The methodology used for this comprehensive study of the LBJ Managed Lanes project was built upon the analysis conducted for the project over the previous studies. The traffic and revenue estimation process involved three levels of analysis:

- **Global Demand Estimates** - The global demand is an estimate of the amount of traffic that would be using the LBJ Freeway corridor, under existing and improved conditions. These estimates were based on the results of the independent economic assessment of growth for the region that was performed as part of this study.

- **Travel Time Simulation Model** - A traffic model of the LBJ Freeway was developed using the VISSIM microsimulation program to identify changes in the travel time and delay on different segments of the general purpose lanes under three alternative project configurations.

- **Market Share Micro-Model** - The market share micro-model is used to estimate the traffic that would choose the Managed Lanes under varying operating conditions and scenarios. The share of corridor traffic in the Managed Lanes is based on several factors, including: location of access points and other differences in configuration of the general purpose lanes between scenarios, time savings offered by the Managed Lanes, and toll rates to be charged.

The flow chart in Figure 4-1 shows the general relationship between these three analysis components.

**Global Demand Estimates**

The corridor global traffic demand is defined as the total traffic traveling in the LBJ Freeway corridor. In this study, the micro-model developed for the corridor encompassed a small windowed section of the overall regional model that included arterials parallel to the LBJ Freeway as well as part of I-35E, since some of the alternatives involved differing assumptions regarding the I-35E/LBJ interchange.

Global demand for the model was developed using trip tables based on the modified socioeconomic forecasts with the NCTCOG regional travel demand model.

The regional travel demand model was used to in two ways: to provide the base travel patterns for the micro-model subarea and to develop growth characteristics for the micro-model subarea.

The calibration process for the regional model used for this study included the following steps:

- Develop trip tables at 2000, 2012, 2015, 2020, and 2025 levels for a.m., midday, p.m., and overnight time periods. Divide trip tables into SOV/Truck, HOV-2, and HOV-3+ components.
Incorporate the results of the origin-destination surveys into the regional model trip tables at base year levels. Also adjust future-year trip tables to reflect results of origin-destination surveys.

Adjust assignment parameters including link speeds and capacities, and speed/flow relationships.

Extract micro-model subarea travel information from base and future years.

### Regional Travel Demand Model Inputs – Highway Network

The Dallas-Fort Worth regional highway network with improvements in accordance with the Mobility 2025 Plan, was used for this study. Specific modifications to this plan related only to assumptions regarding improvements on I-35E and its access to the LBJ free and managed lanes, in addition to the six alternative project configurations for the Managed Lanes.

### Regional Travel Demand Model Inputs – Socioeconomic Assumptions

As noted earlier in this report, a set of independent economic forecasts were developed for use in this study. These housing and employment forecasts were provided to NCTCOG which then developed trip tables for use in this study. These trip tables reflected changes to socioeconomic forecast suggested by the independent economic insight research.

### Base-Year Micro-Model Trip Tables

The subarea trip tables used in the micro-model were initially extracted from region-wide traffic assignments at base-year (2003) levels. These trip tables were used as seed matrices in a calibration process that adjusted the trip tables to traffic volumes representing the average hourly volume (for each of the time periods) for LBJ Freeway ramps and mainlunes for the analysis intervals used in the micromodel, which are summarized in Chapter 2 was used to identify appropriate analysis intervals for use in this study.

The analysis periods used in the windowed model and the micro-model have been defined as follows:

- A.M. Peak period - 6:00-8:00 a.m.
- A.M. Shoulder period – 8:00-9:00 a.m.
- Midday period – 9:00 a.m.-3:00 p.m.
- P.M. Pre-peak Shoulder period – 3:00-4:00 p.m.
- P.M. Peak period – 4:00-6:00 p.m.
- P.M. Post-Peak Shoulder period – 6:00-7:00 p.m.; and
- Daily

The overnight period from 7:00 p.m. to 6:00 a.m. was not analyzed explicitly. The traffic and toll revenue forecasts presented later in this report assume a small fixed percentage of traffic and revenue will occur during the overnight hours, as well as on weekends.

### Future-Year Micro-Model Trip Tables

Future-year (2012, 2015, 2020, and 2025) traffic assignments using the regional model were made to identify potential changes in travel patterns in the corridor. Among other things, these travel patterns are likely to be affected by:

- Forecasted growth in the region;
- The addition of new capacity to the freeway in the form the managed lanes being studied herein;
- Highway improvements to other freeways in the region;
- Changes to the ramp configurations as part of these improvements.

Trip tables representing the micro-model subarea were extracted from each set of runs and compared to those developed for the base-year to estimate zonal growth rates, which were then applied to the calibrated base-year subarea matrices.

In testing the impact of the various project alternatives on traffic demand for the LBJ corridor, WSA determined that two sets of demand estimates would be appropriate. These two scenarios were due primarily to differences in assumptions regarding the amount of capacity to be added in the reversible segments, as well as improvements to IH 35E. One set of trip tables were used with Alternative 2 and the other set was used with Alternative 6. They are based on the same socioeconomic assumptions, but represent subarea extractions from different runs of the regional travel demand model that yield slightly different approach volumes to the freeway.

### Travel Time Simulation Model (VISSIM)

Traditional traffic assignment models do not replicate well the impact of merging and weaving maneuvers on freeway capacity, nor can they reflect the impact of downstream queueing on freeway segments. WSA has used a microscopic simulation model called VISSIM to assist in estimating the impacts of the project traffic travels on different segments of the freeway. VISSIM attempts to model each vehicle as a separate entity. The roadway geometry and interaction with other vehicles influence the behavior of each vehicle in the model. A certain level of randomness in vehicle behavior is also introduced.

A series of VISSIM runs were using differing assumptions on traffic shifts to the managed lanes for each of the six analysis time periods, at 2015 and 2020 levels. As traffic shifts into the managed lanes, the amount of traffic in the general purpose lanes would decrease, resulting in lower congestion levels in the general purpose lanes. A total of eight runs were made for the six primary analysis periods for each direction. Within each time period, 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 all ten runs for each mainline segment, WSA developed scenario-specific volume-delay curves for each mainline link on the general purpose lanes.

Each link in the micro-model was then tagged with a user code to identify a curve to be used to estimate travel speeds for that link during the micro-model assignment process. Links with less weaving and merging tended to be able to accommodate higher traffic volumes at higher speeds before breaking down. Certain sections of the freeway, which may have a large entering ramp volume, tended to break down at lower demand levels, and also may break down more quickly. Other sections of freeway may appear to break down at relatively low levels of demand, but may actually be affected by downstream congestion and queuing from these downstream bottlenecks.

### Market Share Micro-Model

The extracted micro-model subarea used for this study is of a size that covers the freeway from west of Luna Road to south of I-30, and includes arterials and other freeway links within 3 to 4 miles on either side of the freeway. Although the results of only two alternatives are reported here, the micro-model package included six alternative network and three sets of alternative trip tables that were used to estimate traffic and revenue for eighteen combinations of project configuration/tolling alternative.

### Market Share Analysis

In the micro-model, travel time between a path using the tolled managed lanes was compared to travel time on the next best free routes (most likely the general purpose lanes or frontalage roads). 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) vs. the value placed on time savings by the motorist (value of time or VOT).

The share of each traffic movement that is captured by the managed lanes is based on an estimate of the assumed distribution of the VOT, also developed from the stated preference surveys. It was assumed that motorists with a VOT greater than $0.112 per minute (inflated to 2012 levels) for peak period non-business-related trips, and $0.128 per minute for midday non-business-related trips. The 2012 value-of-time for business-related trips was $0.154 per minute.

The micro-model relies on developing an equilibrium condition between the toll cost and the estimated time savings. If more traffic uses the managed lanes, there is less congestion in the free lanes and lower time savings. Less time savings would 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 free lanes (time savings) and the amount of traffic willing to pay a toll to save that same amount of time.

At low toll levels, there is a higher propensity to use the Managed Lanes, and there...
is a lower congestion level in the free lanes. At higher toll levels, there is less traffic in the Managed Lanes and also more congestion in the free lanes.

A full range of toll rates were tested, from $0.05 per mile to $0.60 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. During certain peak periods in the 2020 and 2025 assignments, checks for capacity constraints in the managed lanes indicated a need to use higher toll rates to manage demand to maintain an acceptable level of service at one or two locations in the system. A higher range of toll rates were tested and chosen in those cases, which is reflected in the traffic and revenues presented in Chapter 5.

Vehicle Categories
The micro-model trip tables were separated into five components: SOV non-business, SOV business, HOV-2 non-business, HOV-2 business, and HOV-3+, are assigned simultaneously until an equilibrium condition is reached for that particular toll rate. In the tolling alternatives that involved free passage for either HOV-2+ or HOV-3+ traffic, the HOV traffic is allowed free access to the managed lanes, and the maximum usage level is allowed for this traffic based on prevailing traffic conditions.

Before the analysis began, TxDOT determined that only small trucks would be allowed to use the managed lanes. As a result, WSA separated out a portion of the micro-model trip tables to represent medium and heavy trucks. This trip table was assigned to the arterial streets and general purpose lanes only and used as a preload volume for the main equilibrium assignments.

Effects of Tunnel
A section of the managed lanes project will include three travel lanes in a tunnel for a distance of approximately 5 miles. Given that some drivers may have a reluctance to drive in a tunnel for a number of reasons, this condition was tested using the stated preference surveys. The analysis of the changes in responses after the tunnel was introduced produced an estimate that demand for the managed lanes may be reduced by about 7 percent with the tunnel as described.

The effect of the tunnel was not directly modeled but was taken into account in the assignment process by increasing the tolls for all movements into the tunnel by 10 percent. This would have the effect of making the tunnel section appear to be less attractive and reduce the amount of traffic choosing the managed lanes in that section. For revenue calculations, the nominal toll rates were used, in effect yielding lower revenues.

Major Programmed Highway Improvements
The overall global demand modeling process assumed the proposed highway improvements included in NCTCOGS Mobility 2025 Metropolitan Transportation Plan, 2004 Update. These included the following major programmed highway improvements which are also presented graphically in Figure 4-2:

1. DNT Phase 3 Extension - SH 121 to US 380
2. SH 121 - Preston Road to Tarrant County Line
3. PGBT Eastern Extension - SH 78 to IH 30
4. Trinity Parkway - US 75 to IH 35E
5. PGBT Segment IV -IH 35E to IH 635

New Construction Opened by 2012

6. Loop 12/IH 35E as detailed in Loop 12 Major Investment Study
7. SH 121 - Preston Road to US 75
8. SH 161 - SH 183 to IH 30

New Construction Opened by 2015

In addition, Figure 4-2 highlights proposed major widening projects as well as future assumptions regarding HOV Lane configurations.