

TEXARKANA AREA FRONTAGE ROAD STUDY

**CONVERSION TO ONE – WAY FRONTAGE ROAD
OPERATIONS IN THE TEXARKANA STUDY AREA**

**TEXARKANA URBAN TRANSPORTATION STUDY -
TEXARKANA METROPOLITAN PLANNING
ORGANIZATION**

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EXECUTIVE SUMMARY

This study provides the engineering justification for converting the non-continuous two-way frontage road system in the Texarkana study area to continuous one-way operation. The study is based on Texas Transportation Institute (TTI) research reports 288 and 402. These studies developed traffic volume based warrants for use by planning engineers in determining when it is appropriate to convert from two-way to one-way frontage road operations. Traffic volume data was collected at nine interchanges in the Texarkana study area. This data was analyzed against the warrants developed by TTI. Analysis of the data demonstrated that all of the interchanges meet at least one of the warranting conditions. Conclusions, recommendations and cost estimates follow:

Conclusions

The following conclusions are based on the traffic volume based warrant analysis and the associated discussions presented.

1. Failure to address the current traffic congestion problem will adversely impact many facets of the quality of life in the Texarkana area. Travel time and delay will increase, as will driver frustration, red light running and crash incidents.
2. Traffic volumes will continue to increase at key interchanges in the IH 30 corridor due to planned commercial development. These location include FM 559 (Richmond Rd.) with the development of a new retail center with outlets such as Home Depot, Target and several restaurants adjacent to Movies 12 Theatre, FM 989 (Kings Hwy.) with the development of a new retail center in the northwest corner, FM 1397 (Summerhill Rd.) with the construction of Century Bank and an adjacent office building, and Jefferson Ave. with the planned construction of a Wal-Mart Super Center in the northwest corner.
3. The decision of businesses to locate in the Texarkana area could be impacted because access and a good transportation network are essential to the success of businesses.
4. The transportation system in the Texarkana area would operate more efficiently and safely with continuous one-way frontage roads.
5. Operations at FM 559 (Richmond Rd.) and FM 1397 (Summerhill Rd.) will continue to degrade unless the number of signalized intersections within each interchange is reduced.
6. As development continues north of IH 30 the type of operational problems that exist at FM 559 (Richmond Rd.) and FM 1397 (Summerhill Rd.) will develop at FM 989 (Kings Hwy.), Jefferson Ave. and SH 245 as traffic volumes increase and it becomes necessary to signalize these interchanges.
7. All of the interchanges in the IH 30 corridor from FM 989 (Kings Hwy.) to SH 245 and the US 59 / US 82 interchange met the warrants for conversion to one-way frontage road operations.

Recommendations

These recommendations will improve the flow and circuitry of traffic throughout the transportation network; improve safety; reduce congestion and delay; meet driver expectations; and promote development of abutting property. The following recommendations should be implemented as soon as funding can be secured:

1. Provide turnarounds at FM 989 (Kings Hwy), east side only, FM 559 (Richmond Rd.), FM 1397 (Summerhill Rd.), and Jefferson Ave., west side only.
2. Fill in the gaps in the existing frontage road system FM 989 (Kings Hwy.) to US 59, FM 1397 (Summerhill Rd.) to US 71 (Stateline Ave.) and Jefferson Ave. to SH 245.
3. Convert from two-way to one-way frontage road operations from the east side of FM 989 (Kings Hwy.) to the west side of Jefferson Ave. in the IH 30 corridor and from US 82/US 59 to IH 30.
4. Extend Trinity Boulevard to SH 245 and operate as two-way frontage road.
5. Construct south frontage road from Jefferson Ave. to SH 245
6. Convert to one-way operation between Jefferson Ave. and SH 245
7. Convert the existing two-way frontage roads along SH 245 from IH 30 to Arkansas Blvd. to one-way operations when warranted by traffic conditions.

It is also recommended that a separate origin – destination study be conducted in order to address the issue of travel time under one-way operation versus two-way operation. The results of such a study could be used to inform and educate the public on this issue and would be useful during the design process.

Cost Estimates

Cost estimates were developed for all of the projects necessary to convert from two-way to one-way frontage roads in the Texarkana area. Six turnaround structures would be required: one on the east side of FM 989 (Kings Hwy.), two at both FM 559 (Richmond Rd.) and FM 1397 (Summerhill Rd.), and one on the west side of Jefferson Ave. The \$ 7.5 million cost estimate for constructing these facilities is dependent on the structural design of the existing crossover structures. The \$1.1 million estimate for the north frontage road between US 59 and FM 989 and the \$1.525 million estimate for the south frontage road in this section were obtained from the Texarkana Metropolitan Transportation Plan (MTP) 2000 – 2025. The Texarkana MTP 2000 – 2025 also indicated that conversion of the frontage roads between US 59 and Stateline would cost \$5,775,000. This estimate includes conversion of the frontage roads from US82/US 59 to IH 30 and the completion of the north and south frontage roads from FM 1397 (Summerhill Rd.) to Stateline Ave. It is estimated that the south frontage road between Jefferson Ave. and SH 245 would cost \$ 1.5 million while the north frontage road in this area would cost \$ 600,000. The total cost estimate for converting the frontage road system to one-way operation is \$ 19.5 million. These estimates are shown in Table 8.

INTRODUCTION

Frontage roads, while common in Texas, remain somewhat uncommon on a national scale. Frontage roads were originally built to restore access to abutting property when freeways were built or if the cost of acquiring access rights exceeded the cost of building the frontage road. The benefits of frontage roads include the promotion of economic development, availability of alternative capacity when demand is high, construction work is being performed or during a crash incident. Two-way frontage roads were preferred in rural areas because they reduced travel time for local residents and freeway traffic going to local destinations. Over time the two-way frontage roads in rural areas tend to become the backbone of the local street system. As a result operational problems arise when traffic volumes reach even moderate levels.

Problem Identification

The existing frontage road network in the Texarkana study area consists of a combination of non-continuous two-way and one-way frontage roads. The network includes non-continuous two-way frontage roads along IH 30, a combination of two-way and one-way frontage roads along US 59 and two-way frontage roads along SH 245 from 50th Street to Arkansas Blvd. When IH 30 was constructed this area was primarily rural and continuous frontage roads were not needed to maintain access to abutting property. As the Texarkana area has grown the original frontage roads have been extended, however there are still several gaps in the network. In the absence of a continuous frontage road system, and with no east-west principle arterial, the interstate is used by local traffic for circulation. It is important to note that the limited non-continuous frontage road system in the Texarkana area has precluded conversion to a continuous one-way frontage road configuration. Over time the frontage road and ramp intersections at FM 559 (Richmond Road), FM 1397 (Summerhill Road) and US 71 (Stateline Avenue) have been signalized to improve interchange capacity and address safety concerns. The signalization of the FM 989 (Kings Highway) interchange is also expected within the next year. In the past three to five years the IH 30 corridor has experienced rapid growth with the addition of several new businesses, including retail outlets, restaurants, medical services, financial services, and automobile dealerships. The Texarkana area has enjoyed the economic benefits of this development but the accompanying increase in traffic volumes is taking its toll on the transportation system. During peak periods the interchanges along IH 30, US 59 and adjacent intersections on the local network are straining under the current volume of traffic. Current traffic problems are primarily impacting the interchanges located on the Texas side of the study area. However, the Arkansas side of the study area is also experiencing an increase in traffic volumes. It is anticipated that, in the near future, the interchanges located east of US 71 (Stateline Ave.) will develop operational problems similar to those at interchanges west of US 71 (Stateline Ave.). In an effort to address this growing problem the Texarkana Metropolitan Transportation Plan 2000 – 2025 (1) has identified approximately \$13.8 million worth of projects that are directly related to the construction or improvement of frontage roads in the IH 30 corridor. These projects are listed in Table 1 on the next page.

Table 1: Frontage Road Projects in the IH 30 Corridor
(Excerpted from Texarkana MTP 2000-2025, October 1999)

Description	Priority	Eligible Funding Category	Federal Funding	State/Local Funding	Total Funding
N. Frontage Road US 59 to FM 989	2010-25	NHS-3A, 3B, STP-4D	\$880,000	\$220,000	\$1,100,000
S. Frontage Road US 59 to FM 989	2010-25	NHS-3A, 3B, STP-4D	\$1,220,000	\$305,000	\$1,525,000
Convert Frontage Roads US 59 to Stateline	2010-25	NHS-3A, 3B, STP-4D	\$4,620,000	\$1,155,000	\$5,775,000
S. Frontage Rd – SH 245 to SH 296	Unfunded		\$0	\$1,400,000	\$1,400,000
N. Frontage Rd – SH 245 to SH 296	Unfunded		\$0	\$4,000,000	\$4,000,000
Totals			\$6,720,000	\$7,080,000	\$13,800,000

Scope of Study

Task 5.5 Texarkana Area Frontage Road Study was included in the Texarkana Metropolitan Planning Organizations (MPO) FY 2000 Unified Planning Work Program (UPWP) and approved by the Texarkana Urban Transportation Study Policy Committee on February 29, 2000. The MPO staff was directed to conduct a comprehensive study of the current frontage roads in the Texarkana area. The purpose of this study was to identify potential strategies for upgrading the frontage road network. The ultimate goals of this study include the following: improve traffic flow throughout the transportation network, address safety concerns at the interchanges and encourage continued development along I-30, US 59 and SH 245. The project limits for this study are shown in Figure 1 on the next page.

In June of this year the MPO Technical Committee, Ex-Officio members of the MPO Policy Committee and staff from the Texas Department of Transportation (TxDOT) – Atlanta District Planning Section conducted a Value Engineering (VE) Study (2). The VE study identified projects that would be required for conversion to a continuous one-way frontage road system. Each project was evaluated for its efficiency, functionality, environmental impacts and costs. Basic conceptual designs were also developed for each project and construction staging strategies were discussed. While the VE study recognized the basic operational need for one-way frontage roads and identified several factors involved in transitioning to that system, it did not provide engineering justification

for converting to one-way operation. A warrant study would provide the engineering justification for such a conversion.

A warrant is a minimum standard based on a combination of engineering experience and measurable criteria. In this study current traffic volume counts were collected or developed from existing data and analyzed for conformance with frontage road conversion warrants developed by the Texas Transportation Institute (TTI). Based on recommendations from the VE study, the limits for the warrant study were modified by excluding the FM 2148 and SH 108 interchanges based on the determination that for the foreseeable future the area surrounding these interchanges will remain rural.

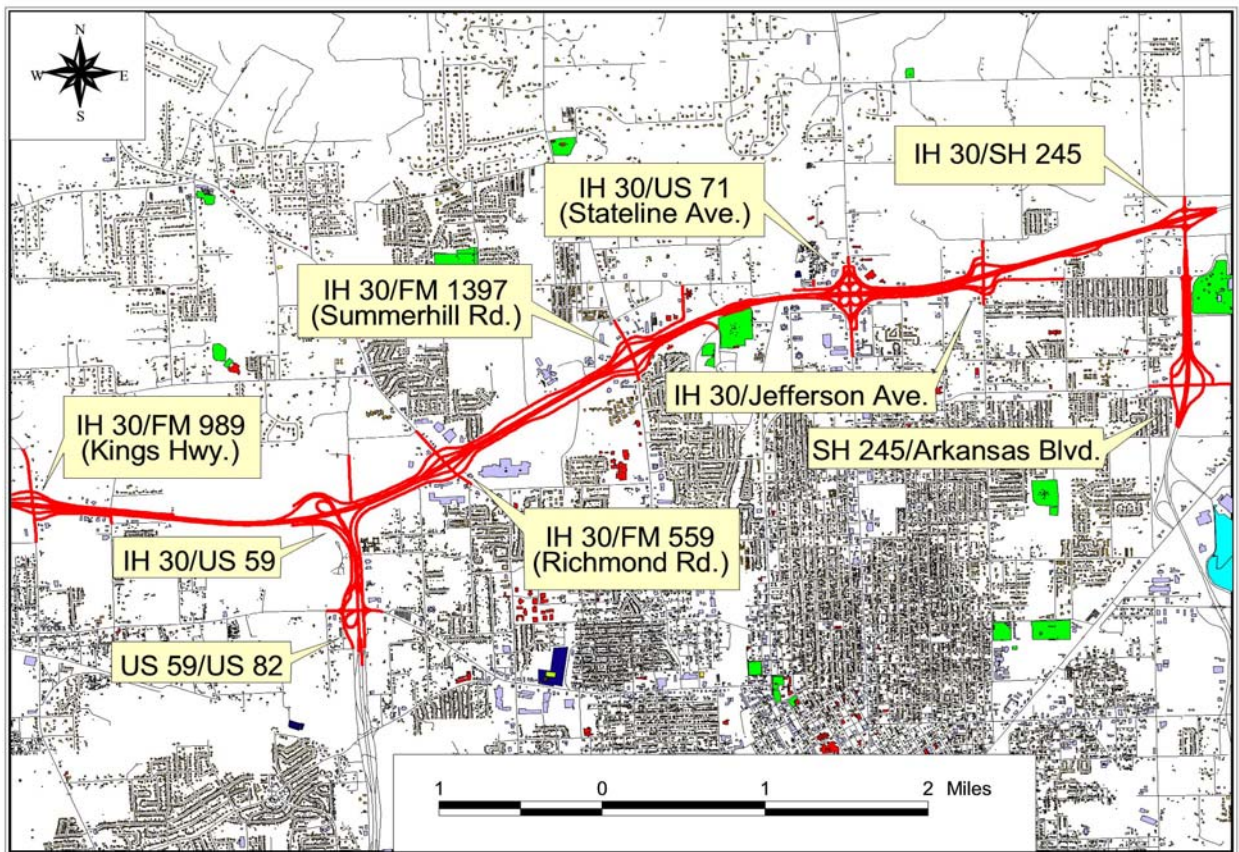


Figure 1: Project Limits Map

Related Research

TxDOT and TTI have conducted research projects focused on frontage roads for several years. These studies have addressed the impacts of basic freeway design on adjacent land use and motorists. Two studies particularly applicable to this report are TTI Studies 288 and 402.

Study 288, conducted by Woods (3), researched freeway ramp and frontage road operations. The study focused on operational and safety effects at ramp terminals. Data on erratic maneuvers and accidents was collected at nine frontage road sites where frontage roads had been converted from two-way to one-way operations. The study concluded that the degree of roadside development and frontage road Average Daily Traffic (ADT) (total of both directions) were the only statistically significant factors influencing the crash data. Based on the data analysis in TTI Study 288 maximum two-way frontage road volumes were identified above which operational safety along the frontage road would likely be seriously compromised.

TTI Study 402, conducted by Messer, et al (4), analyzed traffic volumes and operations at standard diamond interchanges (See Figure 2) that utilized slip ramps between the interstate highway and the frontage roads. This study included an attitude survey (5) and a ramp delay study (6) from earlier study reports, a diamond interchange capacity and traffic delay study, and a travel time study. The basic interchange configuration analyzed by Messer, et al included two-way frontage roads with two basic lanes and one left-turn only lane with the cross road consisting of four basic lanes and a left-turn only lane. Some frontage roads had one additional left-turn only lane at the interchange. Study 402 provided analysis, documentation and implementation procedures for the volume-based warrants that were developed for converting two-way frontage roads to one-way operation.

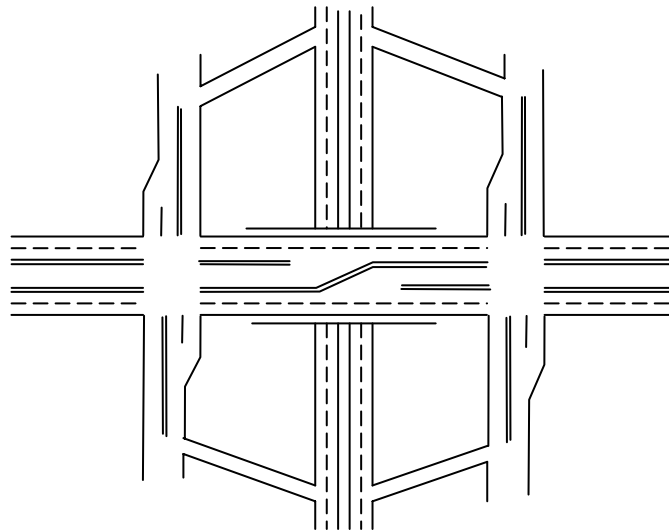


Figure 2: Basic Diamond Interchange with Two-Way Frontage Roads

Summary Of Frontage Road Conversion Warrants

Recommended frontage road volume warrants identified by Woods in Study 288 are presented in Table 2. These volumes were based on frontage road traffic flows between the interchanges.

In Study 402 Messer, et al noted that the safety warrant volumes established in Study 288 were primarily focused on the safety aspects of entrance and exit ramp traffic operations and did not reflect either the capacity of the interchanges or cross street volumes.

Study 402 identified several operational criteria under two-way frontage road operation that the general public recognizes as indicative of deteriorating traffic conditions. These criteria include traffic crashes, ramp conflicts, vehicle delays at signals and ramps, traffic congestion, and added travel time. Messer, et al determined that the conversion warrants should be volume based because all of the above criteria are logically related to volume, volume is understood, readily available, and already used as a common warrant measure. The study developed three levels of warrants for converting from two-way to one-way frontage roads.

Table 2: TTI Study 288 Safety - Based Frontage Road ADT Volume Warrants

Area Type	ADT Warrants Total of Both Frontage Roads
Rural	7,500
Intermediate	6,000
Urban	5,000

The first level warrant simply states that two-way frontage roads should be converted to one-way operation when the safety and operational benefits predicted for one-way operation exceed those for existing two-way flow based on related traffic volume measurements.

The second level warrant is the ADT warrant. The warrant bases conversion to one-way frontage roads on traffic demands estimated for the average day of the year. The average counts are typically the total traffic counted during an average 24-hour day entering the total of eight approaches of two intersections that compose an interchange.

The ADT warranting values are defined by two categories: 1) Desirable – when local conditions are favorable for conversion, and 2) Minimum - where local conditions are not favorable for conversion and traffic operating conditions have reached minimum acceptable conditions. The ADT warrants developed in TTI Study 402 are shown in Table 3.

TTI Study 402 estimated that congestion and delays would be reduced at interchanges and ramps by about 35% during peak hours if one-way operations were implemented at the warranting levels. The study also reported that safety would be significantly improved.

The third level warrant is based on peak-hour turning movement volumes at individual interchanges. This warrant is very sensitive to sight specific characteristics and is data intensive. Application of this warrant requires reliable turning movement counts for all approaches at each interchange. When conditions for conversion to one-way operations are favorable this warrant requires that existing traffic volumes on the critical turning movements at the signalized diamond interchanges reach 65 percent of their phase capacity during the peak 15-minute period of the morning or afternoon peak hour. At least two conflicting movements within the interchange must be critical for this warrant to be met. When conditions are unfavorable the above critical traffic movements must reach 80 percent of their respective phase’s capacity.

Table 3: TTI Study 402 ADT Volume Warrants for Traffic Entering an Interchange

Description of Interchange		Warranting Conditions	
Cross Road	Frontage Road	Desirable	Minimum
2L	2L	20,000	25,000
2L + LT	2L + LT	27,500	35,000
4L + LT	2L	30,000	37,500
4L + LT	2L + LT	35,000	42,000

DATA COLLECTION AND ANALYSIS

This section will describe the data collected for this study and the analysis of that data. The conclusions of the VE study recognized the basic operational need for one-way frontage roads but did not provide a warrant based justification for that conversion. It was reported in TTI Study 402 that all the principal operational measures (crashes, conflicts, delays and congestion) increase with increasing traffic volumes and they are logically related to volume. Based on these two factors it was determined that sufficient justification for conversion to one-way frontage road operation could be obtained if the data indicated that the ADT warrants developed in TTI Studies 288 and 402 had been met. In addition the third level warrants were not evaluated in this report due to the intensive data collection requirements and time constraints.

Data Collection

Field investigations were conducted to identify the geometric configuration of each interchange to be evaluated. Driving from one location to the next and recording the odometer readings determined the separation distance between the interchanges and crossovers. This data was then compared to maps of the study area as a check on the accuracy of the data. Existing interchanges and existing as well as proposed crossover structures were included because they can be used by frontage road traffic as turnaround/access points with one-way operations.

Traffic volume data used in this study was obtained from four sources. Traffic counts were conducted at IH 30 interchanges with FM 989 (Kings Highway), US 59, FM 559 (Richmond Rd.), FM 1397 (Summerhill Rd.) and US 71 (Stateline Ave.) by personnel from the TxDOT-Atlanta District Traffic Section. These traffic counts are shown in Appendix A. The second source of data was the Transportation Planning and Programming (TPP) Division of TxDOT. TxDOT-TPP provided maps showing the 1999 Average Annual Daily Traffic (AADT). The maps are shown in Appendix B. The other two sources were AHTD estimated 1999 AADT Traffic Volume Map and the 1995 TUTS Traffic Map. These maps are shown in Appendices C and D, respectively. This data is presented in the order of its perceived accuracy as related to the purposes of this study. The tube counts performed by the Atlanta District are considered to be the most accurate given that they are the most current data and they match the ADT format used in the conversion warrants. The TxDOT-TPP 1999 AADT data is considered to be applicable given that the data is the most recent AADT volumes available from TxDOT. It should be noted that, while the AADT counts are not in the ADT format used in the warrants, AADT volumes are generally lower than ADT volumes due to several factors including seasonal fluctuations in traffic volumes. The AHTD 1999 AADT volumes are viewed as being less accurate because they had not been officially verified at the time of this report. The 1995 TUTS Traffic Map is considered to be the least applicable because the traffic volumes shown are five years old. In order to improve the accuracy of the 1995 data, growth factors, obtained from AHTD and shown in Appendix E, were applied to estimate the 1999 equivalent traffic volumes.

Data Analysis

The separation distances were used to classify each interchange so the corresponding ADT warrant developed in TTI Study 288 could be identified. On the next page Table 4 shows the spacing between the interchanges, including the existing and proposed crossover facilities that do not have direct access to the freeway and the corresponding classification category.

**Table 4: Interchange Classifications
Based on TTI Study 288**

Interchange/Crossover Location	Separation Distance (miles)	Classification Category
FM 989 – Pecan St.	0.50	Intermediate
Pecan St. – US 59	1.40	Intermediate
US 59 – FM 559	0.80	Urban
FM 559 – Cowhorn Cr	0.60	Urban
Cowhorn Cr – FM 1397	0.75	Urban
FM 1397 – US 71	1.45	Urban
US 71 – Jefferson	0.90	Urban
Jefferson – SH 245	1.30	Intermediate
SH 245 – IH 49	2.00	Rural
IH 49 – SH 108	2.50	Rural

Similarly the geometric design of each interchange was used to determine which ADT warrant developed in Study 402 was applicable. This data was used to identify the applicable warrants developed in TTI Study 402 and are shown in Table 5.

**Table 5: Interchange Classifications
Based on TTI Study 402**

Interchange/Crossover Location	Classification	
	Cross Road	Frontage Road
FM 989	4L + LT	2L +LT
US 59	N/A	N/A
US 82	N/A	N/A
FM 559	4L + LT	2L +LT
FM 1397	4L + LT	2L +LT
US 71	4L + LT	2L
Jefferson Ave.	2L	2L
SH 245	2L	2L
Arkansas Blvd.	N/A	N/A

In order to evaluate the data against the ADT warrants there are two fundamental issues that had to be addressed. First, both of the studies that produced the ADT warrants were based on data collected and evaluations conducted at basic diamond interchanges similar to the one depicted in Figure 2. None of the frontage roads evaluated in this study match that geometric design. At several locations the frontage road and entrance/exit ramps intersect with the cross street at separate points. This has resulted in four separate signalized intersections at each interchange. In order to compare the traffic volume data from this study against the ADT warrants it was necessary to add the ramp volumes to the frontage road volumes to match the warranting conditions. Secondly, neither Study 288 nor Study 402 clearly stated whether the frontage road ADT warrants were based on volumes collected upstream or downstream of the ramp intersection. For purposes of clarity both circumstances are addressed in this report. The traffic volume data and geometric configuration of each interchange are shown in Appendix F. Tables 6 and 7 list each of the interchange locations, their classification, the applicable ADT warrant and a determination as to whether the warrant was met or not.

Table 6: Classifications and Warrants Based on TTI Study 288

Interchange	Classification	Frontage Road				
		Warrant ADT	ADT w/out Ramps	Warrant Met	ADT w/ Ramps	Warrant Met
FM 989	Intermediate	6,000	4,607	N	17,795	Y
US 59	Urban	5,000	8,079	Y	23,510	Y
US 82	Intermediate	6,000	8,079	Y	17,235	Y
FM 559	Urban	5,000	23,707	Y	47,383	Y
FM 1397	Urban	5,000	19,218	Y	42,120	Y
US 71	Urban	5,000	9,177	Y	27,771	Y
Jefferson	Intermediate	6,000	7,116	Y	17,066	Y
SH 245	Intermediate	6,000	N/A	N/A	20,430	Y
Ark. Blvd.	Intermediate	6,000	2,300	N	10,400	Y

A review of the data presented in Table 6 shows that all of the interchanges meet the ADT warrant developed by Woods in TTI Study 288 when the ramp volumes are included with the frontage road volumes. When the ramp volumes are not included all but two of the interchanges still meet the warrant. A third interchange, SH 245, could not be evaluated because there were no traffic volumes available for the frontage roads. The two interchanges that did not meet the warrant were FM 989 and Arkansas Blvd. It should be noted that there is not a complete frontage road system at FM 989. The NE and SE frontage roads are not continuous and there is no frontage road in the SW quadrant. Even with these limitations there were 4,607 vehicles per day using the existing frontage roads. That means that this location met 76.8% of the warrant without a complete frontage road system in place. A more detailed analysis of Arkansas Blvd. indicates that the traffic volumes shown were based on the 1995 TUTS Traffic Map

volumes and are considered to be the least reliable counts used in this study. Arkansas Blvd. only has frontage roads on the north side of the interchange, which obviously impacts the volume of traffic utilizing the frontage roads. This location may still benefit from conversion to one-way operation because doing so would eliminate the exit ramp intersection with the two-way frontage road in the NW quadrant.

Table 7 indicates that there are three interchanges that could not be evaluated using the ADT warrants developed by Messer, et al in Study 402. These interchanges included US 59/IH 30, US 82/IH 30 and Arkansas Blvd./SH 245. These interchanges did not fit the classification criteria established in Study 402. Five of the remaining six interchanges met the Desirable ADT warrant and four of those six also meet the Minimum ADT warrant. It is important to remember that the Desirable warrant is the ADT volume at which local conditions are favorable for conversion to one-way operations and the Minimum ADT warrant is where local conditions have reached the minimum acceptable conditions and conversion is no longer favorable but necessary. Jefferson is the one interchange that met the Desirable warrant but did not meet the Minimum warrant. However, Jefferson Ave. had a total interchange ADT of 24,066 and the Minimum warrant for that location is 25,000. Of the remaining interchanges FM 989 (Kings Hwy.) is the only one that did not meet either of the warranting conditions. Again, it is instructive to note that the current traffic volumes at FM 989 (Kings Hwy.) meet 73.8% of the warranting condition.

Table 7: Classifications and Warrants Based on TTI Study 402

Interchange	Classification		Total Interchange ADT	Warrant Evaluation			
	Cross Road	Frontage Road		Desirable ADT	Warrant Met	Minimum ADT	Warrant Met
FM 989	4L +LT	2L + LT	25,828	35,000	N	42,000	N
US 59	N/A	N/A	39,271	N/A	N/A	N/A	N/A
US 82	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FM 559	4L +LT	2L + LT	69,211	35,000	Y	42,000	Y
FM 1397	4L +LT	2L + LT	65,733	35,000	Y	42,000	Y
US 71	4L +LT	2L	46,771	30,000	Y	37,500	Y
Jefferson	2L	2L	24,066	20,000	Y	25,000	N
SH 245	2L	2L	32,430	20,000	Y	25,000	Y
Ark. Blvd.	N/A	N/A	17,400	N/A	N/A	N/A	N/A

ALTERNATIVES

Do Nothing

The first alternative is the do nothing alternative. At times this is the best alternative however, selecting this option would not address the current operational problems that exist. Local traffic will continue to use the interstate for local trips and the alternative capacity provided by one-way operations would not be available. Travel time and delay will continue to increase and the level of service will degrade at the interchanges in the IH 30 corridor. As development north of IH 30 continues and traffic volumes increase driver frustration, red light running incidents and crash incidents, especially right-angle collisions will increase. The impact on traffic operations will not be limited to the IH 30 corridor but will actually propagate along the north-south arterials as well. These circumstances will also impact the response time for emergency services.

Continuous Two-Way Frontage Roads

The second alternative is to fill in the gaps in the existing frontage road system but continue with two-way operations. This alternative will reduce the use of the interstate by local traffic for local trips but it does not address the congestion and delay that currently exists at FM 559 (Richmond Rd.) and FM 1397 (Summerhill Rd.) due to the four signalized intersections at each interchange. This alternative actually perpetuates this particular problem as volumes increase at other interchanges in the IH 30 corridor leading to the installation of additional signals. This approach would provide alternate routes for use during construction/maintenance work or crash incidents but it would not provide as much capacity as a one-way system. Two-way frontage road operations would result in a short-term reduction in travel time and would increase accessibility to abutting property along the interstate. However, as traffic volumes increase, delay at the interchanges will increase and travel time will begin to increase also.

Continuous One-Way Frontage Roads

The last alternative is to fill in the gaps in the existing frontage road system and convert to one-way operations with ample turnarounds provided to minimize travel distance. It should be noted that a one-way system may increase the travel distance between a given origin and destination but could reduce the actual travel time between those locations when compared to the existing delay involved in traversing the current signalized interchanges. This alternative would provide increased capacity, safer overall operations and an alternative route during periods of high demand, construction/maintenance work or crash incidents. In addition to these benefits, the last alternative is the only one that allows for the elimination of two signalized intersections at the FM 559 (Richmond Rd.) and FM 1397 (Summerhill Rd.) interchanges. It is estimated that delay at those locations would be reduced by at least 25% during peak periods.

SUMMARY

If the decision to convert from two-way operations to one-way operations at any one of the given locations were solely dependent on whether the warranting conditions were met it would be justifiable to convert all of the interchanges along IH 30 from US 59 to SH 245 and US 82 at US 59. However, there are other issues to consider. All warrants allow for the application of engineering judgment. In light of this there are some observations that need to be made. At whatever point the conversion from two-way operations to one-way operations is terminated; there will be a transition between the two configurations. Given that the US 59/IH 30 interchange is the junction of two major freeways with high volumes of traffic it is not a good point to convert from two-way to one-way operations. The next terminus point would be at FM 989 (Kings Hwy)/IH 30. This location, while not meeting all warranting conditions, is in an area that is currently experiencing growth. This growth will result in increased traffic volumes whether the frontage roads are converted to one-way operation or not. In addition, while development is approaching this location from the east, there is little development to the west. This is a logical location for the conversion from two-way to one-way frontage roads. On the east side of the study area, SH 245 appears to be a good location to terminate one-way operations. There are two main reasons for this: one, it is approximately 4.5 miles to the next interchange east of SH 245 at SH 108 and two, future plans call for the proposed IH 49/IH 30 interchange to be located approximately 2.0 miles east of SH 245. Additionally, north of IH 30, Trinity Boulevard could be extended to SH 245 on the west end and converted to a parallel frontage road. This would result in a roadway similar to the north frontage road and Gibson Lane between FM 559 (Richmond Rd.) and FM 989 (Kings Hwy.). One negative is that the Arkansas Tourist Information Center, located south of IH 30 between Jefferson Ave. and SH 245, may need to be relocated. Given the potential for high traffic volumes at the proposed IH 49/IH 30 interchange it would be advisable to design the frontage road system between SH 245 and SH 296 when the IH 49/IH 30 interchange is developed. It is understood that US 82 would be converted to one-way operations given that the frontage roads along IH 30 in that area would be converted and the rest of the US 59 corridor south of this interchange is already a one-way system. The remaining interchange at Arkansas Blvd./SH 245 is currently functioning well within the design criteria for two-way operation. However, converting to one-way operations would eliminate the exit ramp intersection with a two-way frontage road that currently exist and would conform to the one-way frontage operation and driver expectation throughout the rest of the system.

Conclusions

The following conclusions are based on the traffic volume based warrant analysis and the associated discussions presented.

1. Failure to address the current traffic congestion problem will adversely impact many facets of the quality of life in the Texarkana area. Travel time and delay will increase, as will driver frustration, red light running and crash incidents.

2. Traffic volumes will continue to increase at key interchanges in the IH 30 corridor due to planned commercial development. These location include FM 559 (Richmond Rd.) with the development of a new retail center with outlets such as Home Depot, Target and several restaurants adjacent to Movies 12 Theatre, FM 989 (Kings Hwy.) with the development of a new retail center in the northwest corner, FM 1397 (Summerhill Rd.) with the construction of Century Bank and an adjacent office building, and Jefferson Ave. with the planned construction of a Wal-Mart Super Center in the northwest corner.
3. The decision of businesses to locate in the Texarkana area could be impacted because access and a good transportation network are essential to the success of businesses.
4. The transportation system in the Texarkana area would operate more efficiently and safely with continuous one-way frontage roads.
5. Operations at FM 559 (Richmond Rd.) and FM 1397 (Summerhill Rd.) will continue to degrade unless the number of signalized intersections within each interchange is reduced.
6. As development continues north of IH 30 the type of operational problems that exist at FM 559 (Richmond Rd.) and FM 1397 (Summerhill Rd.) will develop at FM 989 (Kings Hwy.), Jefferson Ave. and SH 245 as traffic volumes increase and it becomes necessary to signalize these interchanges.
7. All of the interchanges in the IH 30 corridor from FM 989 (Kings Hwy.) to SH 245 and the US 59 / US 82 interchange met the warrants for conversion to one-way frontage road operations.

Recommendations

These recommendations will improve the flow and circuitry of traffic throughout the transportation network; improve the safety of the transportation system; reduce congestion and delay at the IH 30 interchanges; meet driver expectations; and promote development of abutting property. The following recommendations should be implemented as soon as funding can be secured:

1. Provide turnarounds at FM 989 (Kings Hwy), east side only, FM 559 (Richmond Rd.), FM 1397 (Summerhill Rd.), and Jefferson Ave., west side only.
2. Fill in the gaps in the existing frontage road system FM 989 (Kings Hwy.) to US 59, FM 1397 (Summerhill Rd.) to US 71 (Stateline Ave.) and Jefferson Ave. to SH 245.
3. Convert from two-way to one-way frontage road operations from the east side of FM 989 (Kings Hwy.) to the west side of Jefferson Ave. in the IH 30 corridor and from US 82/US 59 to IH 30.
4. Extend Trinity Boulevard to SH 245 and operate as two-way frontage road.
5. Construct south frontage road from Jefferson Ave. to SH 245
6. Convert to one-way operation between Jefferson Ave. and SH 245
7. Convert existing frontage roads along SH 245 from IH 30 to Arkansas Blvd. to one-way operations when warranted by traffic conditions.

It is also recommended that a separate origin – destination study be conducted in order to address the issue of travel time under one-way operation versus two-way operation. The results of such a study could be used to inform and educate the public on this issue and would be useful during the design process.

Cost Estimates

Cost estimates were developed for each of the frontage road projects that would be needed to convert from two-way to one-way operation in the Texarkana area. These projects and corresponding estimates are shown in Table 8. Project 1 includes six turnaround structures: one on the east side of FM 989 (Kings Hwy.), two at both FM 559 (Richmond Rd.) and FM 1397 (Summerhill Rd.), and one on the west side of Jefferson Ave. The \$ 7.5 million cost estimate for constructing these facilities is dependent on the structural design of the existing crossover structures. Estimates for projects 2,3 and 4 were obtained from the Texarkana Metropolitan Transportation Plan 2000 – 2025. The \$5,775,000 estimate for project 4 includes conversion of the frontage roads from US82/US 59 to IH 30 and the completion of the north and south frontage roads from FM 1397 (Summerhill Rd.) to Stateline Ave. The estimated cost for project 5 from Stateline to Jefferson is \$1.5 million. Based on past projects in this area, the cost of project 6, the south frontage road between Jefferson Ave. and SH 245, is estimated to be \$ 1.5 million while project 7, the extension of Trinity Blvd. as the north frontage, is estimated to cost \$ 600,000. Expenses associated with the relocation of the Arkansas Tourist Information Center are not included in this estimate. The total cost estimate for converting the frontage road system to one-way operation is \$ 19.5 million.

Table 8: Cost Estimates for Recommended Projects

Project Number	Project Description	Estimated Cost / Total Funding
1	Turnaround Structures (FM 989 to SH 245)	\$7,500,000
2	N. Frontage Road US 59 to FM 989	\$1,100,000
3	S. Frontage Road US 59 to FM 989	\$1,525,000
4	Convert Frontage Roads US 59 to Stateline	\$5,775,000
5	Convert Frontage Roads Stateline to Jefferson	\$1,500,000
6	S. Frontage Rd Jefferson to SH 245	\$1,500,000
7	N. Frontage Rd Jefferson to SH 245	\$600,000
Totals		\$19,500,000

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1. "Texarkana Urban Transportation Study Metropolitan Transportation Plan 2000 – 2025." Texarkana Urban Transportation Study, Texarkana, Texas. October 1999.
2. "Value Engineering Study Report – IH 30 Frontage Road Conversion Texarkana, USA." Texarkana Urban Transportation Study-Texarkana Metropolitan Planning Organization, Texarkana, Texas. September 2000.
3. Woods, D.L. "Freeway Frontage Road Operations and Safety Study", Research Report 288-4F. Texas Transportation Institute, Texas A&M University, College Station, TX. March 1984.
4. Messer, C.J., V.G. Stover, and J.L. Gattis. "A Study to Develop Warrants for Conversion to One-Way Frontage Roads." Research Report 402-3F, Texas Transportation Institute, June 1988.
5. Stover, V.G., J.L. Gattis, and C.J. Messer. "Attitudes Concerning Two-Way and One-Way Frontage Roads." Research Report 402-1 Texas Transportation Institute, August 1987.
6. Gattis, J.L., C.J. Messer, and V.G. Stover. "Delay to Frontage Road Vehicles at Intersections with Ramps." Research Report 402-2, Texas Transportation Institute, December 1987.

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APPENDIX A:

**TXDOT - ATLANTA DISTRICT TRAFFIC SECTION
TRAFFIC VOLUME COUNTS**

**FM 989 (King's Highway) @ IH 30
Location 1**

South Bound Lanes				North Bound Lanes				
	6/22/2000	6/23/2000	6/24/2000	6/22/2000	6/23/2000	6/24/2000	6/25/2000	6/26/2000
12:AM	*	12	36	*	21	36	46	20
1:00	*	9	16	*	16	13	34	12
2:00	*	16	18	*	16	28	25	4
3:00	*	12	17	*	8	17	18	18
4:00	*	22	20	*	16	22	18	22
5:00	*	72	52	*	53	34	24	60
6:00	*	196	91	*	134	89	55	172
7:00	*	342	116	*	216	120	56	234
8:00	*	258	175	*	232	168	102	231
9:00	*	274	202	*	238	226	190	194
10:00	*	253	202	*	262	216	168	241
11:00	258	290	238	156	276	237	156	262
12:PM	303	306	*	227	309	253	204	272
1:00	269	286	*	240	260	233	224	231
2:00	255	290	*	234	306	242	214	246
3:00	272	249	*	266	331	228	238	*
4:00	262	293	*	333	391	258	222	*
5:00	316	328	*	436	380	235	247	*
6:00	277	263	*	303	274	192	240	*
7:00	197	191	*	221	212	168	207	*
8:00	170	174	*	190	191	154	140	*
9:00	168	138	*	136	144	134	130	*
10:00	77	90	*	76	101	114	82	*
11:00	41	76	*	46	95	78	48	*
Totals	2865	4440	1183	2864	4482	3495	3088	2219

$$\frac{8,488 \text{ VEH}}{49 \text{ HRS}} = 173.2 \text{ VEH/HR} \times 24 \text{ HRS} = 4,157 \text{ VPD}$$

$$\frac{16,148 \text{ VEH}}{100 \text{ HRS}} = 161.5 \text{ VEH / HR} \times 24 \text{ HRS} = 3,876 \text{ VPI}$$

Combined Volumes for FM 989 Main Lanes

$$4,157 \text{ VPD} + 3,876 \text{ VPD} = 8,033 \text{ VPD}$$

FM 989 @ IH 30 SE Frontage Rd. Location 2				FM 989 @ IH 30 EB Entrance Location 3			
	6/20/2000	6/21/2000	6/22/2000	6/20/2000	6/21/2000	6/22/2000	
12:AM	*	8	*	12:AM	*	22	17
1:00	*	8	*	1:00	*	12	10
2:00	*	13	*	2:00	*	12	17
3:00	*	7	*	3:00	*	10	10
4:00	*	2	*	4:00	*	40	20
5:00	*	25	*	5:00	*	78	70
6:00	*	91	*	6:00	*	273	290
7:00	*	120	*	7:00	*	457	455
8:00	*	78	*	8:00	*	428	394
9:00	*	77	*	9:00	*	348	330
10:00	*	56	*	10:00	*	315	*
11:00	*	104	*	11:00	*	350	*
12:PM	*	115	*	12:PM	*	328	*
1:00	*	92	*	1:00	*	387	*
2:00	*	98	*	2:00	*	264	*
3:00	30	98	*	3:00	*	317	*
4:00	92	84	*	4:00	355	357	*
5:00	174	165	*	5:00	406	370	*
6:00	95	80	*	6:00	354	314	*
7:00	48	24	*	7:00	217	164	*
8:00	40	32	*	8:00	156	112	*
9:00	42	30	*	9:00	136	102	*
10:00	18	8	*	10:00	80	64	*
11:00	12	0	*	11:00	57	46	*
Totals	551	1415	*	Totals	1761	5170	1613

$$\frac{1,966 \text{ VEH}}{33 \text{ HRS}} = 59.6 \text{ VEH/HR} \times 24 \text{ HRS} = 1,430 \text{ VPD}$$

$$\frac{8,544 \text{ VEH}}{42 \text{ HRS}} = 203.4 \text{ VEH/HR} \times 24 \text{ HRS} = 4,882 \text{ VPD}$$

**FM 989 @ IH 30 WB Exit
Location 4**

	6/20/2000	6/21/2000	6/22/2000
12:AM	*	44	36
1:00	*	26	32
2:00	*	12	14
3:00	*	20	12
4:00	*	22	18
5:00	*	72	68
6:00	*	181	182
7:00	*	266	226
8:00	*	248	250
9:00	*	215	231
10:00	*	240	50
11:00	*	276	0
12:PM	*	369	*
1:00	*	320	*
2:00	124	280	*
3:00	327	325	*
4:00	418	404	*
5:00	530	514	*
6:00	325	294	*
7:00	256	198	*
8:00	228	192	*
9:00	210	148	*
10:00	140	106	*
11:00	73	57	*
Totals	2631	4829	1119

$$\frac{8,579 \text{ VEH}}{45 \text{ HRS}} = 190.6 \text{ VEH/HR} \times 24 \text{ HRS} = 1,575 \text{ VPD}$$

**FM 989 @ IH 30 NE Frontage Rd.
Location 5**

	6/20/2000	6/21/2000	6/22/2000
12:AM	*	12	11
1:00	*	6	7
2:00	*	4	5
3:00	*	4	3
4:00	*	5	4
5:00	*	20	16
6:00	*	107	98
7:00	*	231	180
8:00	*	169	169
9:00	*	116	124
10:00	*	102	0
11:00	*	141	*
12:PM	*	182	*
1:00	*	156	*
2:00	24	122	*
3:00	170	162	*
4:00	194	210	*
5:00	327	258	*
6:00	192	221	*
7:00	136	123	*
8:00	106	92	*
9:00	80	63	*
10:00	46	35	*
11:00	31	20	*
Totals	1306	2561	617

$$\frac{4,484 \text{ VEH}}{44 \text{ HRS}} = 101.9 \text{ VEH/HR} \times 24 \text{ HRS} = 2,446 \text{ VPD}$$

**FM 989 @ IH 30 NW Frontage Rd.
Location 6**

	6/20/2000	6/21/2000	6/22/2000
12:AM	*	2	4
1:00	*	2	2
2:00	*	2	2
3:00	*	2	5
4:00	*	7	8
5:00	*	4	8
6:00	*	24	32
7:00	*	38	44
8:00	*	48	56
9:00	*	48	52
10:00	*	46	0
11:00	*	70	*
12:PM	*	44	*
1:00	*	54	*
2:00	*	36	*
3:00	*	56	*
4:00	44	82	*
5:00	74	76	*
6:00	46	64	*
7:00	32	27	*
8:00	28	20	*
9:00	27	19	*
10:00	14	6	*
11:00	14	10	*
Totals	279	787	213

$$\frac{24,862 \text{ VEH}}{114 \text{ HRS}} = 218.1 \text{ VEH/HR} \times 24 \text{ HRS} = 5,234 \text{ VPD}$$

**FM 989 @ IH 30 WB Entrance
Location 7**

	6/23/2000	6/24/2000	6/25/2000	6/26/2000
12:AM	*	9	13	2
1:00	*	8	15	4
2:00	*	5	6	4
3:00	*	12	8	9
4:00	*	24	12	38
5:00	*	44	34	94
6:00	*	77	36	160
7:00	*	73	56	138
8:00	*	91	75	138
9:00	*	153	70	133
10:00	*	148	85	152
11:00	*	132	145	160
12:PM	*	152	131	123
1:00	*	127	106	*
2:00	*	110	101	*
3:00	231	114	122	*
4:00	199	130	122	*
5:00	156	131	103	*
6:00	101	113	115	*
7:00	107	79	102	*
8:00	88	96	77	*
9:00	61	42	46	*
10:00	32	42	21	*
11:00	18	29	10	*
Totals	993	1941	1611	1155

$$\frac{5,700 \text{ VEH}}{70 \text{ HRS}} = 81.4 \text{ VEH/HR} \times 24 \text{ HRS} = 1,954 \text{ VPD}$$

**FM 989 @ IH 30 EB Exit
Location 8**

	6/20/2000	6/21/2000	6/22/2000
12:AM	*	12	18
1:00	*	4	24
2:00	*	6	2
3:00	*	8	15
4:00	*	21	26
5:00	*	60	64
6:00	*	138	144
7:00	*	102	91
8:00	*	110	104
9:00	*	64	78
10:00	*	96	0
11:00	*	120	*
12:PM	*	98	*
1:00	*	164	*
2:00	*	146	*
3:00	118	118	*
4:00	124	158	*
5:00	162	169	*
6:00	108	102	*
7:00	64	62	*
8:00	64	38	*
9:00	48	42	*
10:00	38	23	*
11:00	20	11	*
Totals	746	1872	566

$$\frac{3,184 \text{ VEH}}{43 \text{ HRS}} = 74 \text{ VEH/HR} \times 24 \text{ HRS} = 1,777 \text{ VPD}$$

**US 59 @ IH 30
Location 1**

	North Bound Lanes			South Bound Lanes			
	6/20/2000	6/21/2000	6/22/2000	6/23/2000	6/24/2000	6/25/2000	6/26/2000
12:AM	*	31	24	*	272	304	168
1:00	*	16	28	*	204	172	150
2:00	*	10	16	*	155	153	84
3:00	*	16	16	*	148	92	112
4:00	*	38	14	*	105	102	126
5:00	*	82	80	*	166	113	226
6:00	*	188	183	*	270	184	476
7:00	*	168	126	*	430	289	676
8:00	*	150	155	*	448	318	579
9:00	*	134	0	*	645	462	604
10:00	*	159	*	*	760	572	701
11:00	*	166	*	*	734	696	751
12:PM	*	222	*	*	778	898	814
1:00	*	174	*	*	846	932	894
2:00	209	200	*	*	840	932	736
3:00	233	252	*	48	820	890	0
4:00	288	290	*	989	846	783	*
5:00	457	421	*	1110	790	770	*
6:00	231	184	*	912	764	658	*
7:00	154	116	*	746	657	630	*
8:00	127	133	*	690	572	542	*
9:00	140	102	*	669	556	486	*
10:00	105	52	*	468	488	327	*
11:00	50	41	*	354	322	266	*
Totals	1994	3345	642	5986	12616	11571	7097
$\frac{5,981 \text{ VEH}}{43 \text{ HRS}} = 139.1 \text{ VEH/HR} \times 24 \text{ HRS} = 3,338 \text{ VPD}$				$\frac{37,270 \text{ VEH}}{72 \text{ HRS}} = 517.6 \text{ VEH/HR} \times 24 \text{ HRS} = 12,423 \text{ VPD}$			

Combined Volumes for US 59 Main Lanes

3,338 VPD + 12,423 VPD = 15,761 VPD

**US 59 @ IH 30 SE Frontage Rd.
Location 2**

	6/15/2000	6/16/2000	6/17/2000	6/18/2000	6/19/2000	6/20/2000
12:AM	*	46	47	60	26	53
1:00	*	28	31	32	21	23
2:00	*	30	30	26	12	14
3:00	*	14	34	20	14	12
4:00	*	26	16	11	13	21
5:00	*	54	38	20	56	46
6:00	*	132	66	54	134	136
7:00	*	284	114	54	249	298
8:00	*	274	206	102	287	284
9:00	*	365	330	182	322	32
10:00	*	422	422	222	366	0
11:00	*	514	520	338	430	*
12:PM	*	590	566	417	516	*
1:00	*	583	624	442	486	*
2:00	*	579	634	442	494	*
3:00	164	567	632	454	496	*
4:00	516	584	602	447	540	*
5:00	682	624	562	482	580	*
6:00	477	558	564	449	452	*
7:00	399	500	443	319	372	*
8:00	376	464	378	228	299	*
9:00	249	354	276	204	170	*
10:00	126	229	184	125	114	*
11:00	66	132	92	56	70	*
Totals	3055	7953	7411	5186	6519	919

$$\frac{31,043 \text{ VEH}}{115 \text{ HRS}} = 269.9 \text{ VEH/HR} \times 24 \text{ HRS} = 6,478 \text{ VPD}$$

**US 59 @ IH 30 EB Entrance
Location 3**

	6/20/2000	6/21/2000	6/22/2000
12:AM	*	126	158
1:00	*	107	96
2:00	*	104	130
3:00	*	88	144
4:00	*	174	139
5:00	*	268	282
6:00	*	588	526
7:00	*	952	932
8:00	*	762	809
9:00	*	634	0
10:00	*	654	*
11:00	*	753	*
12:PM	*	758	*
1:00	292	700	*
2:00	746	683	*
3:00	802	750	*
4:00	786	858	*
5:00	927	1042	*
6:00	774	791	*
7:00	616	597	*
8:00	462	472	*
9:00	454	408	*
10:00	352	300	*
11:00	256	204	*
Totals	6467	12773	3216

$$\frac{22,456 \text{ VEH}}{44 \text{ HRS}} = 510.4 \text{ VEH/HR} \times 24 \text{ HRS} = 12,249 \text{ VPD}$$

**US 59 @ IH 30 EB Exit
Location 8**

	6/15/2000	6/16/2000	6/17/2000
12:AM	*	16	26
1:00	*	14	18
2:00	*	11	8
3:00	*	12	20
4:00	*	18	24
5:00	*	80	78
6:00	*	246	236
7:00	*	414	384
8:00	*	249	216
9:00	*	180	0
10:00	*	206	*
11:00	*	164	*
12:PM	*	213	*
1:00	138	161	*
2:00	198	170	*
3:00	246	216	*
4:00	214	186	*
5:00	269	250	*
6:00	182	142	*
7:00	107	70	*
8:00	96	62	*
9:00	70	52	*
10:00	53	46	*
11:00	40	32	*
Totals	1613	3210	1010

$$\frac{5833 \text{ VEH}}{44 \text{ HRS}} = 132.6 \text{ VEH/HR} \times 24 \text{ HRS} = 3,182 \text{ VPD}$$

**US 59 @ IH 30 SW Frontage Rd.
Location 9**

	6/15/2000	6/16/2000	6/17/2000	6/18/2000	6/19/2000	6/20/2000
12:AM	*	5	2	10	2	3
1:00	*	2	1	5	0	0
2:00	*	1	0	1	0	2
3:00	*	0	1	0	1	0
4:00	*	4	2	3	5	3
5:00	*	5	4	0	7	4
6:00	*	22	15	8	17	21
7:00	*	36	30	10	26	22
8:00	*	70	55	22	48	46
9:00	*	93	114	40	78	44
10:00	*	128	172	64	102	*
11:00	*	150	36	95	136	*
12:PM	*	164	94	118	157	*
1:00	*	179	252	146	154	*
2:00	*	183	286	171	142	*
3:00	*	177	272	182	142	*
4:00	110	171	258	162	160	*
5:00	168	166	56	120	156	*
6:00	112	131	14	94	96	*
7:00	101	124	20	32	112	*
8:00	110	150	17	15	68	*
9:00	39	52	4	8	27	*
10:00	15	22	30	17	14	*
11:00	17	11	16	6	10	*
Totals	672	2046	1751	1329	1660	145

$$\frac{7,603 \text{ VEH}}{114 \text{ HRS}} = 66.7 \text{ VEH/HR} \times 24 \text{ HRS} = 1,601 \text{ VPD}$$

**US 82 @ US 59 NE Frontage Rd.
Location 2**

	6/15/2000	6/16/2000	6/17/2000	6/18/2000	6/19/2000	6/20/2000
12:AM	*	46	47	60	26	53
1:00	*	28	31	32	21	23
2:00	*	30	30	26	12	14
3:00	*	14	34	20	14	12
4:00	*	26	16	11	13	21
5:00	*	54	38	20	56	46
6:00	*	132	66	54	134	136
7:00	*	284	114	54	249	298
8:00	*	274	206	102	287	284
9:00	*	365	330	182	322	32
10:00	*	422	422	222	366	0
11:00	*	514	520	338	430	*
12:PM	*	590	566	417	516	*
1:00	*	583	624	442	486	*
2:00	*	579	634	442	494	*
3:00	164	567	632	454	496	*
4:00	516	584	602	447	540	*
5:00	682	624	562	482	580	*
6:00	477	558	564	449	452	*
7:00	399	500	443	319	372	*
8:00	376	464	378	228	299	*
9:00	249	354	276	204	170	*
10:00	126	229	184	125	114	*
11:00	66	132	92	56	70	*
Totals	3055	7953	7411	5186	6519	919

$$\frac{31,043 \text{ VEH}}{115 \text{ HRS}} = 269.9 \text{ VEH/HR} \times 24 \text{ HRS} = 6,478 \text{ VPD}$$

**US 82 @ US 59 NB Entrance
Location 3**

	6/15/2000	6/16/2000	6/17/2000	6/18/2000	6/19/2000	6/20/2000
12:AM	*	42	67	68	30	30
1:00	*	20	40	32	22	23
2:00	*	12	21	30	20	18
3:00	*	20	28	26	4	10
4:00	*	26	18	15	21	13
5:00	*	47	40	22	46	48
6:00	*	124	57	35	112	117
7:00	*	164	85	48	180	166
8:00	*	182	134	70	174	216
9:00	*	166	184	102	192	43
10:00	*	242	237	122	231	*
11:00	*	300	285	191	249	*
12:PM	*	350	300	242	304	*
1:00	*	343	332	254	298	*
2:00	*	342	326	234	318	*
3:00	16	349	371	262	298	*
4:00	383	375	406	252	360	*
5:00	459	442	326	256	422	*
6:00	328	326	257	240	266	*
7:00	240	260	256	180	224	*
8:00	216	278	223	142	200	*
9:00	168	241	228	130	150	*
10:00	108	206	201	86	89	*
11:00	74	116	108	50	50	*
Totals	1992	4973	4530	3089	4260	684

$$\frac{19,528 \text{ VEH}}{91 \text{ HRS}} = 214.6 \text{ VEH/HR} \times 24 \text{ HRS} = 5,150 \text{ VPD}$$

**US 82 @ US 59 SB Exit
Location 4**

	6/15/2000	6/16/2000	6/17/2000
12:AM	*	13	40
1:00	*	9	20
2:00	*	10	16
3:00	*	12	8
4:00	*	14	18
5:00	*	28	30
6:00	*	105	62
7:00	*	150	114
8:00	*	143	144
9:00	*	192	228
10:00	*	240	294
11:00	*	250	303
12:PM	*	249	370
1:00	*	284	382
2:00	*	282	366
3:00	*	273	346
4:00	226	304	301
5:00	273	238	0
6:00	222	253	*
7:00	192	242	*
8:00	141	206	*
9:00	125	186	*
10:00	72	103	*
11:00	34	66	*
Totals	1285	3852	3042

$$\frac{8,179 \text{ VEH}}{49 \text{ HRS}} = 166.9 \text{ VEH/HR} \times 24 \text{ HRS} = 4,006 \text{ VPD}$$

**US 82 @ US 59 NW Frontage Rd.
Location 5**

	6/15/2000	6/16/2000	6/17/2000	6/18/2000	6/19/2000	6/20/2000
12:AM	*	5	2	10	2	3
1:00	*	2	1	5	0	0
2:00	*	1	0	1	0	2
3:00	*	0	1	0	1	0
4:00	*	4	2	3	5	3
5:00	*	5	4	0	7	4
6:00	*	22	15	8	17	21
7:00	*	36	30	10	26	22
8:00	*	70	55	22	48	46
9:00	*	93	114	40	78	44
10:00	*	128	172	64	102	*
11:00	*	150	36	95	136	*
12:PM	*	164	94	118	157	*
1:00	*	179	252	146	154	*
2:00	*	183	286	171	142	*
3:00	*	177	272	182	142	*
4:00	110	171	258	162	160	*
5:00	168	166	56	120	156	*
6:00	112	131	14	94	96	*
7:00	101	124	20	32	112	*
8:00	110	150	17	15	68	*
9:00	39	52	4	8	27	*
10:00	15	22	30	17	14	*
11:00	17	11	16	6	10	*
Totals	672	2046	1751	1329	1660	145

$$\frac{7,603 \text{ VEH}}{114 \text{ HRS}} = 66.7 \text{ VEH/HR} \times 24 \text{ HRS} = 1,601 \text{ VPD}$$

**FM 559 (Richmond Rd.) @ IH 30
Location 1**

North Bound Lanes

South Bound Lanes

	6/15/2000	6/16/2000	6/17/2000	6/18/2000	6/19/2000	6/20/2000
12:AM	*	79	97	133	55	76
1:00	*	51	64	90	27	44
2:00	*	31	34	54	31	18
3:00	*	44	44	36	27	20
4:00	*	54	32	26	52	30
5:00	*	142	99	69	150	186
6:00	*	401	274	212	436	445
7:00	*	676	290	174	70	651
8:00	*	728	485	294	720	780
9:00	*	817	654	390	806	750
10:00	*	972	818	503	896	*
11:00	*	1157	1058	719	1091	*
12:PM	*	1282	1177	965	1196	*
1:00	*	1234	1110	1040	1114	*
2:00	*	1246	1107	918	1096	*
3:00	*	1220	1176	918	1106	*
4:00	490	1399	1344	984	1230	*
5:00	1412	1418	1205	880	1376	*
6:00	1032	1174	1114	870	962	*
7:00	820	1106	1104	760	798	*
8:00	710	860	854	535	668	*
9:00	598	804	810	456	508	*
10:00	301	517	468	276	301	*
11:00	168	258	190	91	134	*
Totals	5531	17670	15608	11393	15481	3000

	7/3/2000	7/4/2000	7/5/2000
12:AM	*	112	66
1:00	*	54	31
2:00	*	39	19
3:00	*	20	24
4:00	*	24	28
5:00	*	41	62
6:00	*	94	175
7:00	*	154	530
8:00	*	172	448
9:00	*	394	544
10:00	*	386	0
11:00	*	474	*
12:PM	*	556	*
1:00	*	548	*
2:00	442	476	*
3:00	850	502	*
4:00	752	458	*
5:00	756	380	*
6:00	646	408	*
7:00	572	322	*
8:00	456	278	*
9:00	347	273	*
10:00	231	200	*
11:00	150	114	*
Totals	5202	6379	1927

$$\frac{68,683 \text{ VEH}}{114 \text{ HRS}} = 602.5 \text{ VEH/HR} \times 24 \text{ HRS} = 14,460 \text{ VPD}$$

$$\frac{13,508 \text{ VEH}}{44 \text{ HRS}} = 307 \text{ VEH/HR} \times 24 \text{ HRS} = 7,368 \text{ VPD}$$

Combined Volumes for FM 559 Main Lanes

14,460 VPD + 7,368 VPD = 21,828 VPD

**FM 559 @ IH 30 SE Frontage Rd.
Location 2**

**FM 559 @ IH 30 EB Entrance
Location 3**

	6/23/2000	6/24/2000	6/25/2000	6/26/2000
12:AM	*	50	50	26
1:00	*	18	19	12
2:00	*	6	10	4
3:00	*	3	4	4
4:00	*	3	1	7
5:00	*	9	6	24
6:00	*	21	9	63
7:00	*	66	20	136
8:00	*	194	42	238
9:00	*	336	80	272
10:00	*	420	118	263
11:00	*	584	278	463
12:PM	*	586	435	530
1:00	*	591	456	550
2:00	84	56	426	0
3:00	592	524	437	*
4:00	592	567	387	*
5:00	663	555	368	*
6:00	570	510	316	*
7:00	525	419	211	*
8:00	441	381	160	*
9:00	368	339	121	*
10:00	164	142	73	*
11:00	67	72	44	*
Totals	4066	6960	4071	2692

	6/15/2000	6/16/2000	6/17/2000
12:AM	*	48	182
1:00	*	29	42
2:00	*	12	32
3:00	*	6	14
4:00	*	23	16
5:00	*	49	47
6:00	*	136	68
7:00	*	203	118
8:00	*	244	158
9:00	*	285	234
10:00	*	343	298
11:00	*	353	342
12:PM	*	372	325
1:00	*	445	260
2:00	*	410	250
3:00	*	415	328
4:00	184	482	390
5:00	475	431	*
6:00	395	170	*
7:00	342	388	*
8:00	284	394	*
9:00	274	411	*
10:00	118	222	*
11:00	72	156	*
Totals	2144	6270	3104

$$\frac{17,789 \text{ VEH}}{72 \text{ HRS}} = 247.1 \text{ VEH/HR} \times 24 \text{ HRS} = 5,930 \text{ VPD}$$

$$\frac{11,518 \text{ VEH}}{49 \text{ HRS}} = 235.1 \text{ VEH/HR} \times 24 \text{ HRS} = 5,641 \text{ VPD}$$

**FM 559 @ IH 30 WB Exit
Location 4**

	6/15/2000	6/16/2000	6/17/2000	6/18/2000	6/19/2000	6/20/2000
12:AM	*	25	42	42	28	29
1:00	*	26	21	26	8	16
2:00	*	9	12	24	18	12
3:00	*	30	16	17	10	12
4:00	*	26	16	16	24	24
5:00	*	65	50	28	71	83
6:00	*	261	143	98	256	251
7:00	*	432	156	73	506	468
8:00	*	411	247	136	428	483
9:00	*	412	350	200	409	464
10:00	*	470	396	252	409	164
11:00	*	514	518	325	452	*
12:PM	*	532	536	524	468	*
1:00	*	426	478	467	434	*
2:00	*	446	418	412	413	*
3:00	227	472	459	380	398	*
4:00	418	484	468	366	406	*
5:00	505	520	462	359	444	*
6:00	437	468	481	326	337	*
7:00	318	452	390	266	278	*
8:00	217	324	282	172	196	*
9:00	154	252	208	158	145	*
10:00	94	162	130	106	96	*
11:00	67	90	60	39	57	*
Totals	2437	7309	6339	4839	6291	1906

$$\frac{29,121 \text{ VEH}}{116 \text{ HRS}} = 251 \text{ VEH/HR} \times 24 \text{ HRS} = 6,025 \text{ VP}$$

**FM 559 @ IH 30 NE Frontage Rd.
Location 5**

	6/15/2000	6/16/2000	6/17/2000	6/18/2000	6/19/2000	6/20/2000
12:AM	*	64	300	334	112	67
1:00	*	6	25	46	11	12
2:00	*	5	4	5	7	0
3:00	*	5	7	3	2	4
4:00	*	7	4	4	9	5
5:00	*	3	16	7	2	6
6:00	*	4	6	7	1	1
7:00	*	12	31	16	9	4
8:00	*	23	38	11	10	19
9:00	*	51	64	36	34	30
10:00	*	71	109	102	59	68
11:00	*	164	208	303	148	0
12:PM	*	221	335	422	154	*
1:00	*	278	405	454	217	*
2:00	*	242	282	340	158	*
3:00	*	300	481	460	204	*
4:00	*	338	546	548	198	*
5:00	139	310	502	308	179	*
6:00	400	584	788	602	334	*
7:00	394	694	798	486	314	*
8:00	239	431	458	254	180	*
9:00	336	659	792	422	270	*
10:00	150	442	430	185	130	*
11:00	86	192	150	76	74	*
Totals	1744	5106	6779	5431	2816	216

$$\frac{22,092 \text{ VEH}}{114 \text{ HRS}} = 193.8 \text{ VEH/HR} \times 24 \text{ HRS} = 4,651 \text{ VPD}$$

**FM 559 @ IH 30 NW Frontage Rd.
Location 6**

	6/23/2000	6/24/2000	6/25/2000	6/26/2000
12:AM	*	51	48	34
1:00	*	19	25	15
2:00	*	18	29	11
3:00	*	13	11	8
4:00	*	16	22	12
5:00	*	44	27	82
6:00	*	131	124	236
7:00	*	144	103	433
8:00	*	196	122	382
9:00	*	267	196	444
10:00	*	382	235	448
11:00	*	436	372	558
12:PM	*	558	529	790
1:00	*	524	475	680
2:00	*	519	523	0
3:00	547	410	384	*
4:00	578	486	353	*
5:00	606	458	380	*
6:00	608	551	396	*
7:00	566	496	376	*
8:00	418	358	274	*
9:00	352	273	182	*
10:00	182	174	146	*
11:00	138	81	88	*
Totals	3996	6618	5420	4133

$$\frac{20,167 \text{ VEH}}{71 \text{ HRS}} = 284 \text{ VEH/HR} \times 24 \text{ HRS} = 6,817 \text{ VP}$$

**FM 559 @ IH 30 WB Entrance
Location 7**

	6/20/2000	6/21/2000	6/22/2000
12:AM	*	39	*
1:00	*	25	*
2:00	*	15	*
3:00	*	16	*
4:00	*	29	*
5:00	*	88	*
6:00	*	190	*
7:00	*	268	*
8:00	*	207	*
9:00	*	233	*
10:00	*	308	*
11:00	319	333	*
12:PM	444	494	*
1:00	456	416	*
2:00	483	*	*
3:00	498	*	*
4:00	522	*	*
5:00	558	*	*
6:00	427	*	*
7:00	368	*	*
8:00	311	*	*
9:00	329	*	*
10:00	153	*	*
11:00	94	*	*
Totals	4962	2661	0

$$\frac{7,623 \text{ VEH}}{27 \text{ HRS}} = 282.3 \text{ VEH/HR} \times 24 \text{ HRS} = 6,776 \text{ VPI}$$

**FM 559 @ IH 30 EB Exit
Location 8**

	6/15/2000	6/16/2000	6/17/2000	6/18/2000	6/19/2000	6/20/2000
12:AM	*	38	78	63	32	30
1:00	*	26	62	58	18	12
2:00	*	35	34	49	15	14
3:00	*	24	27	15	18	10
4:00	*	32	22	13	17	16
5:00	*	34	27	18	30	30
6:00	*	89	39	34	84	100
7:00	*	258	142	76	253	272
8:00	*	270	180	70	228	242
9:00	*	302	288	165	264	256
10:00	*	380	392	202	318	216
11:00	*	435	472	308	358	0
12:PM	*	464	474	432	396	0
1:00	*	436	474	444	382	0
2:00	*	391	441	400	373	0
3:00	*	442	499	369	374	0
4:00	*	475	508	380	372	*
5:00	422	497	480	282	427	*
6:00	373	440	438	300	313	*
7:00	350	452	458	279	262	*
8:00	241	326	256	182	172	*
9:00	158	230	195	142	115	*
10:00	115	166	164	94	71	*
11:00	64	104	84	42	48	*
Totals	1723	6346	6235	4417	4943	1198

$$\frac{24,862 \text{ VEH}}{114 \text{ HRS}} = 218.1 \text{ VEH/HR} \times 24 \text{ HRS} = 5,234 \text{ VPD}$$

**FM 559 @ IH 30 SW Frontage Rd.
Location 9**

	6/15/2000	6/16/2000	6/17/2000	6/18/2000	6/19/2000	6/20/2000
12:AM	*	45	52	56	25	45
1:00	*	28	37	36	20	20
2:00	*	28	28	28	11	14
3:00	*	12	21	19	12	10
4:00	*	16	20	16	12	12
5:00	*	42	32	15	48	40
6:00	*	128	55	44	96	122
7:00	*	229	94	47	222	251
8:00	*	262	194	82	244	270
9:00	*	372	276	166	299	318
10:00	*	479	426	186	375	102
11:00	*	575	541	304	485	0
12:PM	*	650	630	399	539	0
1:00	*	626	618	446	525	0
2:00	*	592	598	391	532	*
3:00	326	619	653	412	514	*
4:00	539	585	62	399	538	*
5:00	636	619	556	406	554	*
6:00	454	518	540	364	403	*
7:00	370	476	448	268	368	*
8:00	342	408	328	213	244	*
9:00	240	308	274	153	170	*
10:00	104	170	128	120	108	*
11:00	71	108	106	52	67	*
Total	3082	7895	7279	4622	6411	1204

$$\frac{30,493 \text{ VEH}}{116 \text{ HRS}} = 262.9 \text{ VEH/HR} \times 24 \text{ HRS} = 6,309 \text{ VPD}$$

**FM 1397 (Summerhill) @ IH 30
Location 1**

North Bound Lanes

South Bound Lanes

	6/23/2000	6/24/2000	6/25/2000	6/26/2000	6/15/2000	6/16/2000	6/17/2000	6/18/2000	6/19/2000	6/20/2000
12:AM	*	138	114	69	*	72	84	67	54	62
1:00	*	76	78	42	*	50	58	53	28	31
2:00	*	54	52	30	*	40	35	54	28	18
3:00	*	43	48	37	*	40	32	19	28	34
4:00	*	43	31	44	*	46	50	24	24	28
5:00	*	58	42	84	*	95	72	58	124	114
6:00	*	132	108	245	*	254	148	90	234	242
7:00	*	280	188	609	*	503	216	120	488	522
8:00	*	432	238	722	*	602	286	188	670	589
9:00	*	547	335	764	*	663	382	244	636	632
10:00	*	660	406	782	*	704	460	288	668	647
11:00	*	742	558	930	*	818	573	380	765	276
12:PM	*	702	640	1038	*	948	570	536	844	0
1:00	*	748	612	989	*	854	541	420	798	*
2:00	536	747	540	0	245	799	510	366	730	*
3:00	1022	624	514	*	743	776	534	343	696	*
4:00	1039	633	472	*	794	762	602	388	796	*
5:00	975	630	531	*	852	834	549	366	841	*
6:00	848	636	445	*	632	592	414	350	532	*
7:00	669	566	440	*	452	516	346	355	412	*
8:00	518	450	312	*	318	396	301	252	294	*
9:00	428	384	294	*	284	403	274	200	226	*
10:00	289	300	186	*	222	242	212	158	138	*
11:00	245	239	144	*	120	178	138	78	108	*
Totals	6569	9864	7328	6385	4662	11187	7387	5397	10162	3195

$\frac{30,146 \text{ VEH}}{48 \text{ HRS}} = 628 \text{ VEH/HR} \times 24 \text{ HRS} = 15,073 \text{ VPD}$

$\frac{41,990 \text{ VEH}}{118 \text{ HRS}} = 355.8 \text{ VEH/HR} \times 24 \text{ HRS} = 8,540 \text{ VPD}$

Combined Volumes for FM 1397 Main Lanes

15,073 VPD + 8,540 VPD = 23,613 VPD

**FM 1397 @ IH 30 SE Frontage Rd.
Location 2**

**FM 1397 @ IH 30 EB Entrance
Location 3**

	7/3/2000	7/4/2000	7/5/2000
12:AM	*	3	3
1:00	*	5	1
2:00	*	2	0
3:00	*	0	0
4:00	*	5	3
5:00	*	2	7
6:00	*	8	16
7:00	*	11	28
8:00	*	30	46
9:00	*	22	50
10:00	*	16	0
11:00	*	26	*
12:PM	*	52	*
1:00	*	55	*
2:00	28	45	*
3:00	64	40	*
4:00	64	48	*
5:00	56	33	*
6:00	67	28	*
7:00	102	46	*
8:00	64	34	*
9:00	62	34	*
10:00	41	20	*
11:00	11	8	*
Totals	559	573	154

$\frac{1,286 \text{ VEH}}{44 \text{ HRS}} = 29.2 \text{ VEH/HR} \times 24 \text{ HRS} = 701 \text{ VPD}$

	6/23/2000	6/24/2000	6/25/2000	6/26/2000
12:AM	*	108	96	54
1:00	*	37	58	26
2:00	*	34	30	20
3:00	*	25	32	12
4:00	*	35	19	30
5:00	*	56	38	66
6:00	*	104	83	184
7:00	*	186	137	341
8:00	*	218	146	330
9:00	*	259	184	386
10:00	*	354	264	400
11:00	*	466	322	562
12:PM	*	438	410	588
1:00	*	530	418	585
2:00	228	510	388	0
3:00	643	472	410	*
4:00	684	470	352	*
5:00	716	484	391	*
6:00	596	467	358	*
7:00	476	444	280	*
8:00	458	382	236	*
9:00	408	376	226	*
10:00	234	256	130	*
11:00	211	190	85	*
Totals	4654	6901	5093	3584

$\frac{20,232 \text{ VEH}}{72 \text{ HRS}} = 281 \text{ VEH/HR} \times 24 \text{ HRS} = 6,744 \text{ VPD}$

**FM 1397 @ IH 30 WB Exit
Location 4**

	6/13/2000	6/14/2000	6/15/2000
12:AM	*	34	40
1:00	*	40	34
2:00	*	28	26
3:00	*	16	16
4:00	*	26	26
5:00	*	80	78
6:00	*	295	240
7:00	*	557	554
8:00	*	498	506
9:00	*	488	495
10:00	*	464	476
11:00	*	507	502
12:PM	*	564	641
1:00	*	547	564
2:00	*	414	0
3:00	362	479	*
4:00	519	529	*
5:00	591	568	*
6:00	475	494	*
7:00	364	345	*
8:00	270	297	*
9:00	190	186	*
10:00	148	112	*
11:00	82	94	*
Totals	3001	7662	4198

$$\frac{14,861 \text{ VEH}}{47 \text{ HRS}} = 316.2 \text{ VEH/HR} \times 24 \text{ HRS} = 7,589 \text{ VPD}$$

**FM 1397 @ IH 30 NE Frontage Rd.
Location 5**

	6/13/2000	6/14/2000	6/15/2000
12:AM	*	13	14
1:00	*	9	5
2:00	*	13	25
3:00	*	16	8
4:00	*	12	22
5:00	*	22	28
6:00	*	50	46
7:00	*	171	180
8:00	*	162	202
9:00	*	168	200
10:00	*	191	216
11:00	*	246	235
12:PM	*	279	298
1:00	*	238	248
2:00	*	218	0
3:00	109	186	*
4:00	164	175	*
5:00	214	204	*
6:00	94	110	*
7:00	72	56	*
8:00	56	35	*
9:00	48	28	*
10:00	60	18	*
11:00	26	22	*
Totals	843	2642	1727

$$\frac{5,212 \text{ VEH}}{47 \text{ HRS}} = 110.9 \text{ VEH/HR} \times 24 \text{ HRS} = 2,661 \text{ VPD}$$

**FM 1397 @ IH 30 NW Frontage Rd.
Location 6**

	6/13/2000	6/14/2000	6/15/2000
12:AM	*	46	44
1:00	*	31	16
2:00	*	17	22
3:00	*	14	10
4:00	*	32	35
5:00	*	71	77
6:00	*	298	274
7:00	*	504	456
8:00	*	497	476
9:00	*	597	536
10:00	*	608	602
11:00	*	720	765
12:PM	*	932	928
1:00	*	766	884
2:00	*	704	0
3:00	280	732	*
4:00	696	728	*
5:00	684	676	*
6:00	550	602	*
7:00	418	375	*
8:00	339	322	*
9:00	256	216	*
10:00	172	176	*
11:00	116	124	*
Totals	3511	9788	5125

$$\frac{18,424 \text{ VEH}}{47 \text{ HRS}} = 392 \text{ VEH/HR} \times 24 \text{ HRS} = 9,408 \text{ VPD}$$

**FM 1397 @ IH 30 WB Entrance
Location 7**

	6/13/2000	6/14/2000	6/15/2000
12:AM	*	27	26
1:00	*	3	13
2:00	*	6	12
3:00	*	16	4
4:00	*	20	25
5:00	*	56	58
6:00	*	134	130
7:00	*	180	174
8:00	*	175	184
9:00	*	192	195
10:00	*	222	218
11:00	*	296	246
12:PM	*	287	310
1:00	*	296	262
2:00	*	263	0
3:00	74	284	*
4:00	314	320	*
5:00	458	437	*
6:00	221	248	*
7:00	230	148	*
8:00	160	143	*
9:00	202	116	*
10:00	84	62	*
11:00	99	28	*
Total	1842	3959	1857

$$\frac{20,167 \text{ VEH}}{71 \text{ HRS}} = 284 \text{ VEH/HR} \times 24 \text{ HRS} = 6,817 \text{ VPD}$$

**FM 1397 @ IH 30 EB Exit
Location 8**

	6/13/2000	6/14/2000	6/15/2000
12:AM	*	30	21
1:00	*	14	10
2:00	*	18	13
3:00	*	16	13
4:00	*	15	16
5:00	*	52	54
6:00	*	133	136
7:00	*	391	377
8:00	*	372	386
9:00	*	332	321
10:00	*	295	280
11:00	*	293	290
12:PM	*	360	358
1:00	*	298	350
2:00	*	278	315
3:00	*	285	0
4:00	298	320	*
5:00	428	386	*
6:00	294	230	*
7:00	205	161	*
8:00	128	128	*
9:00	122	80	*
10:00	52	59	*
11:00	54	57	*
Totals	1581	4603	2940

$$\frac{9,124 \text{ VEH}}{47 \text{ HRS}} = 194.1 \text{ VEH/HR} \times 24 \text{ HRS} = 4,659 \text{ VPD}$$

**FM 1397 @ IH 30 SW Frontage Rd.
Location 9**

	6/13/2000	6/14/2000	6/15/2000
12:AM	*	30	18
1:00	*	6	17
2:00	*	7	8
3:00	*	9	2
4:00	*	8	10
5:00	*	17	15
6:00	*	46	48
7:00	*	144	99
8:00	*	184	206
9:00	*	332	306
10:00	*	341	364
11:00	*	594	559
12:PM	*	704	754
1:00	*	664	654
2:00	*	528	566
3:00	8	460	0
4:00	468	454	*
5:00	597	556	*
6:00	530	533	*
7:00	425	350	*
8:00	288	300	*
9:00	210	192	*
10:00	100	87	*
11:00	48	51	*
Totals	2674	6597	3626

$$\frac{13,508 \text{ VEH}}{44 \text{ HRS}} = 307 \text{ VEH/HR} \times 24 \text{ HRS} = 7,368 \text{ VPD}$$

**US 71 @ IH 30 NW Frontage
Location 6**

	6/13/2000	6/14/2000	6/15/2000
12:AM	*	24	18
1:00	*	11	9
2:00	*	14	9
3:00	*	6	8
4:00	*	16	10
5:00	*	36	28
6:00	*	61	52
7:00	*	112	111
8:00	*	139	126
9:00	*	102	127
10:00	*	120	122
11:00	*	167	151
12:PM	*	192	180
1:00	*	185	0
2:00	86	130	*
3:00	122	138	*
4:00	144	158	*
5:00	166	173	*
6:00	143	178	*
7:00	131	163	*
8:00	136	124	*
9:00	92	83	*
10:00	63	76	*
11:00	36	46	*
Totals	1119	2454	951

$$\frac{4,524 \text{ VEH}}{47 \text{ HRS}} = 96.2 \text{ VEH/HR} \times 24 \text{ HRS} = 2,309 \text{ VPD}$$

**US 71 @ IH 30 WB Entrance
Location 7**

	6/13/2000	6/14/2000	6/15/2000
12:AM	*	49	55
1:00	*	43	56
2:00	*	54	44
3:00	*	40	38
4:00	*	44	46
5:00	*	130	124
6:00	*	276	242
7:00	*	428	386
8:00	*	378	385
9:00	*	348	342
10:00	*	354	376
11:00	*	320	390
12:PM	*	354	417
1:00	*	364	0
2:00	*	370	*
3:00	318	374	*
4:00	420	400	*
5:00	449	451	*
6:00	308	304	*
7:00	240	248	*
8:00	221	175	*
9:00	146	122	*
10:00	111	122	*
11:00	100	76	*
Totals	2313	5824	2901

$$\frac{11,038 \text{ VEH}}{46 \text{ HRS}} = 239.9 \text{ VEH/HR} \times 24 \text{ HRS} = 5,759 \text{ VPD}$$

**US 71 @ IH 30 EB Exit
Location 8**

	6/13/2000	6/14/2000	6/15/2000
12:AM	*	64	74
1:00	*	36	41
2:00	*	43	20
3:00	*	22	22
4:00	*	40	38
5:00	*	90	80
6:00	*	160	168
7:00	*	512	476
8:00	*	472	484
9:00	*	460	416
10:00	*	501	472
11:00	*	550	616
12:PM	*	636	638
1:00	*	600	*
2:00	420	540	*
3:00	594	592	*
4:00	578	646	*
5:00	630	664	*
6:00	542	562	*
7:00	418	404	*
8:00	401	366	*
9:00	322	277	*
10:00	216	185	*
11:00	134	140	*
Totals	4255	8562	3545

$$\frac{16,362 \text{ VEH}}{47 \text{ HRS}} = 348.1 \text{ VEH/HR} \times 24 \text{ HRS} = 8,355 \text{ VPD}$$

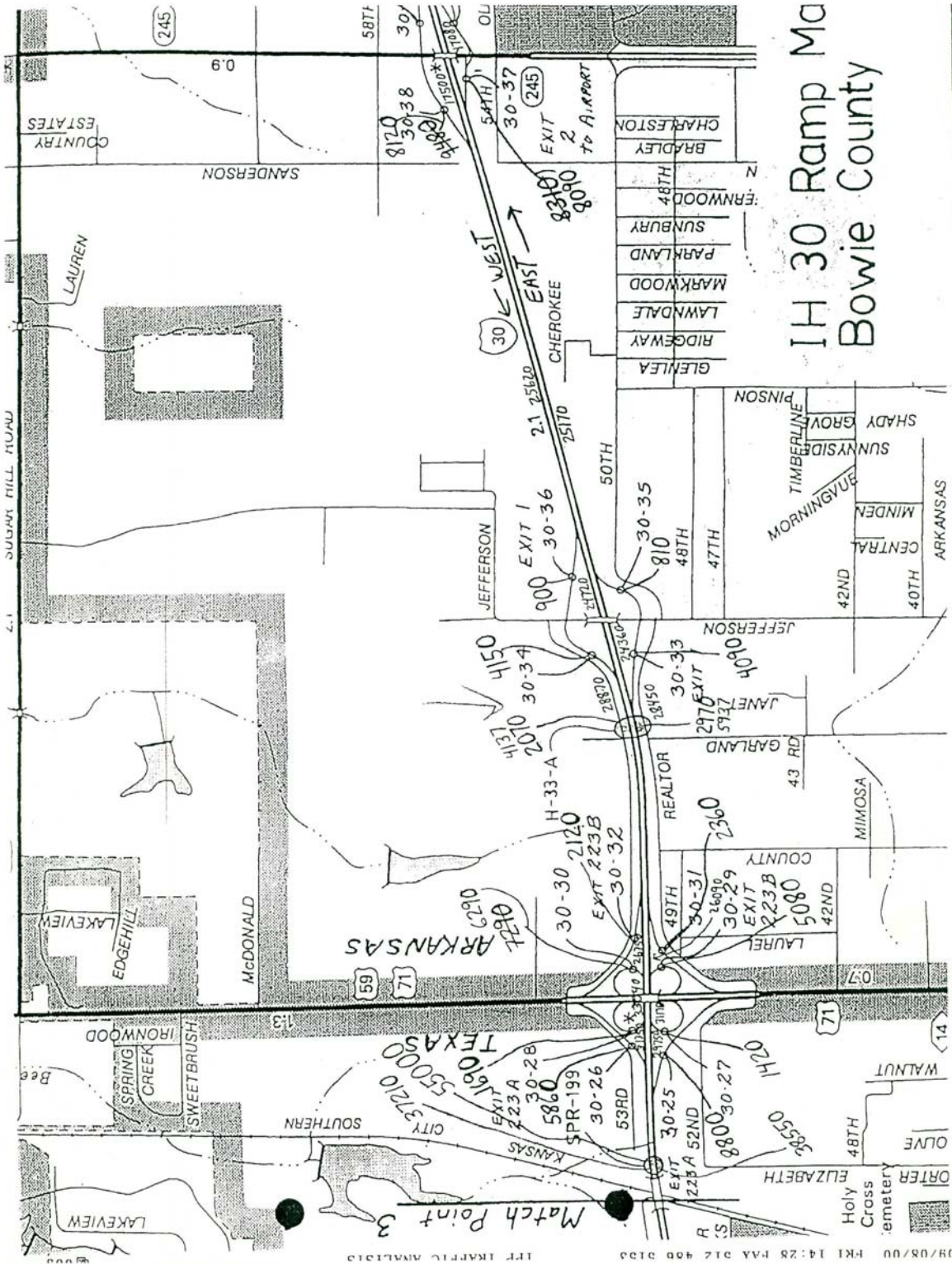
**US 71 @ IH 30 SW Frontage Rd.
Location 9**

	6/13/2000	6/14/2000	6/15/2000
12:AM		29	32
1:00	*	28	46
2:00	*	33	20
3:00	*	20	20
4:00	*	19	10
5:00	*	16	26
6:00	*	52	72
7:00	*	89	105
8:00	*	96	102
9:00	*	94	86
10:00	*	74	98
11:00	*	82	124
12:PM	*	74	106
1:00	*	82	0
2:00	14	102	*
3:00	102	79	*
4:00	122	98	*
5:00	150	122	*
6:00	118	124	*
7:00	86	130	*
8:00	87	102	*
9:00	128	84	*
10:00	74	91	*
11:00	69	62	*
Total	950	1782	847

$$\frac{3,579 \text{ VEH}}{47 \text{ HRS}} = 76.1 \text{ VEH/HR} \times 24 \text{ HRS} = 1,828 \text{ VPD}$$

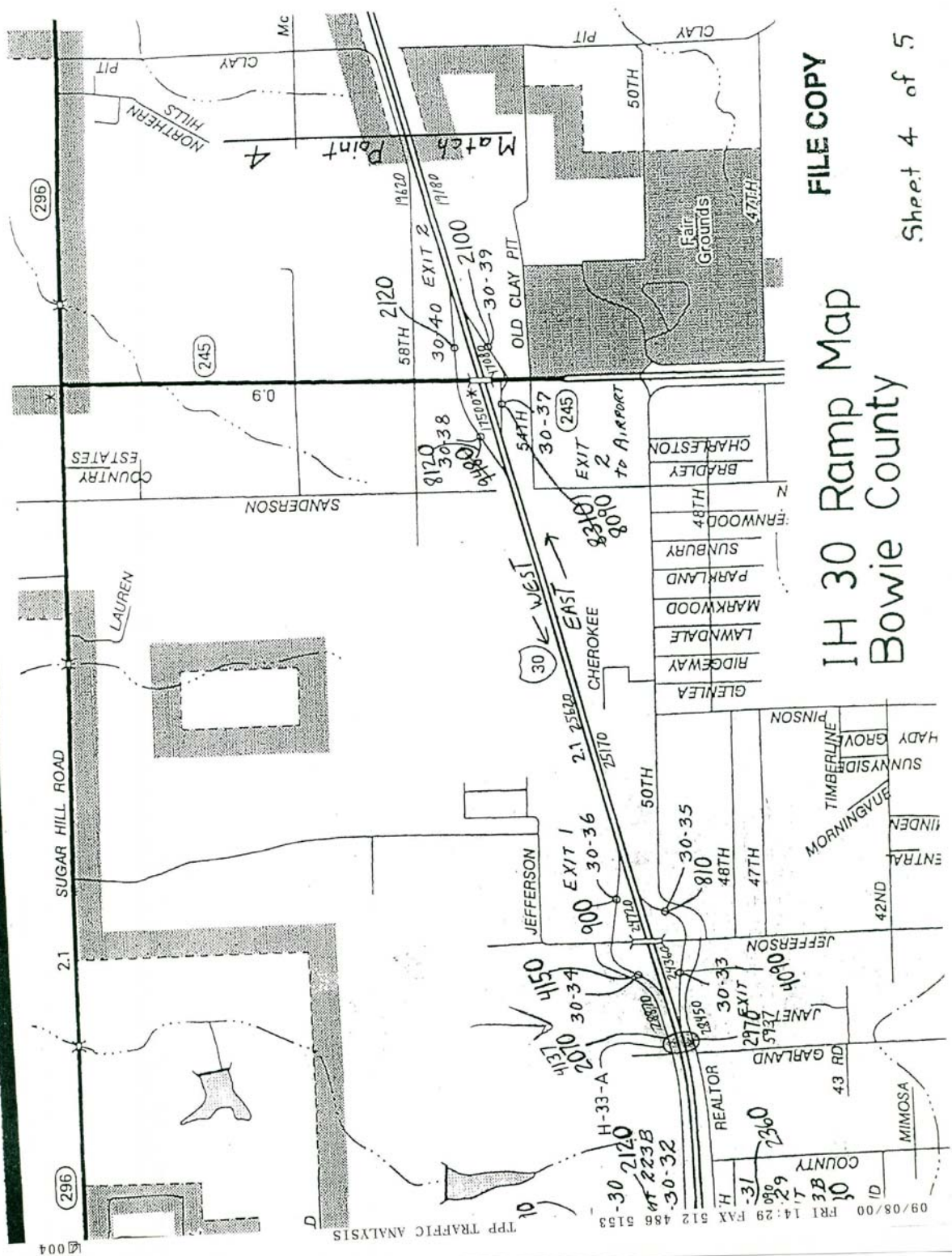
APPENDIX B:

**TXDOT – TRANSPORTATION PLANNING AND PROGRAMMING
DIVISION 1999 AVERAGE ANNUAL DAILY TRAFFIC MAPS**



IH 30 Ramp Ma Bowie County

09/08/00 FKI 14:28 PAX 012 400 0130
 11T TRAFFIC ANALYSIS
 Match Point 3



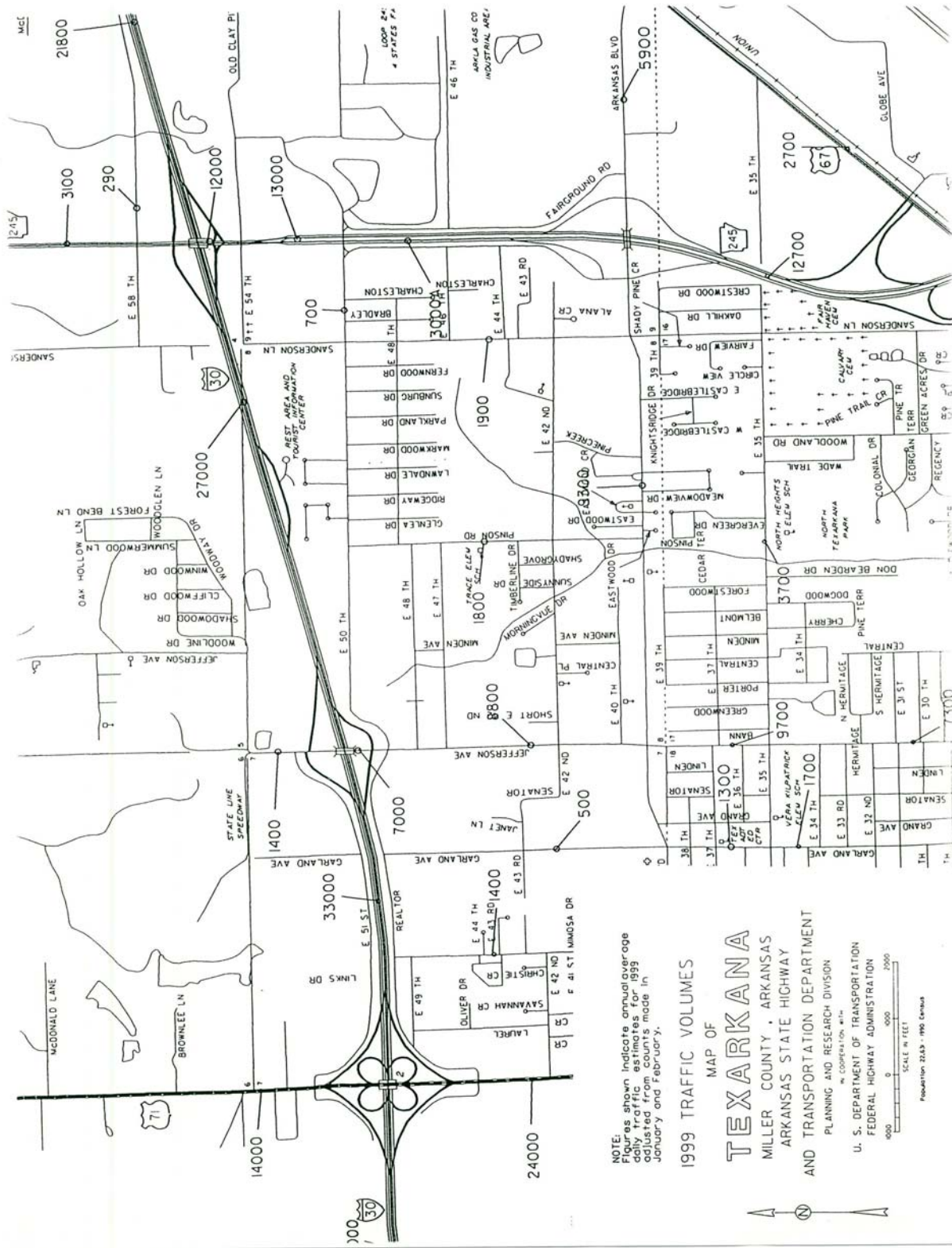
004

TTP TRAFFIC ANALYSIS

09/08/00 FRI 14:29 FAX 512 486 5133

APPENDIX C:

**AHTD – PLANNING AND RESEARCH DIVISION ESTIMATED
1999 AVERAGE ANNUAL DAILY TRAFFIC MAP**



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APPENDIX D:
TUTS 1995 TRAFFIC VOLUME MAP

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APPENDIX E:

**SUMMARY OF GROWTH FACTOR CALCULATIONS FOR
JEFFERSON AVENUE AND ARKANSAS BOULEVARD**

GROWTH RATE CALCULATIONS

Growth Rate Formula: $T_2 = T_1 * G^n$

Where: T_1 = 1995 traffic volume from TUTS Coverage Count Map

T_2 = 1999 calculated traffic volume

G = AHTD growth factor

n = number of years between T_1 and T_2

AHTD GROWTH FACTORS

Location	Growth Factor (G)
W. of SH 245	1.027816
E. of SH 245	1.063268
SH 245 Main Lanes	1.053528

TUTS 1995 AADT Traffic Volumes *

Location Number	Jefferson Avenue		Arkansas Boulevard	
	Location Description	1995 AADT	Location Description	1995 AADT
1	Mainlanes	n/a	Mainlanes	5995
2	SE Frontage Rd.	1860	SW Frontage Rd.	n/a
3	EB Entrance	n/a	SB Entrance	2280
4	WB Exit	n/a	NB Exit	2280
5	NE Frontage Rd.	n/a	SE Frontage Rd.	n/a
6	NW Frontage Rd.	n/a	NE Frontage Rd.	460
7	WB Entrance	n/a	NB Entrance	1170
8	WB Exit	n/a	SB Exit	730
9	SW Frontage Rd.	n/a	NW Frontage Rd.	1550

* Volumes are based on the TUTS 1995 Traffic Map shown in Appendix D

Sample Calculations:

Jefferson Avenue $T_2 = T_1 * G^n$

Location 2 $T_2 = 1860 (1.027816)^4$

SE Frontage Rd. $T_2 = 2076$

Arkansas Blvd. $T_1 = [7950 \text{ (W. of SH 245)} + 4040 \text{ (E. of SH 245)}] / 2 = 5995$

Location 1 $T_2 = [7950(1.027816)^4 + 4040(1.063268)^4] / 2 =$

Mainlanes $T_2 = (8900 + 5200) / 2 = 7000$

Location 3 $T_1 = (14,350 - 9790) / 2 = 2280$

SB Entrance $T_2 = 2280 (1.053528)^4$

$T_2 = 2800$

1999 AADT Traffic Volumes

Location Number	Jefferson Avenue		Arkansas Boulevard	
	Location Description	1999 AADT	Location Description	1999 AADT
1	Mainlanes	n/a	Mainlanes	7000
2	SE Frontage Rd.	2076	SW Frontage Rd.	n/a
3	EB Entrance	n/a	SB Entrance	2800
4	WB Exit	n/a	NB Exit	2800
5	NE Frontage Rd.	n/a	SE Frontage Rd.	n/a
6	NW Frontage Rd.	n/a	NE Frontage Rd.	600
7	WB Entrance	n/a	NB Entrance	1400
8	WB Exit	n/a	SB Exit	1100
9	SW Frontage Rd.	n/a	NW Frontage Rd.	1700

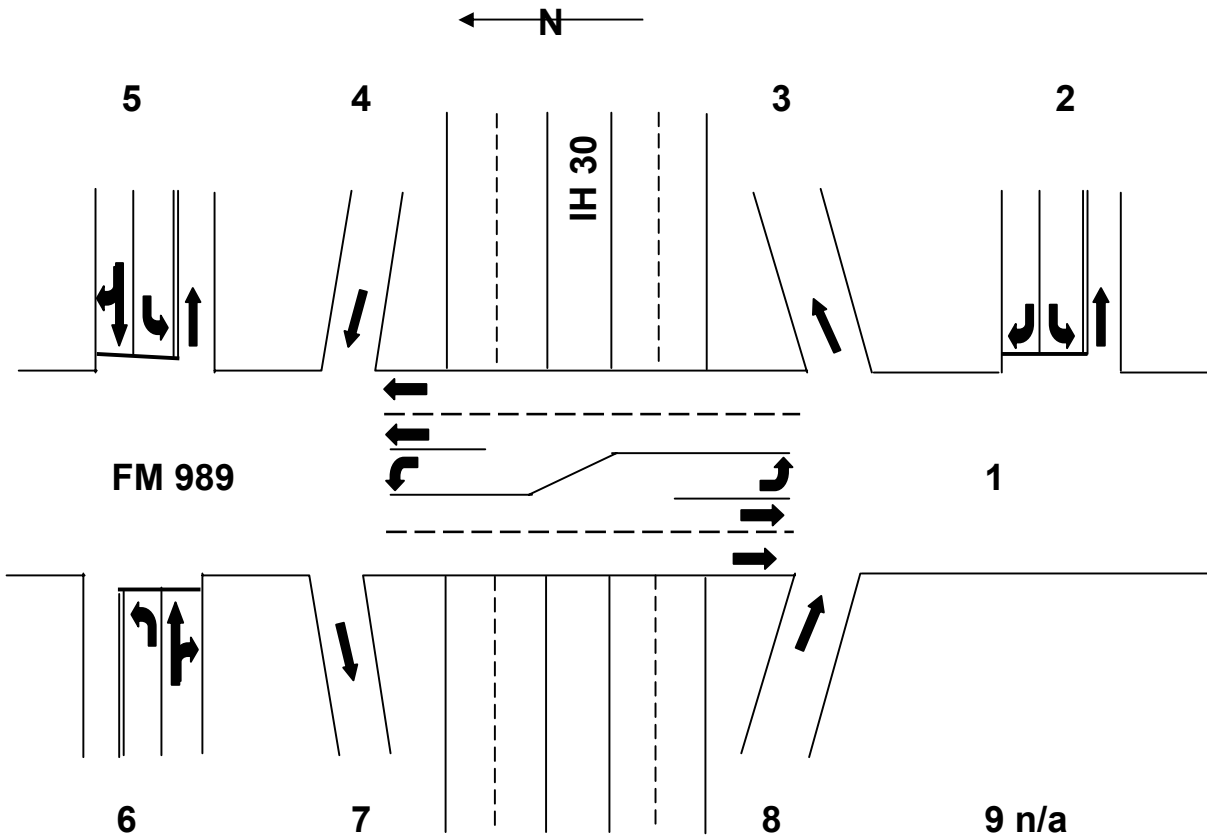
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APPENDIX F:

INTERCHANGE TRAFFIC DATA AND GEOMETRIC CONFIGURATIONS

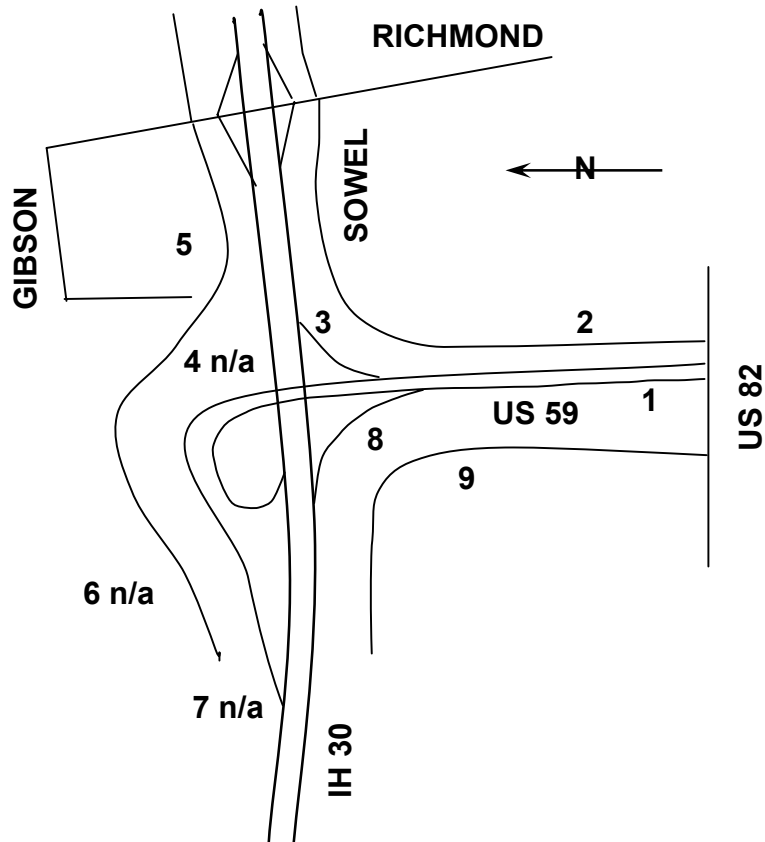
FM 989 (King's Highway)

Location #	Location Description	TxDOT (Atlanta) 6-13 to 7-5-2000 ADT
1	FM 989 Mainlanes	8,033
2	SE Frontage Rd.	1,430
3	EB Entrance	4,882
4	WB Exit	4,575
5	NE Frontage Rd.	2,446
6	NW Frontage Rd.	731
7	WB Entrance	1,954
8	EB Exit	1,777
9	SW Frontage Rd.	N/A
Frontage Rd ADT w/out Ramps		4,607
Frontage Rd ADT with Ramps		17,795
Total Interchange ADT		25,828



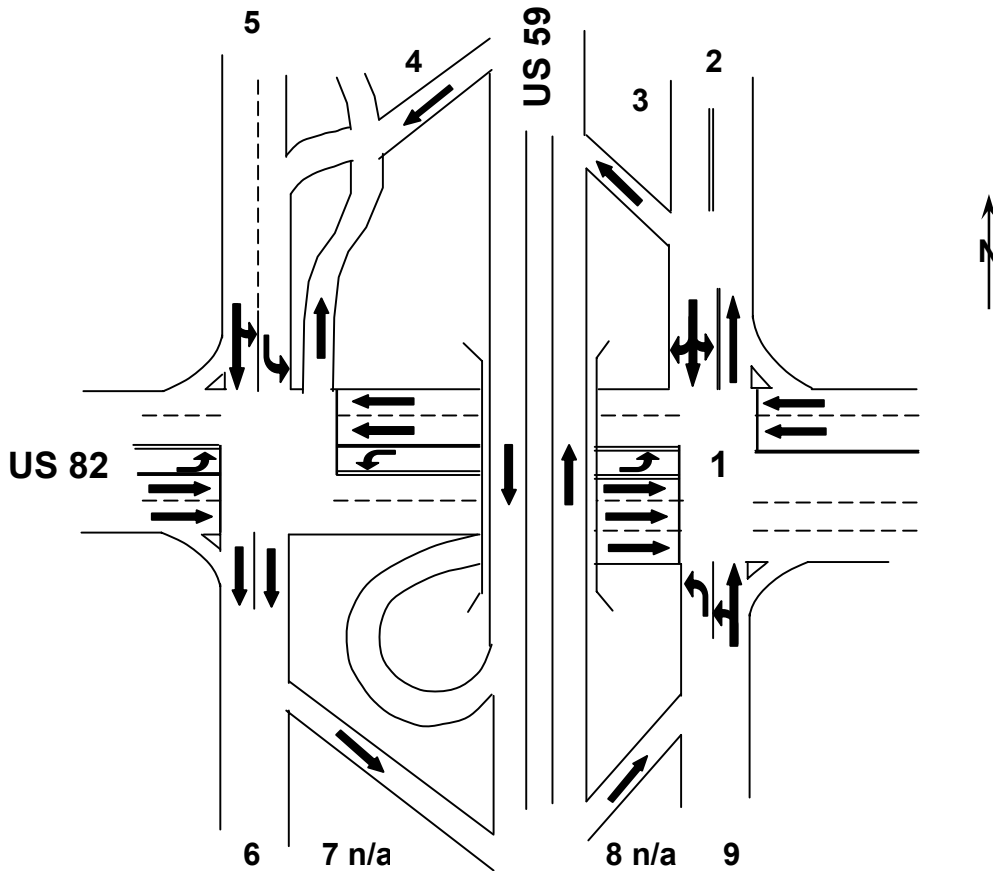
US 59

Location #	Location Description	TxDOT (Atlanta) 6-13 to 7-5-2000 ADT
1	US 59 Mainlanes	15,761
2	SE Frontage	6,478
3	EB Entrance	12,249
4	WB Exit	N/A
5	NE Frontage Rd.	N/A
6	NW Frontage Rd.	N/A
7	WB Exit	N/A
8	EB Exit	3,182
9	SW Frontage	1,601
Frontage Rd ADT w/out Ramps		8,079
Frontage Rd ADT with Ramps		23,510
Total Interchange ADT		39,271



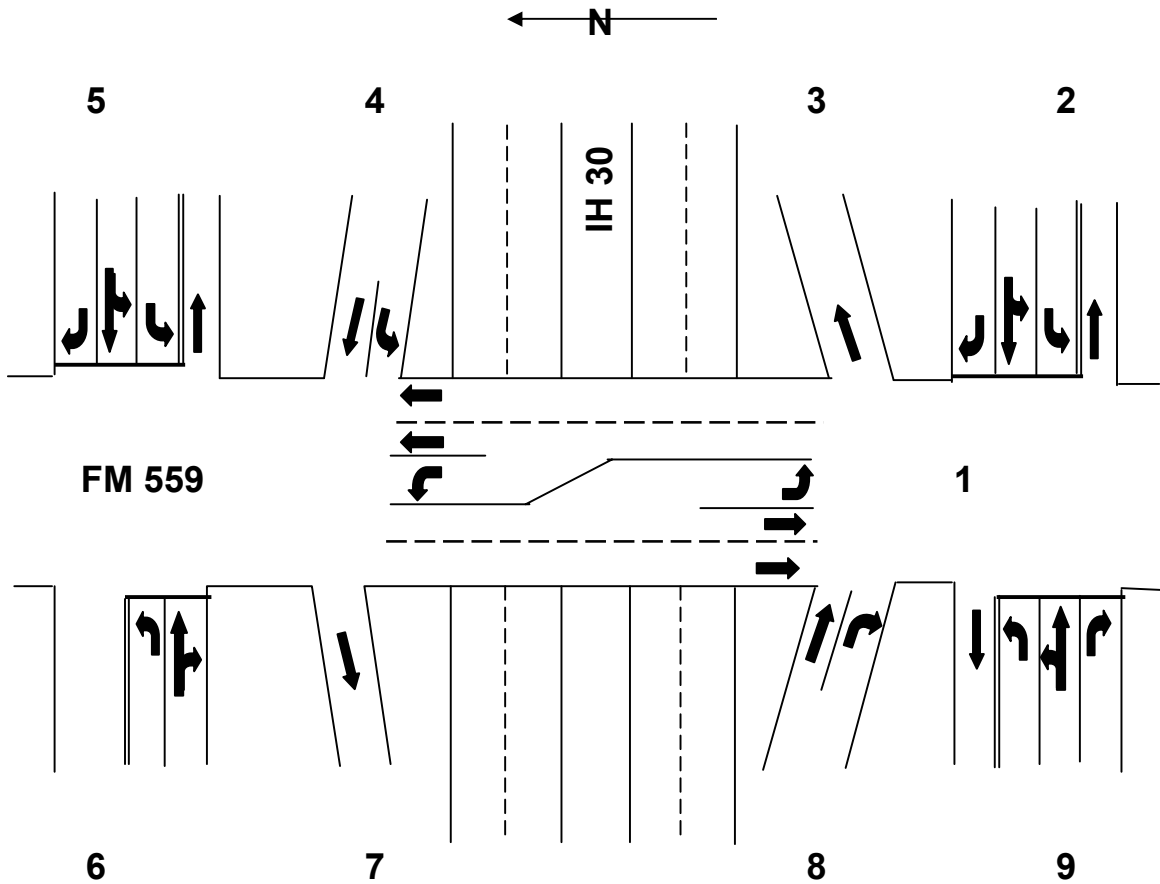
US 82

Location #	Location Description	TxDOT (Atlanta) 6-13 to 7-5-2000 ADT
1	US 82 Mainlanes	N/A
2	NE Frontage Rd.	6,478
3	NB Entrance	5,150
4	SB Exit Ramp	4,006
5	NW Frontage Rd.	1,601
6	SW Frontage	N/A
7	SB Entrance	N/A
8	NB Exit	N/A
9	SE Frontage Rd.	N/A
Frontage Rd ADT w/out Ramps		8,079
Frontage Rd ADT with Ramps		17,235
Total Interchange ADT		N/A



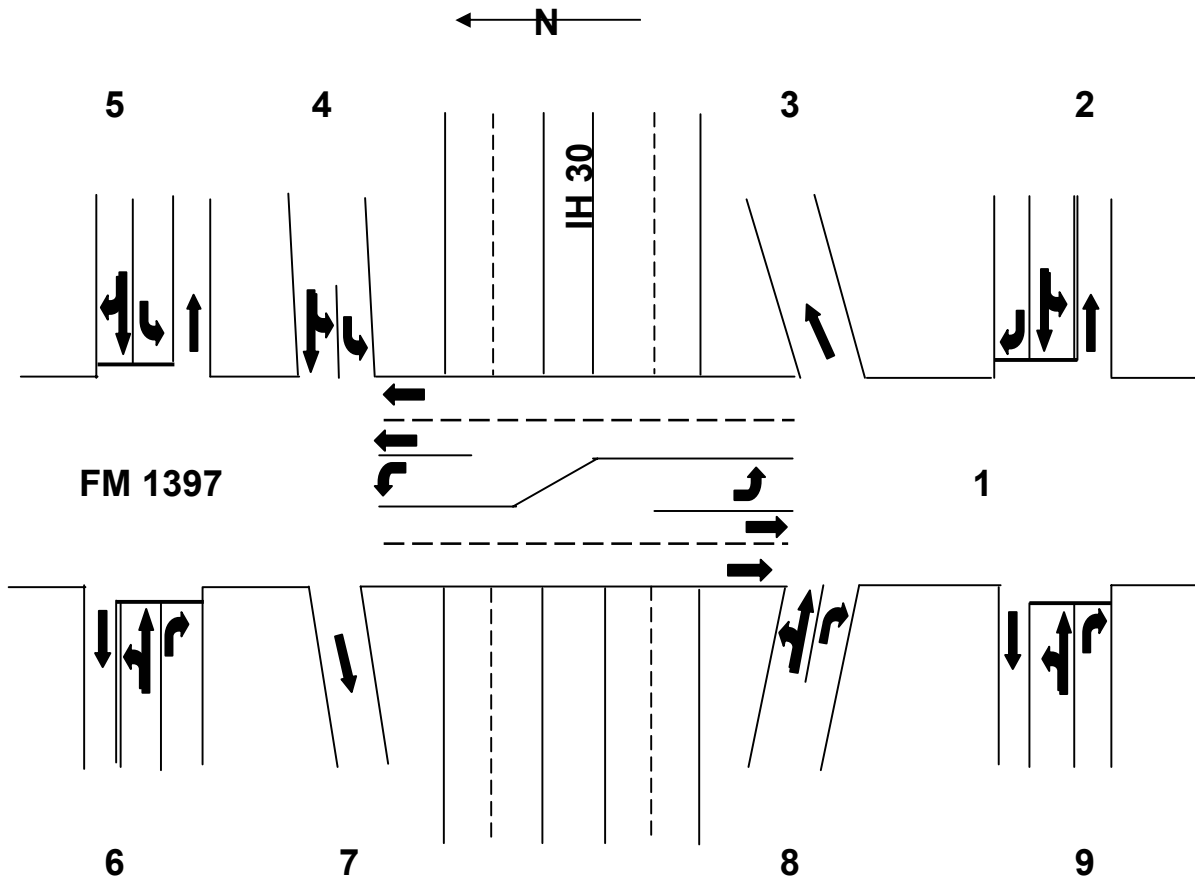
FM 559 (Richmond Road)

Location #	Location Description	TxDOT (Atlanta) 6-13 to 7-5-2000 ADT
1	FM 559 Mainlanes	21,828
2	SE Frontage Rd.	5,930
3	EB Entrance	5,641
4	WB Exit	6,025
5	NE Frontage Rd.	4,651
6	NW Frontage Rd.	6,817
7	WB Entrance	6,776
8	EB Exit	5,234
9	SW Frontage Rd.	6,309
Frontage Rd ADT w/out Ramps		23,707
Frontage Rd ADT with Ramps		47,383
Total Interchange ADT		69,211



FM 1397 (Summerhill Road)

Location #	Location Description	TxDOT (Atlanta) 6-13 to 7-5-2000 ADT
1	NB Mainlane	23,613
2	SE Frontage Rd.	701
3	EB Entrance	6,744
4	WB Exit	7,589
5	NE Frontage Rd.	2,661
6	NW Frontage Rd.	9,408
7	WB Entrance	3,910
8	EB Exit	4,659
9	SW Frontage Rd.	6,448
Frontage Rd ADT w/out Ramps		19,218
Frontage Rd ADT with Ramps		42,120
Total Interchange ADT		65,733

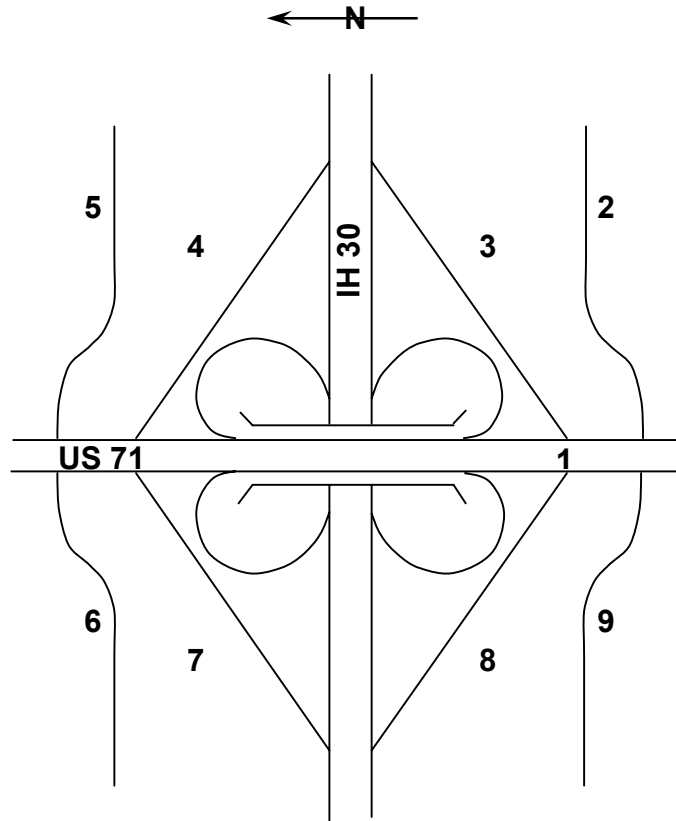


US 71 (Stateline Avenue)

Location #	Location Description	TxDOT (Atlanta) 6-13 to 7-5-2000 ADT
^1	US 71 Mainlanes	19,000
*2	SE Frontage Rd.	2,970
*3	EB Entrance	2,360
*4	WB Exit	2,120
*5	NE Frontage Rd.	2,070
6	NW Frontage Rd.	2,309
7	WB Entrance	5,759
8	EB Exit	8,355
9	SW Frontage Rd.	1,828
Frontage Rd ADT w/o Ramps		9,177
Frontage Rd ADT with Ramps		27,771
Total Interchange ADT		46,771

^ 1999 Estimated AADT from AHTD Traffic Volume Map

* June 1999 AADT from TxDOT Traffic Volume Map



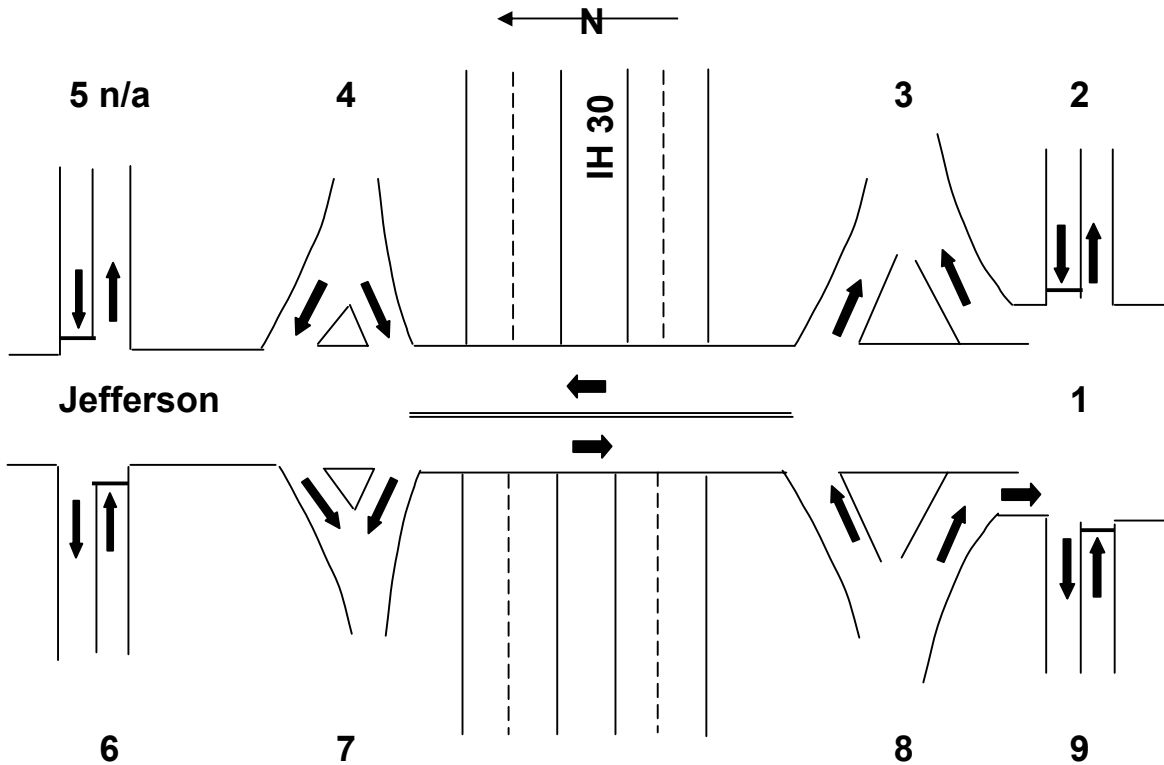
Jefferson Avenue

Location #	Location Description	1999 AADT
^1	Jeff. Mainlanes	7,000
#2	SE Fr. Rd. (50th)	2,076
*3	EB Entrance	810
*4	WB Exit	900
5	NE Frontage Rd.	N/A
*6	NW Frontage Rd.	2,070
*7	WB Entrance	4,150
*8	EB Exit	4,090
*9	SW Frontage Rd.	2,970
Frontage Rd ADT w/out Ramps		7,116
Frontage Rd ADT with Ramps		17,066
Total Interchange ADT		24,066

^ 1999 Estimated AADT from AHTD Traffic Volume Map

Estimated 1999 AADT from 1995 TxDOT Coverage
Counts Using AHTD Growth Factor

* June 1999 AADT from TxDOT Traffic Volume Map

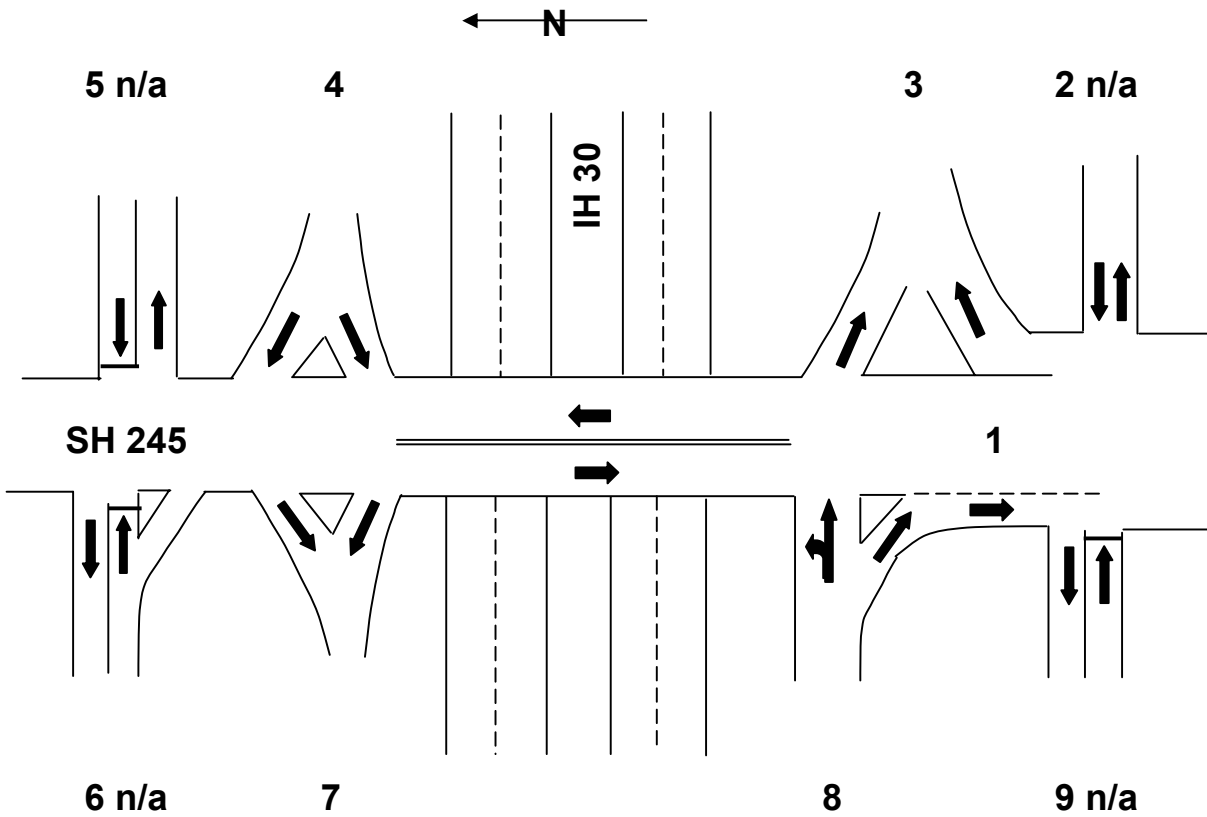


SH 245

Location #	Location Description	1999 AADT
^1	Mainlane	12,000
2	SE Frontage Rd.	N/A
*3	EB Entrance	2,100
*4	WB Exit	2,120
5	NE Frontage Rd.	N/A
6	NW Frontage Rd.	N/A
*7	WB Entrance	8,120
*8	EB Exit	8,090
9	SW Frontage Rd.	N/A
Frontage Rd ADT w/out Ramps		N/A
Frontage Rd ADT with Ramps		20,430
Total Interchange ADT		32,430

^ 1999 Estimated AADT from AHTD Traffic Volume Map

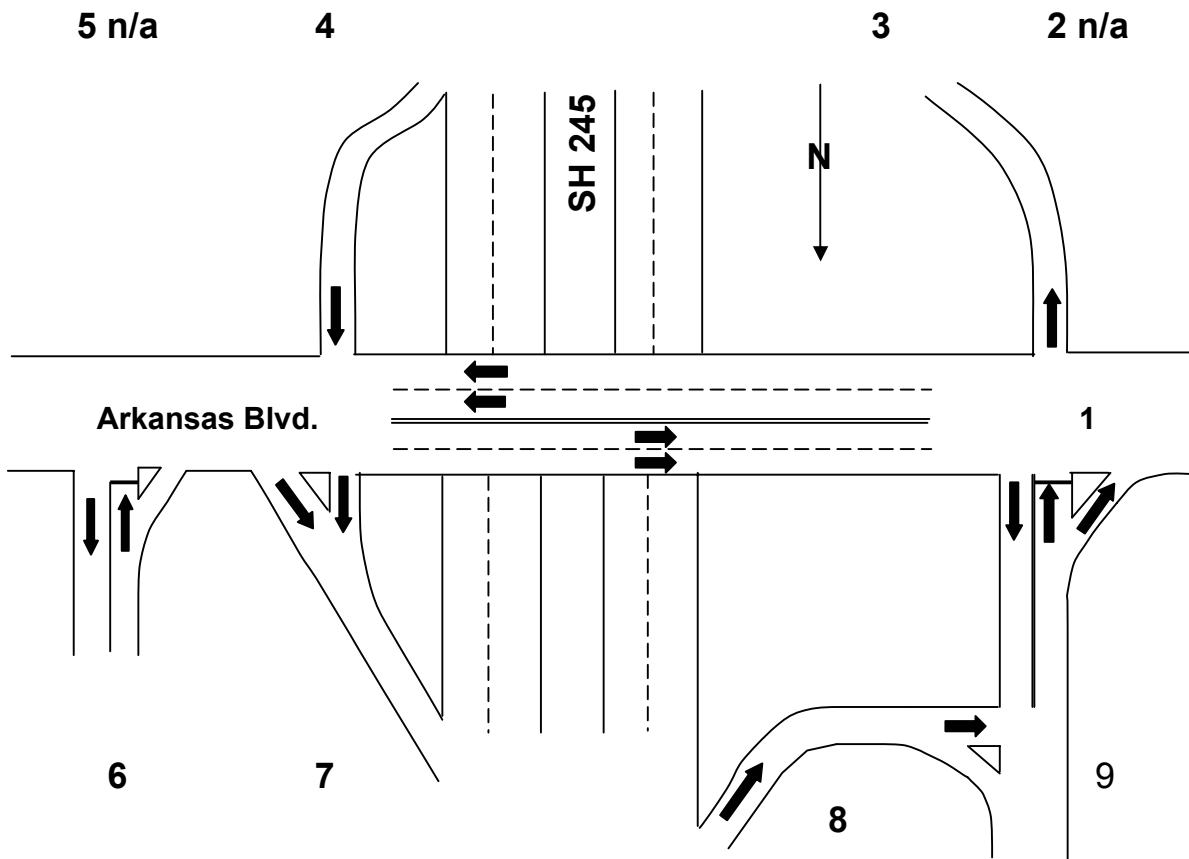
* June 1999 AADT form TxDOT Traffic Volume Map



Arkansas Blvd.

Location #	Location Description	# Estimated 1999 AADT
1	Ark. Mainlanes	7,000
2	SW Frontage Rd.	N/A
3	SB Entrance	2,800
4	NB Exit	2,800
5	SE Frontage Rd.	N/A
6	NE Frontage Rd.	600
7	NB Entrance	1,400
8	SB Exit	1,100
9	NW Frontage Rd.	1,700
Frontage Rd ADT w/out Ramps		2,300
Frontage Rd ADT with Ramps		10,400
Total Interchange ADT		17,400

Estimated 1999 AADT from 1995 TxDOT Coverage Counts Using AHTD Growth Factors



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