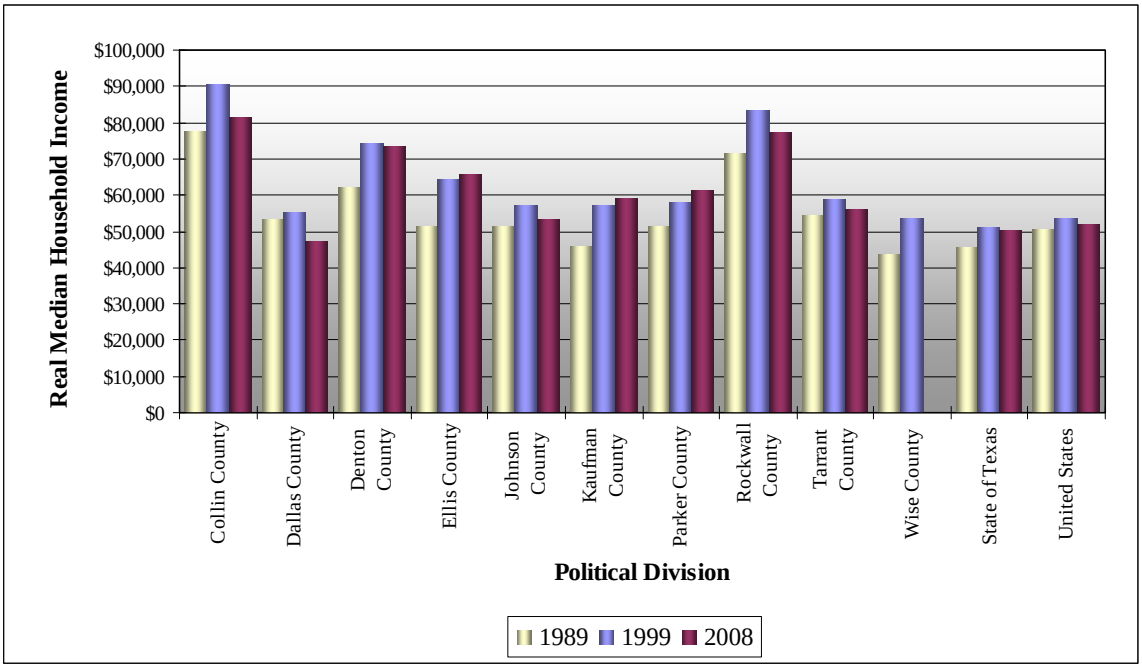


**Figure 4-8. Median Household Income**

The more recent 2009 median household income estimates, derived from the 2000 Census using CPI-U, for cities within the SH 183 managed lane corridor are listed in **Table 4-9**. As shown, many cities within the corridor have median household incomes that exceed $60,000, with the nominal median household income in Highland Park, located east of the SH 183, demonstrating the highest levels at $186,675. **Figure 4-9** illustrates the nominal median household incomes for 2008 at the TSZ level. The 2008 median household income was calculated by using the inflation rate from CPI-U to inflate the 2000 median household incomes numbers to 2008 values. As shown, there are many high income areas within the study corridor, particularly within the cities of Highland Park, University Park, and Grapevine.

**Table 4-9**
**Median Household Income 2009**

| City | Median Household Income |
|---|---|
| Arlington | $62,482 |
| Cockrell Hill | $42,707 |
| Dallas | $54,879 |
| Euless | $62,451 |
| Farmers Branch | $67,778 |
| Fort Worth | $50,231 |
| Grand Prairie | $60,371 |
| Grapevine | $90,751 |
| Highland Park | $186,675 |
| Irving | $58,139 |
| University Park | $115,701 |

Source: Decennial Census (Inflated to 2009 numbers using CPI)

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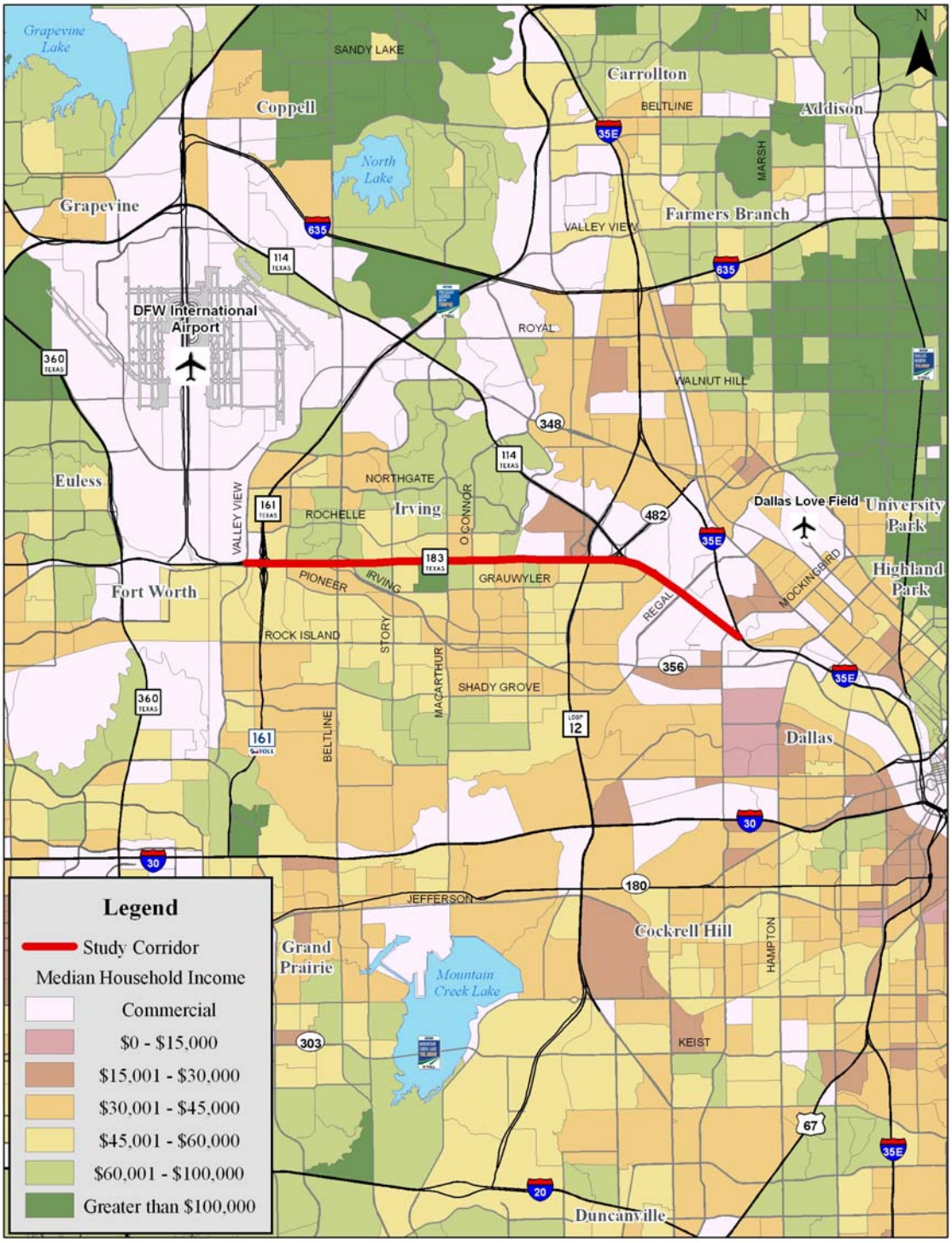


**Figure 4-9. Median Household Income 2008**

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## HISTORICAL AND FUTURE MUNICIPAL GROWTH

The historical and future demographic growth of municipalities in the study area for the proposed SH 183 managed lane corridor is described in this section, with focus on the underlying demographic characteristics of the specific municipalities that the facility will serve. The municipalities in the central portion of the study area that were considered included the cities of Arlington, Cockrell Hill, Dallas, Euless, Farmers Branch, Fort Worth, Grand Prairie, Grapevine, Highland Park, Irving, and University Park. A map illustrating the location of the municipalities evaluated is provided in **Figure 4-10**.

### HISTORICAL MUNICIPAL POPULATION TRENDS

The historical and projected population trends of the municipalities in the study area are presented in **Table 4-10** using sources that include NCTCOG, Texas State Data Center, and U.S. Census Bureau.

Average annual population growth between 1970 and 2000 ranged from a low of -0.5 percent in the city of Highland Park to a high of 4.4 percent in the city of Arlington. The city of Dallas, which is the largest city in the study corridor, experienced an average annual population growth rate of 1.1 percent, and grew from 0.8 million to 1.2 million, (344,179 additional new residents) during this time.

The cities of Arlington and Fort Worth saw large incremental growth from 1970 to 2000. Arlington grew from 0.1 million to 0.3 million (gaining 242,740 additional residents) while Fort Worth's population grew from 0.4 million to 0.5 million (gaining 141,239 additional residents). The city of Irving is another region that experienced high incremental growth, increasing from 0.1 million to 0.2 million (gaining 94,355 additional residents) over the thirty year period.

As a whole, the eleven municipalities within the SH 183 study area grew at an average annual rate of 1.6 percent between 1970 and 2000, compared to an average annual population growth rate of 2.6 for the ten-county area, 2.1 percent for the state, and 1.1 percent for the nation. This growth brought approximately 955,462 new residents to the area surrounding the study corridor over the thirty year period.

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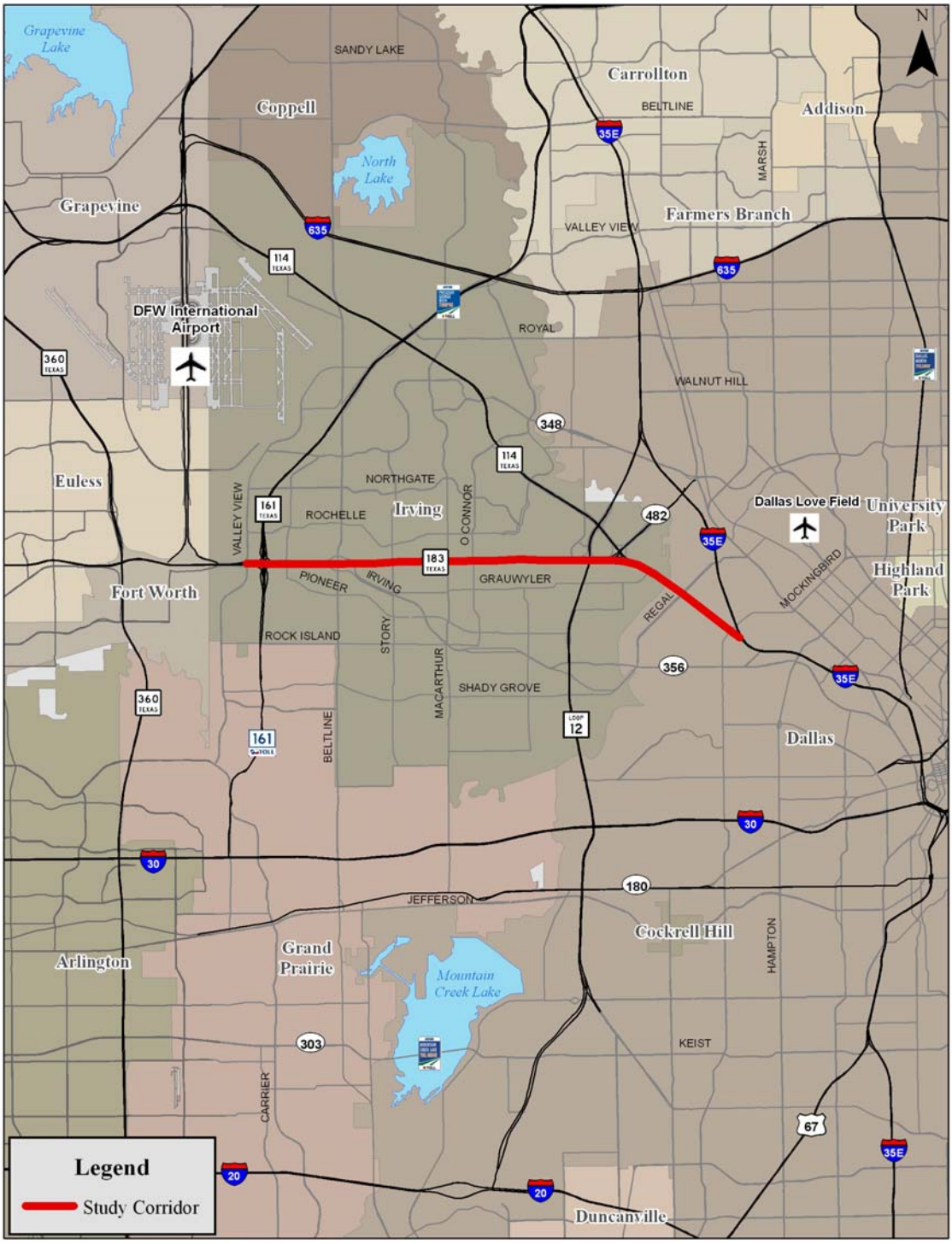


**Figure 4-10. Municipality Locations**

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**Table 4-10**
**Historical Municipal Population Trends and Projections**
**SH 183 Managed Lanes Corridor**

| Municipality | Year 1970 | Year 1980 | Year 1990 | Year 2000 | Year 2008 Estimate | Year 2030 | Annual Percent Growth (1970-2000) | Annual Percent Growth (2000-2030) | Number of New Residents (1970-2000) | Number of New Residents (2000-2030) | Percent Population Distribution By Municipality | | Percentage of New Residents Between 2000 and 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | 2000 | 2030 | |
| Arlington | 90,229 | 160,113 | 261,721 | 332,969 | 374,417 | 437,862 | 4.4% | 0.9% | 242,740 | 104,893 | 13.2% | 13.2% | 13.3% |
| Cockrell Hill | 3,515 | 3,262 | 3,746 | 4,443 | 4,272 | 4,451 | 0.8% | 0.0% | 928 | 8 | 0.2% | 0.1% | 0.0% |
| Dallas | 844,401 | 904,599 | 1,006,877 | 1,188,580 | 1,279,910 | 1,404,847 | 1.1% | 0.6% | 344,179 | 216,267 | 47.0% | 42.4% | 27.4% |
| Euless | 19,316 | 24,002 | 38,149 | 46,005 | 52,579 | 62,314 | 2.9% | 1.0% | 26,689 | 16,309 | 1.8% | 1.9% | 2.1% |
| Farmers Branch | 27,492 | 24,863 | 24,250 | 27,508 | 26,455 | 43,978 | 0.0% | 1.6% | 16 | 16,470 | 1.1% | 1.3% | 2.1% |
| Fort Worth | 393,455 | 385,164 | 447,619 | 534,694 | 703,073 | 826,665 | 1.0% | 1.5% | 141,239 | 291,971 | 21.2% | 24.9% | 37.0% |
| Grand Prairie | 50,904 | 71,462 | 99,606 | 127,427 | 160,641 | 231,011 | 3.1% | 2.0% | 76,523 | 103,584 | 5.0% | 7.0% | 13.1% |
| Grapevine | 11,801 | 7,049 | 29,202 | 42,059 | 50,471 | 49,484 | 4.3% | 0.5% | 30,258 | 7,425 | 1.7% | 1.5% | 0.9% |
| Highland Park | 10,133 | 8,909 | 8,739 | 8,842 | 9,184 | 9,027 | -0.5% | 0.1% | -1,291 | 185 | 0.3% | 0.3% | 0.0% |
| Irving | 97,260 | 109,943 | 155,037 | 191,615 | 201,358 | 225,714 | 2.3% | 0.5% | 94,355 | 34,099 | 7.6% | 6.8% | 4.3% |
| University Park | 23,498 | 22,254 | 22,259 | 23,324 | 24,853 | 20,764 | 0.0% | -0.4% | -174 | -2,560 | 0.9% | 0.6% | -0.3% |
| SH 183 Corridor | 1,572,004 | 1,721,620 | 2,097,205 | 2,527,466 | 2,887,213 | 3,316,117 | 1.6% | 0.9% | 955,462 | 788,651 | 100.0% | 100.0% | 100.0% |
| Ten-County Area | 2,371,256 | 2,957,120 | 3,920,094 | 5,080,603 | 6,211,743 | 9,107,229 | 2.6% | 2.0% | 2,709,347 | 4,026,626 | N/A | N/A | N/A |
| State of Texas | 11,258,480 | 14,337,820 | 16,986,510 | 20,851,820 | 24,304,290 | 31,830,579 | 2.1% | 1.4% | 9,593,340 | 10,978,759 | N/A | N/A | N/A |
| United States | 203,982,310 | 227,225,620 | 248,709,873 | 281,421,906 | 304,374,846 | 362,880,000 | 1.1% | 0.9% | 77,439,596 | 81,458,094 | N/A | N/A | N/A |

Source: NCTCOG, U.S. Census Bureau

### FUTURE MUNICIPAL POPULATION GROWTH

Population estimates for 2030 were developed by NCTCOG for the municipalities in the study corridor. As shown in **Table 4-10**, the population of the study corridor is expected to grow by 788,651 residents, or 31.2 percent, over the next 30 year period. This average annual rate of 0.9 percent between 2000 and 2030 compares to an expected growth rate of 2.0 percent for the ten-county area, 1.4 percent for the state, and 0.9 percent for the nation.

The three cities that are expected to have the largest percentage growth rate are the cities of Farmers Branch, Forth Worth and Grand Prairie. Farmers Branch is expected to gain 16,470 residents between 2000 and 2030 at an average annual growth rate of 1.6 percent. Fort Worth is expected to grow at an average annual growth rate of 1.5 percent which would result in 291,971 new residents. Grand Prairie is projected to experience the highest growth rate of 2.0 percent which will add 103,584 new residents to this city.

The city of Dallas is expected to see high incremental growth gaining 216,267 residents at an average annual rate of 0.6 percent from 2000 to 2030. The forecast shows that city of Arlington will also have high incremental growth, adding 104,893 new residents at an average annual rate of 0.9 percent over the next thirty years. Of all the new residents expected to come to the study area, 37.0 percent are expected to be residents in Fort Worth while 27.4 percent are expected to be residents in Dallas.

In 2000, the city of Dallas accounted for 47 percent of the population of the study area as a whole. By 2030, Dallas's share of the population is expected to decrease to 42.4 percent as population expands within areas surrounding Dallas. The city of Fort Worth's share of the population is expected to increase from 21.2 in 2000 to 24.9 percent by 2030.

### HISTORICAL MUNICIPAL EMPLOYMENT TRENDS

Historical employment trends for the municipalities in the proposed SH 183 managed lane corridor are presented in **Table 4-11**. The eleven municipalities have experienced average annual employment growth between 1990 and 2000 that has ranging from a low of 2.5 percent in the city of Dallas to a high of 6.2 percent in the city of Grand Prairie. Employment information for 1990 was not available for the city of Cockrell Hill.

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**Table 4-11**
**Historical Municipal Employment Trends and Projections**
**SH 183 Managed Lanes Corridor**

| Municipality | Year 1990 | Year 2000 | Year 2030 | Annual Percent Growth (1990-2000) | Annual Percent Growth (2000-2030) | Number of New Employees (1990-2000) | Number of New Employees (2000-2030) | Percent Employment Distribution By Municipality | | Percentage of New Employees Between 2000 and 2030 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 2000 | 2030 | |
| Arlington | 90,100 | 140,947 | 197,390 | 4.6% | 1.1% | 50,847 | 56,443 | 6.9% | 6.6% | 6.0% |
| Cockrell Hill | N/A | 699 | 779 | N/A | 0.4% | N/A | 80 | 0.0% | 0.0% | 0.0% |
| Dallas | 809,650 | 1,038,314 | 1,390,219 | 2.5% | 1.0% | 228,664 | 351,905 | 51.1% | 46.6% | 37.1% |
| Euless | 10,850 | 18,403 | 33,477 | 5.4% | 2.0% | 7,553 | 15,074 | 0.9% | 1.1% | 1.6% |
| Farmers Branch | 50,150 | 75,013 | 156,798 | 4.1% | 2.5% | 24,863 | 81,785 | 3.7% | 5.3% | 8.6% |
| Fort Worth | 330,350 | 449,793 | 701,524 | 3.1% | 1.5% | 119,443 | 251,731 | 22.1% | 23.5% | 26.5% |
| Grand Prairie | 51,800 | 82,664 | 125,866 | 6.2% | 1.4% | 30,864 | 43,202 | 4.1% | 4.2% | 4.6% |
| Grapevine | 27,100 | 49,565 | 85,475 | 4.5% | 1.8% | 22,465 | 35,910 | 2.4% | 2.9% | 3.8% |
| Highland Park | 1,550 | 2,405 | 2,586 | 4.5% | 0.2% | 855 | 181 | 0.1% | 0.1% | 0.0% |
| Irving | 106,600 | 165,435 | 276,941 | 3.3% | 1.7% | 58,835 | 111,506 | 8.1% | 9.3% | 11.8% |
| University Park | 6,500 | 9,012 | 9,716 | 3.3% | 0.3% | 2,512 | 704 | 0.4% | 0.3% | 0.1% |
| SH 183 Corridor | 1,484,650 | 2,032,250 | 2,980,771 | 3.2% | 1.3% | 547,600 | 948,521 | 100.0% | 100.0% | 100.0% |
| Ten-County Area | 2,105,420 | 3,158,202 | 5,416,718 | 4.1% | 1.8% | 1,052,782 | 2,258,516 | N/A | N/A | N/A |
| State of Texas | 6,983,170 | 9,283,286 | 16,743,000 | 2.9% | 2.0% | 2,300,116 | 7,459,714 | N/A | N/A | N/A |
| United States | 108,657,200 | 129,877,063 | 202,431,000 | 1.8% | 1.5% | 21,219,863 | 72,553,937 | N/A | N/A | N/A |

Source: NCTCOG, U.S. Census Bureau

The cities of Grand Prairie, Euless, and Arlington saw the highest average annual growth rates between 1990 and 2000. Employment in Grand Prairie grew at an average annual rate of 6.2 percent resulting in 30,864 new employees. Euless experienced an average annual growth rate of 5.4 percent gaining 7,553 employees. Arlington's employment grew by 50,847 at an average annual rate of 4.6 percent.

The city of Dallas experienced the largest incremental growth from 1990 to 2000 gaining 228,664 employees at an average annual rate of 2.5 percent. The city of Fort Worth gained 119,443 employees at an average annual rate of 3.1 percent.

As a whole, employment along the SH 183 managed lane corridor grew by 547,600 employees at an average annual rate of 3.2 percent. This compares to average annual growth rates of 4.1 percent, 2.9 percent, and 1.8 percent for the ten-county area, state of Texas, and the United States respectively.

### Future Municipal Employment Growth

Also presented in **Table 4-11** are estimates of future employment growth through 2030, as estimated by NCTCOG. The SH 183 managed lane study area is expected to grow at an average annual rate of 1.3 percent between 2000 and 2030 which would add 948,521 employees. This compares to average annual growth rates of 1.8 percent for the ten-county area, 2.0 percent for the state of Texas, and 1.5 percent for the United States. The city of Dallas is expected to add 351,905 employees at an average annual growth rate of 1.0 percent from 2000 through 2030. This accounts for 37.1 percent of all new employment within the SH 183 managed lane corridor during this time.

The city of Farmers Branch is expected to gain the highest average annual growth rate of 2.5 percent from 2000 to 2030 bringing 81,785 employees to this city. The city of Euless is projected to experience an average annual growth rate of 2.0 percent which will add approximately 15,074 new employees during the next thirty years.

The city of Fort Worth is expected to house 26.5 percent of all new employees along the corridor between 2000 and 2030. It is projected that Fort Worth will add 251,731 employees at an average annual rate of 1.5 percent. The city of Irving is expected to add 111,506 employees at an average annual rate of 1.7 percent. This will account for 11.8 percent of all new employment within the SH 183 managed lane corridor during this time.

The city of Dallas is expected to maintain its large share of employment in the study corridor with a share of 46.6 percent by 2030. This compares to an employment share of 51.1 percent that Dallas held in 2000. It is projected that the city of Fort Worth's share of employment will increase by 1.4 percent with the city of Irving's share also increasing by 1.2 percent.

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## SH 183 MANAGED LANE CORRIDOR CURRENT AND FUTURE DEVELOPMENT GROWTH

The current and future economic development potential along the SH 183 managed lane corridor is described in this section. Much of the analysis of future development potential is based on the identification of major employment establishments located within the study corridor and potential new developments to the study area. This includes an examination of the demographic forecasts for the area immediately adjacent to and within the proposed SH 183 managed lane corridor, which is defined as the area within a five-mile buffer from the SH 183 centerline alignment.

### MAJOR EMPLOYMENT ESTABLISHMENTS

The Dallas Morning News ranks the top 150 major public corporations and the top 75 major private corporations in the Dallas-Fort Worth metropolitan area every year. The ranking is based on the total revenue generated by each corporation in the previous year. From the 2009 rankings, 53 of those public and 26 of those private corporations are located within an approximate five-mile distance of the proposed managed lanes facility. Lists of those corporations are presented in **Tables 4-12** and **4-13** and their locations are illustrated in **Figures 4-11 and 4-12**.

For major public corporations, Exxon Mobil Corporation in Irving is ranked 1st with $425.1 billion in revenue in 2008. AT&T Incorporated in Dallas ranked 2nd with $124 billion in 2008 revenue, while AMR Corporation in Fort Worth ranked 3rd with $23.8 billion in 2008 revenue. Fluor Corporation and Kimberly-Clark Corporation, also in Irving, ranked 4th and 5th respectively with $22.3 and $19.4 billion in 2008 revenue. These high ranked businesses are specifically highlighted in **Figure 4-11**.

The two highest ranked private corporations are located within the study corridor. Energy Future Holdings in Dallas ranked 1st with $11.4 billion in 2008 revenue. Neiman Marcus Group, which is also in Dallas, ranked 2nd with $4.6 billion in 2008 revenue. Hunt Consolidation Incorporated, Lincoln Property Corporation, and Austin Industries Incorporated ranked 9th, 13th and 14th, respectively. These companies are all located in Dallas and each earned over $1 billion in revenue in 2008. **Figure 4-12** highlights the locations of these top ranked companies.

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**Table 4-12**
**Major Public Corporations Ranked by the Dallas Morning News**

| Name | 2009 Rank | 2008 Revenue (in millions) | Name | 2009 Rank | 2008 Revenue (in millions) |
|---|---|---|---|---|---|
| Exxon Mobil Corp. | 1 | $425,071 | Eagle Materials Inc. | 64 | $750 |
| AT&T Inc. | 2 | $124,028 | Belo Corp. | 65 | $733 |
| AMR Corp. | 3 | $23,766 | A.H. Belo Corporation | 67 | $637 |
| Fluor Corp. | 4 | $22,326 | Odyssey HealthCare Inc. | 68 | $616 |
| Kimberly-Clark Corp. | 5 | $19,415 | Frozen Food Express Industries Inc. | 73 | $491 |
| Dean Foods Co. | 9 | $12,455 | SWS Group Inc. | 74 | $478 |
| Southwest Airlines Co. | 10 | $11,023 | Carbo Ceramics Inc. | 81 | $388 |
| Commercial Metals Co. | 11 | $10,427 | Penson Worldwide Inc. | 82 | $384 |
| Energy Transfer Partners LP | 12 | $9,294 | Reddy Ice Holdings Inc. | 85 | $329 |
| Centex Corp. | 15 | $8,276 | Nexstar Broadcasting Group Inc. | 88 | $285 |
| Celanese Corp. | 18 | $6,823 | Texas Capital BancShares Inc. | 89 | $271 |
| Affiliated Computer Services Inc. | 20 | $6,161 | Silverleaf Resorts Inc. | 92 | $257 |
| Holly Corp. | 21 | $5,868 | I2 Technologies Inc. | 93 | $256 |
| Blockbuster Inc. | 23 | $5,288 | Gainsco Inc. | 96 | $191 |
| Crosstex Energy LP | 25 | $4,907 | Hallwood Group Inc. | 101 | $162 |
| Flowserve Corp. | 26 | $4,473 | DG FastChannel Inc. | 102 | $157 |
| Comerica Inc | 29 | $3,944 | PMFG Inc. | 107 | $140 |
| Trinity Industries Inc. | 30 | $3,883 | EF Johnson Technologies Inc. | 110 | $126 |
| ENSCO International Inc. | 39 | $2,450 | Holly Energy Partners LP | 111 | $118 |
| Pioneer Natural Resources Co. | 40 | $2,277 | Hilltop Holdings Inc. | 116 | $103 |
| Zale Corp. | 41 | $2,138 | Dorchester Minerals LP | 120 | $90 |
| Regency Energy Partners LP | 43 | $1,885 | Toreador Resources Corp. | 126 | $62 |
| FelCor Lodging Trust Inc. | 55 | $1,130 | Westwood Holdings Group Inc. | 132 | $46 |
| Builders FirstSource Inc. | 57 | $1,035 | RBC Life Sciences Inc | 137 | $30 |
| Texas Industries Inc. | 59 | $1,029 | Zix Corp. | 138 | $28 |
| CEC Entertainment Inc. | 61 | $815 | Thomas Group Inc. | 141 | $25 |
| Darling Internationl Inc. | 62 | $807 | ---------- | -------- | -------- |

Source: Dallas Morning News: Biggest Dallas-Fort Worth Public Companies 2009

**Table 4-13**
**Major Private Corporations Ranked by the Dallas Morning News**

| Name | 2009 Rank | 2008 Revenue (in millions) | Name | 2009 Rank | 2008 Revenue (in millions) |
|---|---|---|---|---|---|
| Energy Future Holdings | 1 | $11,364 | Direct Fuels | 36 | $573 |
| Neiman Marcus Group | 2 | $4,600 | ACE Cash Express Inc. | 39 | $444 |
| Hunt Consolidated Inc. | 9 | $2,300 | HKS Inc. | 40 | $420 |
| Lincoln Property Co. | 13 | $1,900 | Locke Lord Bissell & Liddell | 41 | $401 |
| Austin Industries Inc. | 14 | $1,876 | Sourcecorp Inc. | 44 | $356 |
| Freeman | 19 | $1,377 | Haynes and Boone LLP | 49 | $288 |
| Beck Group | 24 | $977 | Thompson & Knight LLP | 52 | $234 |
| Omni Hotels | 27 | $921 | Mosaic Sales Solutions Holding Co. | 54 | $200 |
| LQ Management LLC | 28 | $848 | Taco Bueno Restaurants Inc. | 55 | $187 |
| Stream Gas & Electric Ltd. | 30 | $825 | Rave Motion Pictures | 57 | $180 |
| Akin Gump Strauss Hauer & Feld LLP | 31 | $781 | Center Operating Co. | 58 | $175 |
| Atrium Companies Inc. | 33 | $650 | Gardere Wynne Sewell LLP | 60 | $170 |
| VHA Inc. | 34 | $625 | Corgan Associates Inc. | 63 | $106 |

Source: Dallas Morning News: Biggest Dallas-Fort Worth Private Companies 2009

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**Figure 4-11. Biggest DFW Public Companies**

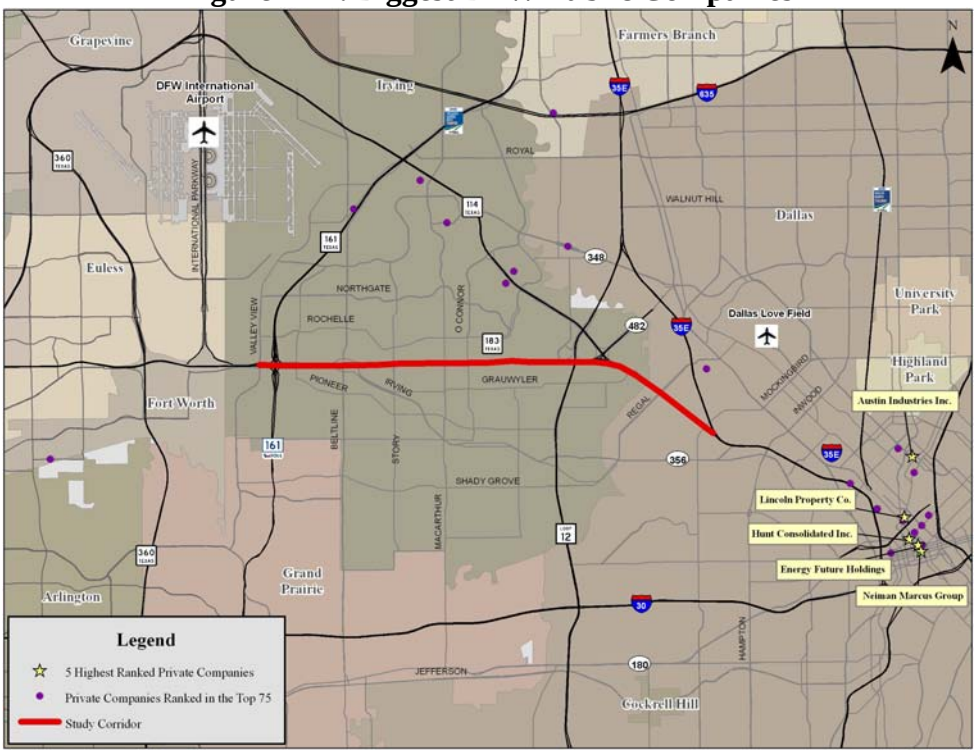


**Figure 4-12. Biggest DFW Private Companies**

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## FUTURE POPULATION AND EMPLOYMENT ALONG THE PROPOSED SH 183 MANAGED LANE CORRIDOR

The population and employment growth between 2000 and 2030 for areas surrounding the proposed SH 183 managed lane corridor disaggregated at the Traffic Survey Zone (TSZ) level is highlighted in **Figures 4-13** through **4-20**.

### POPULATION GROWTH ESTIMATES

**Figure 4-13** identifies the estimated incremental population growth between 2000 and 2030 by TSZ, as provided by NCTCOG. A significant amount of incremental population growth in the southern area of the study region is expected over the next thirty years. Many zones south of Mountain Creek Lake are expected to grow by more than 5,000 residents. High incremental population growth is also expected north of DFW International Airport. The growth within the immediate corridor given the mature nature of the corridor is shown to be minimal over the next thirty years such that the growth in traffic demand within the corridor will most likely be a result of the growth from regions beyond the vicinity of the corridor.

Most zones immediately surrounding the SH 183 corridor are expected to grow within the range of 1 to 500 residents between 2000 and 2030. This in part reflects the mature state of residency in Irving and Dallas, both of which already have high population densities and therefore less capacity to absorb additional growth. Several zones show no growth and reflect either uninhabitable areas such as the industrial parks of the DFW Airport.

The compounded annual population percentage growth rates between 2000 and 2030 are presented in **Figure 4-14**. Most zones in the study area are projected to experience average annual growth rates of 2.5 percent or less during this time period. Again, this is due to the already high population densities of zone surrounding the corridor as well as the uninhabitable areas in the region. Zones further south and north of the corridor around Mountain Creek Lake and Grapevine Lake are expected to experience a higher rate of growth during this time.

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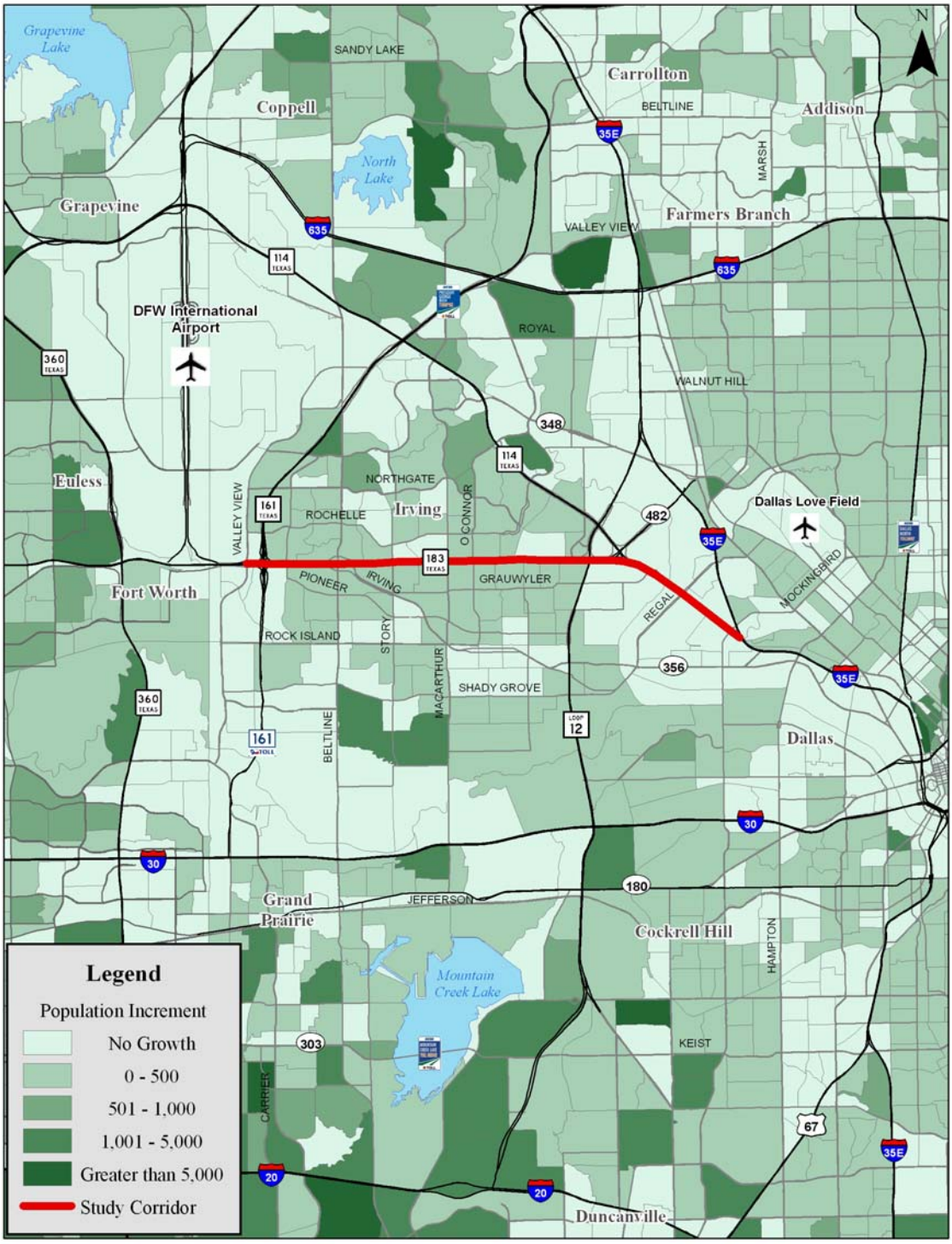


**Figure 4-13. Population Increment (2000 to 2030)**

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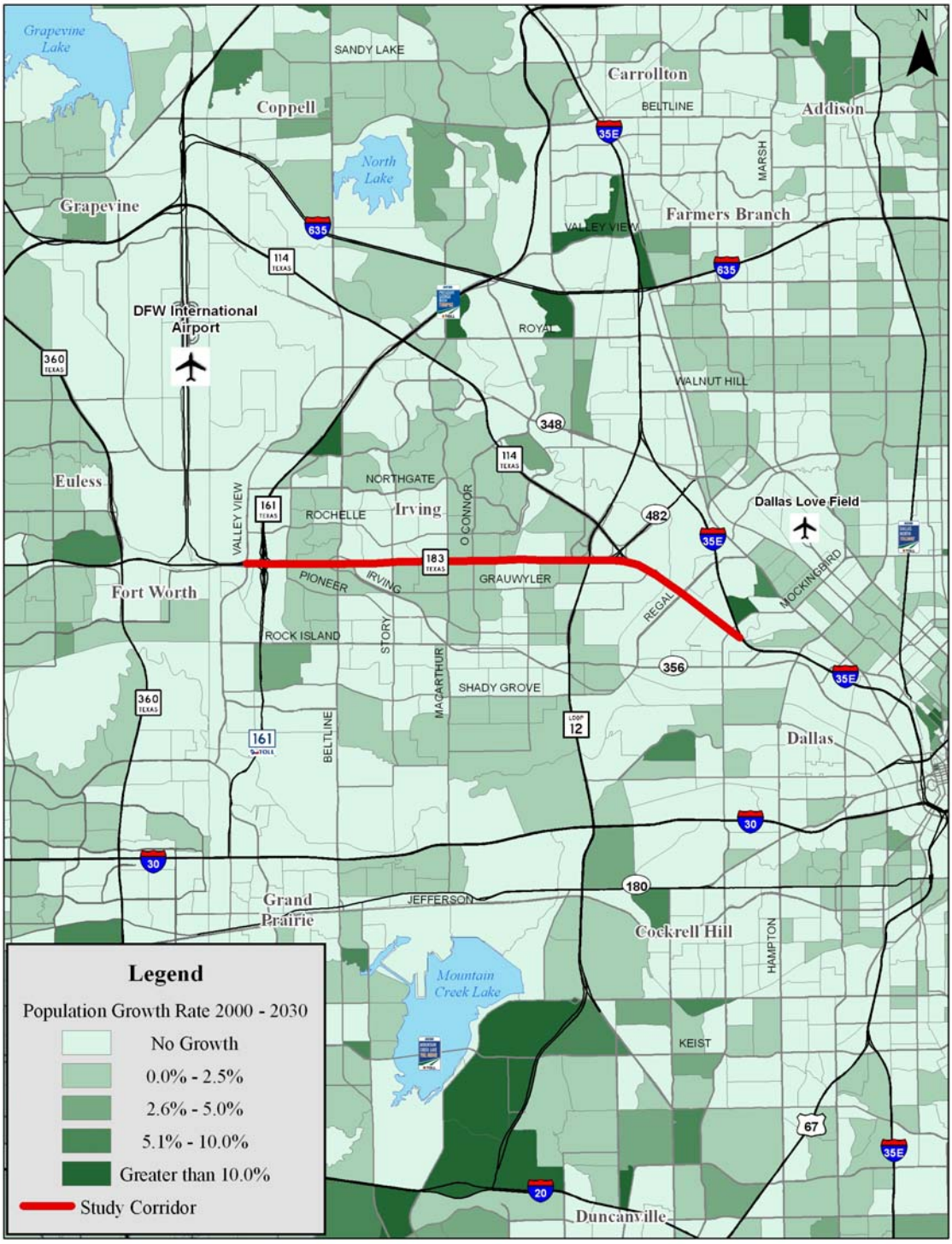


**Figure 4-14. Population Annual Growth (2000 to 2030)**

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**Figures 4-15** and **4-16** show the population densities for TSZ's surrounding the SH 183 managed lane corridor for the years 2000 and 2030 respectively. The population density reflects the number of residents per acre within each zone. Population density is expected to remain relatively similar between 2000 and 2030.

In 2000, the zones directly surrounding the study corridor were highly dense with many zones having more than 10 residents per acre. Since the region is highly industrial and rich in employment, there are a large amount of zones with less than 1 person per acre. Many of these zones, such as those within the DFW International Airport, are uninhabitable.

By 2030, zones in the northern and southern portions of the study region will see some increase in population density. Zones surrounding Grapevine Lake and Mountain Creek Lake are expected to become denser by 2030.

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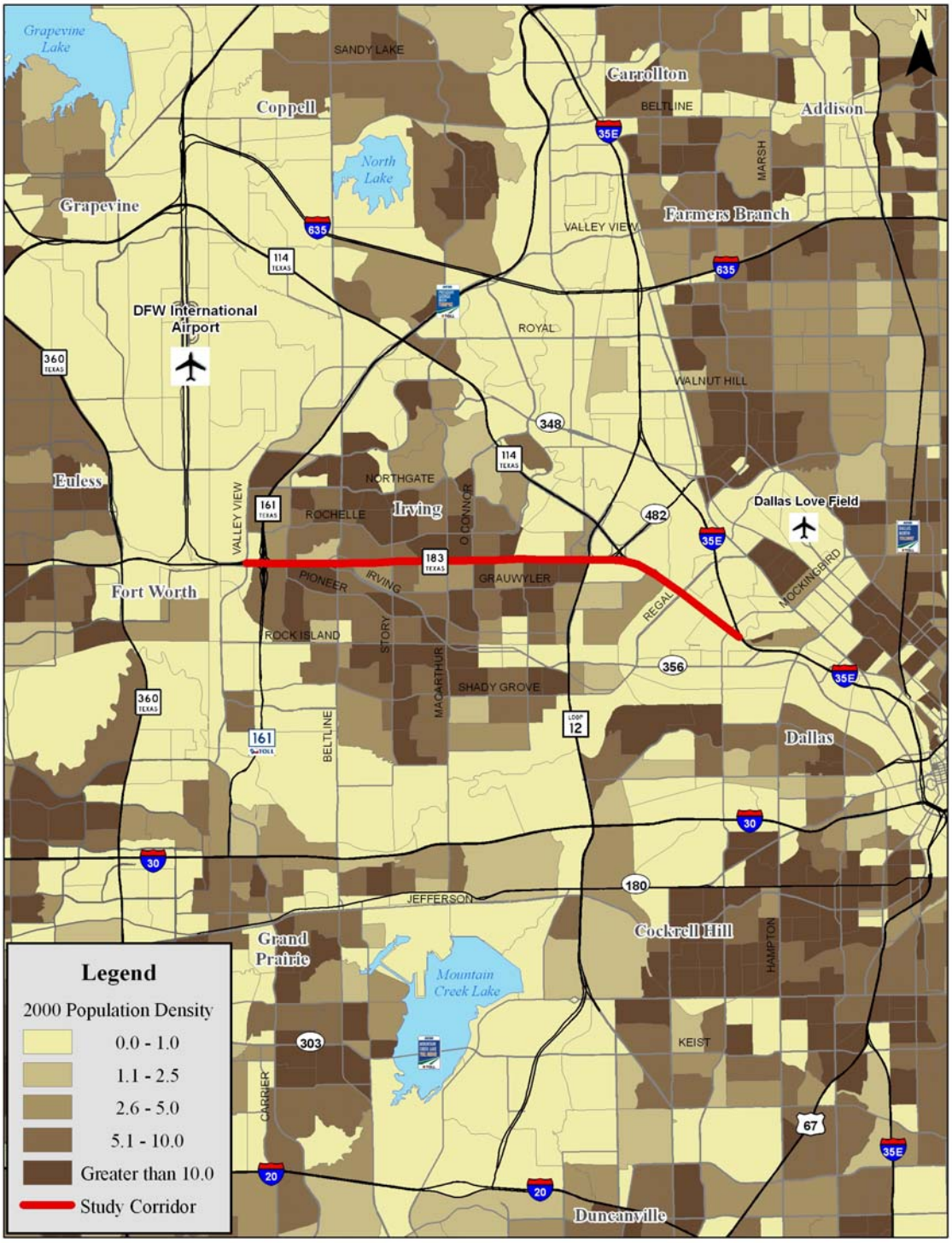


**Figure 4-15. 2000 Population Density**

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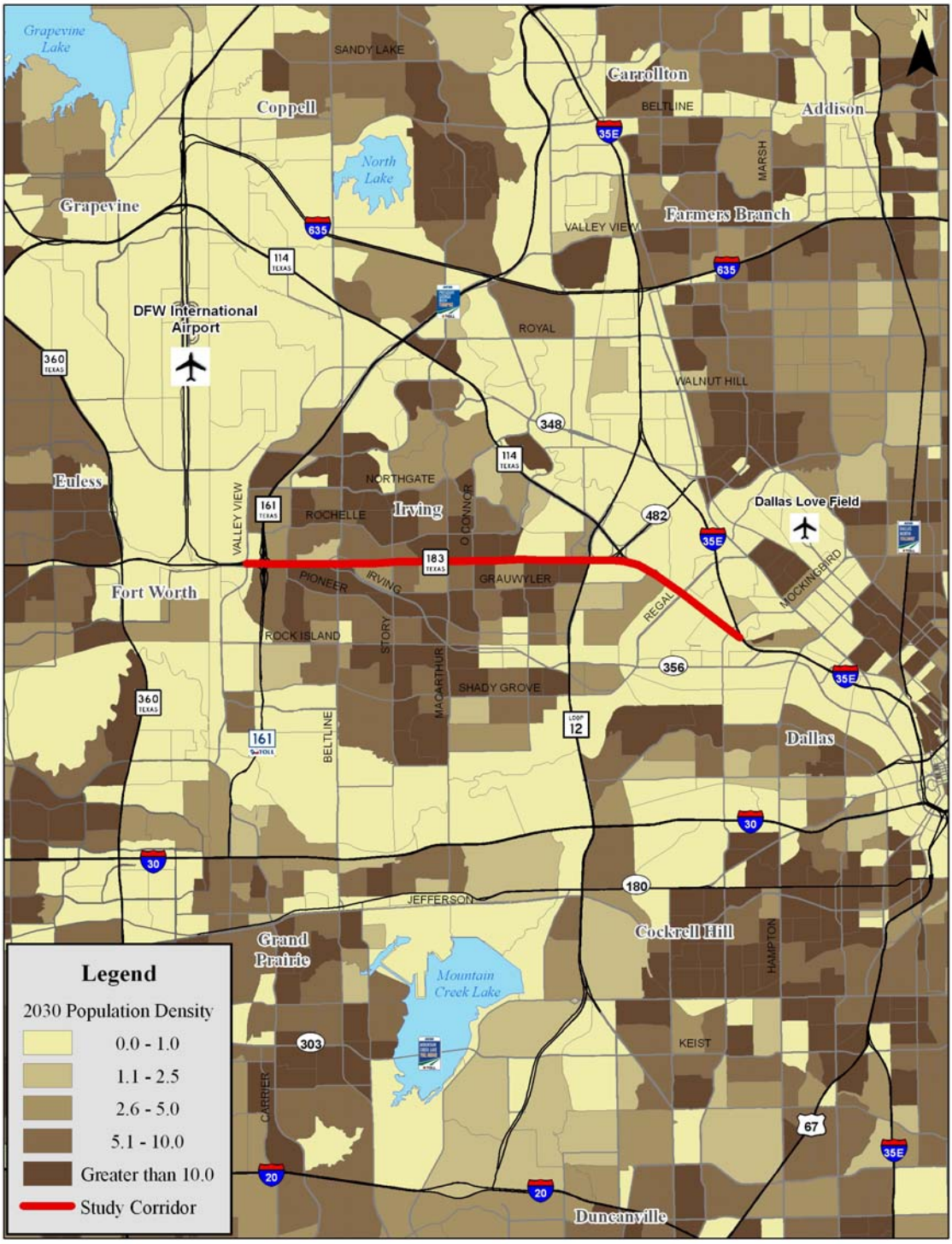


**Figure 4-16. 2030 Population Density**

### EMPLOYMENT GROWTH ESTIMATES

**Figure 4-17** identifies the estimated incremental employment growth between 2000 and 2030, as provided by NCTCOG. The zones surrounding DFW International Airport just north and west of the study corridor are expected to see high incremental employment growth over the next 30 years. The zones directly north and south of the SH 183 study corridor are only expected to see employment growth of less than 250 employees. This is predominately a result of the highly residential composition of this area that the maturation of the population and employment within these zones.

The compounded annual employment percentage growth rate from 2000 to 2030 is presented in **Figure 4-18**. Several zones at the south end of DFW International Airport, directly west of the study corridor, are projected to experience high average annual growth rates of greater than 10.0 percent during this time. High growth is also expected in zones around Grapevine Lake to the northwest of the corridor.

**Figures 4-19** and **4-20** show the employment densities for the TSZ's surrounding the SH 183 managed lane corridor for the years 2000 and 2030 respectively. Many of the zones particularly to the north of the SH 183 corridor within the study area are expected to see a significant increase in employment density from 2000 to 2030.

In 2000, there were several zones just east of the SH 183 managed lane corridor that had high employment densities that were greater than 10.0 employees per acre. The zones in and surrounding downtown Dallas already had high density along with several zones directly along IH 35E north of SH 183. By 2030, the employment density is expected to greatly increase in zones just north of the study corridor many of the zones are expected to reach densities of greater than 10.0 employees per acre. The majority of the zones directly to the south of the corridor are expected to maintain their 2000 employment densities given the mature and established nature of the development within these zones.

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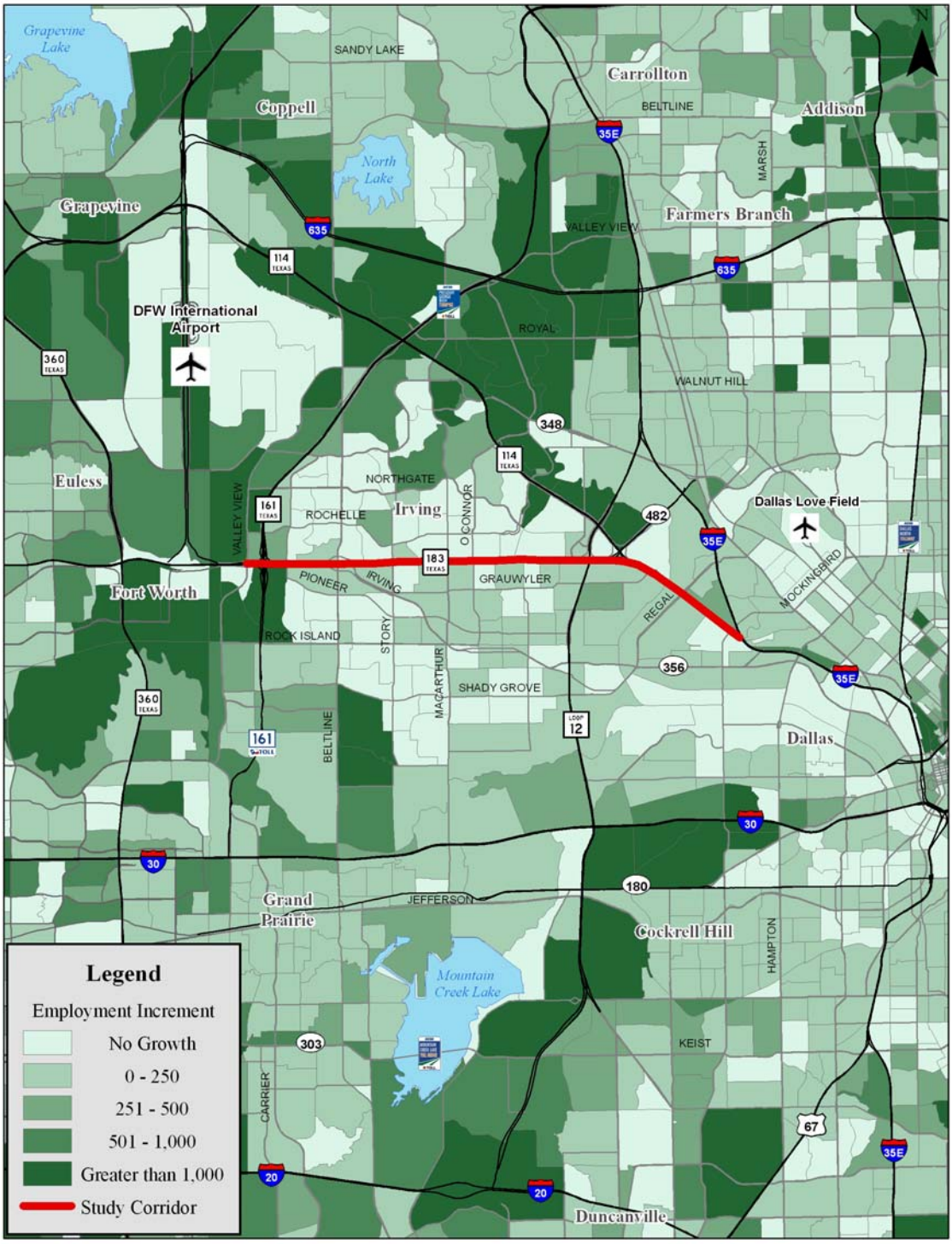


**Figure 4-17. Employment Increment (2000 to 2030)**

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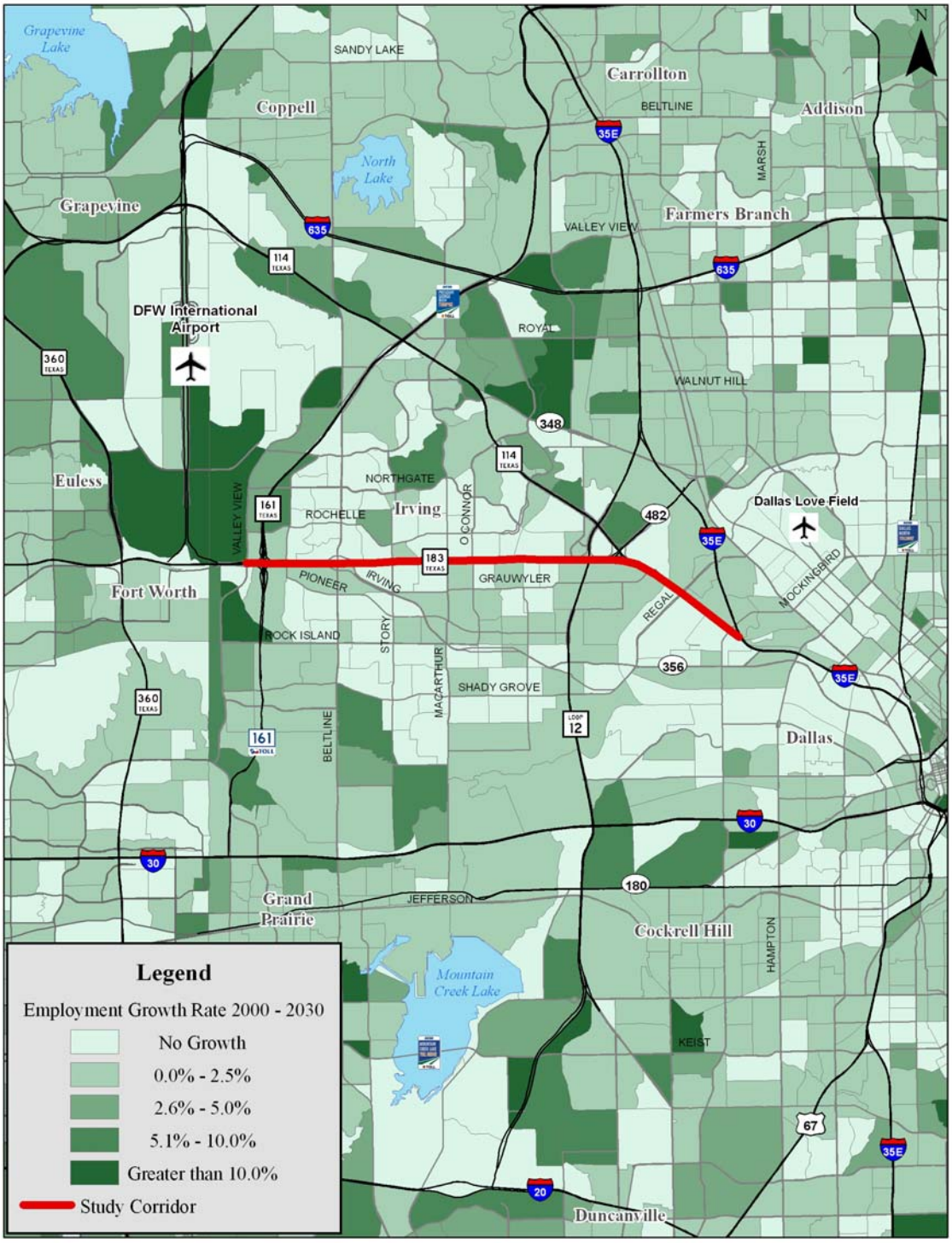


**Figure 4-18. Employment Annual Growth (2000 to 2030)**

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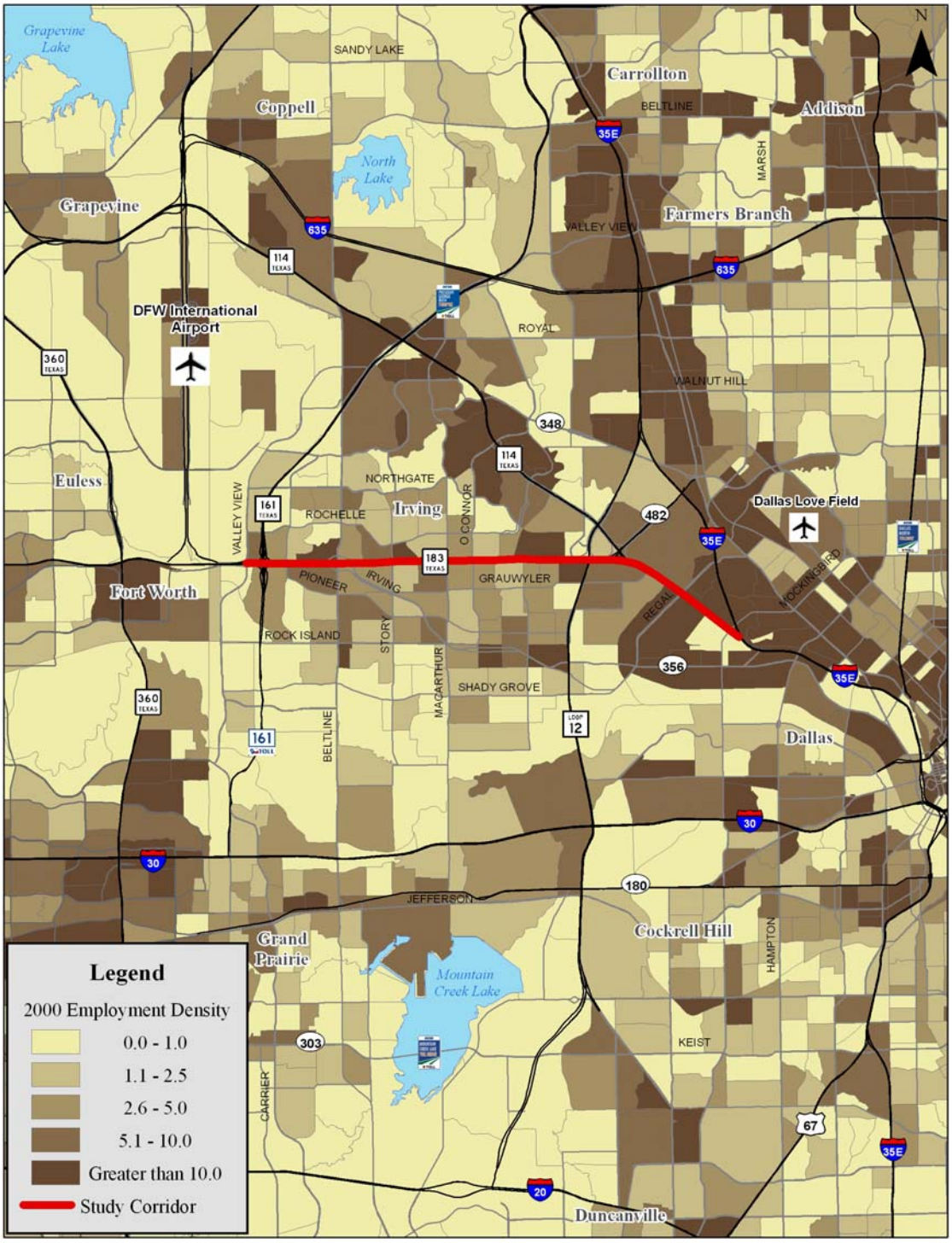


**Figure 4-19. 2000 Employment Density**

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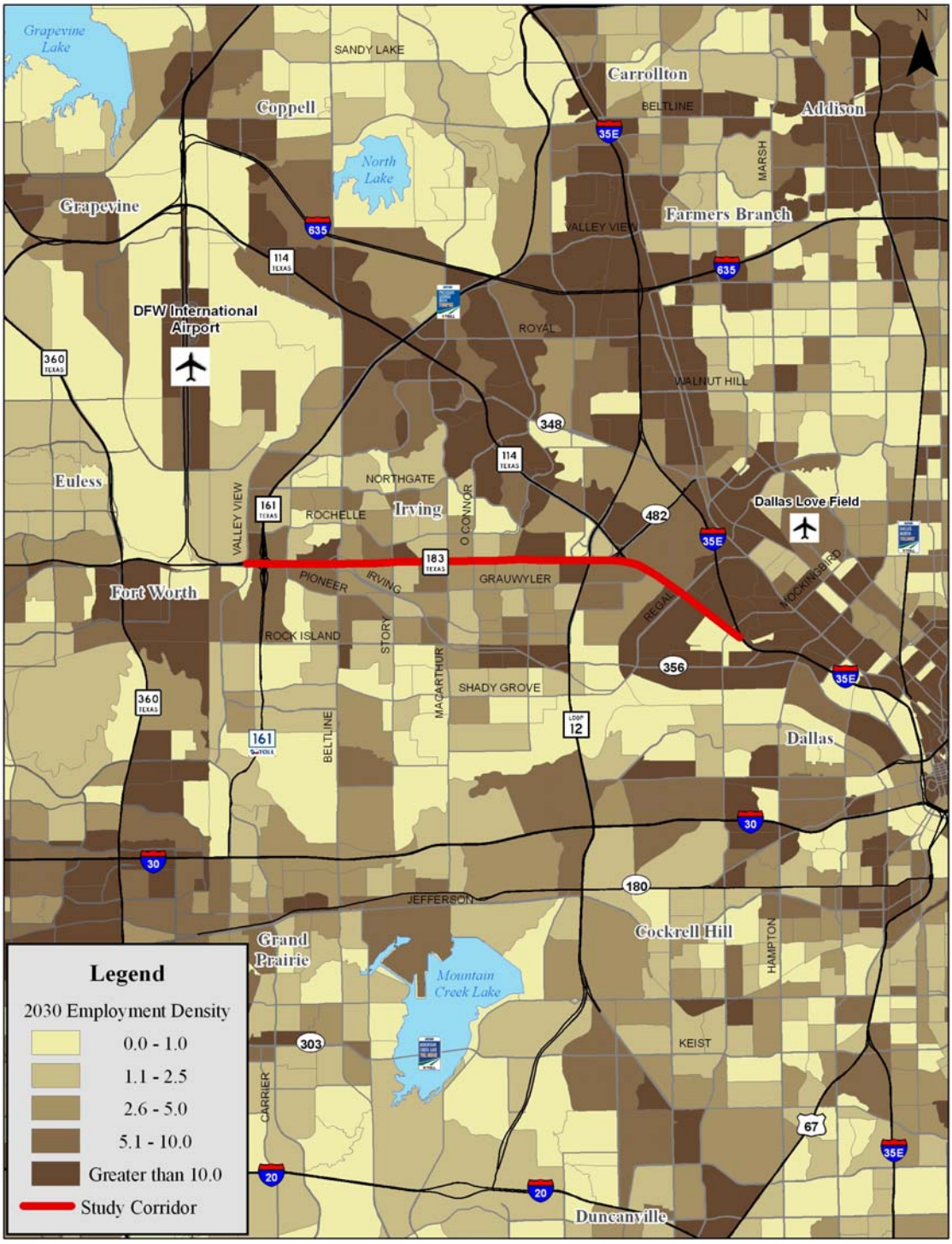


**Figure 4-20. 2030 Employment Density**

***Projected Future Growth Profiling***

The population growth in the Dallas region has recently been exceeding the State Data Center growth trends consistently over the past eight years. Long-term trends from the historical census also indicate that the forecasts have been continuously outpacing the projections that were made historically. The Dallas region, in particular, has shown that its current population growth, as defined by the July 1, 2008 Census Population Vintage estimate series for metropolitan statistical areas published in March 2009, has been outpacing the projected growth, such that the 2008 population levels for the Dallas region are higher than the State Data Center 0.5 migration scenario projections for 2010, as illustrated below in **Figure 4-21**.

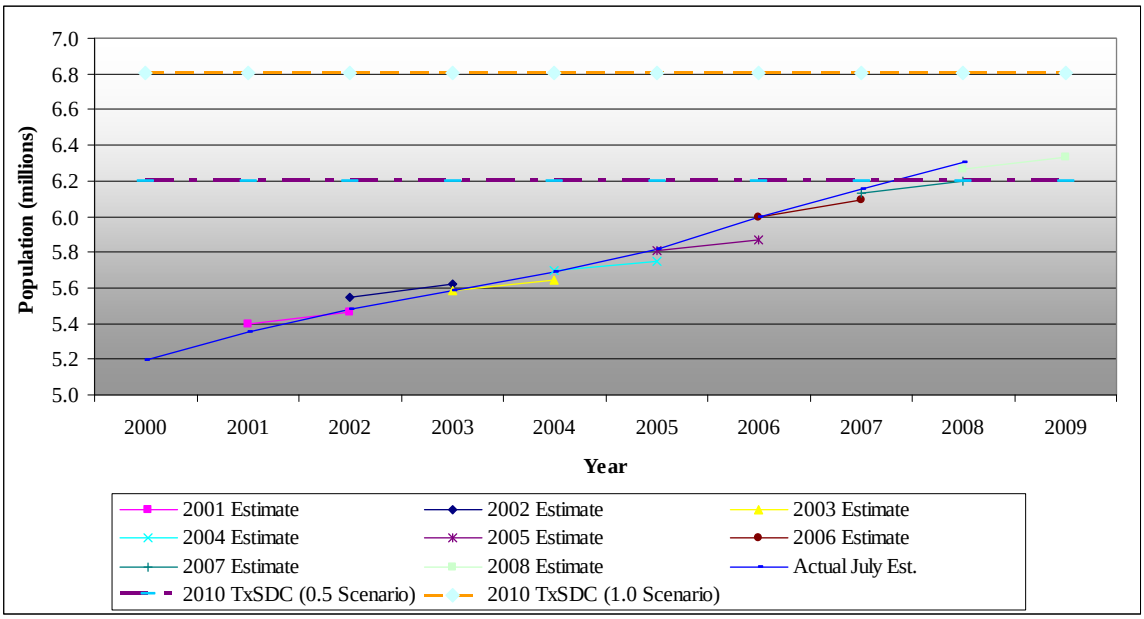


**Figure 4-21. Dallas MSA Regional Short-term Forecasts**

A further look at the growth patterns of all ten counties show a similar trend, whereby the current trends are either very close to or exceeding most of the previously forecasted trends, as illustrated in **Figure 4-22**. The NCTCOG model and regional demographics will typically benchmark their forecast to fall between the TSDC's 0.5 migration scenario and 1.0 percent migration scenario. As illustrated, the July 1, 2008 Census Population Vintage estimate series published in March 2009 shows that the 2008 population estimates are already very close to the 2010 TSDC 0.5 Scenario forecasts for the ten-county region.

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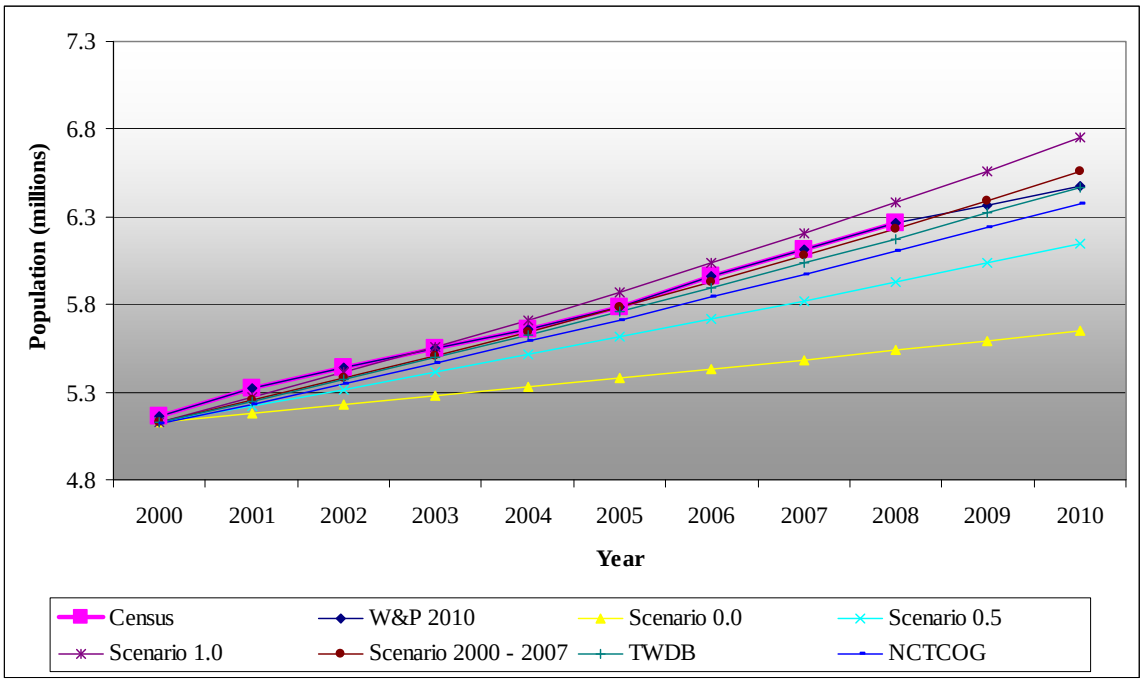


**Figure 4-22. Ten-County Region Short-term Population Forecasts**

A review of the long-term forecasts from several sources is illustrated in **Figure 4-23** shows that the recent trends, as depicted by the 2000-2007 Scenario, exceeded most sources of forecasts when compared to the Texas Water Development Board, the State Data Center, and the Woods and Poole data sources. The 2000-2007 Scenario, which falls between the 0.0 and 0.5 migration scenarios and the 2030 NCTCOG demographic forecasts that were recently adopted by the NCTCOG as part of the 2030 MTP, are also shown to fall within a similar range.

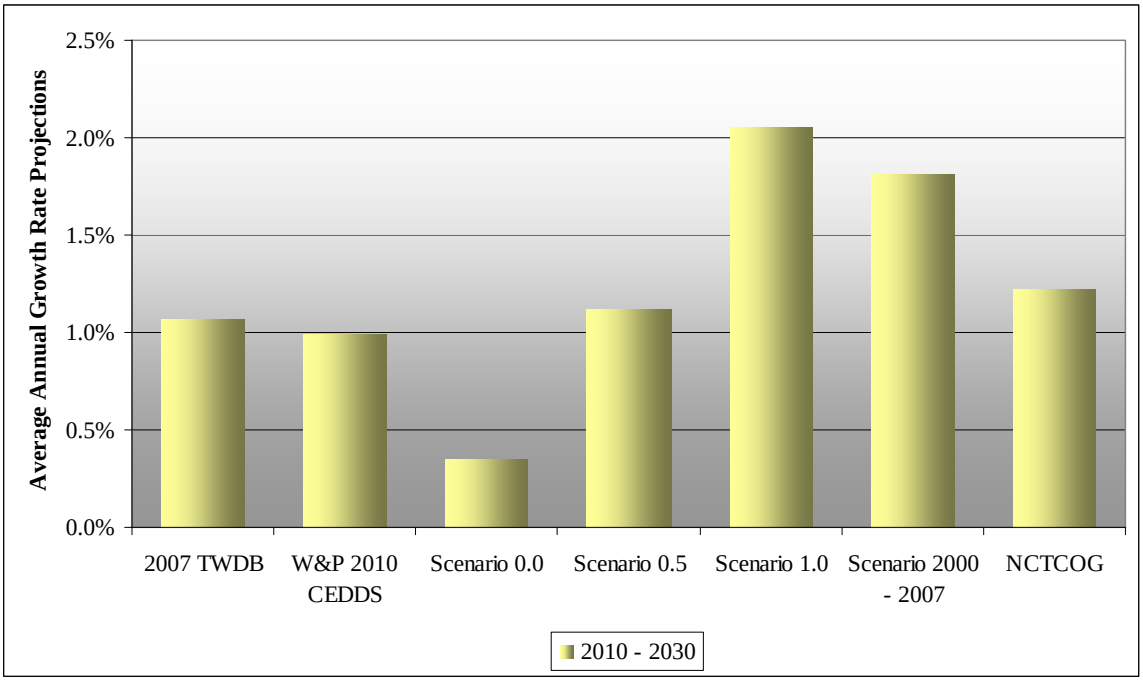


**Figure 4-23. Ten-County Region Long-term Average Annual Growth**

The recent trends provide evidence that the region has grown faster than expected over the past eight years. It is worth noting that the current 2030 MTP baseline demographics already takes into account the normalization effect as a result of the trends between 2000 and 2005.

## OTHER ECONOMIC INDICATORS

### CONSUMER PRICE INDEX

The consumer price index for all urban consumers (CPI-U) is the most widely used measure of inflation and serves as an economic indicator. The CPI-U determines the aggregate price level of a specific market basket of goods and services that are consumed by typical urban households. This is done by calculating the average going price of each item in the market basket. Food, clothing, housing, transportation (including tolls) and entertainment are all included in the basket. Not included are income taxes and investment items such as stocks and bonds. The Bureau of Labor and Statistics of the U.S. Department of Labor calculates the CPI-U every month.

$$CPI-U \text{ for a given time frame} = \frac{\text{Cost of market basket in given time frame}}{\text{Cost of market basket in base time frame}} \times 100$$

The consumer price index for the base time frame (1982-1984) is 100. Inflation is determined by finding the percentage change in the CPI-U from one year to the next.

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**Table 4-14** gives the historical trends for CPI-U from 1998 through 2009 for the Dallas-Fort Worth Metro Area. Annual inflation is shown in two different ways: the change in the yearly average CPI-U and the change in the CPI-U for November year-to-year.

As seen in **Table 4-14**, inflation has recently experienced a steep and rapid decrease As a result of the economic recession, and fall demand that has affect prices. From 2008 to 2009, the CPI-U decreased by 0.6 percent compared to a much higher increase of 4.4 percent between 2007 and 2008. The CPI-U was 198.6 in January of 2009 but showed a slight increase to 202.1 by January of 2010.

**Figure 4-24** illustrates the long-term trend of CPI-U from 1967 to 2009 for the Dallas-Fort Worth MSA, the Southern Region, and the United States. The average annual growth rates have historically been consistently similar for all three CPI-U indices. **Figure 4-25** illustrates the average annual growth of the CPI-U for the Dallas-Fort Worth metropolitan area which spiked in the late 1970's but has maintained moderate levels since then.

**Table 4-14**
**Consumer Price Index for the Dallas-Fort Worth Metro Area**

| Year | January | March | May | July | September | November | Annual Average | Inflation (Avg to Avg) | Inflation (Jan toJan) |
|---|---|---|---|---|---|---|---|---|---|
| **1998** | 152.1 | 153.0 | 153.0 | 154.2 | 154.5 | 154.0 | 153.6 | *** | *** |
| **1999** | 155.0 | 156.4 | 157.2 | 158.3 | 159.8 | 160.1 | 158.0 | 2.9% | 1.9% |
| **2000** | 160.4 | 163.1 | 163.2 | 166.2 | 166.9 | 166.8 | 164.7 | 4.2% | 3.5% |
| **2001** | 167.3 | 168.9 | 169.4 | 171.5 | 172.8 | 171.5 | 170.4 | 3.5% | 4.3% |
| **2002** | 170.6 | 172.1 | 172.9 | 172.9 | 173.2 | 173.6 | 172.7 | 1.3% | 2.0% |
| **2003** | 174.0 | 176.8 | 176.9 | 176.5 | 177.0 | 175.9 | 176.2 | 2.0% | 2.0% |
| **2004** | 175.7 | 177.7 | 179.1 | 179.1 | 179.7 | 179.9 | 178.7 | 1.4% | 1.0% |
| **2005** | 180.0 | 181.3 | 183.5 | 184.3 | 188.9 | 187.8 | 184.7 | 3.4% | 2.4% |
| **2006** | 188.6 | 188.4 | 191.2 | 191.7 | 192.0 | 188.4 | 190.1 | 2.9% | 4.8% |
| **2007** | 188.9 | 190.2 | 192.8 | 194.3 | 194.8 | 196.5 | 193.2 | 1.7% | 0.2% |
| **2008** | 197.1 | 198.6 | 202.4 | 206.4 | 205.9 | 200.1 | 201.8 | 4.4% | 4.3% |
| **2009** | 198.6 | 200.0 | 199.3 | 200.7 | 201.8 | 202.0 | 200.5 | -0.6% | 0.8% |
| **2010** | 202.1 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.8% |

Source: Bureau of Labor Statistics

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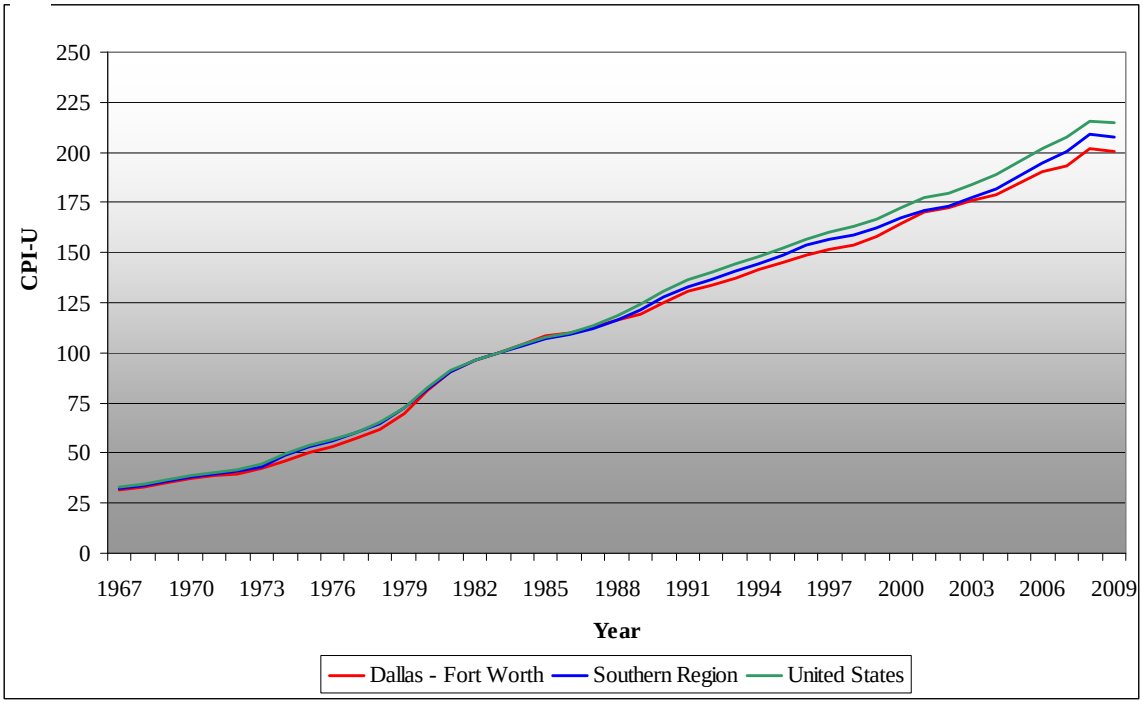


**Figure 4-24. CPI-U (1967 – 2008)**

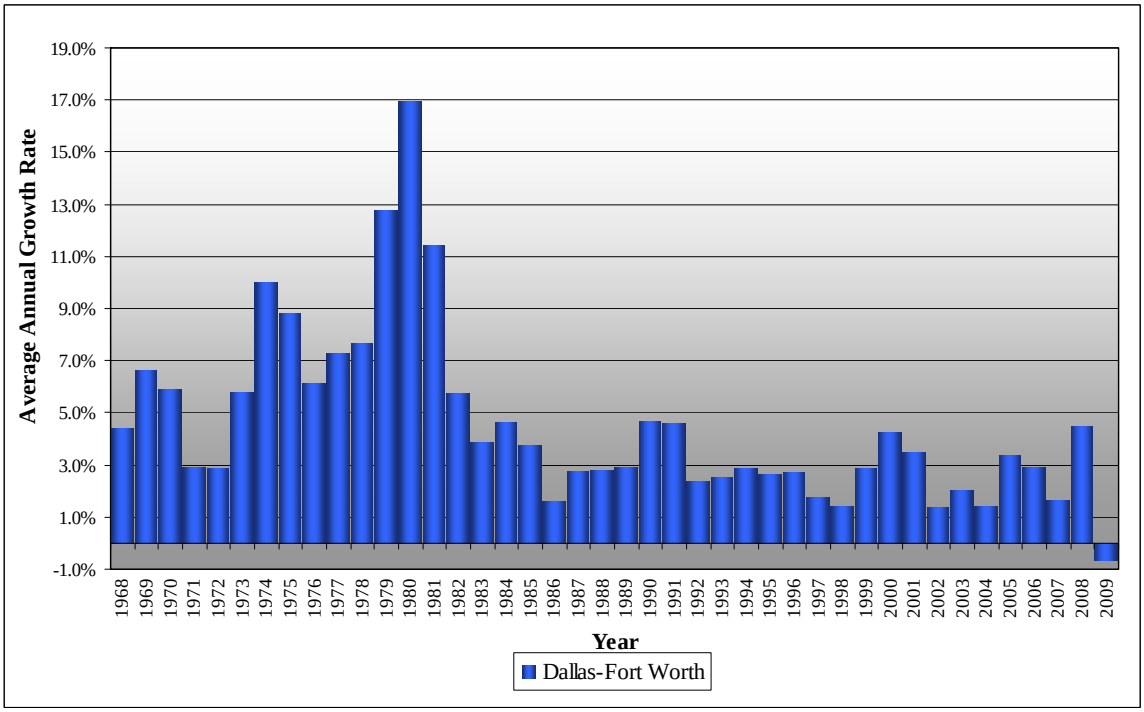


**Figure 4-25. DFW Inflation Rate ( 1967 – 2008)**

A review of the long-term consumer price index (CPI) is useful for determining future CPI projections and escalation of the estimated future value-of-times (VOTs). Comparable markets to the Dallas MSA include the Houston, and Southern Region and are summarized in **Figure 4-26**. As exhibited, the average annual growth between 1970 and 2008 was approximately 4.6 percent for the Dallas, Houston, and Southern Region. Over the 24-year period (1985-2009), the average CPI ranged from 2.6 to 3.0 percent. The assumed 2.75 percent per year value-of-time escalation that is used as part of this study falls in the middle range of the historical trend.

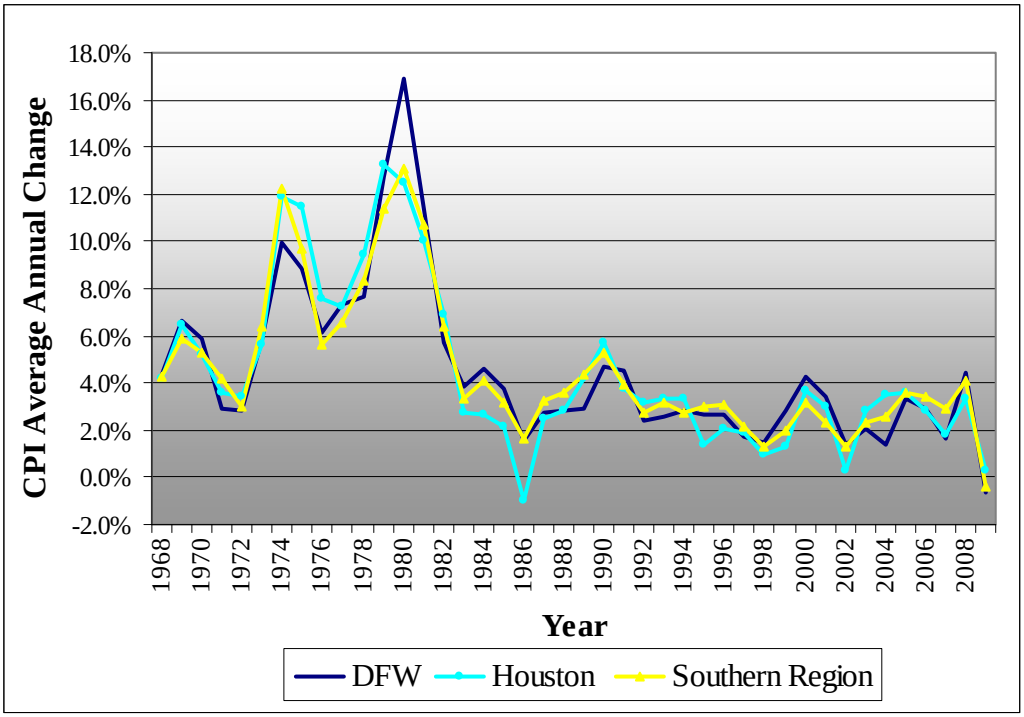


**Figure 4-26. Consumer Price Index (CPI) Historical Trends**

### Residential Housing Activity

The number of homes that are sold and the amount of time that those homes are on the market is typically indicative of the strength of the economy. Sustained growth in the number of homes sold in combination with declining inventories indicates a strong housing market and serves as an indicator of regional economic strength. Trends in residential housing activity, including the number of homes sold, the median price, and the average monthly inventories are presented for the Dallas Multiple Listing Service (MLS) Area and the state of Texas in **Table 4-15**.

In 1990, homes stayed on the market for an average of 14.1 months in the Dallas MLS. By 2009, the average month's inventory had dropped to only 6.3 months. Similar

numbers were seen for the State of Texas with an average of 11.6 months inventory in 1990 dropping to 6.9 months in 2009. It should be noted that the average month's inventory has increased from 2006 to 2009 by 0.7 percent in the Dallas MLS and 1.9 percent in the state of Texas.

The number of homes sold in the Dallas MLS increased at an average annual rate of 5.2 percent from 1990 to 2009 while the median price of homes sold increased at an average annual rate of 3.0 percent. In Texas, the number of homes sold increased at an average annual rate of 4.1 percent and the median price increased at an average annual rate of 4.1 percent.

### Trends in Building Permits

The housing industry accounts for a large percentage of investment spending. Building permits are one of the leading economic indicators as they help predict what the economy will be like in the near future. Sustained declines in building permits slow the economy and can be indicative of a potential recession. Likewise, increases in this leading indicator can be a key indicator of possible economic growth. Building permit activity provides some short-term insight into housing and overall economic activity in the upcoming months.

Building permits are also useful for creating revised demographics that normalize the 2003 NCTCOG demographic forecasts to existing trends. New homes being built typically indicate expected population growth within the area. **Figure 4-27** illustrates the historical trend in single family building permits from 1980 to 2009 for Dallas and Tarrant Counties. Tarrant County historically experienced very strong growth in single family building permits and has issued more permits than County since 2000. Both counties have experienced a decrease in single family permits issued from 2006 to 2009.

A comparison of the annual growth rate year-to-year from 1980 to 2009 is illustrated in **Figure 4-28** for Dallas and Tarrant Counties as well as the state of Texas and the United States. All areas saw a negative growth rate from 2006 to 2009; however the number of single-family permits has been decreasing at a lower rate since 2008.

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**Table 4-15**
**Residential Housing Activity**
**Home Sale and Market Inventory Trends**

| Year | Dallas MLS | | | State of Texas | | |
|---|---|---|---|---|---|---|
| | Number of Homes Sold | Average Months Inventory [1] | Median Price | Number of Homes Sold | Average Months Inventory [1] | Median Price |
| 1990 | 17,528 | 14.1 | $88,600 | 99,939 | 11.6 | $68,000 |
| 1991 | 16,858 | 13.8 | $86,100 | 99,408 | 10.5 | $71,200 |
| 1992 | 19,742 | 11.3 | $86,000 | 107,107 | 9.6 | $75,200 |
| 1993 | 21,406 | 9.2 | $88,800 | 116,604 | 8.5 | $78,200 |
| 1994 | 22,999 | 7.8 | $91,800 | 122,134 | 7.0 | $80,000 |
| 1995 | 24,968 | 7.8 | $92,700 | 121,901 | 7.6 | $81,600 |
| 1996 | 30,128 | 6.3 | $94,900 | 137,854 | 7.3 | $86,300 |
| 1997 | 33,884 | 5.3 | $101,500 | 146,395 | 6.8 | $90,600 |
| 1998 | 40,051 | 4.1 | $107,400 | 170,638 | 5.2 | $96,200 |
| 1999 | 43,199 | 4.0 | $116,100 | 184,054 | 4.6 | $100,900 |
| 2000 | 45,446 | 3.8 | $121,400 | 188,738 | 4.5 | $112,100 |
| 2001 | 46,992 | 4.6 | $134,300 | 196,401 | 5.1 | $119,400 |
| 2002 | 47,199 | 5.5 | $141,500 | 201,528 | 5.4 | $124,500 |
| 2003 | 49,278 | 6.5 | $144,900 | 215,834 | 6.1 | $127,800 |
| 2004 | 54,514 | 6.3 | $148,500 | 240,733 | 5.9 | $129,700 |
| 2005 | 59,980 | 5.8 | $149,600 | 266,842 | 5.4 | $136,800 |
| 2006 | 64,226 | 5.6 | $154,800 | 292,805 | 5.0 | $142,900 |
| 2007 | 59,695 | 6.0 | $156,900 | 275,584 | 5.6 | $147,300 |
| 2008 | 50,848 | 6.2 | $159,700 | 232,388 | 6.6 | $146,900 |
| 2009 | 45,778 | 6.3 | $156,000 | 213,181 | 6.9 | $145,800 |
| **AAPC [2]** | 5.2% | *** | 3.0% | 4.1% | *** | 4.1% |

[1] Average number of months homes are on the market.
[2] Average Annual Percentage Change

Source: Real Estate Center at Texas A&M University

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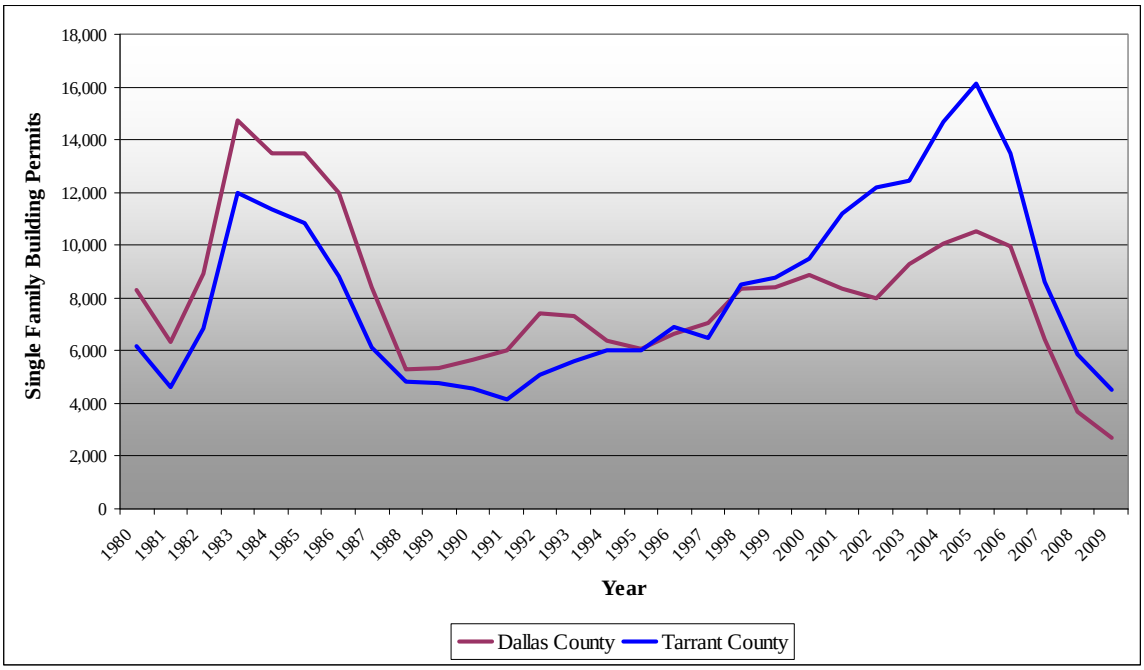


**Figure 4-27. Single Family Building Permits by County**

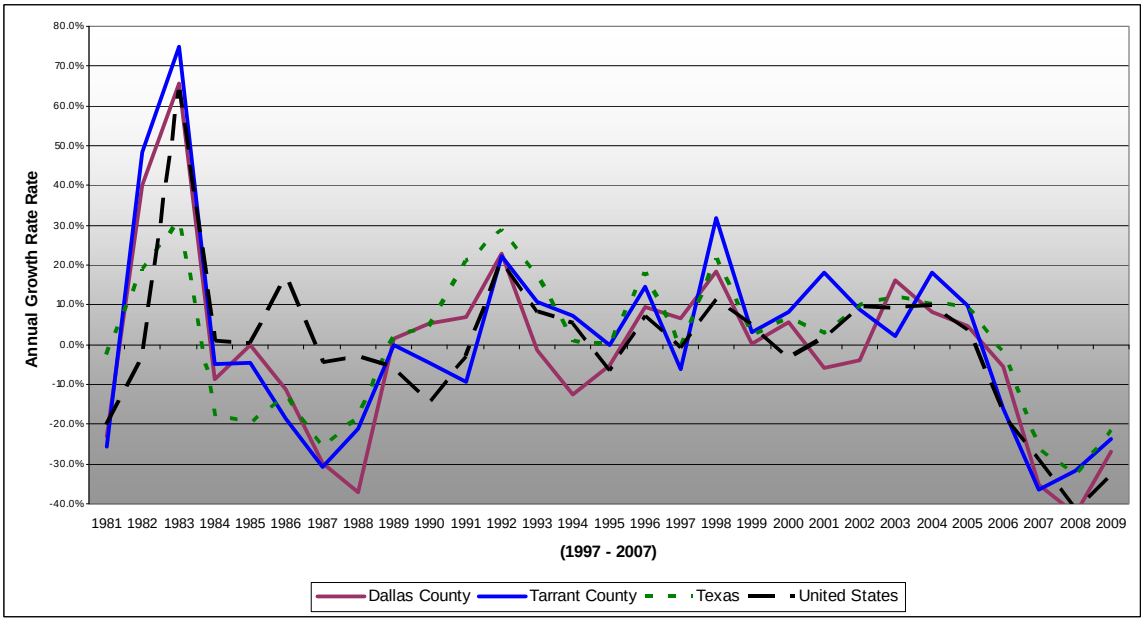


**Figure 4-28. Annual Growth Rate in Single Family Building Permits**

## REVISED DEMOGRAPHICS

The travel demand models developed by NCTCOG as part of the 2030 Mobility Plan – utilized as the baseline for this study – are based on the demographic forecasts developed in 2003 using the Census 2000 survey. The NCTCOG is in the process of developing the 2040 demographic forecast, which will use 2005 data as the new baseline. The 2005 base data was published in 2008, however, the demographic forecasts for other years are still under the internal review and were not available for use in this study. As part of the economic growth analysis and demographic forecast review, revised demographics were created to take into account the more recent economic and demographic data since 2003 and to incorporate any changes of growth trends within the region made from the recent 2005 base data.

The process employed to develop the revised demographic included reviewing the recent developments along the study corridor, updating the future year forecasts based on the 2005 base data to reflect any potential changes to the growth trend within the region, evaluating the county and regional control totals of NCTCOG's demographic forecast by comparing these to forecasts from other sources, modifying the county population forecast control totals based on the evaluation, allocating the county control totals into the traffic analysis zone (TAZ) level based on NCTCOG's forecasts and performing various checks to ensure the reasonableness of population forecasts in the TAZ level. The employment forecast at the TAZ level was modified based on the revised population forecast by considering the population/employment ratio will remain similar to NCTCOG's forecasts and was then reviewed for reasonableness. The demographic forecast sources reviewed as part of the revised demographic process included the Texas State Data Center (TSDC), the Texas Water Development Board (TWDB), the North Central Texas Council of Governments (NCTCOG), and Woods and Poole (W&P).

The qualifier "official" is used to refer to the NCTCOG demographics datasets, which were prepared by NCTCOG in 2003. The population and employment forecasts developed by WSA to update the NCTCOG official demographic datasets in the counties surrounding the IH 35E corridor are referred to as the "revised" demographic datasets. The baseline traffic and revenue estimates for the IH 35E managed lane project included in this report were developed using the developed revised demographics datasets.

**Tables 4-16** and **4-17** show a comparison of the official and revised demographic (population and total employment) projections for Collin, Dallas, Denton and Tarrant Counties for year 2010, 2020 and 2030 respectively. The revised population and employment estimates are in general higher than the official demographics developed by NCTCOG. The population from 1990 and 2000 Census survey and the 2005 base data are added to the population comparison table to show the historical population growth in these counties. Population in Collin County has been growing at an annual average

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growth rate of 6.4 percent from 1990 to 2000 and 5.7 percent from 2000 to 2005. Recent development within this county indicates that it is still experiencing strong growth. Given these recent trends, it is more reasonable to assume a higher population growth rate for the period of 2005 to 2010 than the 2.9 percent growth rate estimated by NCTCOG. This increased growth rate, however, was gradually decreased in the following decades. Similar trends were found for the other three counties that were evaluated. The employment forecasts were also adjusted upward for the revised demographics in the range of 14 to 20 percent for Collin and Denton counties and 6 to 9 percent for Dallas and Tarrant counties respectively to reflect the observed current trends.

**Table 4-16**
**Comparison of Official and Revised Population Projections**

| Year | Collin County | | Dallas County | | Denton County | | Tarrant County | |
|---|---|---|---|---|---|---|---|---|
| | Official | Revised | Official | Revised | Official | Revised | Official | Revised |
| **1990** | 264,036 | 264,036 | 1,852,810 | 1,852,810 | 273,525 | 273,525 | 1,170,103 | 1,170,103 |
| **2000** | 491,675 | 491,675 | 2,218,899 | 2,218,899 | 432,976 | 432,976 | 1,446,219 | 1,446,219 |
| **2005** | 658,877 | 658,877 | 2,303,568 | 2,303,568 | 556,479 | 556,479 | 1,618,151 | 1,618,151 |
| **2010** | 749,343 | 792,345 | 2,486,989 | 2,512,225 | 643,572 | 691,428 | 1,746,082 | 1,812,914 |
| **2020** | 938,681 | 1,120,523 | 2,624,989 | 2,729,729 | 862,332 | 1,013,078 | 2,047,553 | 2,188,782 |
| **2030** | 1,166,645 | 1,482,055 | 2,817,191 | 2,930,268 | 1,085,343 | 1,322,222 | 2,291,723 | 2,509,999 |
| **Growth Rate 1990-2000** | 6.4% | 6.4% | 1.8% | 1.8% | 4.7% | 4.7% | 2.1% | 2.1% |
| **Growth Rate 2000-2005** | 6.0% | 6.0% | 0.8% | 0.8% | 5.1% | 5.1% | 2.3% | 2.3% |
| **Growth Rate 2010-2020** | 2.3% | 3.5% | 0.5% | 0.8% | 3.0% | 3.9% | 1.6% | 1.9% |
| **Growth Rate 2020-2030** | 2.2% | 2.8% | 0.7% | 0.7% | 2.3% | 2.7% | 1.1% | 1.4% |

Note: 1. Official data represent NCTCOG demographic forecast; revised represent revised demographic developed by WSA.
2. 1990 and 2000 represent census actual; 2005 data are adapted from NCTCOG annual population estimate.

**Table 4-17**
**Comparison of Official and Revised Employment Projections**

| Year | Collin County | | Dallas County | | Denton County | | Tarrant County | |
|---|---|---|---|---|---|---|---|---|
| | Official | Revised | Official | Revised | Official | Revised | Official | Revised |
| **2010** | 291,456 | 355,096 | 2,052,703 | 2,205,415 | 227,394 | 254,555 | 1,072,516 | 1,165,659 |
| **2020** | 414,402 | 482,121 | 2,351,172 | 2,499,047 | 327,180 | 373,178 | 1,264,095 | 1,370,246 |
| **2030** | 527,853 | 612,763 | 2,540,076 | 2,706,060 | 423,293 | 494,339 | 1,393,459 | 1,511,928 |
| **Growth Rate 2010-2020** | 3.6% | 3.1% | 1.4% | 1.3% | 3.7% | 3.9% | 1.7% | 1.6% |
| **Growth Rate 2020-2030** | 2.4% | 2.4% | 0.8% | 0.8% | 2.6% | 2.9% | 1.0% | 1.0% |

Note: 1. Official data represent NCTCOG demographic forecast; revised represent revised demographic developed by WSA.

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**Figure 4-29** illustrates a four-county comparison of the WSA revised population forecasts with the population forecasts of various sources that include Woods and Poole (W&P), Texas State Data Center (TSDC) forecasts with three migration scenarios and 2000-2004 update, namely TSDC 0.0, TSDC 0.5, TSDC 1.0 and TSDC 2000-2004, Texas Water Development Board (TWDB), and the North Central Texas Council of Governments (NCTCOG) 2030 mobility plan demographic forecast (COG 2030 MP). As shown, revised demographics are in general higher than NCTCOG's demographic forecast with slight upward adjustment for Dallas and Tarrant County and relatively larger adjustment for Collin and Denton Counties. The revised demographic represents a moderate to high growth expectation compared to other sources of forecasts. The revised demographics were applied to the NCTCOG travel demand model to develop another set of trip tables, which are referred to as the "revised trip tables" in the following chapters and serve as the basis for the baseline traffic and revenue estimates.

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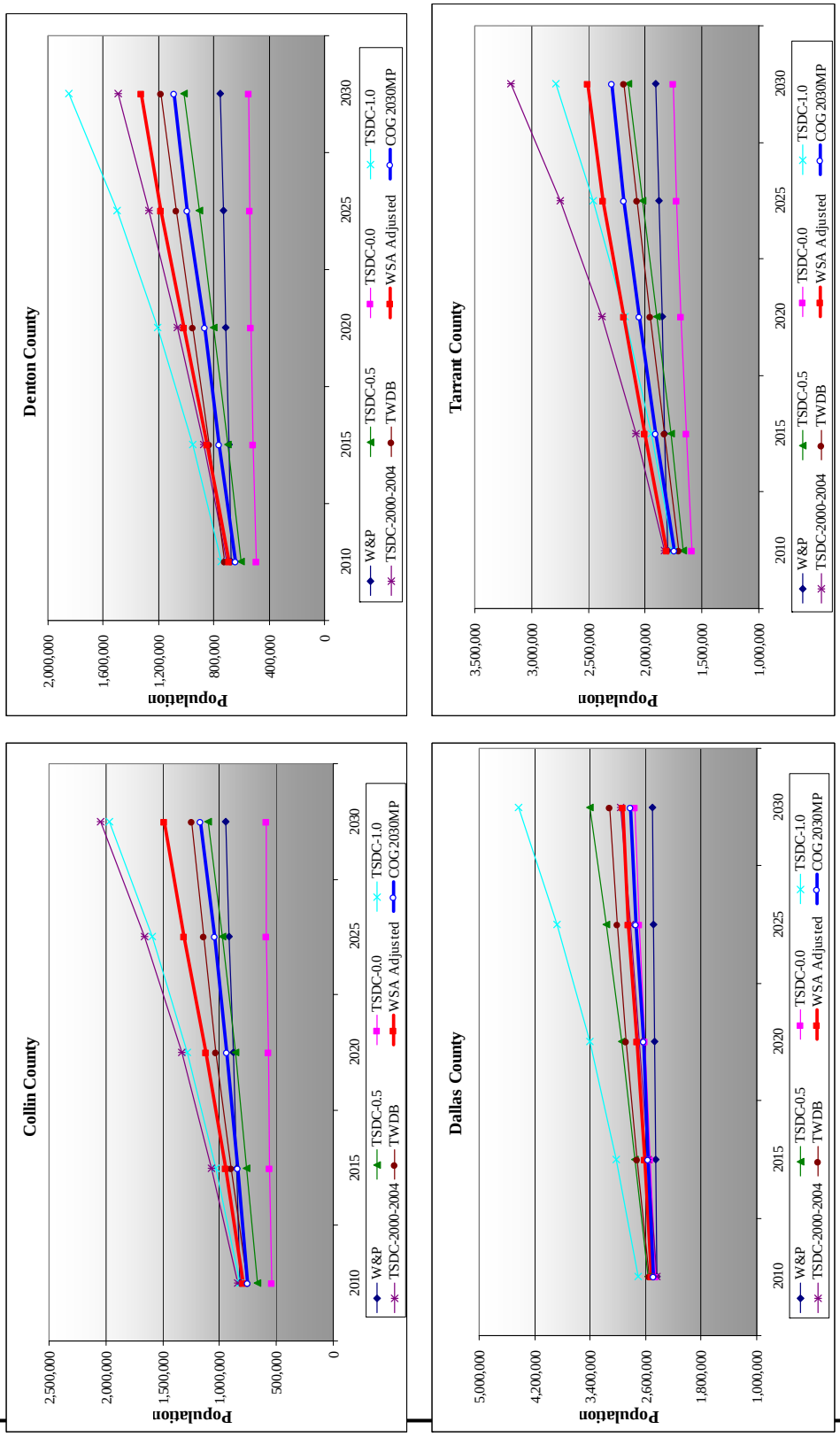


**Figure 4-29. Comparison of Revised Demographic Projections**

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# CHAPTER 5

# MODEL DEVELOPMENT AND CALIBRATION

The following chapter describes the travel demand model calibration and validation process used to evaluate the SH 183 managed lane corridor, and the database modifications and updates that were made to the travel demand model network and socio-economic databases. **Figure 5-1** summarizes the travel demand modeling process used to develop the traffic and toll revenue forecasts for the SH 183 managed lane facility that aims to answer three fundamental questions:

- How much demand currently exists in the corridor?
- How much will demand grow in the future? and
- What share of traffic is expected to use the toll facility and what will drivers be willing to pay to use it?

A detailed profile of the existing travel demand, hourly traffic profiles, travel time surveys, and other travel characteristics collected as part of this study are presented in Chapter 2. The collected traffic volume and speed characteristics were used to calibrate the base year travel demand model prior to its application to model future conditions. The model development for the traffic and revenue estimation process involved three levels of analysis that are described in more detail below:

***Global Demand Estimates*** – The global demand quantifies the amount of traffic that will use the SH 183 corridor under existing and future conditions. The global demand estimates from the North Central Texas Council of Governments (NCTCOG) model were developed using the results from the economic assessment of regional demographics performed as part of this study and summarized in Chapter 4. The projected trend of key socioeconomic variables and the respective distribution of the growth within the region,

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along with the historical building permit trends were all used to modify the base year demographics and trip tables to reflect recent and projected developments. These factors were also used to conduct a series of sensitivity tests that were also performed as part of the analysis.

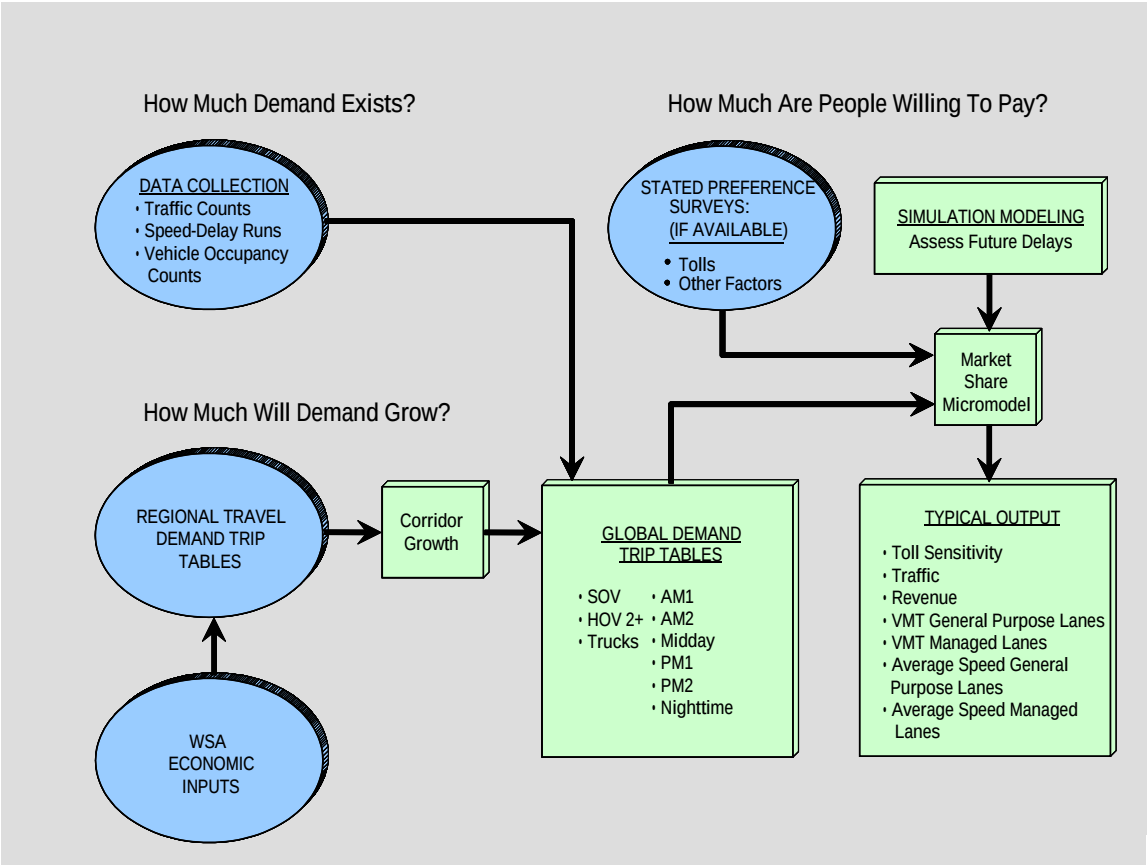


**Figure 5-1. Model Development Process**

***Travel Time Simulation Model*** - A traffic simulation model of the SH 183 managed lane corridor was developed using the VISSIM traffic micro-simulation software to obtain volume delay relationships that closely resemble the existing corridor congestion patterns and traffic operational bottlenecks. The simulation model was used to assess the systematic influence that the travel patterns, the magnitude of travel demand, and the geometric configuration of the roadway will have on congestion patterns within the SH 183 corridor. This evaluation was used to develop volume-delay functions (VDFs) that were incorporated into the travel forecasting model to better predict changes in travel time as a consequence of queued traffic upstream of bottlenecks, metered traffic flows downstream of bottlenecks, and any additional operational elements such as merging and

weaving areas. Accurate time saving estimates are a primary measure used to determine the proportion of corridor users willing to pay a given toll to use the managed lanes.

***Market Share Micro-Model*** - The market share micro-model was used to estimate the traffic that will use the managed lanes under varying conditions. The managed lane share is based on several factors that include the travel patterns of the corridor demand, the location of the access points, the configuration of the general purpose lanes, the time savings offered by the managed lanes, and the toll rates charged to use the managed lanes.

## MODEL DEVELOPMENT UPDATE

The trip tables and highway networks from the NCTCOG's 2030 Mobility Plan – 2009 Amendment were used as the base for this study. Trip tables from the NCTCOG's model were available in three time periods: AM peak, PM peak and Off-peak time period (which included both midday and night time periods). The trip tables were segmented into three modes including drive alone, high-occupancy, and trucks for 2009 (base), 2019, 2025, and 2030 forecast years. The highway networks obtained from the NCTCOG model included link parameters such as length, functional class, area type, number of lanes, speed, and capacity.

Analysis of the traffic movements along SH 183, from Valley View Lane (west of SH 161) and IH 35E Stemmons Freeway East/Trinity Parkway, were performed using the existing NCTCOG model to determine the share of through- trip movements versus internal trips. The analysis also evaluated the distribution of traffic that was accessing the major cross streets along the SH 183 and a comparison was made to assess the differences in the existing and future (2030) traffic movements. The NCTCOG model results were compared to the comprehensive traffic counts and the speed delay information conducted within the corridor in the Fall of 2009.

Managed lane projects typically need to be studied in more detailed time periods to evaluate the variable pricing operational characteristics. Extensive toll rate sensitivity analyses were performed for each time period to gauge the optimum toll rates that ensured the managed lanes would operate above the required minimum travel speeds of 35 miles per hour as defined by the Regional Transportation Council (RTC) managed lane policy. The highway networks obtained from NCTCOG encompassed six full counties and three partial counties that were segmented into 4,874 Traffic Analysis Zones (TAZs). The entire model therefore required approximately 7-10 hours of computer execution time to perform a traffic assignment for a single time period. Given the model intensive runs required to evaluate a managed lane facility, a windowed subsection of the full NCTCOG model area was defined for this study. The subarea network, as shown in

**Figure 5-2**, covered a large area surrounding the proposed SH 183 managed lane project and included all of the major competing and connecting routes within the study area.

The subarea trip tables were extracted from the full trip tables as part of the subarea analysis and were then disaggregated into seven time periods described in more detail below. The procedure adopted to update the subarea trip tables for both base year and future years and for the different time periods is further described below and summarized in **Figure 5-3**.

The official trip tables provided by NCTCOG are in three time periods with AM peak from 6:30-9:00 AM, PM peak from 3:00-6:30 PM and an off-peak period that represents the remaining hours of the day (midday and night time periods). The seven time periods defined for the managed lane study were based on the temporal distribution of traffic counts collected along the SH 183 corridor, along with the traffic counts collected in the area from other projects and other available historical counts. The seven time period definitions that were used in the model were:

- AM1 Peak Period – 6:30 AM to 8:00 AM
- AM2 Peak Period – 8:00 AM to 9:00 AM
- Midday Period – 9:00 AM to 3:00 PM
- PM1 Peak Period – 3:00 PM to 4:30 PM
- PM2 Peak Period – 4:30 PM to 6:30 PM
- PM3 Peak Period – 6:30 PM to 7:30 PM
- Night Time Period – 7:30 PM to 6:30 AM

The AM1 and AM2 periods comprised of the original AM peak used in the NCTCOG model. The original PM peak was divided into PM1 and PM2 periods while the original off-peak period was split into Midday, PM3 and night time periods. The factors used to disaggregate the trip tables into each of seven the time periods were calculated based on the extensive traffic count data that was obtained for this study. The base year trip tables were first disaggregated into seven time periods by applying temporal distribution factors. An Origin-Destination Matrix Estimation (ODME) technique was then applied to update the subarea trip tables to reflect existing traffic volumes along the major highways and screenlines within the corridor. The ODME procedure was applied to each of the seven time periods separately and an extensive evaluation was performed to ensure the trip tables generated from the ODME procedure reflect the existing traffic characteristics indicated by both the traffic counts and the origin-destination survey patterns.

In addition to the typical volume and travel time model calibration, select link analyses at several locations along SH 183 and IH 35E were conducted “before” and “after” the ODME procedure to evaluate the overall changes in travel patterns generated from the ODME process. The results indicated no anomalies or drastic changes to the overall

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distributions and showed that for the most part the variations of changes were uniformly distributed within the subarea. Delta trip tables were calculated using the before and after ODME trip tables for each of the seven time periods for the base year. These delta trip tables were then applied to future year trip tables separately for each period to reflect the corrections applied to base year model.

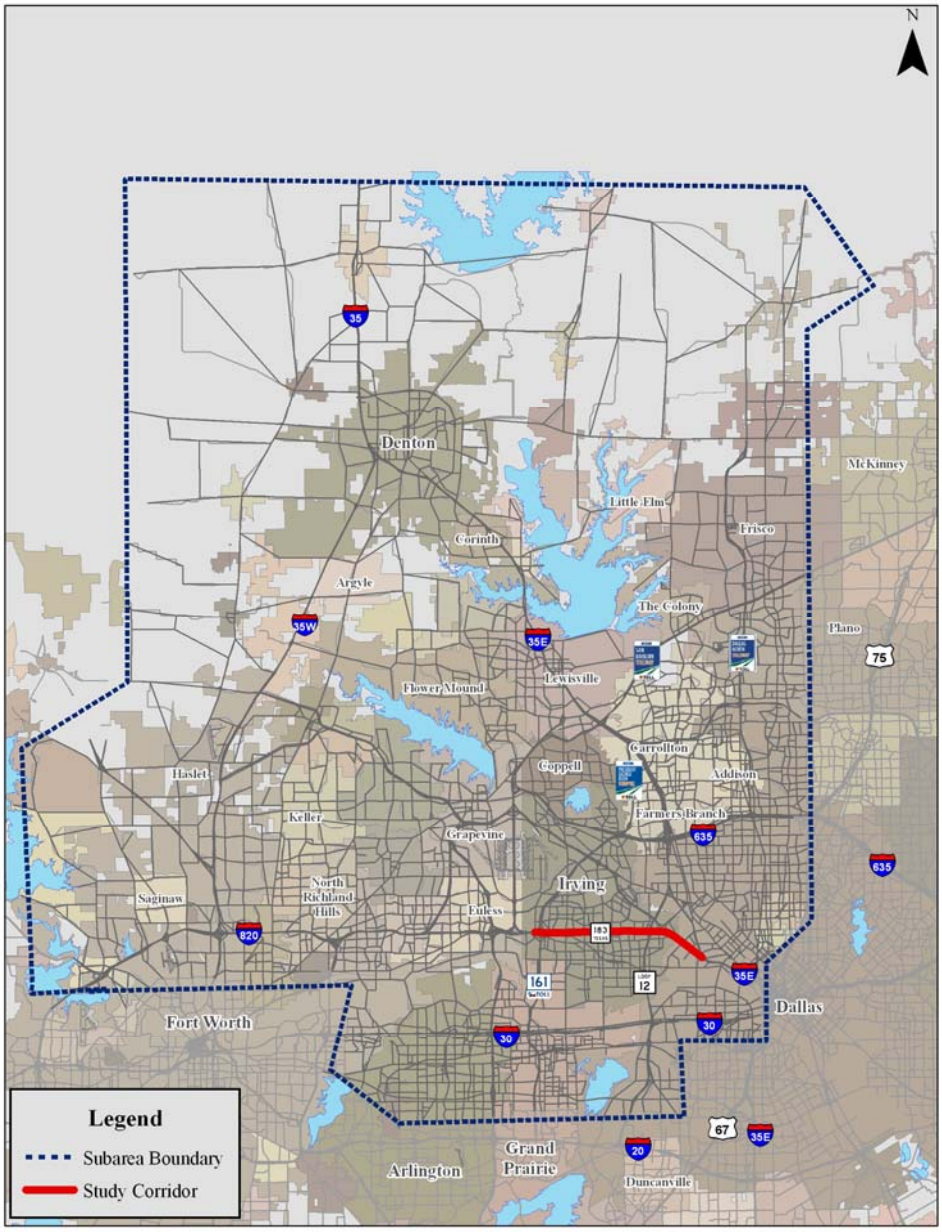


**Figure 5-2. Subarea Network Boundary**

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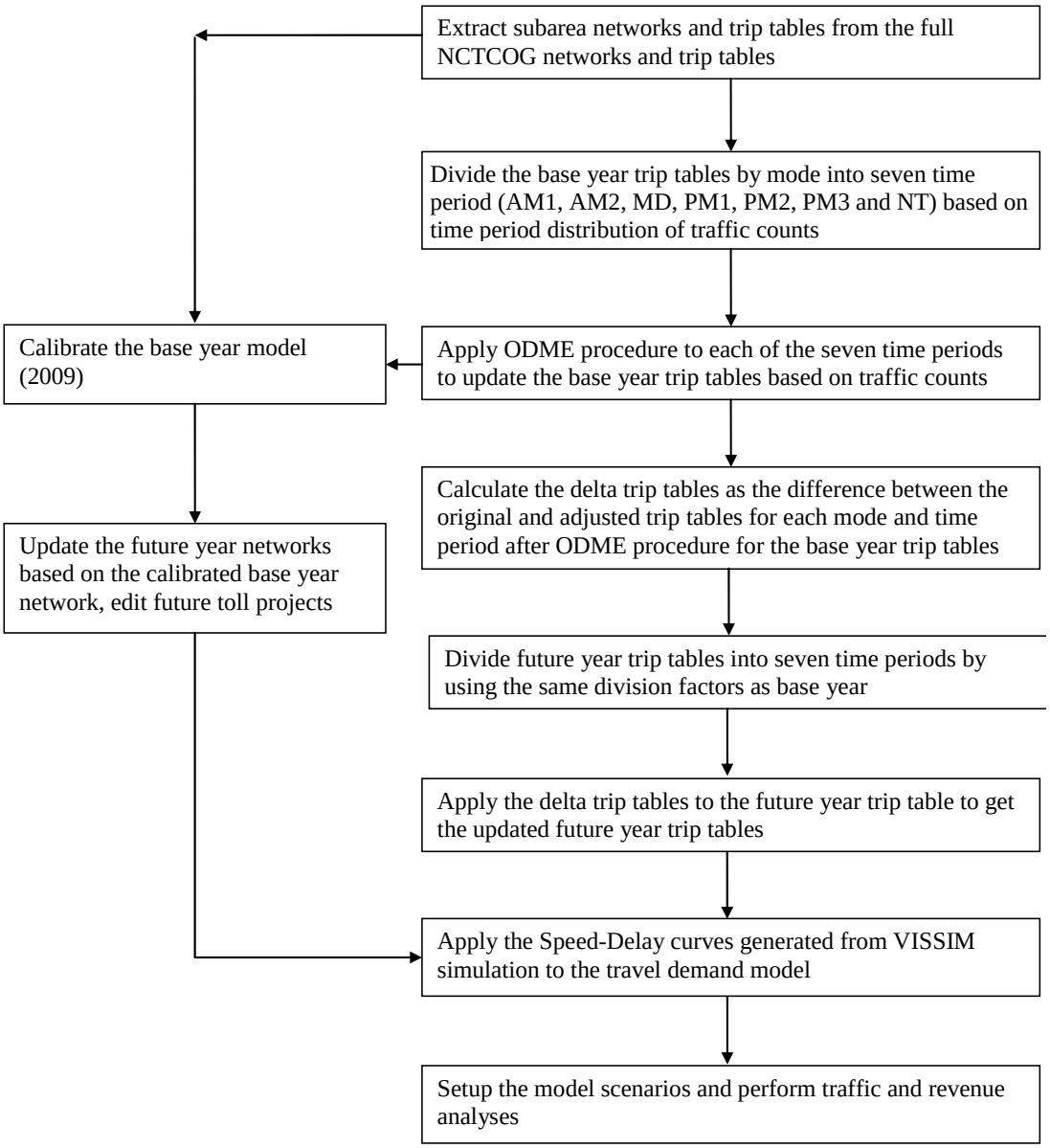


**Figure 5-3. Flowchart of Model Update Process**

## GLOBAL DEMAND ESTIMATES

The global traffic demand is defined as the total potential traffic traveling in the SH 183 corridor including frontage road, general purpose lanes and managed lanes was determined using the sub-area models developed within the SH 183 corridor. The regional travel demand model was used in two ways: 1) to provide the base travel patterns for the micro-model sub-area, and 2) to develop traffic growth characteristics for the micro-model sub-area. The calibration process for the regional model used for this study included the following steps:

- The development of trip tables for the years 2009, 2019, 2025, and 2030 levels for the seven modeling time periods as defined earlier. The trip tables were segmented into SOV (single-occupant vehicle), Truck, and HOV2+ components for a more detailed analysis of each market segment.

- The adjustment of assignment parameters including link speeds and capacities, and speed/flow relationships to reflect the current travel characteristics in the corridor. This process utilized the extensive traffic data collection program to ensure that the model accounted for current traffic volumes and speeds along the SH 183 corridor and major competing routes in the study area.

- Extraction of the micro-model sub-area travel information for base and future years.

The model development for future global demand estimate involved updates to the highway network, the development of socio economic database, and trip table modifications, which are described in more detail below.

### Highway Network

The Dallas-Fort Worth regional highway network based on the 2030 Mobility Transportation Plan (MTP) – 2009 Amendment was used as the base network for this study. The networks within the SH 183 managed lane project study area were reviewed and updated to ensure the future projects and highway improvements were correctly coded in the future networks. The SH 183 corridor was edited to incorporate the latest schematic design of the project that included the ramp configuration, the segment lengths, and the number of lanes. Several future networks were also developed to reflect the various project scenarios that were being tested as part of the study as defined by the TxDOT district staff.

Other elements in the networks were also reviewed that include centroid connection, free flow speed, link length, number of lanes and link capacity. The reviewed networks were tested to ensure that all the network characteristics were accurately incorporated in the

coded networks. The full NCTCOG model networks were then windowed to include the potential competing routes, feeding roadways and other important connecting roads within the corridor. The defined subarea consisted of a total of 2,009 of the original 4,874 TAZs, of which 1,839 were internal TAZs and 170 were external stations, The use of subarea network significantly reduced the computer execution time of the traffic assignment process, while conserving all the important traffic characteristics within the study area such as total traffic demand and trip distribution patterns.

### Socioeconomic Assumptions

The future year demographic forecasts developed by NCTCOG that are part of the 2030 MTP used information from the 2000 census as the base data. The development of the 2035 MTP by NCTCOG is currently underway but will not be available until sometime in 2011. The NCTCOG previously released the base "2005 update" demographic data in early 2008, however, the future year demographic forecasts were still under internal review while this study was being conducted. In order to reflect potential changes in the socio-economic data between 2000 and 2009, the original 2030 MTP demographic forecast of 2009 were updated based on the 2005 base data, 2009 population estimate data developed by NCTCOG and other available population and employment data.

Another important element used to review the NCTCOG socioeconomic database was the regional and county level total population and employment forecasts. The population forecasts from several other sources that included the Texas State Data Center, the Texas Water Development Board, and Woods & Poole were reviewed and compared with NCTCOG demographic forecasts. Adjustments to the county population and employment forecasts of NCTCOG were then made based on this review to reflect the macroscopic trends within the various regions. The modified county demographic forecasts were then allocated to the TAZ level based on the updated 2008 forecasts and the original 2030 MTP future year demographic forecasts for individual TAZs. Detailed description of the development of the modified socioeconomic database is provided in Chapter 4.

### Micro-Model Trip Tables

The subarea trip tables used in the micro-model were initially extracted from region-wide base year (2009) traffic assignments. The collected traffic count profiles were then used to determine the time period segmentation to reflect similar traffic flow volumes and patterns. The trip tables were also compared to collected vehicle occupancy and classification counts to ensure that the distributions of single-occupancy (SOV), High-Occupancy Vehicles (HOV 2+), and trucks were reasonably represented in the model.

As described earlier, trip tables for each analysis period were used as seed matrices in a matrix estimation process to adjust the trip tables using the traffic counts that were collected along the SH 183 general purpose lanes, ramps and frontage roads. Screenline counts conducted along other major arterials in the study area were also used for this

process. The matrix estimation adjustments ensured that the traffic volumes assigned from the adjusted base-year subarea trip tables closely matched the observed traffic counts.

The regional model future-year (2019, 2025, and 2030) traffic assignments were used to quantify the future corridor traffic demand along the SH 183 corridor and were influenced by factors such as:

- Population and employment growth in the region;
- Additional new roadway capacity that will compete for traffic with the managed lanes being studied herein;
- Highway improvements to other freeways in the region that may provide accessibility to the corridor; and
- Changes to the ramp configurations.

As described in the model development section, the trip tables representing the micro-model subarea were extracted from the regional model for each forecast year (2019, 2025 and 2030) and the trip table adjustments that were determined as part of the matrix estimation process were applied to all future year trip tables to reflect the regional growth patterns with the updated trip distributions.

## MODEL CALIBRATION

The traffic counts collected in 2009 were analyzed and the characteristics of traffic by time periods were developed. The traffic data based on this analysis was used to validate the model outputs and adjust the network characteristics where needed. The calibration was performed for each of the seven time periods and along the six screenlines as shown in **Figure 5-4**. Four screenlines were selected to cross SH 183 and were evenly spaced along the study corridor west of SH 161, east of Story Road, west of Loop 12 and west of Regal Row. Two additional screenlines were configured to parallel the SH 183 corridor and were located to the south and north of the SH 183 corridor to measure the traffic feeding into the corridor.

**Figure 5-5** shows the modeled traffic volumes compared to the observed traffic volumes by direction and time period for the six screenlines as percent deviation. The calibration results were summarized as of total daily screenline volumes for each direction. The maximum desirable deviation curve for screenlines was adapted from the "*NCHRP 255: Highway Traffic Data For Urbanized Area Project Planning and Design*" published by the Transportation Research Board as a guide for checking the reasonableness of the model validation process. This type of model validation check has been widely used in the travel demand modeling practice. As shown, the percentage differences between the

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model volumes and traffic counts were all well within the acceptable ranges for each of the six screenlines and by direction.

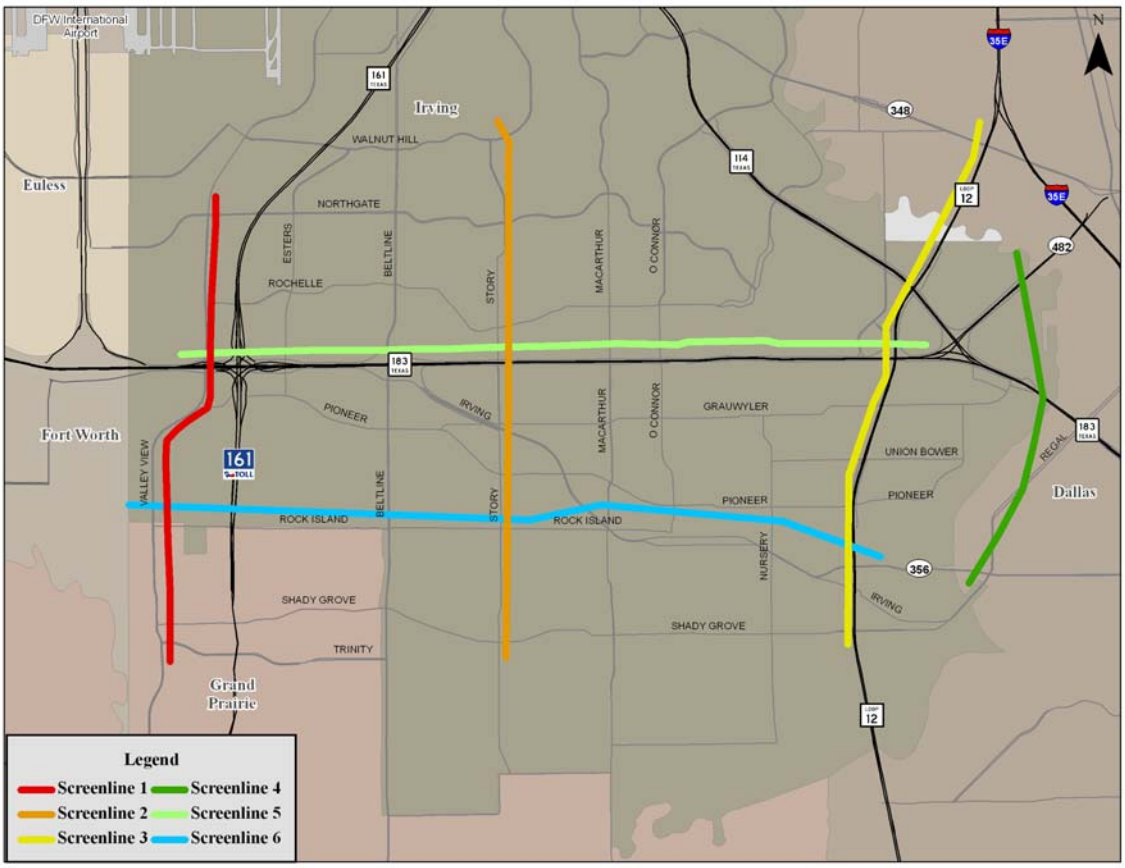


**Figure 5-4. Screeline Locations**

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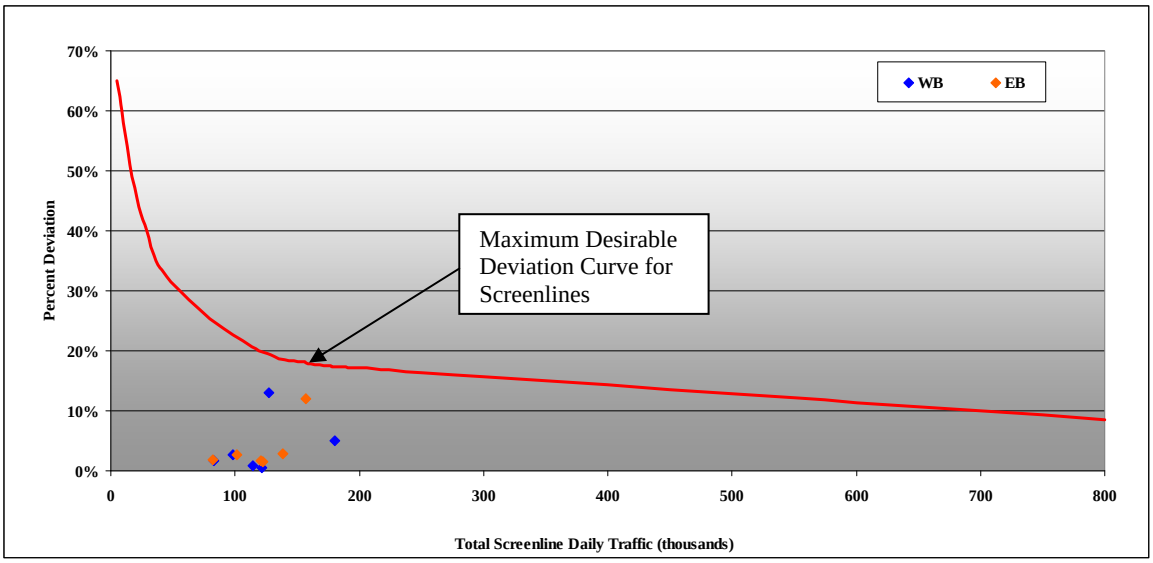


**Figure 5-5. Model Calibration Results for Total Screenline Volumes**

**Figure 5-6** through **5-11** shows the comparison of the modeled estimated traffic volume with the observed traffic counts for individual locations along the six screenlines for individual time periods. As shown in the figure, almost all of the points scatter closely around the diagonal line with slight variation from the regression line slope. The $R^2$ of each time period is close to 1, which again indicates the base-year model was well calibrated and reflected the existing traffic conditions.

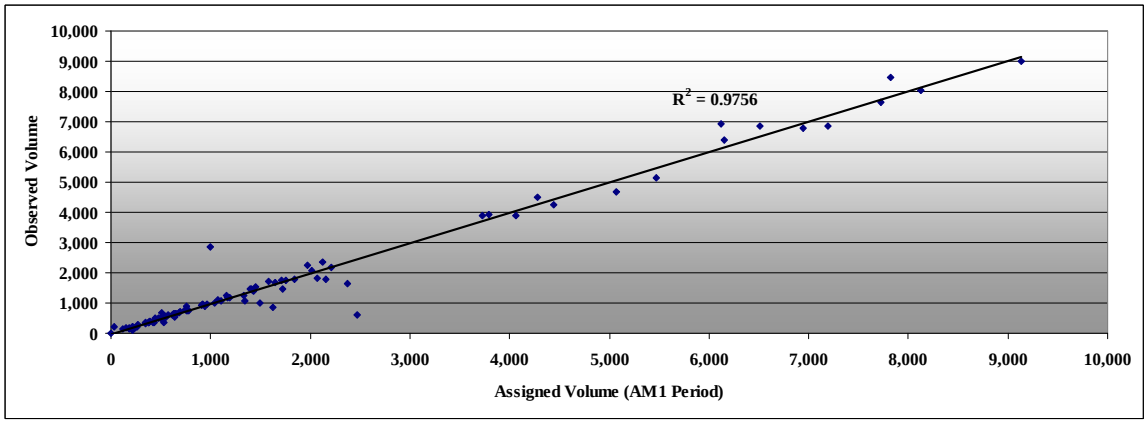


**Figure 5-6. Model Calibration Results of Individual Locations for AM1 Period**

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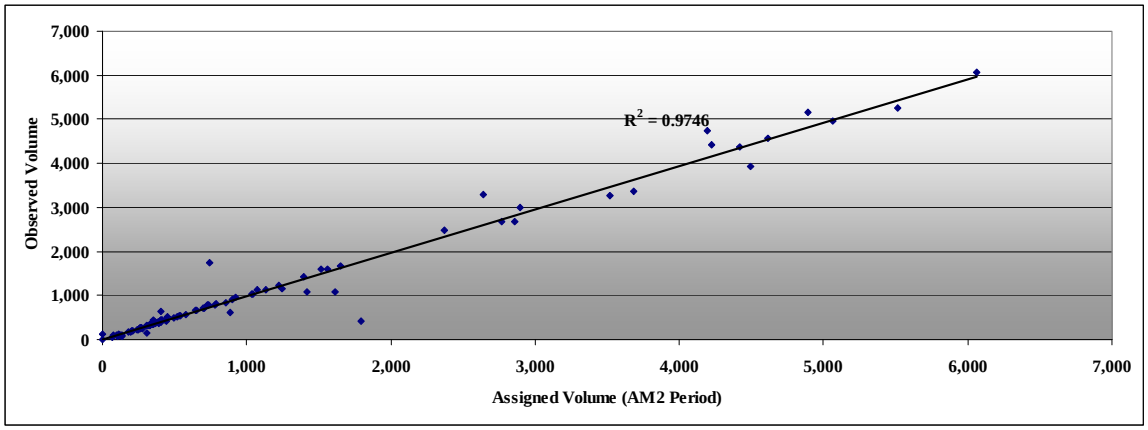


**Figure 5-7. Model Calibration Results of Individual Locations for AM2 Period**

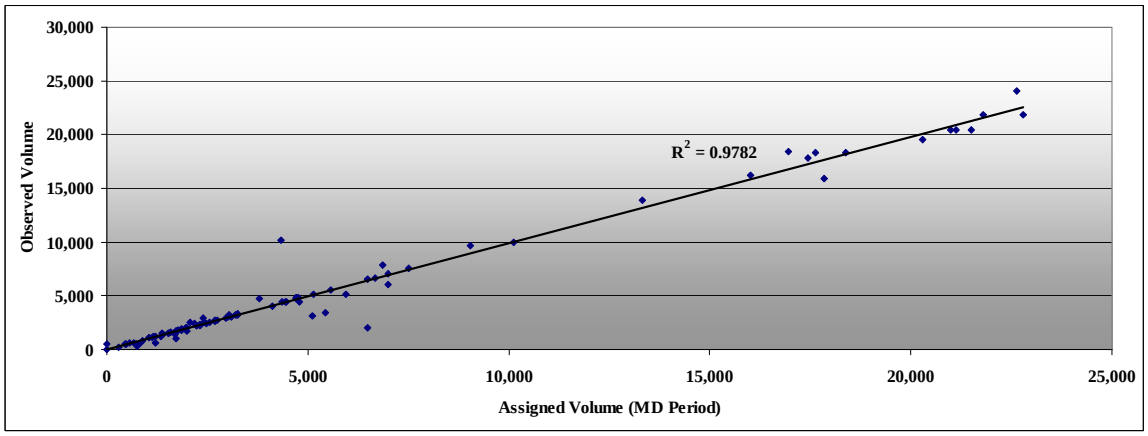


**Figure 5-8. Model Calibration Results of Individual Locations for MD Period**

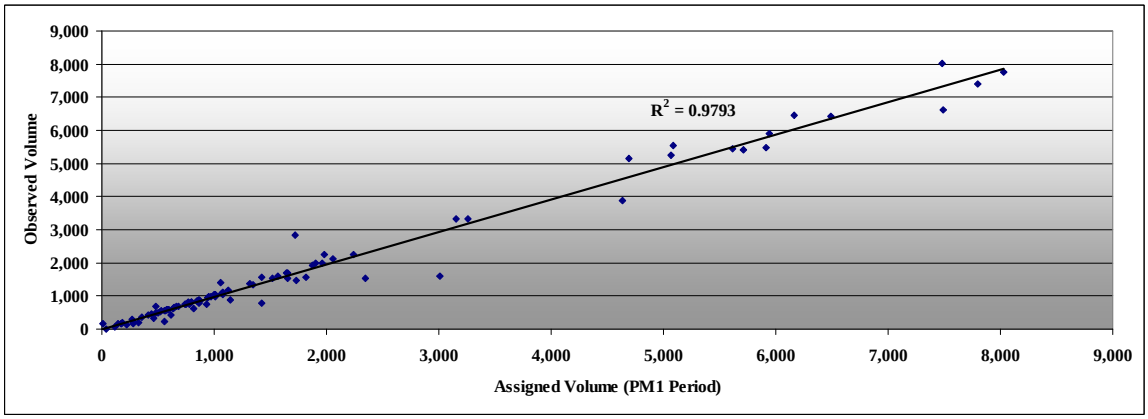


**Figure 5-9. Model Calibration Results of Individual Locations for PM1 Period**

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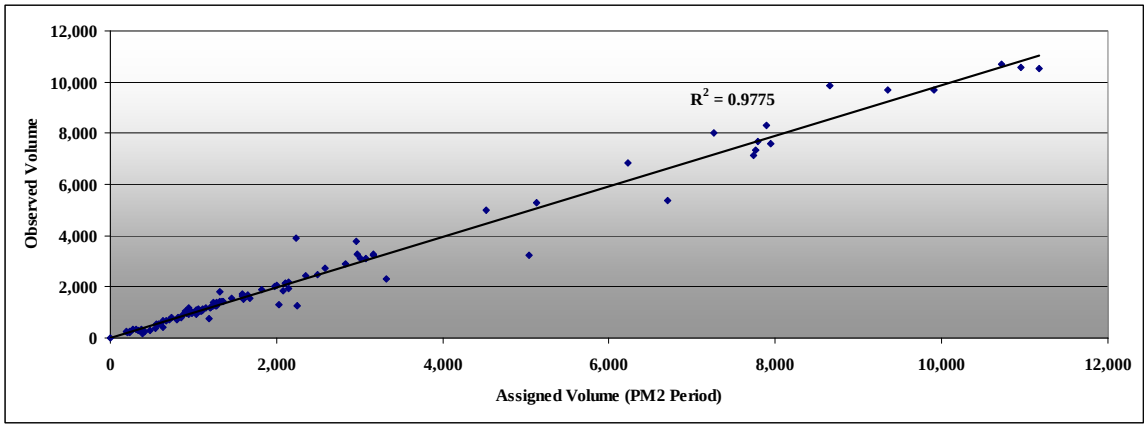


**Figure 5-10. Model Calibration Results of Individual Locations for PM2 Period**

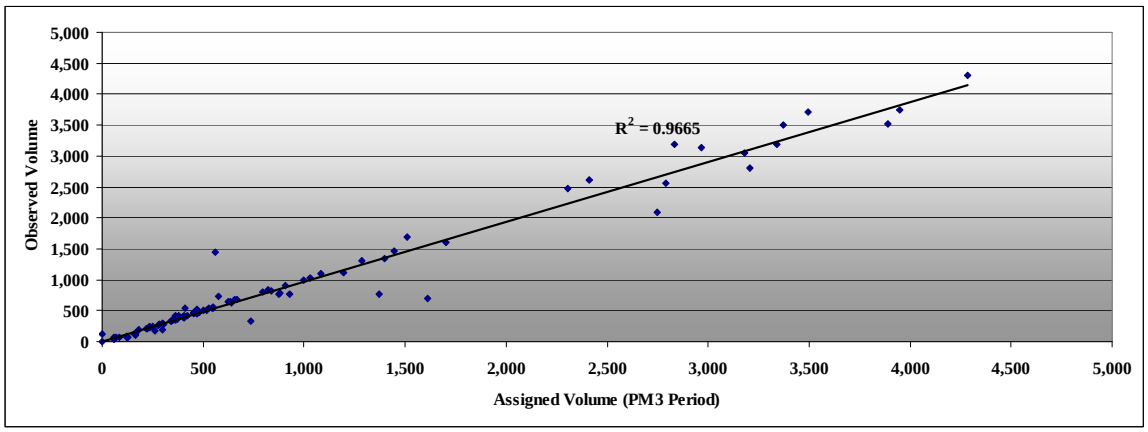


**Figure 5-11. Model Calibration Results of Individual Locations for PM3 Period**

## TRAVEL TIME SIMULATION MODEL (VISSIM)

Travel demand model volume-delay functions and roadway segment capacities typically do not adequately replicate the impact of merging and weaving maneuvers on the freeway operating speeds and capacity, and nor can they reflect the impact of downstream queuing along the freeway segments or the flow metering effects of bottlenecks within the network. The VISSIM, a microscopic simulation model, was used to assist in estimating the impacts of travel speeds on different segments of the SH 183, taking into consideration the geometrical configuration of the existing and proposed managed lane facility. The VISSIM model attempts to evaluate each vehicle as a separate entity and introduces a certain level of randomness to the vehicles' behavior. The roadway geometry and interaction with other vehicles, influences the behavior of each vehicle in the model and provides a profile of the delay characteristics that each link is

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likely to exhibit as demand builds along the various corridor segments.

**Figure 5-12** depicts the VISSIM model process and reflects the field data collection, base-year model calibration, future-year VISSIM model development, and the VISSIM runs used to create volume-delay functions. The development of base-year model required the current geometrical configuration of the SH 183 study corridor, the traffic volume at each of the on/off ramps, and the corridor travel speed profiles. The base-year model was developed for both the AM and PM peak periods.

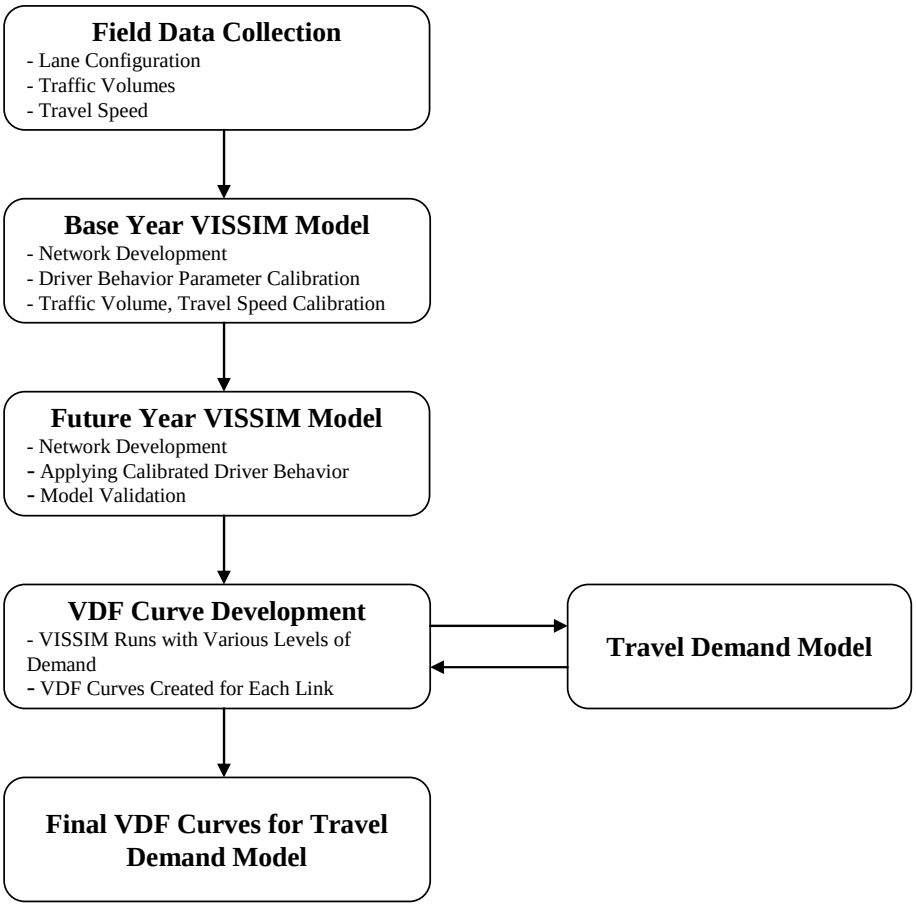


**Figure 5-12. VDF Curves Development Process using VISSIM Simulation Model**

The base-year VISSIM network was constructed by coding the roadway network in the VISSIM model using aerial photographs as the background and included the number of lanes, location of the auxiliary lanes, and the lane drops, all of which were then confirmed during field survey visits. The subarea model total demand was used an input to the VISSIM model and the corridor was calibrated to reflect the traffic characteristics within the corridor. The traffic volume and travel speed generated from the VISSIM

model were then compared to the observed field data to ensure that the base-year VISSIM model adequately reflected the actual field traffic conditions.

Future-year VISSIM model was developed based on the Microstation design files of the future roadway configuration and used to model the future corridor travel characteristics. Travel volumes from travel demand model were fed into the VISSIM model and model results were reviewed to ensure that the models were performing reasonably. A series of VISSIM model runs were performed using differing assumptions regarding traffic shifts to the managed lanes for each of the six time periods identified for the analysis. A series of traffic volumes at different toll rates were used as input to the VISSIM model based on several iterations that eventually resulted in equilibrium between toll rate, speed and traffic share. As congestion increased across general purpose lanes, the traffic shifted into the managed lanes resulting in lower congestion levels in the general purpose lanes. With lower congestion, traffic then shifted back into general purposed lanes again resulting in increased congestion. The increased congestion along general purposed lanes then diverts traffic back to the managed lanes. This process was repeated through several iterations until equilibrium was reached. Several model runs were performed for the six primary analysis periods for each direction.

Within each time period, and for each link, a relationship was developed between the "traffic demand" on the link and its modeled travel speed. By graphing the relationship between traffic demand and travel speed for the various model runs for each general purpose lane segment, specific volume-delay curves were developed for each link along the general purpose lanes. These volume-delay curves were fed into the travel demand model and traffic assignment was then performed to generate the final set of traffic volumes.

## MARKET SHARE ANALYSIS

In the micro-model, the travel time between a path using the tolled managed lanes was compared to the travel time along a path using the next best non-toll route (most likely the general purpose lanes). For each travel movement, the proportion of motorists expected to use the managed lanes is a function of the computed time savings and the cost to use the lanes (cost-per-minute saved) versus the value-of-time (VOT) placed on time savings by the motorist.

The share of each traffic movement that is captured by the managed lanes is dependent on the distribution of the VOT within the traveling market, which was developed from the income levels in the area. Motorists with a greater VOT than the cost per minute saved would tend to more likely choose the managed lanes while those with a lower VOT would likely tend to not choose the managed lanes.

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***Value of Time*** - The VOTs used in this study were based on an analysis of the responses from the stated preference surveys conducted within the corridor in the fall of 2009. The implementation of the stated preference survey is described in Chapter 2. Further details of the survey process can be found in the report "Data Collection Project – SH 183 Managed Lanes" dated January 2010. The median VOT used for this analysis was **$15.2** per hour (in 2009 dollars) for peak traffic and **$9.6** per hour for the off peak traffic.

***Optimum Toll Rate*** - The micro-model relies on developing an equilibrium condition between the toll cost and the estimated travel time savings. If more traffic uses the managed lanes, there is less congestion in the non-toll lanes resulting in lower time savings. These lower time savings will in turn result in less traffic choosing the managed lanes. For each toll rate level, there exists an equilibrium point between the level of traffic congestion in the non-toll lanes (time savings) and the amount of traffic willing to pay a toll to save that same amount of time that optimizes the revenues generated from the facility.

At lower toll rates, there is a higher propensity to use the managed lanes, leading to lower congestion level in the non-toll lanes. At higher toll levels, there is less traffic in the managed lanes and more congestion in the non-toll general purpose lanes.

A full range of toll rates were tested, from $0.00 per mile to $0.80 per mile, for each time period and travel direction. The toll rates chosen for use in the traffic and revenue analysis generally reflect those that maximize revenues for each individual time period and optimized revenues as a policy objective. Given the proximity of the managed and general purposed lanes several non-peak periods and directions may yield optimized toll rates that are not sufficient to cover the minimum transaction/operating costs given their limited travel time savings. The scenarios developed as part of this analysis were based on a pure revenue optimization analysis and did not consider a minimum toll rate.

***Vehicle Categories*** - The micro-model trip tables were separated into three components: single-occupancy vehicles (SOVs), high-occupancy vehicles with two or more occupants (HOV 2+), and trucks. Each trip table was assigned simultaneously until an equilibrium condition was reached for that particular toll rate. In consultation with TxDOT Dallas District, it was decided that trucks would be allowed to use the managed lanes at a higher toll than SOVs. The toll rates were determined to fall in line with the Regional Transportation Council (RTC) managed lane tolling policy. The truck toll rate factors were determined using the existing axle count data that was collected along the corridor.

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# CHAPTER 6

# TRAFFIC AND TOLL REVENUE ESTIMATES

The following chapter summarizes the traffic and toll revenue assessment of the proposed SH 183 managed lanes, from Valley View Lane just west of SH 161 to IH 35E Stemmons Freeway East/Trinity Parkway. The 52-year projections are based on the configuration described in Chapter 1 using the modeling methodology outlined in Chapter 5. In addition, this chapter outlines the toll sensitivity analyses that were performed to identify the optimal toll rates and further describes the forecasted traffic characteristics within the corridor. The chapter also presents the estimated average weekday traffic for the 2015, 2019, 2025, and 2030 model years, and the resulting estimates of the annual transactions and toll revenues for a 52-year projection period.

## PROJECT DESCRIPTION AND ALTERNATIVES

The SH 183 corridor connects the cities of Dallas and Fort Worth, located directly to the south of the DFW airport, and provides one of the primary connections between the two central business districts of both cities. The proposed 9.5 mile long SH 183 corridor segment evaluated under this Level 2 study is located entirely within Dallas County and extends from Valley View Lane just west of SH 161 at the western termini to IH 35E/Trinity Parkway at the eastern termini. The majority of the SH 183 study corridor traverses the city of Irving and part of the city of Dallas at the eastern terminus where SH 183 merges with IH 35E.

The ultimate configuration of the proposed SH 183 study corridor includes approximate eight general purpose lanes to the west of SH 114 and ten general purpose lanes east of SH 114. Two concurrent tolled managed lanes in each direction running from Valley View Lane up to the intersection of SH 114 will be constructed with three concurrent managed lanes in each direction beyond SH 114 to IH 35E. The study corridor will connect to the North Tarrant Express Segment 2E at its west end, which will have three

managed lanes in each direction extending until IH 820. The proposed SH 183 managed lanes are expected to connect at the east termini of the project to a 2-lane reversible lane facility along IH 35E. Direct connections will ultimately be constructed to connect the SH 183 managed lanes to the proposed Trinity Parkway and the SH 114 managed lanes based on expected opening dates provided by TxDOT staff. The corridor was evaluated as two segments to facilitate anticipated project development phasing scenarios as defined below and shown in **Figure 6-1**:

- Middle Segment: A 6.3 mile concurrent managed lane facility with two lanes in each direction, from Valley View Lane west of SH 161 to Loop 12; and
- East Segment: A 3.2 mile concurrent managed lane facility with three lanes in each direction, from Loop 12 to IH 35E.

Five project alternatives were identified and evaluated as part of this study to reflect the different combinations and phasing of the various corridor segments. The toll operation and pricing policies followed the guidelines defined by the Regional Transportation Council (RTC) managed lane policy. Under this policy, the single occupant vehicles (SOVs) will pay the full toll rate, while the high occupant vehicles with two or more passengers (HOV 2+) will receive a 50 percent discount during the peak periods but pay the full toll rate during the off-peak periods until 2025 after which no further discounts will be provided to all markets. Four of the alternatives as described below assumed the RTC policy while the duration of the discounted toll for the HOV traffic is assumed to extend until 2030 for Alternative 5. The five alternatives reflect early or delayed opening dates for the full build-out of the project corridor and combinations of the phased opening of east segment and middle segments outlined below:

*Alternative 1 (Early Combined)* – Both the middle and east segments will be constructed and open to traffic by 2015 and reflects the most optimistic construction plan of the five project alternatives;

*Alternative 2 (East only)* – East segment will be constructed and open to traffic by 2019 with the middle segment opening by 2030;

*Alternative 3 (Middle Only)* – Middle segment will be constructed and open to traffic by 2019 with the east segment opening by 2030;

*Alternative 4 (MTP Combined)* – Both the middle and east segments will be constructed and open to traffic by 2019, which is consistent with the latest NCTCOG's 2030 Mobility Plan – 2009 Amendment;

*Alternative 5 (Delayed Combined)* – Both middle and east segments are assumed to be constructed and open to traffic by 2025, which reflects a 6-year deferral

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from the current NCTCOG's 2030 Mobility Plan – 2009 Amendment. Under this alternative, the HOV2+ discount is also assumed to extend until 2030.

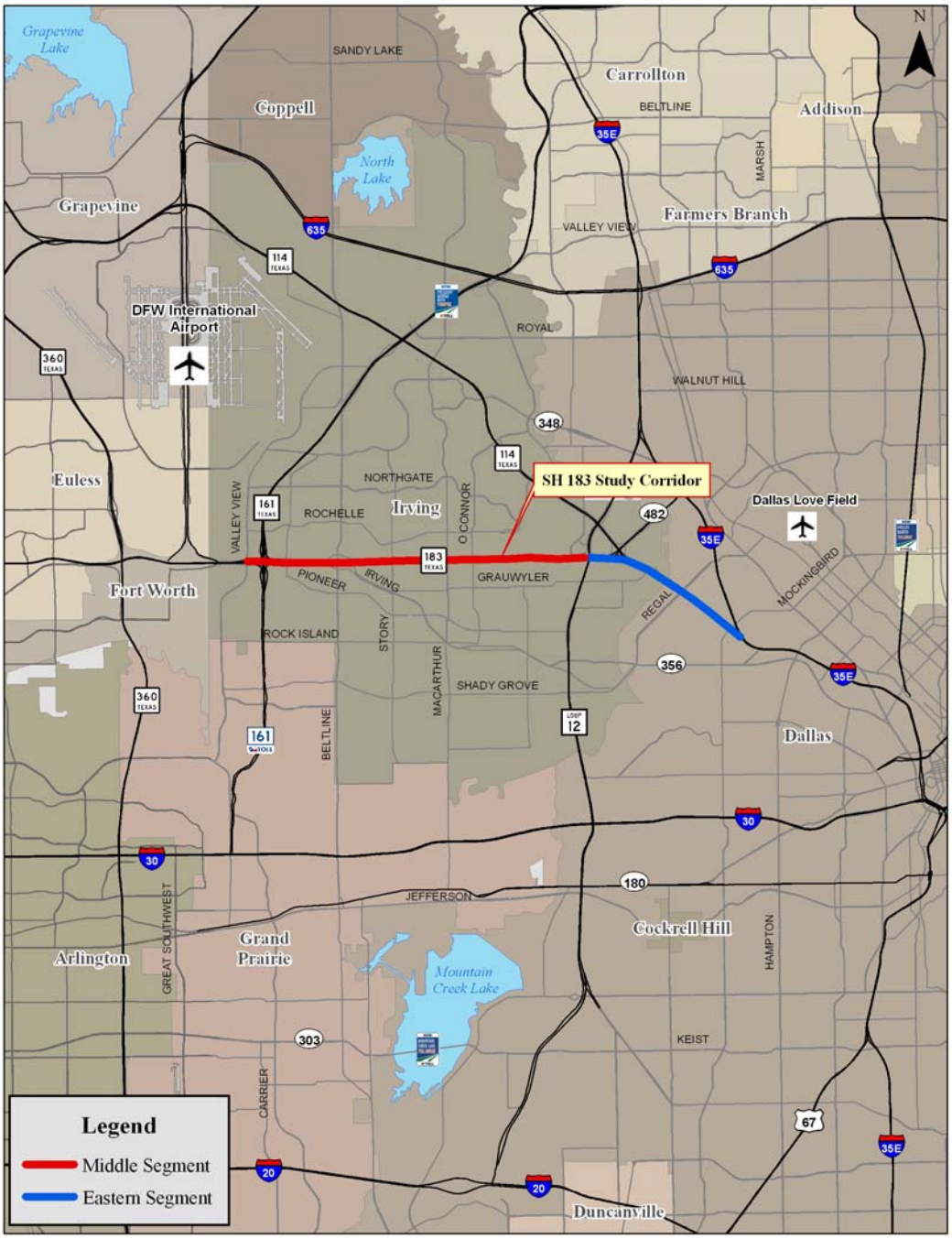


**Figure 6-1. SH 183 Managed Lane Project Location and Segments**

## TRAFFIC AND REVENUE ESTIMATE BASIC ASSUMPTIONS

The 52-year traffic and toll revenue estimates for the five alternatives were calculated based on the project configuration described in Chapter 1, the corridor growth discussed in Chapter 4, and the following additional basic assumptions:

- The SH 183 managed lanes would run from Valley View Lane just west of SH 161 to IH 35E Stemmons Freeway East/Trinity Parkway. The managed lane segments will open to traffic in various years and phases depending on the defined alternative. The collection of tolls begins at the opening of the various project segments for purposes of analyzing the revenue generation potential of the corridor;

- The configurations, vehicle types, and operating speeds of the managed lanes, including the proposed access locations, and per mile toll rates will be as described in this report;

- The tolls will be collected using electronic toll collection (ETC) with revenue-neutral video tolling based on distance traveled and no cash will be accepted. The ETC operations are assumed to be actively monitored and strictly enforced to minimize the potential revenue loss due to toll evasion. *No toll evasion adjustments were made to the toll revenue estimates included in this report*;

- Transportation improvements as detailed in NCTCOG's Mobility Plan 2030: 2009 Amendment will be implemented; no other competing routes or capacity improvements will be constructed within the forecast period and no additional general purpose lane capacity besides those proposed in the MTP will be implemented within the SH 183 corridor;

- Commercial vehicles/trucks with more than two-axles will have access to the managed lanes and will be charged 2.8 times the normal toll rate as derived from the average truck axle distribution along the corridor;

- Estimates of annual toll revenue included in this report have been adjusted to reflect "ramp-up" during the first three years of operation. The ramp-up volume was assumed to be 80 percent of the model estimate in the opening year, 90 percent in the following year, and 100 percent for all subsequent years;

- The HOV2+ vehicles will receive a 50 percent discount during the AM and PM peak periods until 2025, to conform with the current Regional Transportation

Council (RTC) managed lane policy, with the exception of Alternative 5 which assumes the extension of the HOV2+ discount until 2030;

- The value-of-time was increased at an average rate of 2.75 percent per year for the forecast period based on an economic analysis of the region;
- Weekend traffic is assumed to be approximately 20 percent of weekday managed lane traffic, which correspond to the annual days of 275 for annual transaction calculation. Weekend revenue is calculated using reduced weekday toll rates;
- Traffic during the night time (7:30 p.m. - 6:30 a.m.) was not directly modeled in the travel demand model. Instead, the potential revenue generation during the night time was assumed to be 2 percent of the total daily revenue;
- Given the uncertainty at the time of this study associated with the duration and construction plans for several feeding and connecting facilities such as the Trinity Parkway, no adjustments have been made to the forecasts to account for the interruption of service of both the managed lane and/or the general purpose lanes that could possibly result from construction activities within the study area;
- The SH 183 managed lanes will be well maintained, efficiently operated, and effectively signed and promoted to encourage maximum usage;
- Economic growth in the study corridor is based upon projections and growth patterns as described in Chapter 4;
- Motor fuel will remain in adequate supply and increases in price will not substantially exceed overall inflation over the long term; and
- No local, regional, or national emergency will arise that may abnormally restrict the use of motor vehicles.

Any significant departure from the above basic assumptions could materially affect estimated traffic and toll revenue for the proposed SH 183 managed lanes facility.

## TOLL RATE/OPERATIONS PROFILES

Unlike a typical toll road, managed lanes facilities lie in the same corridor as their direct competition. The traffic and revenue as a result has a high degree of sensitivity to the operating conditions within the general purpose lanes. Typically, as toll rates in the managed lanes are reduced, a higher share of the general purpose lane users will choose to use the managed lanes. The resulting reduction in traffic along the general purpose lanes will then decrease congestion which then diminishes the time savings associated with using the managed lanes. Theoretically, this series of trade-offs continues until an equilibrium is reached between the operating conditions in the general purpose lanes, the managed lanes, and the toll rates set to use the managed lanes.

To depict these trade-offs, toll rate/operation profiles were developed for the AM1 peak, AM2 peak, Midday, PM1 peak, PM2 peak, PM3 peak and Nighttime (NT) conditions. The analysis included model runs for the five scenarios using the 2009, 2019, 2025, and 2030 model years for each of the following period segments:

- AM1 Peak Period – 6:30 AM to 8:00 AM
- AM2 Peak Period – 8:00 AM to 9:00 AM
- Midday Period – 9:00 AM to 3:00 PM
- PM1 Peak Period – 3:00 PM to 4:30 PM
- PM2 Peak Period – 4:30 PM to 6:30 PM
- PM3 Peak Period – 6:30 PM to 7:30 PM

The proposed SH 183 managed lanes were assumed to operate through the entire day, seven day a week. Although the nighttime period traffic forecasts were conducted for purposes of calibrating to the daily traffic volume forecasts, the absence of travel time savings during this time period generated little demand along the managed lane facility. A minimal revenue generation of 2 percent additional revenue generation was therefore assumed to occur during this period from 7:30 PM to 6:30 AM to account for possible vanity trips that will use the facility.

The toll rate/operations profiles were based on the results of a toll sensitivity analysis conducted for each alternative that ranged between $0.00 and $0.80 per mile in $0.05 per mile increments. This analysis was performed for each model year and time interval to determine which rates will deliver the optimum revenues and ensure free flow operations along the managed lanes facility. The optimum rates were selected for each time period and travel direction to estimate the final traffic and revenue potential for the different alternatives that were tested.

The 2019 and 2030 optimum per mile nominal toll rates are shown in **Tables 6-1** and **6-2** respectively. The 2019 optimum toll rates are presented instead of 2015 given that 2019 opening year of SH 183 corridor is consistent with the most recent MTP and is considered the most probable opening year. As shown, for Alternative 1 and 4, the

maximum optimum toll rate in 2019 during afternoon peak (PM2) is close to $0.40 per mile for East Segment and slightly over $0.50 for the Middle Segment. The optimum toll rates during morning peak and peak direction are similar to afternoon peak for each of the segments. The nominal toll rate during Mid-day and non-peak directions were approximately $0.13 per mile in 2019. The optimum toll rates during peak period dropped slightly under Alternative 2 and 3, when either East Segment or Middle Segment was solely constructed.

**Table 6-1**
**2019 Optimum Per Mile Toll Rate (in 2019 Dollars)**

| Segment | Direction | Period | | | | | |
|---|---|---|---|---|---|---|---|
| | | AM1 | AM2 | MD | PM1 | PM2 | PM3 |
| **Alternatives 1, 4** | | | | | | | |
| East | WB | $0.13 | $0.13 | $0.13 | $0.26 | $0.39 | $0.20 |
| Middle | WB | $0.13 | $0.13 | $0.13 | $0.39 | $0.52 | $0.20 |
| South | EB | $0.39 | $0.26 | $0.13 | $0.13 | $0.13 | $0.13 |
| Middle | EB | $0.52 | $0.39 | $0.13 | $0.13 | $0.13 | $0.13 |
| **Alternatives 2** | | | | | | | |
| East | WB | $0.13 | $0.13 | $0.13 | $0.20 | $0.33 | $0.13 |
| Middle | WB | | | | | | |
| South | EB | $0.33 | $0.26 | $0.13 | $0.13 | $0.13 | $0.13 |
| Middle | EB | | | | | | |
| **Alternatives 3** | | | | | | | |
| East | WB | | | | | | |
| Middle | WB | $0.13 | $0.13 | $0.13 | $0.39 | $0.46 | $0.20 |
| South | EB | | | | | | |
| Middle | EB | $0.46 | $0.39 | $0.13 | $0.13 | $0.13 | $0.13 |

**Table 6-2**
**2030 Optimum Per Mile Toll Rate (in 2030 Dollars)**

| Segment | Direction | Period | | | | | |
|---|---|---|---|---|---|---|---|
| | | AM1 | AM2 | MD | PM1 | PM2 | PM3 |
| **All Alternatives** | | | | | | | |
| East | WB | $0.27 | $0.27 | $0.27 | $0.44 | $0.71 | $0.27 |
| Middle | WB | $0.27 | $0.27 | $0.27 | $0.62 | $0.80 | $0.35 |
| South | EB | $0.71 | $0.44 | $0.27 | $0.27 | $0.27 | $0.27 |
| Middle | EB | $0.80 | $0.62 | $0.27 | $0.27 | $0.27 | $0.27 |

The optimum toll rates reached as high as $0.80 per mile in the westbound direction during peak periods along the SH 183 Middle Segment due to the high demand of traffic,

the limited general purpose lane capacity, and accessibility to managed lanes. The peak direction in morning peak period showed similar toll rate levels to the peak direction in afternoon peak period along both the East and Middle Segments. The optimum nominal toll rates for Mid-day and non-peak directions were approximately $0.27 by 2030.

**Figures 6-2** through **6-9** summarize the toll sensitivity curves for the full build-out Alternatives 1 and 4, which are considered to be representative of the other alternatives. The figures illustrate the effects that toll rates have on revenue, vehicle miles traveled (VMT), and the average speed on both the managed lanes and general purpose lanes. The graphics are presented for the AM Peak, Midday, and PM Peak periods, and for the three defined segments. The revenues shown in the figures reflect the daily revenue, however, these numbers are for illustrative purposes and do not take into consideration several additional factors that are incorporated to calculate the final annual revenue as described later sections of this chapter, such as ramp-up factors. The optimum toll rates shown in these graphics are in real 2009 dollars.

Each figure provides a summary of the directional characteristics for the three models years for the three time periods modeled. The first row of each figure illustrates the relationship between the toll rates and the daily revenues and highlights the revenue optimization points within each respective time period. This maximum point represents the optimum toll rate beyond which additional increases in toll rates will likely result in a larger reduction in traffic that diminishes the corridor's overall revenue potential.

The second row in each figure shows the decreasing estimated vehicle miles traveled (VMT) along the managed lane facility as the toll rates are increased. The rate of decrease during the peak periods is lower for the HOV 2+ markets due to the fifty percent discount that is provided until 2024.

The third row in each figure shows the impact that the toll rates will have on the average operating speeds in the managed lanes and general purpose lanes. These graphs show the operational trade-offs between revenue, optimal distribution of demand, and operating conditions along the SH 183 corridor.

**Figures 6-2** to **6-5** depicts the 2019 toll operation profiles for the ultimate build-out configuration of SH 183. The profiles are presented separately by direction for East and Middle Segments. **Figures 6-6** to **6-9** show the various toll operation profiles for 2030.

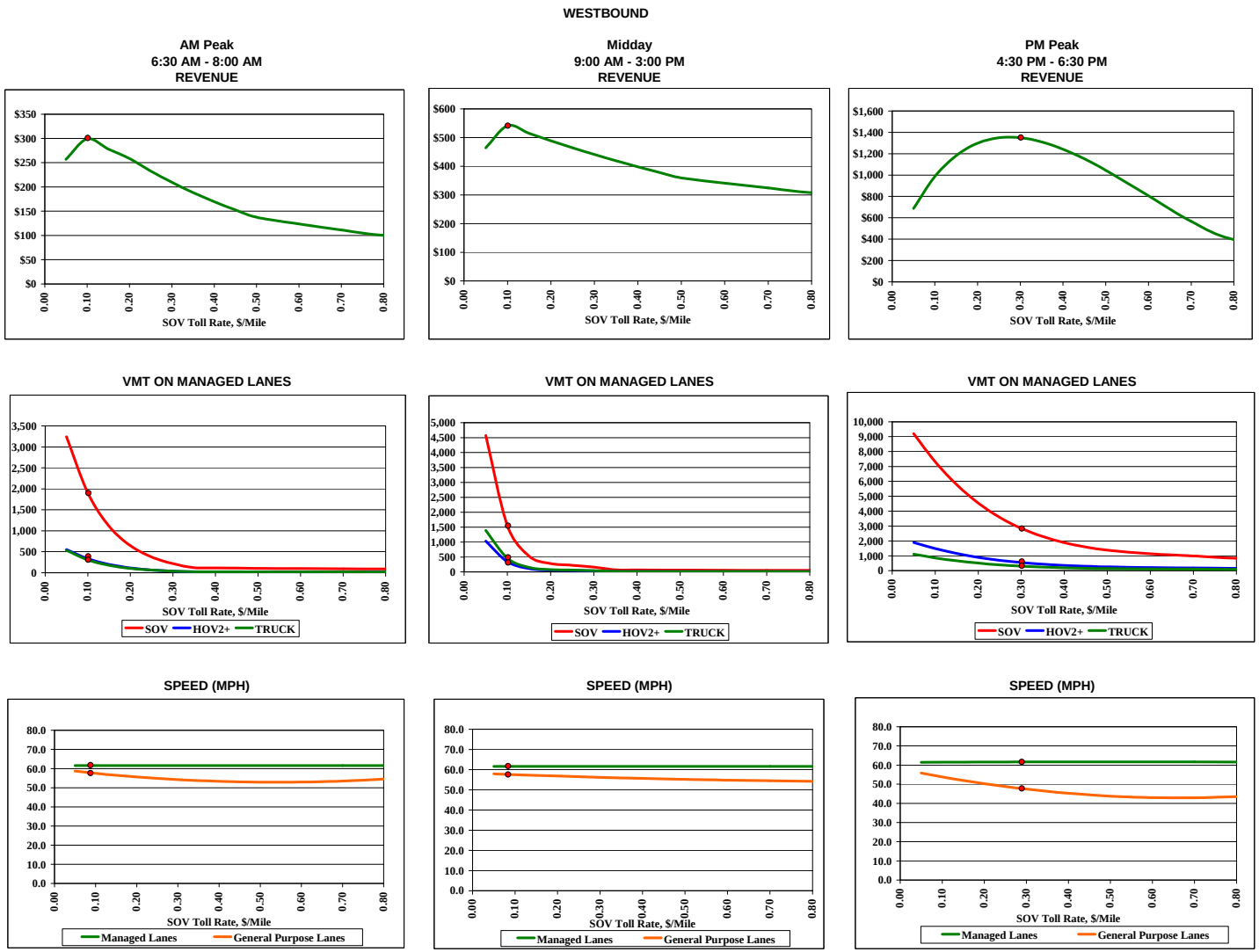



**Figure 6-2. 2019 Alternative 1 Toll Rate/Operations Profile –Westbound East Segment**

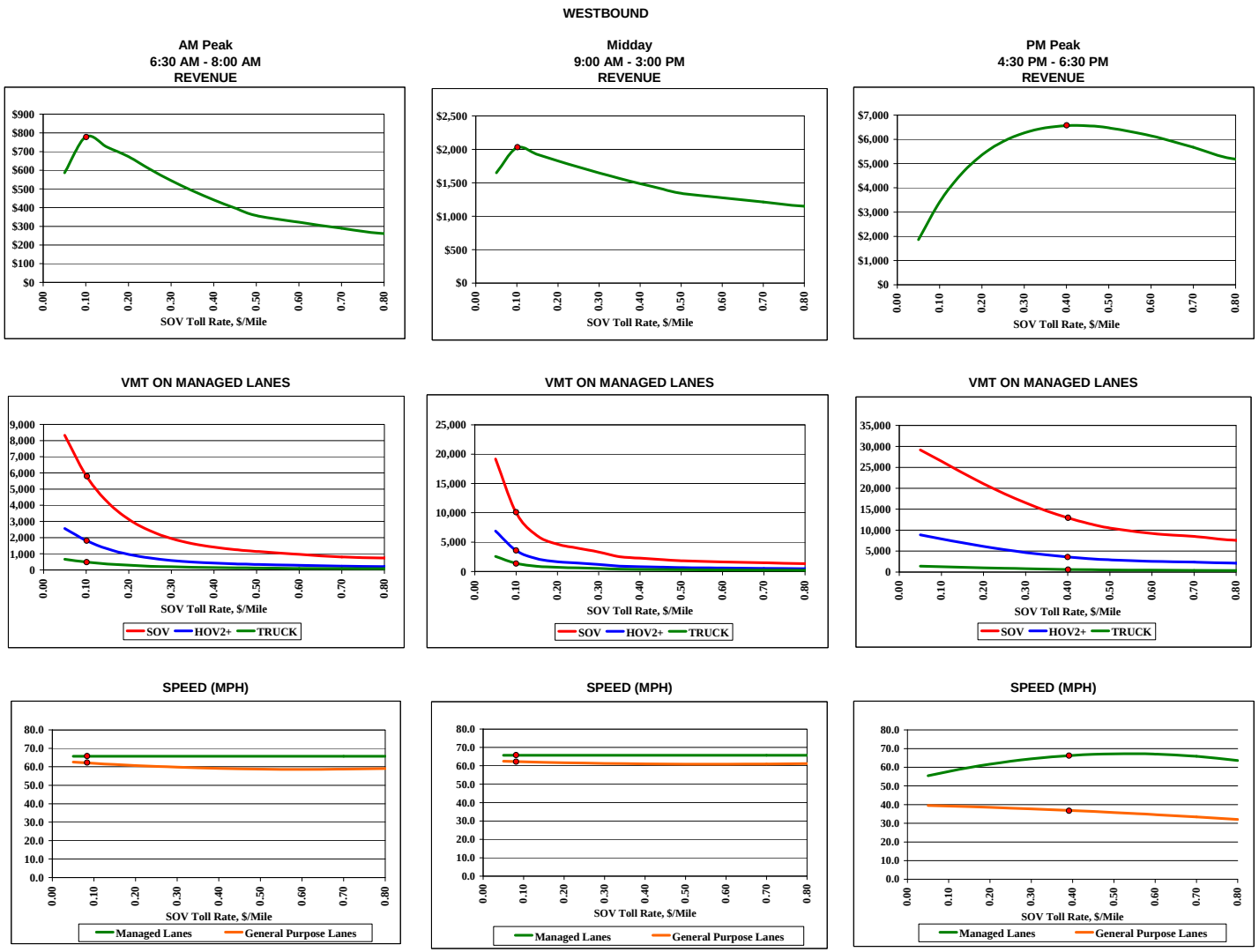



**Figure 6-3. 2019 Alternative 1 Toll Rate/Operations Profile –Westbound Middle Segment**

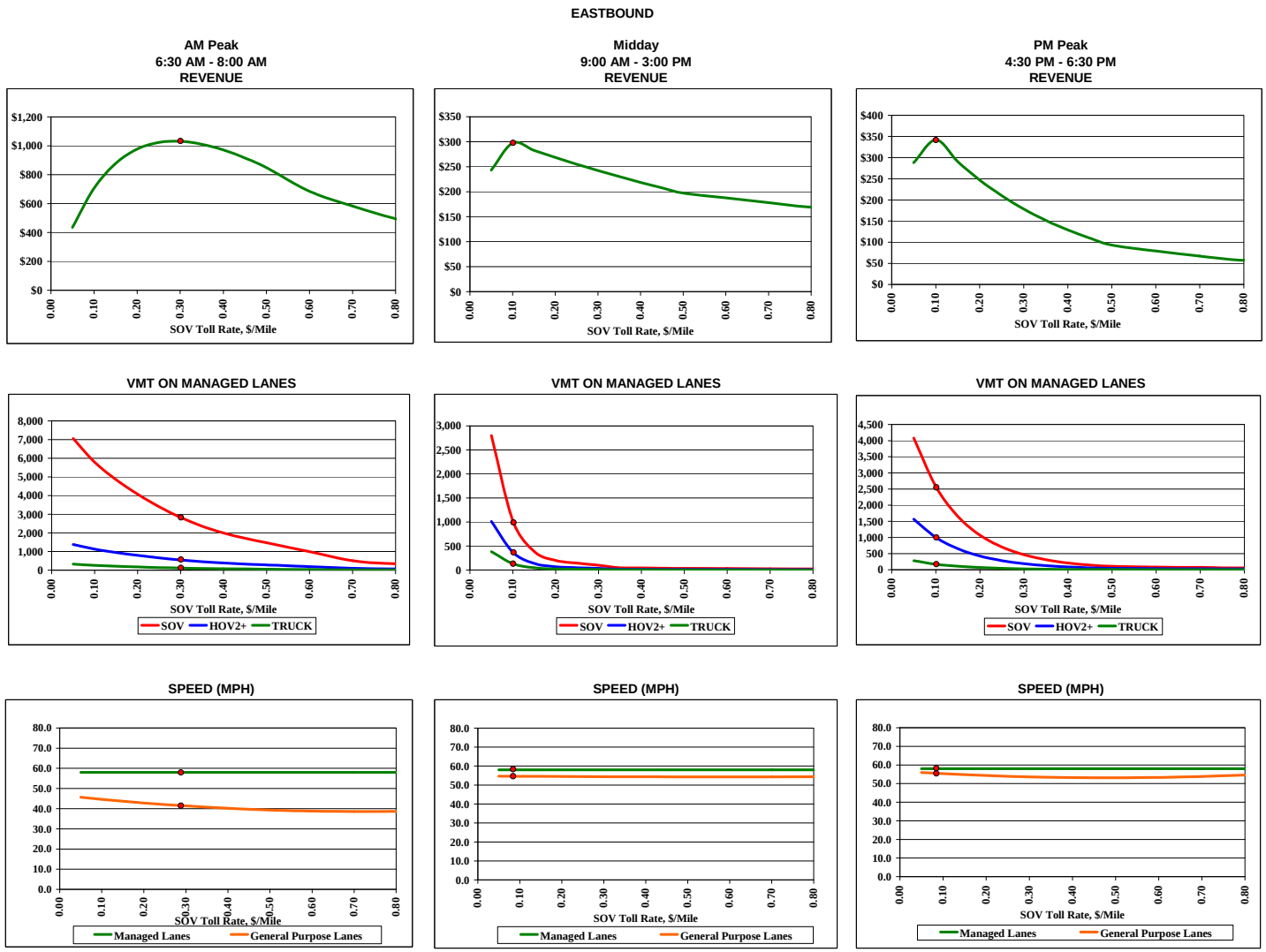



**Figure 6-4. 2019 Alternative 1 Toll Rate/Operations Profile –Eastbound East Segment**

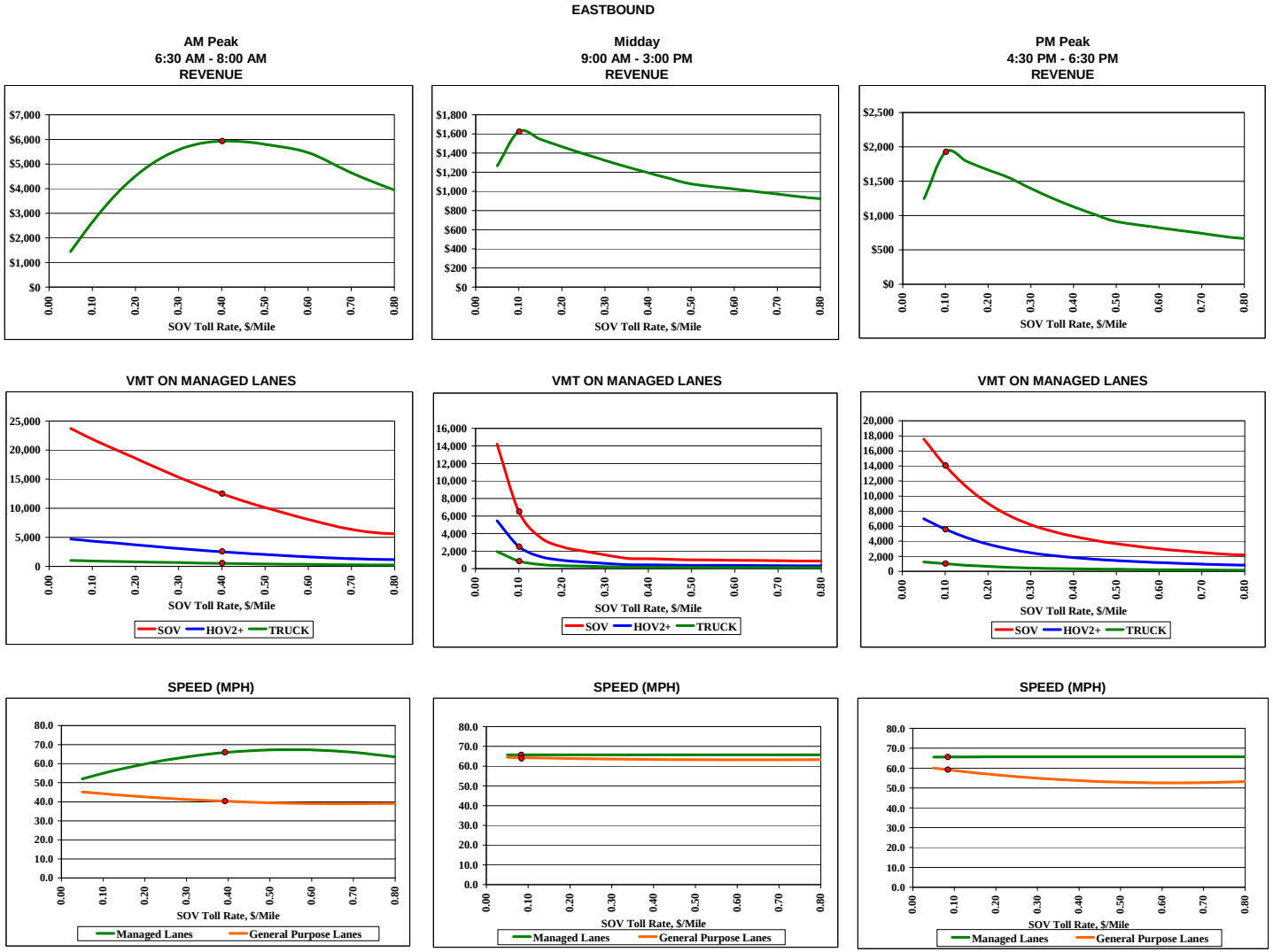



**Figure 6-5. 2019 Alternative 1 Toll Rate/Operations Profile –Eastbound Middle Segment**

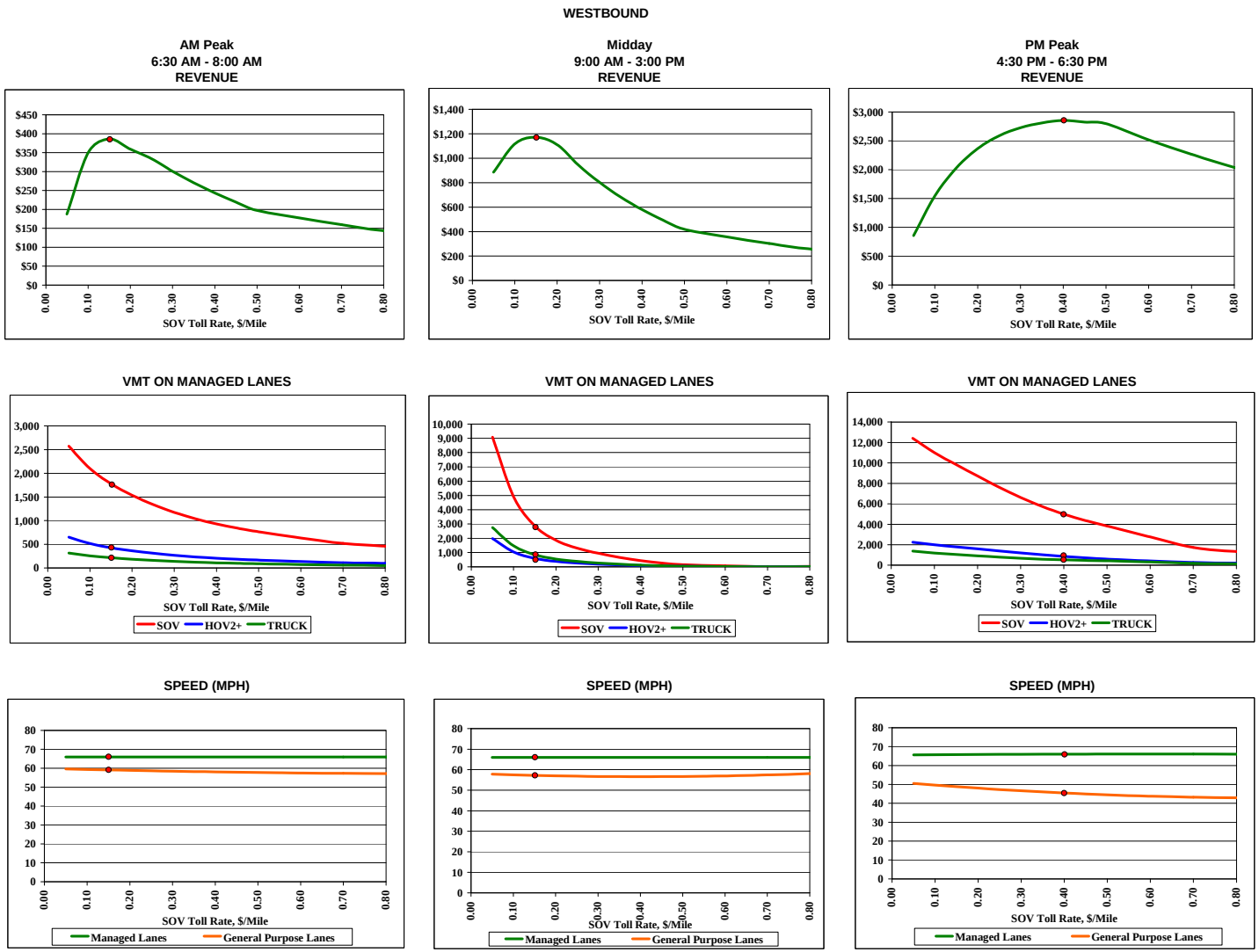



**Figure 6-6. 2030 Alternative 1 Toll Rate/Operations Profile –Westbound East Segment**

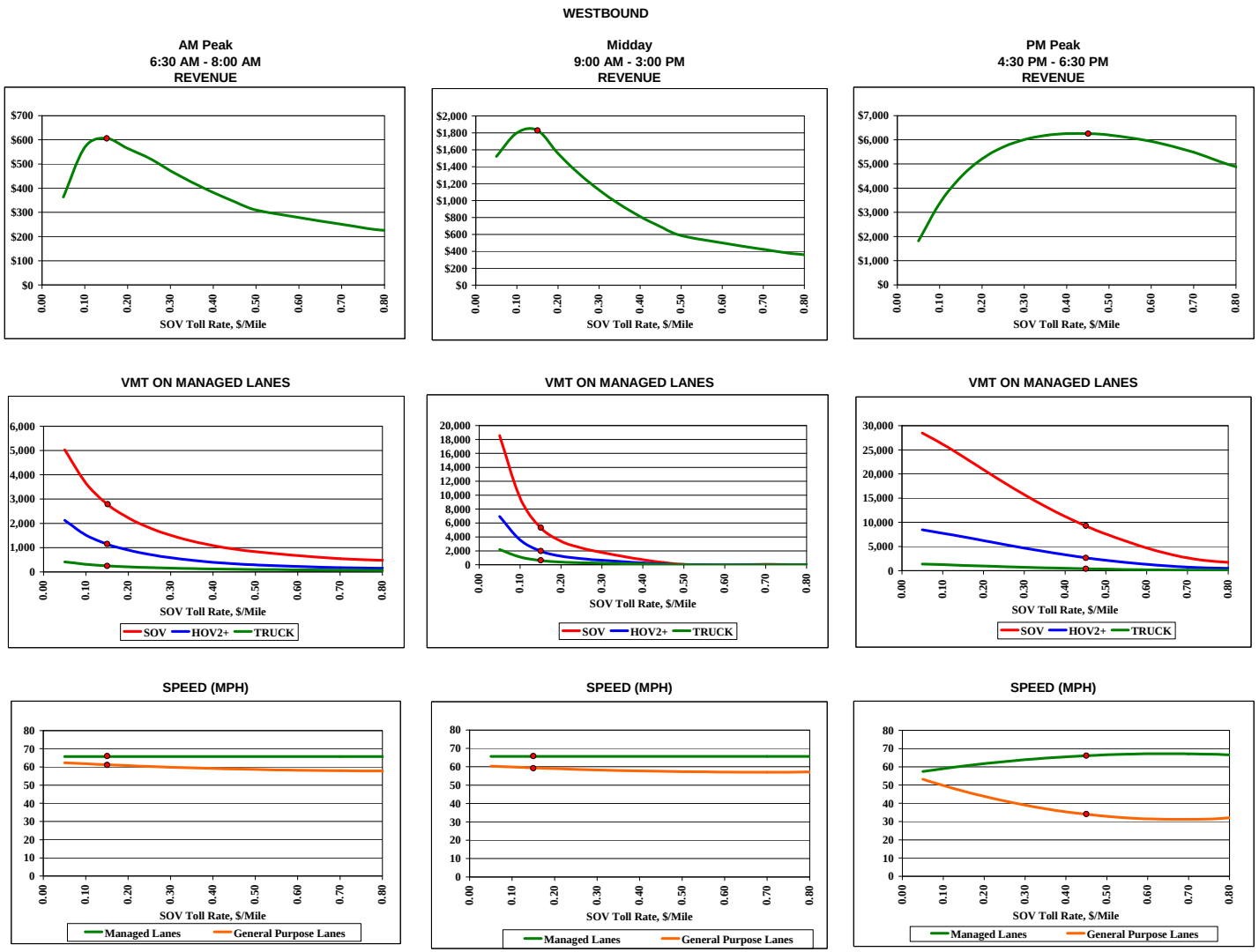



**Figure 6-7. 2030 Alternative 1 Toll Rate/Operations Profile –Westbound Middle Segment**

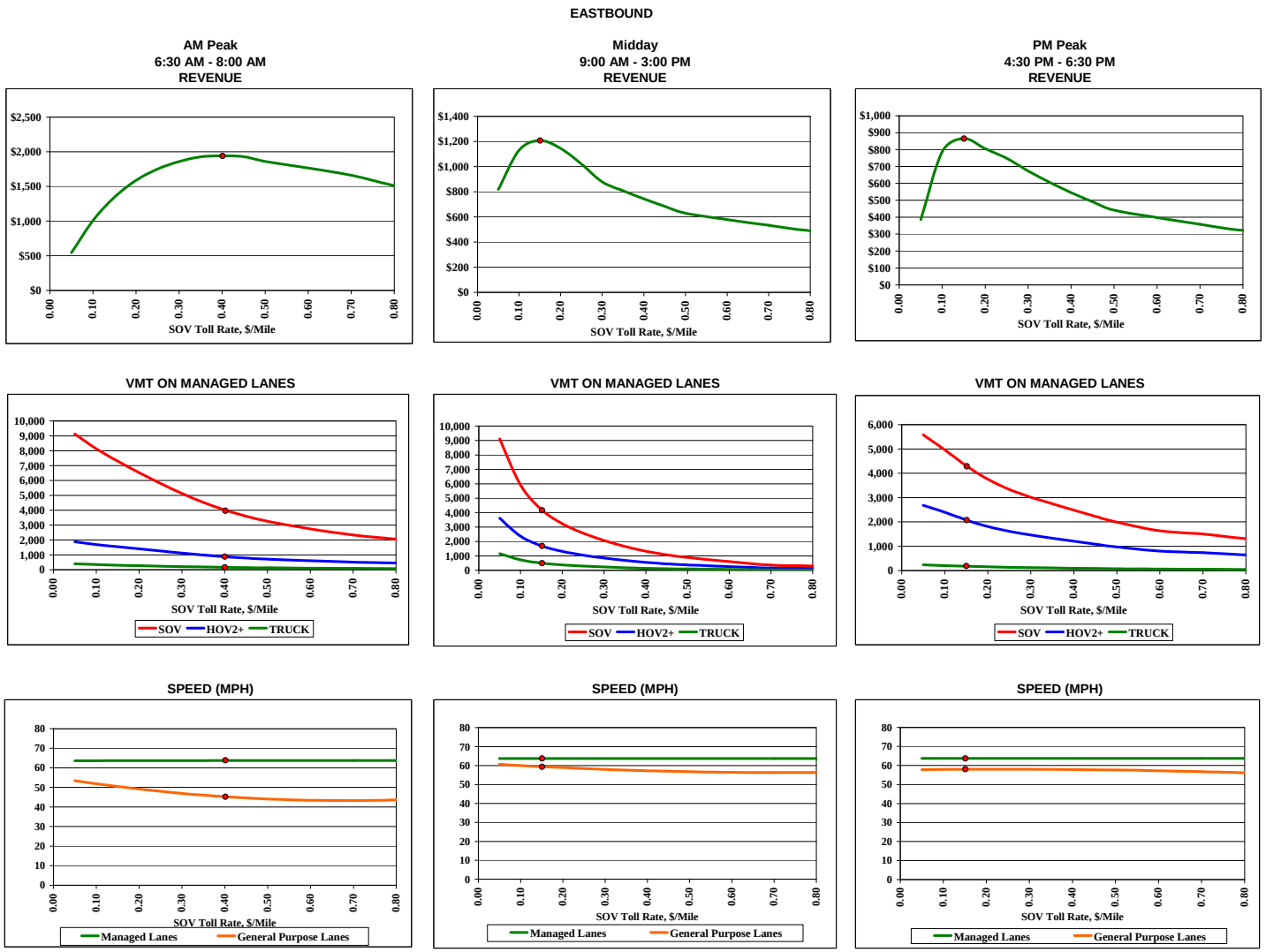



**Figure 6-8. 2030 Alternative 1 Toll Rate/Operations Profile –Eastbound East Segment**

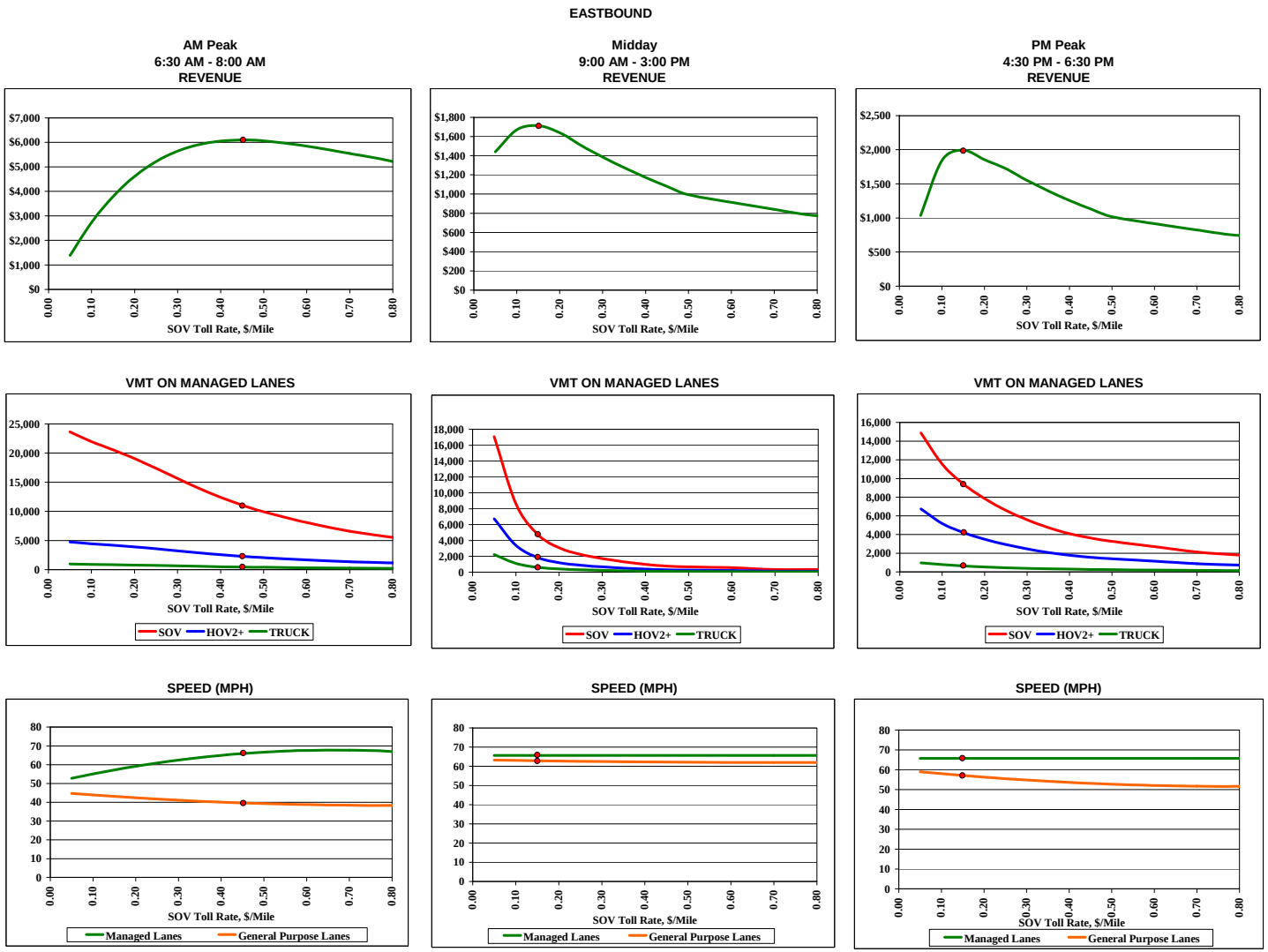



**Figure 6-9. 2030 Alternative 1 Toll Rate/Operations Profile –East Middle Segment**

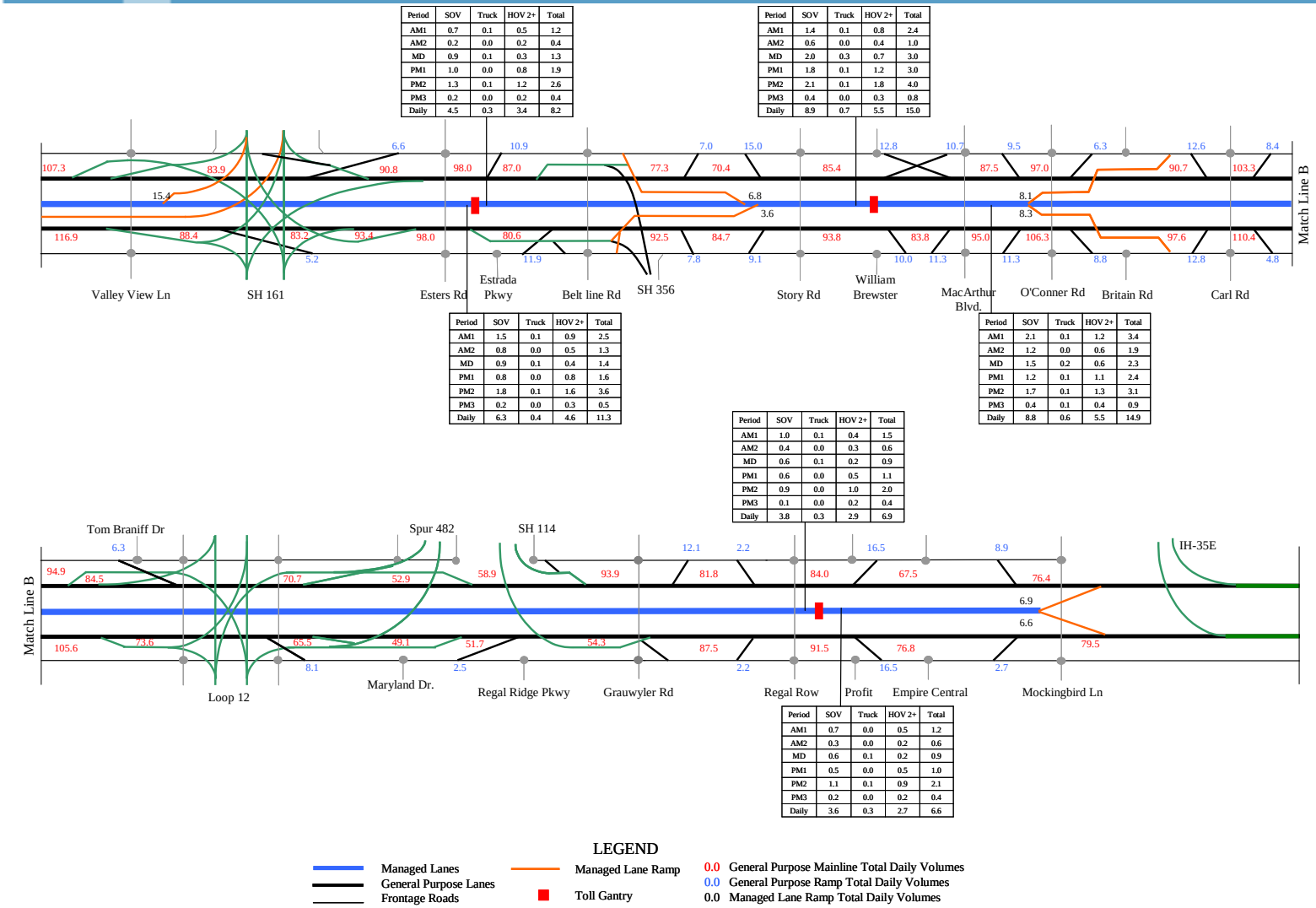
## ESTIMATED WEEKDAY MANAGED LANE TRAFFIC

**Figures 6-10** through **6-13** illustrate the estimated daily traffic along the proposed managed lanes and the general purpose lanes under the five alternatives for both 2019 and 2030. The daily volumes are presented in thousands for the general purpose lanes, managed lanes, and access ramps to/from each of the respective lanes. The directional volumes on the managed lanes are also shown by time period and vehicle type for each of the toll gantry location. The volumes shown in **Figures 6-10** through **6-13** do not reflect any reduction in traffic due to ramp-up

The 2019 daily traffic under Alternatives 1 and 4, reflecting the full build-out of both East and Middle segments, is shown in **Figure 6-10**. Given that the IH 35E reversible managed lane connecting to SH 183 managed lanes and direct connection to Trinity Parkway are not constructed by 2019, a pair of slip ramps was added for the interim connection from general purpose lanes to managed lane. The managed lane traffic for the segment between Story Road and MacArthur Boulevard within the study area is estimated to be 29,900 daily vehicles for both directions while traffic at eastern end of the project at Mockingbird Lane is estimated to be 13,500 daily vehicles

The 2019 daily traffic under Alternative 2 reflecting the construction of only East segment is shown in **Figure 6-11.** The managed lanes constructed under Alternative 2 are only about a third in length as compared to Alternative 1 with no continuity and connection to the managed lanes to the west of SH 161. Therefore, as expected, the managed lane traffic for the eastern segment under Alternative 2 is lower and is projected to be 11,800 daily vehicles for both directions. The 2019 daily traffic under Alternative 3 with the construction of only Middle segment is shown in **Figure 6-12**. The 2019 managed lane traffic for the segment between Story Road and MacArthur Boulevard within the study area is estimated to be 27,000 daily vehicles for both directions.

The 2030 managed lane traffic for all alternatives is shown in **Figure 6-13**. The managed lane traffic for the segment between Story Road and MacArthur Boulevard within the study area is estimated to be 18,800 daily vehicles for both directions. The reduction of managed lane traffic at the location is mainly due to the opening of SH 114 and Loop 12 managed lane, the capacity improvement along SH 114 and Loop 12 general purpose lanes. The 2030 managed lane traffic is estimated to be 18,600 daily vehicles at the eastern end of the project at Mockingbird Lane.




| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 0.7 | 0.1 | 0.5 | 1.2 |
| AM2 | 0.2 | 0.0 | 0.2 | 0.4 |
| MD | 0.9 | 0.1 | 0.3 | 1.3 |
| PM1 | 1.0 | 0.0 | 0.8 | 1.9 |
| PM2 | 1.3 | 0.1 | 1.2 | 2.6 |
| PM3 | 0.2 | 0.0 | 0.2 | 0.4 |
| Daily | 4.5 | 0.3 | 3.4 | 8.2 |

| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 1.4 | 0.1 | 0.8 | 2.4 |
| AM2 | 0.6 | 0.0 | 0.4 | 1.0 |
| MD | 2.0 | 0.3 | 0.7 | 3.0 |
| PM1 | 1.8 | 0.1 | 1.2 | 3.0 |
| PM2 | 2.1 | 0.1 | 1.8 | 4.0 |
| PM3 | 0.4 | 0.0 | 0.3 | 0.8 |
| Daily | 8.9 | 0.7 | 5.5 | 15.0 |

| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 1.5 | 0.1 | 0.9 | 2.5 |
| AM2 | 0.8 | 0.0 | 0.5 | 1.3 |
| MD | 0.9 | 0.1 | 0.4 | 1.4 |
| PM1 | 0.8 | 0.0 | 0.8 | 1.6 |
| PM2 | 1.8 | 0.1 | 1.6 | 3.6 |
| PM3 | 0.2 | 0.0 | 0.3 | 0.5 |
| Daily | 6.3 | 0.4 | 4.6 | 11.3 |

| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 2.1 | 0.1 | 1.2 | 3.4 |
| AM2 | 1.2 | 0.0 | 0.6 | 1.9 |
| MD | 1.5 | 0.2 | 0.6 | 2.3 |
| PM1 | 1.2 | 0.1 | 1.1 | 2.4 |
| PM2 | 1.7 | 0.1 | 1.3 | 3.1 |
| PM3 | 0.4 | 0.1 | 0.4 | 0.9 |
| Daily | 8.8 | 0.6 | 5.5 | 14.9 |

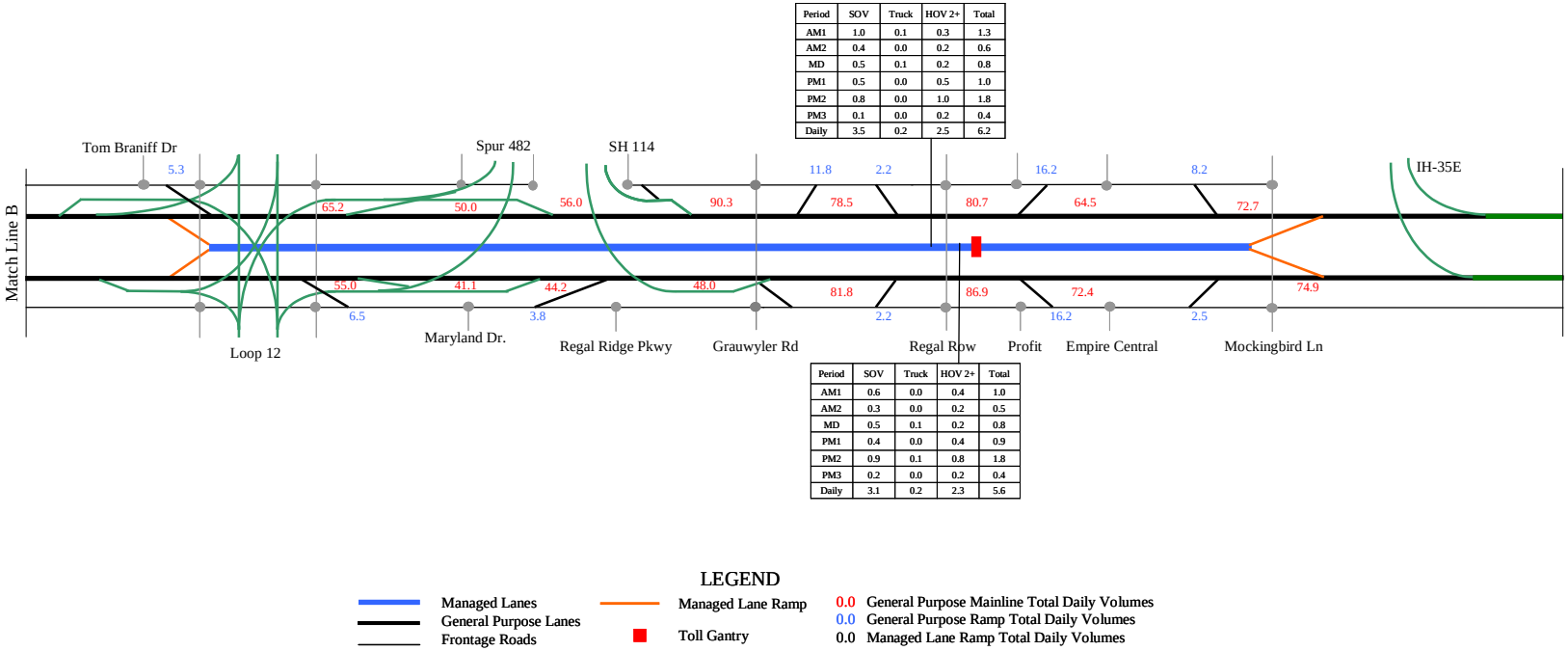
| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 1.0 | 0.1 | 0.4 | 1.5 |
| AM2 | 0.4 | 0.0 | 0.3 | 0.6 |
| MD | 0.6 | 0.1 | 0.2 | 0.9 |
| PM1 | 0.6 | 0.0 | 0.5 | 1.1 |
| PM2 | 0.9 | 0.0 | 1.0 | 2.0 |
| PM3 | 0.1 | 0.0 | 0.2 | 0.4 |
| Daily | 3.8 | 0.3 | 2.9 | 6.9 |

| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 0.7 | 0.0 | 0.5 | 1.2 |
| AM2 | 0.3 | 0.0 | 0.2 | 0.6 |
| MD | 0.6 | 0.1 | 0.2 | 0.9 |
| PM1 | 0.5 | 0.0 | 0.5 | 1.0 |
| PM2 | 1.1 | 0.1 | 0.9 | 2.1 |
| PM3 | 0.2 | 0.0 | 0.2 | 0.4 |
| Daily | 3.6 | 0.3 | 2.7 | 6.6 |

LEGEND

Managed Lanes
General Purpose Lanes
Frontage Roads
Managed Lane Ramp
Toll Gantry
0.0 General Purpose Mainline Total Daily Volumes
0.0 General Purpose Ramp Total Daily Volumes
0.0 Managed Lane Ramp Total Daily Volumes

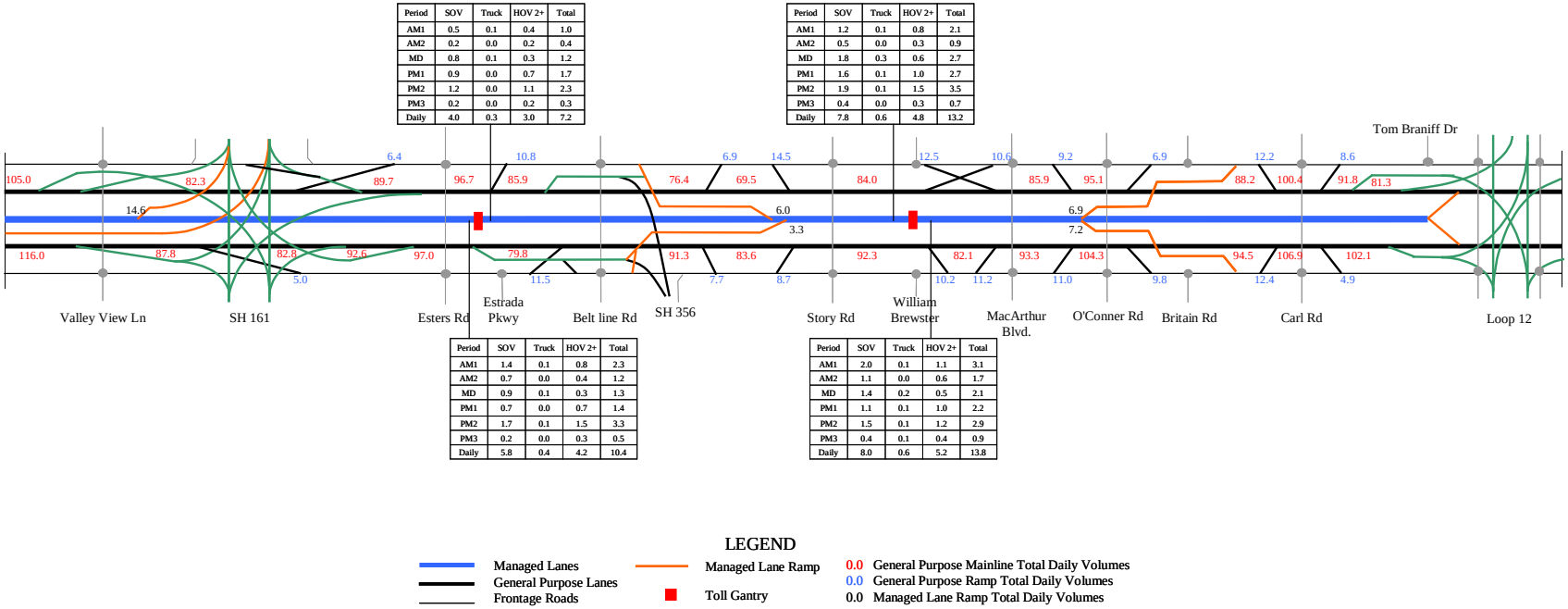
**Figure 6-10. 2019 Alternative 1 Managed Lane Daily Traffic**




| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 1.0 | 0.1 | 0.3 | 1.3 |
| AM2 | 0.4 | 0.0 | 0.2 | 0.6 |
| MD | 0.5 | 0.1 | 0.2 | 0.8 |
| PM1 | 0.5 | 0.0 | 0.5 | 1.0 |
| PM2 | 0.8 | 0.0 | 1.0 | 1.8 |
| PM3 | 0.1 | 0.0 | 0.2 | 0.4 |
| Daily | 3.5 | 0.2 | 2.5 | 6.2 |

| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 0.6 | 0.0 | 0.4 | 1.0 |
| AM2 | 0.3 | 0.0 | 0.2 | 0.5 |
| MD | 0.5 | 0.1 | 0.2 | 0.8 |
| PM1 | 0.4 | 0.0 | 0.4 | 0.9 |
| PM2 | 0.9 | 0.1 | 0.8 | 1.8 |
| PM3 | 0.2 | 0.0 | 0.2 | 0.4 |
| Daily | 3.1 | 0.2 | 2.3 | 5.6 |

**Figure 6-11. 2019 Alternative 2 Managed Lane Daily Traffic**



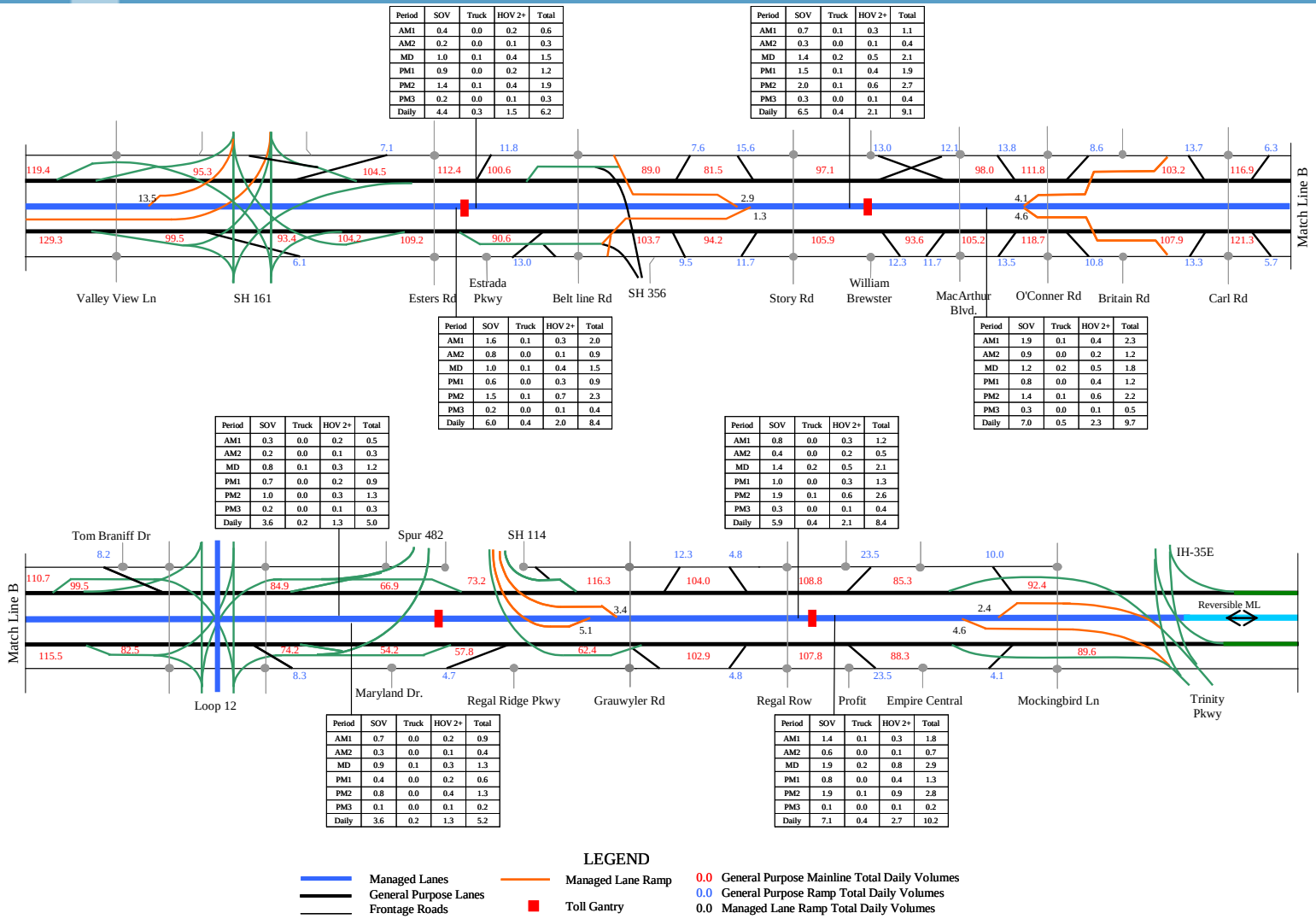

| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 0.5 | 0.1 | 0.4 | 1.0 |
| AM2 | 0.2 | 0.0 | 0.2 | 0.4 |
| MD | 0.8 | 0.1 | 0.3 | 1.2 |
| PM1 | 0.9 | 0.0 | 0.7 | 1.7 |
| PM2 | 1.2 | 0.0 | 1.1 | 2.3 |
| PM3 | 0.2 | 0.0 | 0.2 | 0.3 |
| Daily | 4.0 | 0.3 | 3.0 | 7.2 |

| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 1.2 | 0.1 | 0.8 | 2.1 |
| AM2 | 0.5 | 0.0 | 0.3 | 0.9 |
| MD | 1.8 | 0.3 | 0.6 | 2.7 |
| PM1 | 1.6 | 0.1 | 1.0 | 2.7 |
| PM2 | 1.9 | 0.1 | 1.5 | 3.5 |
| PM3 | 0.4 | 0.0 | 0.3 | 0.7 |
| Daily | 7.8 | 0.6 | 4.8 | 13.2 |

| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 1.4 | 0.1 | 0.8 | 2.3 |
| AM2 | 0.7 | 0.0 | 0.4 | 1.2 |
| MD | 0.9 | 0.1 | 0.3 | 1.3 |
| PM1 | 0.7 | 0.0 | 0.7 | 1.4 |
| PM2 | 1.7 | 0.1 | 1.5 | 3.3 |
| PM3 | 0.2 | 0.0 | 0.3 | 0.5 |
| Daily | 5.8 | 0.4 | 4.2 | 10.4 |

| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 2.0 | 0.1 | 1.1 | 3.1 |
| AM2 | 1.1 | 0.0 | 0.6 | 1.7 |
| MD | 1.4 | 0.2 | 0.5 | 2.1 |
| PM1 | 1.1 | 0.1 | 1.0 | 2.2 |
| PM2 | 1.5 | 0.1 | 1.2 | 2.9 |
| PM3 | 0.4 | 0.1 | 0.4 | 0.9 |
| Daily | 8.0 | 0.6 | 5.2 | 13.8 |

**Figure 6-12. 2019 Alternative 3 Managed Lane Daily Traffic**




| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 0.4 | 0.0 | 0.2 | 0.6 |
| AM2 | 0.2 | 0.0 | 0.1 | 0.3 |
| MD | 1.0 | 0.1 | 0.4 | 1.5 |
| PM1 | 0.9 | 0.0 | 0.2 | 1.2 |
| PM2 | 1.4 | 0.1 | 0.4 | 1.9 |
| PM3 | 0.2 | 0.0 | 0.1 | 0.3 |
| Daily | 4.4 | 0.3 | 1.5 | 6.2 |

| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 0.7 | 0.1 | 0.3 | 1.1 |
| AM2 | 0.3 | 0.0 | 0.1 | 0.4 |
| MD | 1.4 | 0.2 | 0.5 | 2.1 |
| PM1 | 1.5 | 0.1 | 0.4 | 1.9 |
| PM2 | 2.0 | 0.1 | 0.6 | 2.7 |
| PM3 | 0.3 | 0.0 | 0.1 | 0.4 |
| Daily | 6.5 | 0.4 | 2.1 | 9.1 |

| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 1.6 | 0.1 | 0.3 | 2.0 |
| AM2 | 0.8 | 0.0 | 0.1 | 0.9 |
| MD | 1.0 | 0.1 | 0.4 | 1.5 |
| PM1 | 0.6 | 0.0 | 0.3 | 0.9 |
| PM2 | 1.5 | 0.1 | 0.7 | 2.3 |
| PM3 | 0.2 | 0.0 | 0.1 | 0.4 |
| Daily | 6.0 | 0.4 | 2.0 | 8.4 |

| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 1.9 | 0.1 | 0.4 | 2.3 |
| AM2 | 0.9 | 0.0 | 0.2 | 1.2 |
| MD | 1.2 | 0.2 | 0.5 | 1.8 |
| PM1 | 0.8 | 0.0 | 0.4 | 1.2 |
| PM2 | 1.4 | 0.1 | 0.6 | 2.2 |
| PM3 | 0.3 | 0.0 | 0.1 | 0.5 |
| Daily | 7.0 | 0.5 | 2.3 | 9.7 |

| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 0.3 | 0.0 | 0.2 | 0.5 |
| AM2 | 0.2 | 0.0 | 0.1 | 0.3 |
| MD | 0.8 | 0.1 | 0.3 | 1.2 |
| PM1 | 0.7 | 0.0 | 0.2 | 0.9 |
| PM2 | 1.0 | 0.0 | 0.3 | 1.3 |
| PM3 | 0.2 | 0.0 | 0.1 | 0.3 |
| Daily | 3.6 | 0.2 | 1.3 | 5.0 |

| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 0.8 | 0.0 | 0.3 | 1.2 |
| AM2 | 0.4 | 0.0 | 0.2 | 0.5 |
| MD | 1.4 | 0.2 | 0.5 | 2.1 |
| PM1 | 1.0 | 0.0 | 0.3 | 1.3 |
| PM2 | 1.9 | 0.1 | 0.6 | 2.6 |
| PM3 | 0.3 | 0.0 | 0.1 | 0.4 |
| Daily | 5.9 | 0.4 | 2.1 | 8.4 |

| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 0.7 | 0.0 | 0.2 | 0.9 |
| AM2 | 0.3 | 0.0 | 0.1 | 0.4 |
| MD | 0.9 | 0.1 | 0.3 | 1.3 |
| PM1 | 0.4 | 0.0 | 0.2 | 0.6 |
| PM2 | 0.8 | 0.0 | 0.4 | 1.3 |
| PM3 | 0.1 | 0.0 | 0.1 | 0.2 |
| Daily | 3.6 | 0.2 | 1.3 | 5.2 |

| Period | SOV | Truck | HOV 2+ | Total |
|---|---|---|---|---|
| AM1 | 1.4 | 0.1 | 0.3 | 1.8 |
| AM2 | 0.6 | 0.0 | 0.1 | 0.7 |
| MD | 1.9 | 0.2 | 0.8 | 2.9 |
| PM1 | 0.8 | 0.0 | 0.4 | 1.3 |
| PM2 | 1.9 | 0.1 | 0.9 | 2.8 |
| PM3 | 0.1 | 0.0 | 0.1 | 0.2 |
| Daily | 7.1 | 0.4 | 2.7 | 10.2 |

**Figure 6-13. 2030 Managed Lane Daily Traffic for All Alternatives**

## MANAGED LANE TRAFFIC SHARE

**Table 6-3** shows the 2030 traffic share of managed lanes under the ultimate build-out of the project for the five alternatives. The managed lane traffic shares in the table summarize the results for the peak directions during the peak periods and peak shoulder periods. The managed lane (ML) and general purpose (GP) lane traffic volume presented in table reflect the average volume along the specific segment. Therefore, the ML share represents the average share along the segment.

The highest traffic shares occur in the Middle Segment which is consistent with the traffic volume patterns and the proposed managed lane access configuration along the corridor. For the AM 1 peak period in the eastbound direction, the traffic share of managed lanes for the Middle Segment was approximately 17.0 percent, while the East Segment captured a share of approximately 11.4 percent. The managed lane shares during the morning peak shoulder time (AM 2) are somewhat lower than AM 1 given the relatively lower traffic demand in this period. The managed lane share during evening peak period (PM2) reached 15.3 percent in the Middle Segment and 12.1 percent along the East Segment. These shares were again approximately three to four percent higher than those during evening peak shoulder period (PM1).

**Table 6-3**
**2030 Managed Lane Share**

| Period | Direction | Segment | GP Volume | ML Volume | Total Volume | ML share |
|---|---|---|---|---|---|---|
| AM 1 | Eastbound | East | 9,400 | 1,210 | 10,610 | 11.4% |
| | | Middle | 10,390 | 2,130 | 12,520 | 17.0% |
| AM 2 | Eastbound | East | 6,440 | 530 | 6,970 | 7.6% |
| | | Middle | 7,190 | 1,040 | 8,230 | 12.6% |
| PM 1 | Westbound | East | 9,210 | 1,090 | 10,300 | 10.6% |
| | | Middle | 8,980 | 1,510 | 10,490 | 14.4% |
| PM 2 | Westbound | East | 13,050 | 1,800 | 14,850 | 12.1% |
| | | Middle | 12,580 | 2,270 | 14,850 | 15.3% |

## TRAVEL TIME SAVINGS ANALYSIS

The primary factor influencing travelers' decisions to use a managed lanes facility is the travel time savings offered. The 2030 travel time savings offered by the SH 183 managed lanes is summarized in **Table 6-4** for the peak direction during both AM and PM peak periods, under the ultimate build-out configuration. The travel times on the general

purpose and managed lanes are summarized along with the respective travel time savings in minutes, and the savings as a percentage of the general purpose lanes travel time. The time savings offered by the managed lanes are expected to be significant on a percentage basis given the short distance of the corridor. A trip on the eastbound managed lanes will be approximately 39 percent shorter (over 5 minutes less) than an equivalent trip on the general purpose lanes during the AM1 peak.

The westbound traffic during PM peak also exhibited a similar time saving percentage as the eastbound in the AM peak. The time savings, during PM2 period, to travel the entire managed lane project is expected to be approximately 47 percent of the travel time on the general purpose lanes and will average approximately 7 minutes (it is worth noting that these travel time savings are an average overall summary under the equilibrium assignment, and thus individual trips may experience significantly higher travel time savings).

**Table 6-4**
**2030 Travel Time Saving Analysis**

| Period | Direction | Segment | Travel Time (min) | | | Time Savings (%) |
|---|---|---|---|---|---|---|
| | | | GP Lanes | Managed Lanes | Time Savings | |
| AM1 | Eastbound | East | 6.6 | 4.4 | 2.1 | 32.7% |
| | | Middle | 6.6 | 3.6 | 2.9 | 44.6% |
| | | Total | 13.2 | 8.1 | 5.1 | 38.6% |
| AM2 | Eastbound | East | 5.5 | 4.4 | 1.0 | 19.1% |
| | | Middle | 5.2 | 3.6 | 1.6 | 30.3% |
| | | Total | 10.7 | 8.1 | 2.6 | 24.6% |
| PM1 | Westbound | East | 6.8 | 4.5 | 2.2 | 33.0% |
| | | Middle | 6.2 | 3.6 | 2.7 | 43.1% |
| | | Total | 13.0 | 8.1 | 4.9 | 37.9% |
| PM2 | Westbound | East | 8.0 | 4.5 | 3.5 | 43.6% |
| | | Middle | 7.3 | 3.6 | 3.8 | 51.5% |
| | | Total | 15.4 | 8.1 | 7.3 | 47.4% |
| PM3 | Westbound | East | 5.3 | 4.5 | 0.8 | 15.0% |
| | | Middle | 5.0 | 3.6 | 1.5 | 29.5% |
| | | Total | 10.4 | 8.1 | 2.3 | 22.1% |

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## ESTIMATED AVERAGE WEEKDAY TRANSACTIONS AND ANNUAL TOLL REVENUE

**Table 6-5** shows the estimated 2019 and future year 2030 daily transaction and revenue for each of the time periods modeled. The average transactions shown in **Table 6-5** for the different time periods reflect the directional traffic along the SH 183 corridor, and showed that the eastbound direction will capture higher volumes during the morning peak while the westbound direction will capture higher volumes during the afternoon peak. The average toll rates summarized in the tables is calculated by dividing the total toll revenues with the total transactions along the entire corridor. The 2019 total daily transactions for both directions are estimated to range between approximately 17,100 under Alternative 2 to 69,000 under Alternatives 1 and 4. These toll transactions are expected to generate 2019 daily toll revenues of approximately $5,600 (yielding an average toll rate of $0.33) and $35,300 (yielding an average toll rate of $0.51) under Alternative 2 and Alternative 1 respectively. The 2030 total daily transactions are expected to be approximately 60,400 transactions yielding daily toll revenues of approximately $61,500 at an average toll rate of $1.02 per transaction. The transactions in 2030 are slightly lower than the 2019 levels as a result competing project improvements within the region (which reduces the overall traffic demand in the corridor) and a significantly higher optimized toll rate. The estimated toll revenue is forecasted to be over 70 percent higher than the 2019 levels for the full build out Alternatives, as a result on the growing congestion within the corridor.

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**Table 6-5**

**Estimated Daily Transactions and Revenue**

| Time Period | Westbound | | | Eastbound | | | Both Directions | | |
|---|---|---|---|---|---|---|---|---|---|
| | Transactions | Revenue | Average Toll | Transactions | Revenue | Average Toll | Transactions | Revenue | Average Toll |
| **Year 2019 - Alternatives 1, 4** | | | | | | | | | |
| AM1 | 5,970 | $1,756 | $0.29 | 7,523 | $7,370 | $0.98 | 13,493 | $9,126 | $0.68 |
| AM2 | 2,523 | $703 | $0.28 | 3,967 | $2,827 | $0.71 | 6,490 | $3,530 | $0.54 |
| Midday | 5,619 | $1,766 | $0.31 | 5,046 | $1,618 | $0.32 | 10,665 | $3,385 | $0.32 |
| PM1 | 6,579 | $4,450 | $0.68 | 5,502 | $1,416 | $0.26 | 12,081 | $5,867 | $0.49 |
| PM2 | 9,733 | $8,772 | $0.90 | 9,957 | $2,697 | $0.27 | 19,691 | $11,469 | $0.58 |
| PM3 | 1,813 | $709 | $0.39 | 2,130 | $565 | $0.27 | 3,943 | $1,274 | $0.32 |
| Daily Total | 33,528 | $18,520 | $0.55 | 35,490 | $16,824 | $0.47 | 69,018 | $35,344 | $0.51 |
| **Year 2019 - Alternative 2** | | | | | | | | | |
| AM1 | 2,457 | $603 | $0.25 | 1,827 | $1,149 | $0.63 | 4,284 | $1,752 | $0.41 |
| AM2 | 1,099 | $259 | $0.24 | 917 | $383 | $0.42 | 2,017 | $642 | $0.32 |
| Midday | 1,455 | $376 | $0.26 | 1,436 | $370 | $0.26 | 2,891 | $746 | $0.26 |
| PM1 | 1,886 | $560 | $0.30 | 1,619 | $328 | $0.20 | 3,505 | $888 | $0.25 |
| PM2 | 3,293 | $1,913 | $0.58 | 3,250 | $685 | $0.21 | 6,542 | $2,598 | $0.40 |
| PM3 | 658 | $131 | $0.20 | 658 | $139 | $0.21 | 1,316 | $270 | $0.20 |
| Daily Total | 11,282 | $3,919 | $0.35 | 10,096 | $3,114 | $0.31 | 21,378 | $7,033 | $0.33 |
| **Year 2019 - Alternative 3** | | | | | | | | | |
| AM1 | 3,820 | $931 | $0.24 | 6,419 | $5,441 | $0.85 | 10,239 | $6,372 | $0.62 |
| AM2 | 1,554 | $373 | $0.24 | 3,471 | $2,522 | $0.73 | 5,025 | $2,895 | $0.58 |
| Midday | 4,756 | $1,346 | $0.28 | 4,065 | $1,178 | $0.29 | 8,821 | $2,524 | $0.29 |
| PM1 | 5,172 | $3,598 | $0.70 | 4,335 | $1,005 | $0.23 | 9,507 | $4,603 | $0.48 |
| PM2 | 6,989 | $5,515 | $0.79 | 7,007 | $1,716 | $0.24 | 13,995 | $7,231 | $0.52 |
| PM3 | 1,281 | $464 | $0.36 | 1,653 | $407 | $0.25 | 2,934 | $871 | $0.30 |
| Daily Total | 24,514 | $12,470 | $0.51 | 28,029 | $12,515 | $0.45 | 52,542 | $24,985 | $0.48 |
| **Year 2030 - All Alternative** | | | | | | | | | |
| AM1 | 3,287 | $2,122 | $0.65 | 6,890 | $11,648 | $1.69 | 10,177 | $13,770 | $1.35 |
| AM2 | 1,505 | $979 | $0.65 | 3,222 | $3,382 | $1.05 | 4,727 | $4,361 | $0.92 |
| Midday | 6,826 | $4,742 | $0.69 | 7,425 | $5,196 | $0.70 | 14,251 | $9,938 | $0.70 |
| PM1 | 5,275 | $6,807 | $1.29 | 4,012 | $2,548 | $0.63 | 9,287 | $9,355 | $1.01 |
| PM2 | 8,418 | $15,275 | $1.81 | 8,429 | $5,451 | $0.65 | 16,847 | $20,727 | $1.23 |
| PM3 | 1,488 | $1,202 | $0.81 | 1,316 | $898 | $0.68 | 2,804 | $2,101 | $0.75 |
| Daily Total | 27,872 | $31,751 | $1.14 | 32,545 | $29,706 | $0.91 | 60,418 | $61,458 | $1.02 |

The annual toll revenue and average weekday traffic along the corridor for each of the five alternatives is shown in **Table 6-6** for the 52-year forecast period**.** The traffic and revenue is presented until 2076 considering Alternative 5 is assumed to open by 2025. **Figure 6-14** graphically summarizes the annual revenue for the three of 2019, 2025, and 2030 model years for all five alternatives. The average traffic summarized in the table reflects the average volumes along the entire corridor (total vehicle mile travelled/length). Alternative 1 represents the most optimistic full build-out of the entire corridor and is expected in the 2015 opening year to generate revenues of approximately $4.50 million and is estimated to grow to $16.3 million by 2030. Alternatives 2 and 3 are both open in 2019 and expected to generate $1.5 million and $5.3 million respectively with the consideration of project ramp up. All five alternatives assume that the entire corridor will ultimately be built by 2030. The ramp up factors applied to Alternatives 2 and 3 result in slight variations in the revenue among alternatives. The SH 183 managed lanes are expected to generate toll revenues of approximately $107.2 million by 2076, which reflects a seven folds increase in revenue over the following 40 year period after 2030.

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**Table 6-6**
**Estimated Daily Transaction and Annual Revenue**

| Year | Alternative 1 | | Alternative 2 | | Alternative 3 | | Alternative 4 | | Alternative 5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Weekday Traffic | Annual Revenue | Weekday Traffic | Annual Revenue | Weekday Traffic | Annual Revenue | Weekday Traffic | Annual Revenue | Weekday Traffic | Annual Revenue |
| 2015 | 9,970 | $4,500 | | | | | | | | |
| 2016 | 12,280 | $5,800 | | | | | | | | |
| 2017 | 14,820 | $7,300 | | | | | | | | |
| 2018 | 16,010 | $8,300 | | | | | | | | |
| 2019 | 17,210 | $9,300 | 4,910 | $1,500 | 7,360 | $5,300 | 13,770 | $7,400 | | |
| 2020 | 17,030 | $9,600 | 5,550 | $1,800 | 8,030 | $6,000 | 15,320 | $8,700 | | |
| 2021 | 16,870 | $10,000 | 6,200 | $2,300 | 8,650 | $6,600 | 16,870 | $10,000 | | |
| 2022 | 16,710 | $10,200 | 6,230 | $2,400 | 8,380 | $6,600 | 16,710 | $10,200 | | |
| 2023 | 16,540 | $10,500 | 6,270 | $2,700 | 8,100 | $6,600 | 16,540 | $10,500 | | |
| 2024 | 16,350 | $10,800 | 6,300 | $2,900 | 7,810 | $6,600 | 16,350 | $10,800 | | |
| 2025 | 13,250 | $11,700 | 5,490 | $3,400 | 6,030 | $6,900 | 13,250 | $11,700 | 12,930 | $8,800 |
| 2026 | 13,450 | $12,600 | 5,680 | $3,800 | 6,170 | $7,800 | 13,450 | $12,600 | 14,670 | $10,500 |
| 2027 | 13,650 | $13,400 | 5,870 | $4,200 | 6,320 | $8,400 | 13,650 | $13,400 | 16,440 | $12,500 |
| 2028 | 13,860 | $14,300 | 6,060 | $4,600 | 6,480 | $9,100 | 13,860 | $14,300 | 16,590 | $13,300 |
| 2029 | 14,080 | $15,300 | 6,250 | $5,000 | 6,630 | $9,800 | 14,080 | $15,300 | 16,750 | $14,100 |
| 2030 | 14,290 | $16,300 | 12,860 | $14,600 | 12,860 | $14,800 | 14,290 | $16,300 | 14,290 | $16,300 |
| 2031 | 14,500 | $17,200 | 13,770 | $16,300 | 13,770 | $16,400 | 14,500 | $17,200 | 14,500 | $17,200 |
| 2032 | 14,710 | $18,100 | 14,710 | $18,100 | 14,710 | $18,100 | 14,710 | $18,100 | 14,710 | $18,100 |
| 2033 | 14,930 | $19,100 | 14,930 | $19,100 | 14,930 | $19,100 | 14,930 | $19,100 | 14,930 | $19,100 |
| 2034 | 15,160 | $20,100 | 15,160 | $20,100 | 15,160 | $20,100 | 15,160 | $20,100 | 15,160 | $20,100 |
| 2035 | 15,390 | $21,200 | 15,390 | $21,200 | 15,390 | $21,200 | 15,390 | $21,200 | 15,390 | $21,200 |
| 2036 | 15,540 | $22,200 | 15,540 | $22,200 | 15,540 | $22,200 | 15,540 | $22,200 | 15,540 | $22,200 |
| 2037 | 15,700 | $23,200 | 15,700 | $23,200 | 15,700 | $23,200 | 15,700 | $23,200 | 15,700 | $23,200 |
| 2038 | 15,860 | $24,300 | 15,860 | $24,300 | 15,860 | $24,300 | 15,860 | $24,300 | 15,860 | $24,300 |
| 2039 | 16,020 | $25,400 | 16,020 | $25,400 | 16,020 | $25,400 | 16,020 | $25,400 | 16,020 | $25,400 |
| 2040 | 16,180 | $26,500 | 16,180 | $26,500 | 16,180 | $26,500 | 16,180 | $26,500 | 16,180 | $26,500 |
| 2041 | 16,350 | $27,700 | 16,350 | $27,700 | 16,350 | $27,700 | 16,350 | $27,700 | 16,350 | $27,700 |
| 2042 | 16,510 | $29,000 | 16,510 | $29,000 | 16,510 | $29,000 | 16,510 | $29,000 | 16,510 | $29,000 |
| 2043 | 16,680 | $30,200 | 16,680 | $30,200 | 16,680 | $30,200 | 16,680 | $30,200 | 16,680 | $30,200 |
| 2044 | 16,860 | $31,600 | 16,860 | $31,600 | 16,860 | $31,600 | 16,860 | $31,600 | 16,860 | $31,600 |
| 2045 | 17,030 | $32,900 | 17,030 | $32,900 | 17,030 | $32,900 | 17,030 | $32,900 | 17,030 | $32,900 |
| 2046 | 17,200 | $34,300 | 17,200 | $34,300 | 17,200 | $34,300 | 17,200 | $34,300 | 17,200 | $34,300 |
| 2047 | 17,370 | $35,700 | 17,370 | $35,700 | 17,370 | $35,700 | 17,370 | $35,700 | 17,370 | $35,700 |
| 2048 | 17,540 | $37,200 | 17,540 | $37,200 | 17,540 | $37,200 | 17,540 | $37,200 | 17,540 | $37,200 |
| 2049 | 17,710 | $38,700 | 17,710 | $38,700 | 17,710 | $38,700 | 17,710 | $38,700 | 17,710 | $38,700 |
| 2050 | 17,890 | $40,300 | 17,890 | $40,300 | 17,890 | $40,300 | 17,890 | $40,300 | 17,890 | $40,300 |
| 2051 | 18,060 | $41,900 | 18,060 | $41,900 | 18,060 | $41,900 | 18,060 | $41,900 | 18,060 | $41,900 |
| 2052 | 18,240 | $43,600 | 18,240 | $43,600 | 18,240 | $43,600 | 18,240 | $43,600 | 18,240 | $43,600 |
| 2053 | 18,420 | $45,300 | 18,420 | $45,300 | 18,420 | $45,300 | 18,420 | $45,300 | 18,420 | $45,300 |
| 2054 | 18,610 | $47,100 | 18,610 | $47,100 | 18,610 | $47,100 | 18,610 | $47,100 | 18,610 | $47,100 |
| 2055 | 18,790 | $49,000 | 18,790 | $49,000 | 18,790 | $49,000 | 18,790 | $49,000 | 18,790 | $49,000 |
| 2056 | 18,980 | $50,900 | 18,980 | $50,900 | 18,980 | $50,900 | 18,980 | $50,900 | 18,980 | $50,900 |
| 2057 | 19,170 | $52,900 | 19,170 | $52,900 | 19,170 | $52,900 | 19,170 | $52,900 | 19,170 | $52,900 |
| 2058 | 19,360 | $54,900 | 19,360 | $54,900 | 19,360 | $54,900 | 19,360 | $54,900 | 19,360 | $54,900 |
| 2059 | 19,550 | $57,100 | 19,550 | $57,100 | 19,550 | $57,100 | 19,550 | $57,100 | 19,550 | $57,100 |
| 2060 | 19,740 | $59,300 | 19,740 | $59,300 | 19,740 | $59,300 | 19,740 | $59,300 | 19,740 | $59,300 |
| 2061 | 19,940 | $61,600 | 19,940 | $61,600 | 19,940 | $61,600 | 19,940 | $61,600 | 19,940 | $61,600 |
| 2062 | 20,140 | $64,000 | 20,140 | $64,000 | 20,140 | $64,000 | 20,140 | $64,000 | 20,140 | $64,000 |
| 2063 | 20,340 | $66,400 | 20,340 | $66,400 | 20,340 | $66,400 | 20,340 | $66,400 | 20,340 | $66,400 |
| 2064 | 20,540 | $68,900 | 20,540 | $68,900 | 20,540 | $68,900 | 20,540 | $68,900 | 20,540 | $68,900 |
| 2065 | 20,750 | $71,600 | 20,750 | $71,600 | 20,750 | $71,600 | 20,750 | $71,600 | 20,750 | $71,600 |
| 2066 | 20,960 | $74,200 | 20,960 | $74,200 | 20,960 | $74,200 | 20,960 | $74,200 | 20,960 | $74,200 |
| 2067 | 21,170 | $77,100 | 21,170 | $77,100 | 21,170 | $77,100 | 21,170 | $77,100 | 21,170 | $77,100 |
| 2068 | 21,380 | $80,000 | 21,380 | $80,000 | 21,380 | $80,000 | 21,380 | $80,000 | 21,380 | $80,000 |
| 2069 | 21,590 | $83,000 | 21,590 | $83,000 | 21,590 | $83,000 | 21,590 | $83,000 | 21,590 | $83,000 |
| 2070 | 21,810 | $86,100 | 21,810 | $86,100 | 21,810 | $86,100 | 21,810 | $86,100 | 21,810 | $86,100 |
| 2071 | 22,030 | $89,300 | 22,030 | $89,300 | 22,030 | $89,300 | 22,030 | $89,300 | 22,030 | $89,300 |
| 2072 | 22,250 | $92,600 | 22,250 | $92,600 | 22,250 | $92,600 | 22,250 | $92,600 | 22,250 | $92,600 |
| 2073 | 22,470 | $96,100 | 22,470 | $96,100 | 22,470 | $96,100 | 22,470 | $96,100 | 22,470 | $96,100 |
| 2074 | 22,690 | $99,700 | 22,690 | $99,700 | 22,690 | $99,700 | 22,690 | $99,700 | 22,690 | $99,700 |
| 2075 | 22,920 | $103,400 | 22,920 | $103,400 | 22,920 | $103,400 | 22,920 | $103,400 | 22,920 | $103,400 |
| 2076 | 23,150 | $107,200 | 23,150 | $107,200 | 23,150 | $107,200 | 23,150 | $107,200 | 23,150 | $107,200 |

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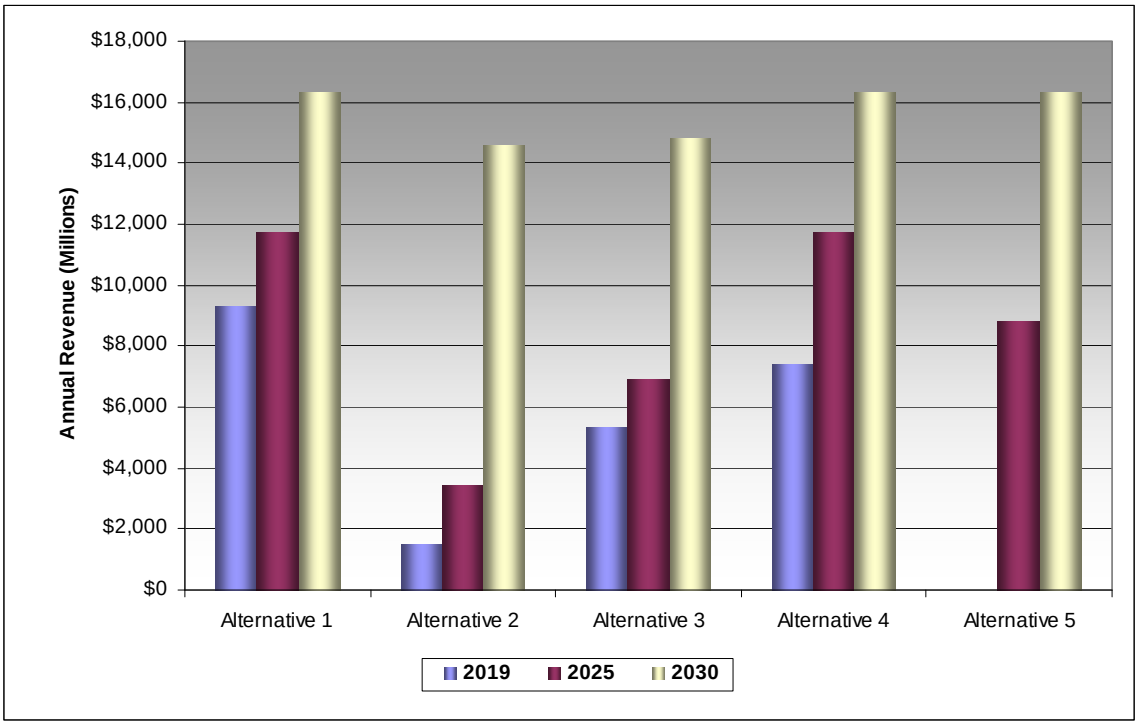


**Figure 6-14. Annual Toll Revenue Profile**

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# CHAPTER 7

# TOLL REVENUE RISK ANALYSIS

The forecast of future traffic demand on potential toll facilities has a certain level of uncertainty associated with multiple key variables, upon which the travel demand is dependent. Traffic and revenue forecasts are typically point forecasts that are generated based on assumptions developed from reasonable historical and forecasted averages that outline the most likely case future scenarios. However, the level of uncertainty around the average assumptions also needs to be taken into account for purposes of evaluating the potential range under which the toll revenue generation potential of the facility may fall. The level of upward or downward deviations from the mean, in concert with the likelihood of one variable occurrence over the other, is an important consideration in developing the full range of possible outcomes. While a full account of the overall risk associated with forecasting into the future is difficult to quantify, the following risk analysis undertaken as part of this study identifies some key variables whose influence and effect on the toll revenue generation of a corridor are significant enough to warrant further analysis and description.

This chapter describes the toll revenue risk analysis undertaken for the SH 183 managed lanes project that takes into consideration the variation of several key variables that may affect the travel demand and revenue forecast. The risk analysis of the toll revenue forecasts were performed for a modified case reflecting a higher risk profile and a midline case which employs the intermediate risk between the baseline and modified case.

## RISK ANALYSIS METHODOLOGY

The sources of uncertainty in the traffic and revenue forecasting can, in general, be classified under two categories: the modeling methodology and the forecasted model variable inputs. The modeling methodology is typically addressed by using the state-of-the-art and best practices regarding the industry accepted methodologies. These are continuously evolving as both software, hardware and data becomes more advanced and readily available for use within the modeling/forecasting community. The four-step travel demand models used as the base for this study were developed and maintained by NCTCOG and standard accepted practices were used and applied in developing these models. The model frameworks were therefore not analyzed quantitatively, however, they were reviewed for compliance with standard practices in their development, and reasonableness checks of the inputs and forecasts were also undertaken. The forecast model variable inputs to some extent can generate the largest uncertainty in the future forecast of the travel demand regionally, locally, and within the proposed study corridor. In the case of this study, the key model input variables investigated include the ramp-up factors, truck percentage shares, truck toll factors, revenue days, social economic forecasts, values of time, and toll diversion.

## RISK ANALYSIS ASSUMPTIONS

The key variables that have been considered for the risk analysis of the toll revenue forecasts are discussed in this section and **Table 7-1** outlines the assumptions used of each of these variables for the three defined revenue risk scenarios.

**Ramp-up Factor**

Most new toll facilities experience a ramping up of their demand as travelers become accustomed to the benefits of the new facility in comparison to their current routes. In the case of a managed lane project, a significant amount of the attracted traffic generally comes directly from the demand that is currently using the corridor with the remaining coming from other parallel routes. Thus future managed lane users are typically expected to be very familiar with the travel characteristics of the facility. However, as the managed lanes concept is still relatively new to North Texas travelers, some travelers may still need to get used to the access/exit locations and the tolling policy, and therefore the baseline ramp-up factor assumptions of 80 percent and 90 percent were assumed for the first two years of the SH 183 managed lane operations. As a risk sensitivity, the fact that a managed lane will be opened during the same timeframe at the eastern termini of the project and the possibility of a successful marketing and public outreach by both TxDOT and NTTA, may dampen the ramp-up in the corridor, especially in sections where

congestion is already prevalent today. As such, a reasonably aggressive ramp up factor assumption for the modified case reflected a 90 percent and 95 percent for the first two years, and the midline revenue case falling at the middle point between baseline and modified cases.

**Truck Percentage Share and Truck Toll Factors**

Trucks are allowed to drive on the proposed SH 183 managed lanes at a higher toll rate. The classification counts collected as part of this study and described in Chapter 2 show that traffic along the SH 183 study corridor generally consists of 6 to 9 percent truck traffic. Given the relatively low truck traffic along the study corridor and the truck market is not expected to experience significantly high growth in the future, the truck percentage share on managed lanes will reflect the similar pattern across the three revenue cases. However, the relatively faster growth of heavy truck traffic in general could potentially increase the managed lane revenue.

Similar to the truck toll rate policy on other North Texas toll facilities, trucks are typically charged using an axle-based classification that is typically modeled as a truck toll factor over and above the passenger car toll rate (N or N-1 classifications are typical with N representing the number of truck axles). An average truck toll factor was calculated as 2.8 for truck traffic along the SH 183 corridor based on the distribution of the existing truck axles obtained from the classification counts. Given that on the eastern side of the managed lanes, IH 35E corridor carries long haul freight through the corridor, several national freight initiatives may in the future make allowances for larger truck sizes or combinations that could potentially increase the distribution of the truck profile in the region, which would thus result in the need for a higher truck toll factor to account for this. The truck toll factor was assumed to grow to 3.5 for the modified case, as shown in **Table 7-1,** to account for the possible deviation from the existing distributions.

**Annual Traffic Factor**

The travel demand model could only forecast weekday traffic. Weekend traffic typically was estimated based on the weekend/weekday traffic ratio calculated based on seven day counts collected at locations along SH 183 as part of this study. The weekend traffic estimation also take into consideration of specific managed lane operation and managed lane traffic characteristics.. An average annual traffic factor of 275 is assumed for the baseline annual traffic calculation, which is equivalent to approximately 20 percent weekend/weekday traffic ratio. This is found to be consistent with the observations of the several existing managed lane facilities in the nation. However, it is expected that more traffic will use the managed lanes during the weekend in the future as traffic further grows along the corridor. For the modified case, the annual traffic factor was assumed to be 330 for the annual transaction and revenue projection purpose. The midline revenue

scenario uses 300 annual traffic factor. The weekend revenue is calculated based on the estimated weekend traffic and the minimum toll rate assessed during weekday.

**ETC Penetration Rate**

The level of electronic toll collection penetration rates plays a key role in determining the share of traffic that will pay the ETC toll rates and higher video toll rates. The level of participation is a function of the number of toll tag users that constitute frequent users of the proposed corridor. The ETC penetration rates will likely be higher within this corridor given the numerous existing traditionally tolled facilities within the project area that include the DFW Airport toll road (International Parkway) and other NTTA system toll roads (PGBT, and SH 121) that intersect with the study corridor. The implementation of a system of managed lanes within the region will also likely increase the ETC participation rates, due to the familiarity of the users to the benefits of this system of managed lane facilities that will all become operational within the same time frame.

As such, the traveling market is expected to be well versed with toll road usage by the 2015 opening of the proposed SH 183 managed lane corridor. The ETC penetration rate is therefore expected to be in mature state. These levels, however, will be dependent, to a large extent, on the marketing that is implemented to encourage ETC usage and promote awareness of the advantages that the multiple toll facilities in the corridor study area provide to the potential users. In addition, the existing NTTA efforts to promote use of its system, along with the marketing efforts currently being undertaken by TxDOT to promote the statewide interoperability of TxTag, will no doubt accelerate the regional participation rates. In addition, the proposed facility may also benefit from the marketing efforts that may be undertaken for several other managed lane facilities that include IH 35E, IH 635 and North Tarrant Express (IH 35/SH 183).

An ETC penetration of 80 percent for the opening year in 2015, increasing to 85 percent by 2020, and 95 percent by 2025 and beyond is the baseline assumption used for this analysis. The ETC penetration rates for the intermediate years were interpolated. Even higher ETC penetration rates may become realized sooner with aggressive marketing strategies, and if vehicles become automatically equipped with transponders and/or with transponders, and/or as technological advances improve the ETC tag technology and its widespread implementation. Therefore, the ETC penetration of 85 percent for the opening year 2015 and 95 percent in 2020 and beyond was assumed for the modified revenue case. The current out-of-state traffic percentage accounts for approximately 2? percent along the SH 183 corridor and this market will likely remain video billed unless reciprocity and recapture policies with neighboring states are established.

**Long Term Growth Trends**

The long-term trends beyond 2030 were estimated to reflect forecasted average annual growth trend between 2015, 2025 and 2030. A review of the Denton, Collin, Dallas and Tarrant county population growth in the past decades revealed an average annual growth rate of 3.1 percent between 1990 and 2000. Some other available long-term demographic forecasts in this region, such as Texas Water Board, were also reviewed to gauge the expected long-term growth profile of the SH 183 managed lane traffic. For the purpose of the 52-year revenue forecast, the average annual traffic growth rate was assumed to be 1.5 percent beyond 2030 and reduced by 0.5 percent every 5 years with 1.0 percent growth cap thereafter. To account for the potential higher long-term growth in this region, it is assumed that the average annual traffic growth rate to be 2.5 percent beyond 2030 and reduced by 0.5 percent every 5 years until a capped growth of 1.0 percent.

Some other key variables considered for the risk analysis include socioeconomic forecasts, which are discussed in Chapter 4 of this report, values of time, and toll diversion as also presented in **Table 7-1**.

**Table 7-1**
**Baseline and Risk Assessment Traffic and Revenue Assumptions**

| Parameters | Baseline | Midline | Modified |
|---|---|---|---|
| **Ramp Up** | 80%, 90% for first two years, respectively | 85%, 95% for first two years, respectively | 90%, 95%, for first two years, respectively |
| **Truck Toll Factors** | 3.5 | 3.75 | 4.0 |
| **Nighttime Share** | 2 percent | 3 percent | 5 percent |
| **Revenue Days per year** | 275 | 300 | 330 |
| **ETC Penetration Rates** | 80% in opening year | 85% in opening year | 85% in opening year |
| | 85% in 2020 | 90% in 2020 | 95% in 2020+ |
| | 95% in 2025+ | 95% in 2025+ | |
| | | | |
| **Toll Leakage** | No leakage assumed | No leakage assumed | No leakage assumed |
| **Socioeconomic Data** | Modified baseline assumptions (2.5% in 2015 and 7% in 2030)* | Mid point betweet baseline and risk assumptions | Risk Analysis assumptions (4% in 2015 and 16% in 2030)* |
| **Traffic Growth Rates Beyond 2030** | 1.5% beyond 2030 and reducing by 0.5% every 5 years; with 1.0% constant beyond | 2.0% beyond 2030 and reducing by 0.5% every 5 years; with 1.0% constant beyond | 2.5% beyond 2030 and reducing by 0.5% every 5 years, with 1.0% constant beyond; |
| **Value of Time** | Baseline assumptions | Increasing with values of time by 30 percent. | Increasing with values of time by 60 percent. |
| **Toll Diversion** | Based on current observed sensitivities | Adjusted to provide a 5 percent toll road bias. | Adjusted to provide a 10 percent toll road bias. |
| **Length of T&R Forecast** | 52 years | 52 years | 52 years |

*The demographic adjustment was made by county and varies in each traffic analysis zone (TAZ). The percentages presented in this table are for illustration purpose only and represent the overall DFW region-wide demographic adjustment made in each alternative comparing to NCTCOG's official demographics.

## RISK ANALYSIS TOLL REVENUE

The risk analysis toll revenue was estimated based on the various key variables described above for two scenarios of midline and modified. **Tables 7-2** and **7-3** show the risk analysis toll revenue for the 52-year forecast period. The baseline revenue discussed in Chapter 6 is also included for comparison purpose. The same risk assumptions and methodology were applied to create the risk toll revenue for various alternatives; therefore all the alternatives have similar risk profiles. Alternative 1 revenue results are used herein as the example for illustration purposes and are also shown in **Figure 7-1**.

The managed lanes are expected to generate $4.5 million in toll revenue in the opening year of 2015 under the baseline assumptions, while approximately $12.9 million in revenue is expected under the modified scenario assumptions, reflecting an approximate 2.9 factor increase over the baseline revenues. The toll revenue is estimated to grow to $16.3 million by 2030 for the baseline case, and $54.5 for the modified case, reflecting an approximate 3.3 factor over the baseline revenues. By 2070, the SH 183 managed lanes are expected to generate $86.1 million in toll revenue under the baseline assumptions, and $345.7 million in revenue under the modified revenue assumptions. As is expected, the uncertainty for managed lanes revenue forecast may be significantly higher than the traditional toll road given some unique operating characteristics of managed lanes that include the parallel competing alternatives, and more specifically the congestion pricing that needs to be implemented to effectively manage the demand along the managed facilities.

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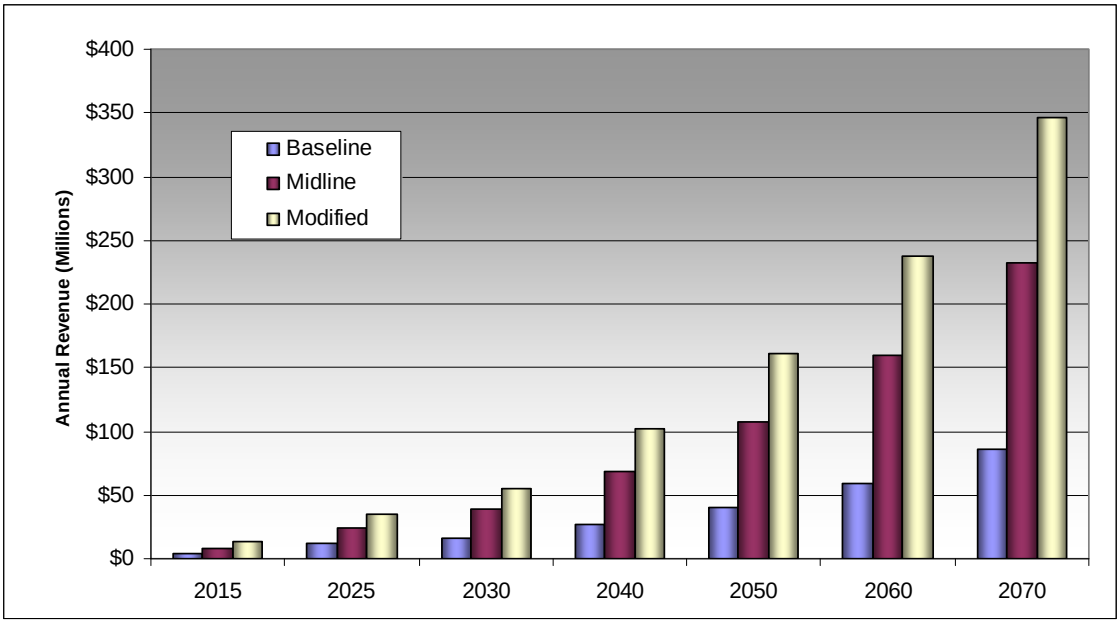


**Figure 7-1. Risk Revenue Profile of Alternative 1**

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**Table 7-2**
**Estimated Risk Analysis Annual Toll Revenue for Alternatives 1, 2 and 3**

| Year | Alternative 1 | | | Alternative 2 | | | Alternative 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Baseline | Midline | Modified | Baseline | Midline | Modified | Baseline | Midline | Modified |
| 2015 | $4,500 | $8,400 | $12,900 | | | | | | |
| 2016 | $5,800 | $10,200 | $14,800 | | | | | | |
| 2017 | $7,300 | $11,600 | $16,900 | | | | | | |
| 2018 | $8,300 | $12,500 | $18,200 | | | | | | |
| 2019 | $9,300 | $13,500 | $19,600 | $1,500 | $2,400 | $4,700 | $5,300 | $7,300 | $10,200 |
| 2020 | $9,600 | $14,600 | $21,300 | $1,800 | $3,000 | $5,800 | $6,000 | $8,400 | $11,100 |
| 2021 | $10,000 | $15,900 | $23,200 | $2,300 | $3,500 | $7,100 | $6,600 | $9,100 | $12,000 |
| 2022 | $10,200 | $17,200 | $25,100 | $2,400 | $3,900 | $8,200 | $6,600 | $9,300 | $12,200 |
| 2023 | $10,500 | $18,600 | $27,200 | $2,700 | $4,300 | $9,300 | $6,600 | $9,500 | $12,500 |
| 2024 | $10,800 | $20,200 | $29,400 | $2,900 | $4,800 | $10,600 | $6,600 | $9,600 | $12,800 |
| 2025 | $11,700 | $24,200 | $35,500 | $3,400 | $6,900 | $13,800 | $6,900 | $10,800 | $15,200 |
| 2026 | $12,600 | $26,600 | $38,800 | $3,800 | $8,100 | $16,100 | $7,800 | $13,300 | $17,600 |
| 2027 | $13,400 | $29,300 | $42,400 | $4,200 | $9,400 | $18,800 | $8,400 | $15,400 | $20,400 |
| 2028 | $14,300 | $32,100 | $46,200 | $4,600 | $10,700 | $21,700 | $9,100 | $17,600 | $23,300 |
| 2029 | $15,300 | $35,100 | $50,200 | $5,000 | $12,200 | $24,900 | $9,800 | $20,100 | $26,500 |
| 2030 | $16,300 | $38,300 | $54,500 | $14,600 | $35,600 | $49,700 | $14,800 | $35,200 | $51,500 |
| 2031 | $17,200 | $40,900 | $58,400 | $16,300 | $40,000 | $55,800 | $16,400 | $39,800 | $56,800 |
| 2032 | $18,100 | $43,700 | $62,500 | $18,100 | $43,700 | $62,500 | $18,100 | $43,700 | $62,500 |
| 2033 | $19,100 | $46,500 | $66,800 | $19,100 | $46,500 | $66,800 | $19,100 | $46,500 | $66,800 |
| 2034 | $20,100 | $49,600 | $71,300 | $20,100 | $49,600 | $71,300 | $20,100 | $49,600 | $71,300 |
| 2035 | $21,200 | $52,700 | $76,100 | $21,200 | $52,700 | $76,100 | $21,200 | $52,700 | $76,100 |
| 2036 | $22,200 | $55,700 | $80,800 | $22,200 | $55,700 | $80,800 | $22,200 | $55,700 | $80,800 |
| 2037 | $23,200 | $58,900 | $85,600 | $23,200 | $58,900 | $85,600 | $23,200 | $58,900 | $85,600 |
| 2038 | $24,300 | $62,200 | $90,800 | $24,300 | $62,200 | $90,800 | $24,300 | $62,200 | $90,800 |
| 2039 | $25,400 | $65,500 | $96,100 | $25,400 | $65,500 | $96,100 | $25,400 | $65,500 | $96,100 |
| 2040 | $26,500 | $69,100 | $101,700 | $26,500 | $69,100 | $101,700 | $26,500 | $69,100 | $101,700 |
| 2041 | $27,700 | $72,400 | $106,900 | $27,700 | $72,400 | $106,900 | $27,700 | $72,400 | $106,900 |
| 2042 | $29,000 | $75,900 | $112,500 | $29,000 | $75,900 | $112,500 | $29,000 | $75,900 | $112,500 |
| 2043 | $30,200 | $79,400 | $118,300 | $30,200 | $79,400 | $118,300 | $30,200 | $79,400 | $118,300 |
| 2044 | $31,600 | $83,100 | $124,300 | $31,600 | $83,100 | $124,300 | $31,600 | $83,100 | $124,300 |
| 2045 | $32,900 | $87,000 | $130,500 | $32,900 | $87,000 | $130,500 | $32,900 | $87,000 | $130,500 |
| 2046 | $34,300 | $90,800 | $136,200 | $34,300 | $90,800 | $136,200 | $34,300 | $90,800 | $136,200 |
| 2047 | $35,700 | $94,700 | $141,900 | $35,700 | $94,700 | $141,900 | $35,700 | $94,700 | $141,900 |
| 2048 | $37,200 | $98,800 | $148,000 | $37,200 | $98,800 | $148,000 | $37,200 | $98,800 | $148,000 |
| 2049 | $38,700 | $103,000 | $154,200 | $38,700 | $103,000 | $154,200 | $38,700 | $103,000 | $154,200 |
| 2050 | $40,300 | $107,300 | $160,700 | $40,300 | $107,300 | $160,700 | $40,300 | $107,300 | $160,700 |
| 2051 | $41,900 | $111,800 | $167,300 | $41,900 | $111,800 | $167,300 | $41,900 | $111,800 | $167,300 |
| 2052 | $43,600 | $116,500 | $174,100 | $43,600 | $116,500 | $174,100 | $43,600 | $116,500 | $174,100 |
| 2053 | $45,300 | $121,300 | $181,200 | $45,300 | $121,300 | $181,200 | $45,300 | $121,300 | $181,200 |
| 2054 | $47,100 | $126,200 | $188,600 | $47,100 | $126,200 | $188,600 | $47,100 | $126,200 | $188,600 |
| 2055 | $49,000 | $131,400 | $196,200 | $49,000 | $131,400 | $196,200 | $49,000 | $131,400 | $196,200 |
| 2056 | $50,900 | $136,600 | $203,900 | $50,900 | $136,600 | $203,900 | $50,900 | $136,600 | $203,900 |
| 2057 | $52,900 | $142,100 | $212,100 | $52,900 | $142,100 | $212,100 | $52,900 | $142,100 | $212,100 |
| 2058 | $54,900 | $147,700 | $220,500 | $54,900 | $147,700 | $220,500 | $54,900 | $147,700 | $220,500 |
| 2059 | $57,100 | $153,500 | $229,100 | $57,100 | $153,500 | $229,100 | $57,100 | $153,500 | $229,100 |
| 2060 | $59,300 | $159,500 | $238,000 | $59,300 | $159,500 | $238,000 | $59,300 | $159,500 | $238,000 |
| 2061 | $61,600 | $165,700 | $247,300 | $61,600 | $165,700 | $247,300 | $61,600 | $165,700 | $247,300 |
| 2062 | $64,000 | $172,200 | $256,900 | $64,000 | $172,200 | $256,900 | $64,000 | $172,200 | $256,900 |
| 2063 | $66,400 | $178,800 | $266,700 | $66,400 | $178,800 | $266,700 | $66,400 | $178,800 | $266,700 |
| 2064 | $68,900 | $185,600 | $276,900 | $68,900 | $185,600 | $276,900 | $68,900 | $185,600 | $276,900 |
| 2065 | $71,600 | $192,700 | $287,500 | $71,600 | $192,700 | $287,500 | $71,600 | $192,700 | $287,500 |
| 2066 | $74,200 | $200,100 | $298,400 | $74,200 | $200,100 | $298,400 | $74,200 | $200,100 | $298,400 |
| 2067 | $77,100 | $207,600 | $309,700 | $77,100 | $207,600 | $309,700 | $77,100 | $207,600 | $309,700 |
| 2068 | $80,000 | $215,400 | $321,300 | $80,000 | $215,400 | $321,300 | $80,000 | $215,400 | $321,300 |
| 2069 | $83,000 | $223,600 | $333,300 | $83,000 | $223,600 | $333,300 | $83,000 | $223,600 | $333,300 |
| 2070 | $86,100 | $231,900 | $345,700 | $86,100 | $231,900 | $345,700 | $86,100 | $231,900 | $345,700 |
| 2071 | $89,300 | $240,600 | $358,600 | $89,300 | $240,600 | $358,600 | $89,300 | $240,600 | $358,600 |
| 2072 | $92,600 | $249,500 | $371,900 | $92,600 | $249,500 | $371,900 | $92,600 | $249,500 | $371,900 |
| 2073 | $96,100 | $258,700 | $385,600 | $96,100 | $258,700 | $385,600 | $96,100 | $258,700 | $385,600 |
| 2074 | $99,700 | $268,200 | $399,600 | $99,700 | $268,200 | $399,600 | $99,700 | $268,200 | $399,600 |
| 2075 | $103,400 | $278,100 | $414,300 | $103,400 | $278,100 | $414,300 | $103,400 | $278,100 | $414,300 |
| 2076 | $107,200 | $288,400 | $429,400 | $107,200 | $288,400 | $429,400 | $107,200 | $288,400 | $429,400 |

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**Table 7-3**
**Estimated Risk Analysis Annual Toll Revenue for Alternatives 4,and 5**

| Year | Alternative 4 | | | Alternative 5 | | |
|---|---|---|---|---|---|---|
| | Baseline | Midline | Modified | Baseline | Midline | Modified |
| 2015 | | | | | | |
| 2016 | | | | | | |
| 2017 | | | | | | |
| 2018 | | | | | | |
| 2019 | $7,400 | $11,400 | $17,700 | | | |
| 2020 | $8,700 | $13,900 | $20,300 | | | |
| 2021 | $10,000 | $15,900 | $23,200 | | | |
| 2022 | $10,200 | $17,200 | $25,100 | | | |
| 2023 | $10,500 | $18,600 | $27,200 | | | |
| 2024 | $10,800 | $20,200 | $29,400 | | | |
| 2025 | $11,700 | $24,200 | $35,500 | $8,800 | $18,600 | $28,600 |
| 2026 | $12,600 | $26,600 | $38,800 | $10,500 | $22,800 | $32,900 |
| 2027 | $13,400 | $29,300 | $42,400 | $12,500 | $26,400 | $37,700 |
| 2028 | $14,300 | $32,100 | $46,200 | $13,300 | $28,900 | $41,000 |
| 2029 | $15,300 | $35,100 | $50,200 | $14,100 | $31,500 | $44,400 |
| 2030 | $16,300 | $38,300 | $54,500 | $16,300 | $38,300 | $54,500 |
| 2031 | $17,200 | $40,900 | $58,400 | $17,200 | $40,900 | $58,400 |
| 2032 | $18,100 | $43,700 | $62,500 | $18,100 | $43,700 | $62,500 |
| 2033 | $19,100 | $46,500 | $66,800 | $19,100 | $46,500 | $66,800 |
| 2034 | $20,100 | $49,600 | $71,300 | $20,100 | $49,600 | $71,300 |
| 2035 | $21,200 | $52,700 | $76,100 | $21,200 | $52,700 | $76,100 |
| 2036 | $22,200 | $55,700 | $80,800 | $22,200 | $55,700 | $80,800 |
| 2037 | $23,200 | $58,900 | $85,600 | $23,200 | $58,900 | $85,600 |
| 2038 | $24,300 | $62,200 | $90,800 | $24,300 | $62,200 | $90,800 |
| 2039 | $25,400 | $65,500 | $96,100 | $25,400 | $65,500 | $96,100 |
| 2040 | $26,500 | $69,100 | $101,700 | $26,500 | $69,100 | $101,700 |
| 2041 | $27,700 | $72,400 | $106,900 | $27,700 | $72,400 | $106,900 |
| 2042 | $29,000 | $75,900 | $112,500 | $29,000 | $75,900 | $112,500 |
| 2043 | $30,200 | $79,400 | $118,300 | $30,200 | $79,400 | $118,300 |
| 2044 | $31,600 | $83,100 | $124,300 | $31,600 | $83,100 | $124,300 |
| 2045 | $32,900 | $87,000 | $130,500 | $32,900 | $87,000 | $130,500 |
| 2046 | $34,300 | $90,800 | $136,200 | $34,300 | $90,800 | $136,200 |
| 2047 | $35,700 | $94,700 | $141,900 | $35,700 | $94,700 | $141,900 |
| 2048 | $37,200 | $98,800 | $148,000 | $37,200 | $98,800 | $148,000 |
| 2049 | $38,700 | $103,000 | $154,200 | $38,700 | $103,000 | $154,200 |
| 2050 | $40,300 | $107,300 | $160,700 | $40,300 | $107,300 | $160,700 |
| 2051 | $41,900 | $111,800 | $167,300 | $41,900 | $111,800 | $167,300 |
| 2052 | $43,600 | $116,500 | $174,100 | $43,600 | $116,500 | $174,100 |
| 2053 | $45,300 | $121,300 | $181,200 | $45,300 | $121,300 | $181,200 |
| 2054 | $47,100 | $126,200 | $188,600 | $47,100 | $126,200 | $188,600 |
| 2055 | $49,000 | $131,400 | $196,200 | $49,000 | $131,400 | $196,200 |
| 2056 | $50,900 | $136,600 | $203,900 | $50,900 | $136,600 | $203,900 |
| 2057 | $52,900 | $142,100 | $212,100 | $52,900 | $142,100 | $212,100 |
| 2058 | $54,900 | $147,700 | $220,500 | $54,900 | $147,700 | $220,500 |
| 2059 | $57,100 | $153,500 | $229,100 | $57,100 | $153,500 | $229,100 |
| 2060 | $59,300 | $159,500 | $238,000 | $59,300 | $159,500 | $238,000 |
| 2061 | $61,600 | $165,700 | $247,300 | $61,600 | $165,700 | $247,300 |
| 2062 | $64,000 | $172,200 | $256,900 | $64,000 | $172,200 | $256,900 |
| 2063 | $66,400 | $178,800 | $266,700 | $66,400 | $178,800 | $266,700 |
| 2064 | $68,900 | $185,600 | $276,900 | $68,900 | $185,600 | $276,900 |
| 2065 | $71,600 | $192,700 | $287,500 | $71,600 | $192,700 | $287,500 |
| 2066 | $74,200 | $200,100 | $298,400 | $74,200 | $200,100 | $298,400 |
| 2067 | $77,100 | $207,600 | $309,700 | $77,100 | $207,600 | $309,700 |
| 2068 | $80,000 | $215,400 | $321,300 | $80,000 | $215,400 | $321,300 |
| 2069 | $83,000 | $223,600 | $333,300 | $83,000 | $223,600 | $333,300 |
| 2070 | $86,100 | $231,900 | $345,700 | $86,100 | $231,900 | $345,700 |
| 2071 | $89,300 | $240,600 | $358,600 | $89,300 | $240,600 | $358,600 |
| 2072 | $92,600 | $249,500 | $371,900 | $92,600 | $249,500 | $371,900 |
| 2073 | $96,100 | $258,700 | $385,600 | $96,100 | $258,700 | $385,600 |
| 2074 | $99,700 | $268,200 | $399,600 | $99,700 | $268,200 | $399,600 |
| 2075 | $103,400 | $278,100 | $414,300 | $103,400 | $278,100 | $414,300 |
| 2076 | $107,200 | $288,400 | $429,400 | $107,200 | $288,400 | $429,400 |

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