

**APPENDIX C:
MODEL VALIDATION REPORT**

Travel Demand Model Validation Update

In order to evaluate existing travel patterns and to anticipate future travel conditions in the Wichita Falls area, the Wichita Falls Travel Demand Model was updated to analyze current and projected demographic data. The primary goal in developing and validating the travel demand model is to more accurately identify future needs and to help with the decision making process for transportation improvements.

Model validation is the process in which a model's credibility is based on replicating observed conditions, primarily through existing traffic counts and vehicle miles of travel. This document is a validation update to the previous model validation that was performed by the Transportation Planning & Programming Division of the Texas Department of Transportation (TxDOT) that was completed in 2003.

Travel Demand Model Background

The Wichita Falls Travel Demand Model was last validated for a base year of 2000 and is maintained by TxDOT. The data for this travel demand model update was provided to Kimley-Horn & Associates from TxDOT through the Wichita Falls Metropolitan Planning Organization (MPO). The model was run using TransCAD 4.8 and the inputs supplied were adjusted to match the existing conditions for a new base year of 2005. The following report provides detail of the steps used to validate the current model to match existing trends in Wichita Falls.

Demographic Database

In April 2008, the Socioeconomic Data Collection and Forecast Study was completed for the Wichita Falls MPO. This study analyzed current trends in order to forecast future demographics, namely population and employment as a spatial component in Wichita Falls. The study, which was a key element in the model validation process, separated the base year population and employment demographics into Traffic Analysis Zones (TAZ) from 2005 to 2035 in five-year increments. This data was provided to the consultant in both a database format and as an ESRI shapefile.

The TAZ structure remained almost constant between this update and the previous model validation. However, the socioeconomic study did emphasize a change in TAZ structure within the boundary of the Sheppard Air Force Base, (**Figure 1**)

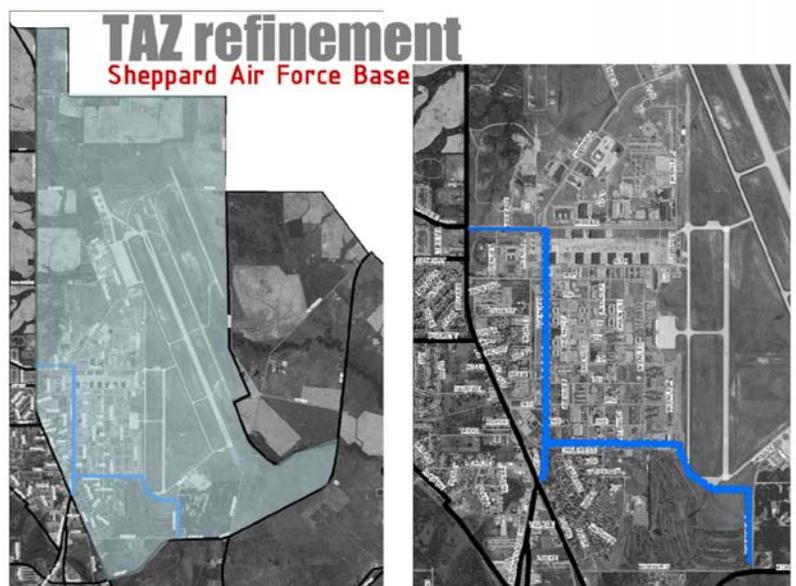


Figure 1: Base TAZ refinement (graphic from 2008 Socioeconomic Study)



the City of Lakeside City and on the north MPO boundary, TAZ ID 298 was divided.

In order to accommodate the addition of these new TAZs, extra centroids were placed in these locations. The new centroids were pulled from “dummy” nodes located on the periphery of the model network. Instead of creating brand new nodes and assigning them demographic data, these “dummy” nodes were created for the purpose of anticipating future TAZ growth. In the travel demand model network, all of the nodes that are centroids have a related ID of less than 320. All other nodes are not connected with any demographic data. The “dummy” nodes that were used have ID numbers of 161, 229 and 257. ID 161 was assigned to the TAZ in Lakeside City; ID 229 was used on the north boundary along with ID 298; and, ID’s 98, 257 and 299 were used for the 3 TAZs at the Sheppard Air Force Base (Figure 1)

The socioeconomic study took the existing population numbers from the Census Transportation Planning Package (CTPP) and compared them to the TAZ data aggregated by Census Blocks. To go beyond simply using the census as a way to determine the existing population, the study also estimated current population by looking at new building permits between 2000 and 2005 and new houses by TAZ. This process can better determine new growth within the study area. **Table 1** identifies the current base year (2005) with the previous travel demand model base year (2000).

Table 1 - Summary of Demographic Data

| | 2005 |
|---------------------------------|----------|
| Population | 112,700 |
| Households | 41,650 |
| Household Size | 2.71 |
| Median HH Income | \$29,825 |
| Basic Employment | 12,464 |
| Retail Employment | 13,220 |
| Service Employment | 17,333 |
| Special Generators | 14,781 |
| Total Employment | 63,127 |
| Population/ Employment Ratio | 1.79 |

Employment in the region was also determined in the MPO socioeconomic study. The data for the new employment estimates were derived from 2005 Texas Workforce Commission dataset as well as the Claritas 2005 dataset. The employment numbers were divided into five different employment types: basic, retail, service, education and special generators. The employment types are standardized by North American Industry Classification System (NAICS) for each business type. However, due to the fact that the travel demand model only recognizes basic, retail, service and special generators, the education employment numbers were joined into the service employment category.



Special generators in this travel demand model differ from the typical business types that are found in the demographic set (i.e. basic, retail, and service). According to TxDOT,

Trip production and trip attraction models are for average or usual conditions and development types. Certain developments, however, are considered unique and are considered special generators. For each identified special generator within an urban area, trip productions and attractions are considered separately using individual trip production and attraction rates for that generator.

In the socioeconomic study, a special generator was defined as a large employment center with over 100 employees in most cases. However, large employers can have similar trip patterns to the regular three trip types. For example, a large employer such as communications distributor with over 100 employees will have similar trip patterns as determined in the service employment type category of the travel demand model. On the other hand, Sheppard Air Force Base or Midwestern State University will have different trip patterns from the typical basic, retail, or service employment types and therefore deserve a closer look at the trip distribution.

In this validation update, the only land use types that were set apart as special generators were universities, colleges, high schools, hospitals, and the military base. (Table 2)

Table 2 - Special Generator Distribution

| TAZ | POP | EMP | Basic | Retail | Service | EDUCATION | Trip Rate/ Employee | Total Trips |
|-----|-----|------|-------|--------|---------|--|------------------------|-------------|
| 136 | 411 | 31 | 0 | 0 | 31 | MSU Recreation | 9.1 | 283 |
| 140 | 680 | 556 | 0 | 0 | 556 | MSU Campus | 9.1 | 5076 |
| 151 | 9 | 48 | 0 | 0 | 48 | MSU Residences/Vernon College | 9.1 | 438 |
| 221 | 0 | 97 | 0 | 0 | 97 | Hirschi High School | 19.7 | 1915 |
| 250 | 0 | 138 | 0 | 0 | 138 | S.H. Rider High School | 19.7 | 2724 |
| 120 | 0 | 131 | 0 | 0 | 131 | Wichita Falls High School | 19.7 | 2586 |
| 246 | 0 | 4 | 0 | 0 | 4 | Wayland Baptist University - Call Field | 15.6 | 62 |
| 178 | 0 | 22 | 0 | 0 | 22 | Vernon College | 15.6 | 342 |
| | | | | | | HOSPITALS | | |
| 70 | 0 | 1265 | 0 | 0 | 1265 | Red River Hospital and United Health Care System | 5.2 | 6578 |
| 71 | 0 | 859 | 0 | 0 | 859 | United Regional Health Care System - Bethania | 5.2 | 4467 |
| 160 | 0 | 906 | 0 | 0 | 906 | North Texas State Hospital | 5.2 | 4711 |
| 272 | 0 | 224 | 0 | 0 | 224 | Kell West Regional Hospital | 5.2 | 1165 |
| 83 | 0 | 496 | 0 | 0 | 496 | Health South Rehabilitation Hospital | 5.2 | 2579 |
| 224 | 0 | 153 | 0 | 0 | 153 | Wichita Valley Rehabilitation Hospital | 5.2 | 796 |
| 250 | 0 | 140 | 0 | 0 | 140 | Hospice of Wichita Falls | 5.2 | 728 |
| | | | | | | MILITARY | | |
| 299 | 0 | 9711 | 0 | 0 | 9711 | University, Sheppard Air Force Base | 1.8 | 17286 |

The trip rates for the special generators were determined using ITE’s Trip Generation 8th Edition, by determining the number of employees by land use type. As seen from the Trip Rate/Employee column in **Table 2**, there is a different trip rate for universities, community colleges, and high schools, as well as different trip rates for hospitals and military bases. Each of the total trip amounts were allocated into the model by identifying the unique productions and attractions by trip type.

The remaining large employers identified in the 2008 socioeconomic study as special generators that are not listed in **Table 2** above were joined up with the basic, retail and service employment types of their respective TAZ location in the travel demand model.

Network Adjustments

Instead of recreating the network from scratch using aerials, road centerline shapefiles, or other data, the 2005 base year network was adjusted from the year 2000 network received from TxDOT. From 2000 to 2005, a number of network improvements have occurred. These changes were identified using 2005 aerial photos provided by the MPO. **Figures 2** through **5** show the areas in which network adjustments were made to the travel demand model.

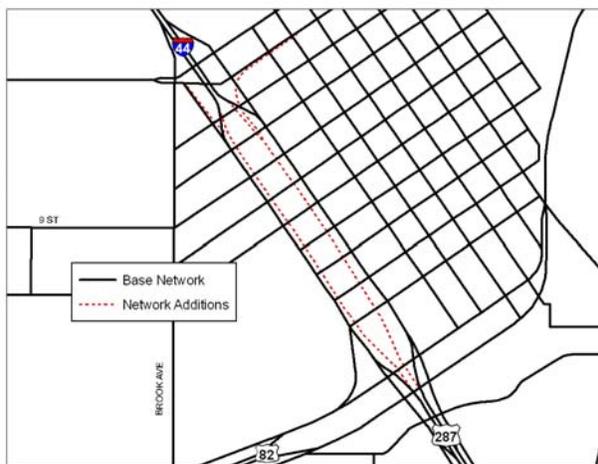


Figure 2: Raised freeway on the west end of downtown



Figure 3: Main lanes added to U.S. 82 in southwest Wichita Falls from Kemp to Fairway



Figure 4: Frontage roads on IH 44 in north Wichita Falls from Reilly Rd to the MPO boundary

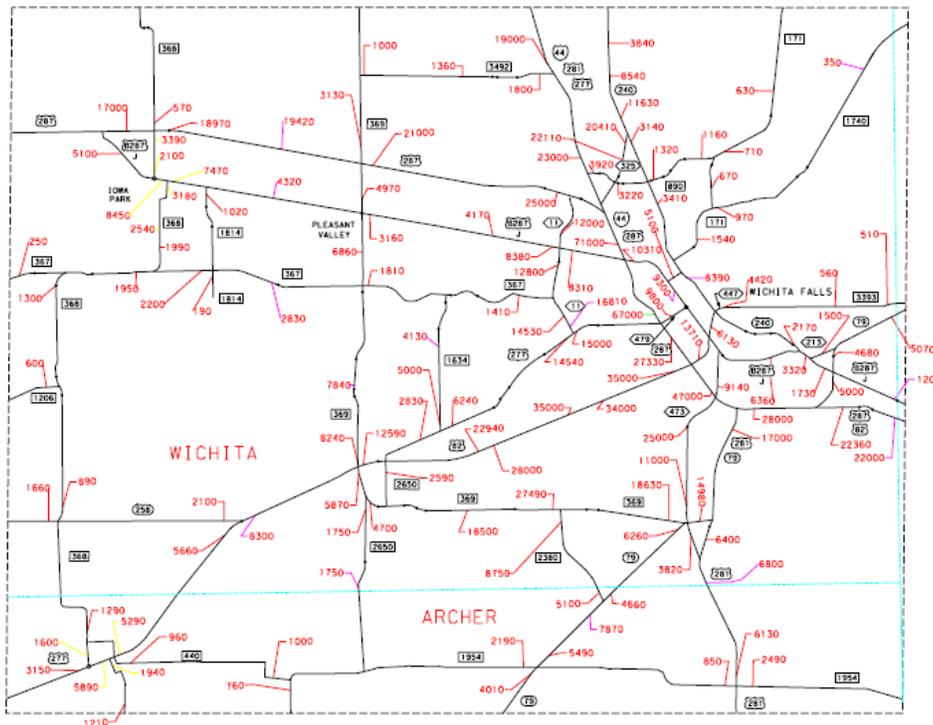


Figure 5: Interchange ramps along U.S. 287 northwest of Wichita Falls from IH 44 to the MPO Boundary

These adjustments were added to the 2005 base year network in order to reflect current traffic patterns in the Wichita Falls region. All of the added network links were assigned capacities and speeds based on similar functional class, area type and number of lanes of existing network links. Once all of the new network links were updated with their appropriate capacity and speed amounts, the free flow time field was updated and populated. The free flow time is defined in the model as $(\text{length} / \text{speed}) \times 60$.

These adjustments increase the accuracy of the model in projecting future travel patterns in the region. Once the network is updated, the model can be validated with observed traffic patterns.

Model Validation Update



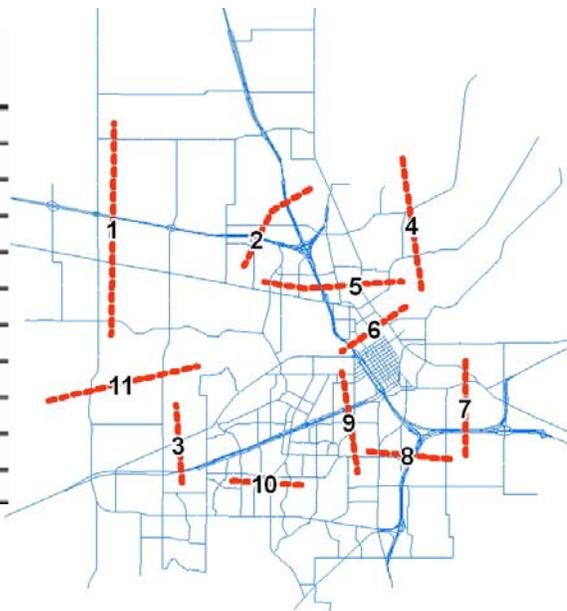
In order to match the observed 2005 counts with the modeled volumes, a number of comparisons took place to ensure model validity. The model’s validity is determined by comparing the modeled traffic volumes to the actual counts in the network. Three validation methods were used to perform this task: screenline traffic volume validation, area type validation, and functional class validation. The following paragraphs describe these three methods in greater detail.

Screenlines, which are traffic flows that are found on parallel facilities or within a corridor, were developed in the model to determine validity. The benchmark set for this validation update was for screenline model volumes to be within 85% to 115% (+/- 15%) of the actual traffic counts. **Figure 7** below shows the screenlines developed for this model update.

Figure 7: Screenline distribution within the Wichita Falls region

Table 3 - Screenline Validation

| Screenline | Model Volume | Total Count | Total Ratio |
|------------|--------------|-------------|-------------|
| 1 | 29,122 | 27,330 | 1.07 |
| 2 | 43,437 | 41,222 | 1.05 |
| 3 | 32,664 | 29,180 | 1.12 |
| 4 | 1,535 | 1,680 | 0.91 |
| 5 | 82,645 | 84,540 | 0.98 |
| 6 | 96,076 | 84,690 | 1.13 |
| 7 | 40,240 | 36,530 | 1.10 |
| 8 | 34,828 | 42,000 | 0.83 |
| 9 | 56,453 | 52,991 | 1.07 |
| 10 | 36,951 | 40,990 | 0.90 |
| 11 | 12,052 | 11,970 | 1.01 |



| Screenline | Screenline Roads | | | | | | | | | | |
|------------|------------------|--------|-------------|---------|---------|-------------|-----------|---------------|-----------------|---------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Road 1 | FM 367 | IH 44 | Seymour Hwy | FM 171 | FM 171 | Eastside Dr | US 287 | US 281 | Midwestern Pkwy | Kemp Blvd | Barnett Rd |
| Road 2 | Iowa Park Rd | US 287 | US 82 | FM 1740 | Loop 11 | IH 44 | Scott Ave | Old Jacksboro | US 82 | Maplewood Ave | FM 369 |
| Road 3 | US 287 | | | | | Scott Ave | SH 240 | | | McNiel Ave | |
| Road 4 | | | | | | | | | | Rhea Rd | |

As seen in **Figure 7**, the screenlines attempt to encompass traffic flows along major corridors and parallel facilities to maintain accuracy in trip characteristics. All but one of the 11 screenlines sampled fell within the +/- 15% target range. The screenline results are consistent with the previous model validation performed in 2003. **Table 3** shows the screenline results.



Along with developing a screenline validation of the model, accurate volumes were identified with respect to functional class and area type. In this process, the vehicle miles traveled (VMT) element of the observed counts and the modeled volumes were compared to determine the precision of the model. VMT is defined as the number of vehicles times the length of roadway traversed. The standard of error for these comparisons is a range 90% and 110% (+/- 10%). **Table 4** identifies the comparison of observed volumes to modeled volumes with respect to area type and the functional classification of roadways.

Table 4
Comparison of Observed to Assigned VMT

| Area Type | Observed | Assigned | Percent Difference |
|-------------------------|----------------|----------------|--------------------|
| CBD Fringe | 150,538 | 151,830 | 100.86 |
| Urban | 329,332 | 357,253 | 108.48 |
| Suburban | 52,425 | 49,746 | 94.89 |
| Total | 532,294 | 558,828 | 104.98 |
| Functional Class | | | |
| Interstate | 57,834 | 61,418 | 106.20 |
| Other Freeways | 172,388 | 186,383 | 108.12 |
| Principal Arterial | 224,106 | 232,197 | 103.61 |
| Minor Arterial | 54,721 | 55,629 | 101.66 |
| Collectors | 18,650 | 18,297 | 98.11 |
| Frontage Roads | 4,596 | 4,906 | 106.73 |
| Total | 532,294 | 558,828 | 104.98 |

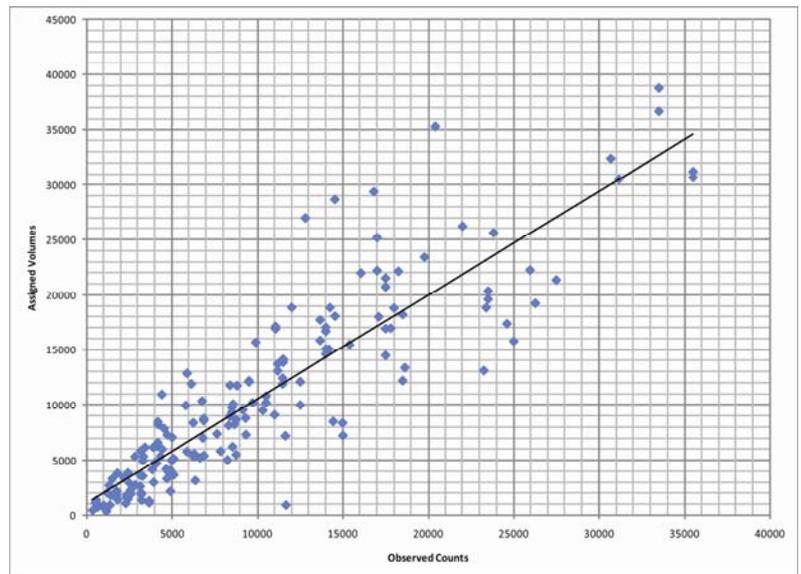


Figure 8: Distribution of all observed counts and modeled volumes arranged in a scatter plot diagram

As a region, the percent difference between actual counts and modeled volumes is close, with a difference of approximately 5 percentage points. **Table 4** also shows that certain functional classification types have a greater degree of error. For example, Frontage Roads have almost a 7% difference and Other Freeways have an 8% difference. However, the previous validation report identified similar results, with Frontage Roads and Other Freeways having the greatest percent difference when comparing functional classification.

Conclusion

As a result of the 2005 base model update and the model validation process, the 2005 base model successfully replicates base year travel characteristics. This updated validation model will help to identify where to focus transportation priorities in the future using forecasted demographic data. This model will be a useful tool in identifying existing capacity issues within the transportation network as well as addressing potential deficiencies in the coming years. The horizon year demographic data as well as data acquired from the public workshop will be used to identify future growth pattern scenarios for the Wichita Falls MPO.