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16. Abstract

This report presents the results of sensitivity analyses performed on a traffic diversion methodology developed to estimate the potential demand for an alternate route in the Austin/San Antonio corridor. Two earlier research reports present the results of an origin-destination (O-D)survey conducted to identify travel patterns in the study corridor, and the results of the use of that survey data to estimate the traffic diversion potentials of a proposed alternate route, based on the assumption that the alternate route would be a four-lane, limited access facility (i.e., comparable to I-35). This report presents an extension of the analyses described in the two earlier project reports. Specifically, the analyses presented in this report examine the traffic diversion potentials of a four-lane divided highway without access controls. The analyses were directed at: 1) Evaluating the effects of varying the assumption concerning the amount of time savings necessary to induce traffic to divert to the alternate route; and 2) Evaluating the diversion effects of varying the assumed travel speed for the alternate route. The resulting estimates of diverted traffic were evaluated and a "best estimate" of the diversion potentials of a four-lane divided highway without access controls was identified. The results of the analyses indicate that the alternate route offers only modest time savings over other roadways in the corridor. Small reductions in assumed travel speeds, or small increases in the assumed time savings necessary to induce diversion produce dramatic reductions in the estimates of alternate route traffic.

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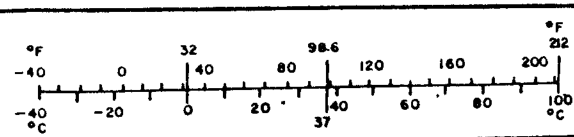
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



AUSTIN/SAN ANTONIO ORIGIN-DESTINATION STUDY
Sensitivity Analysis of Traffic Diversion Methodology

by

Robert W. Stokes
Associate Research Planner

and

Gene Hawkins
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Research Report 1186-3F
Origin-Destination Study Concepts: Austin/San Antonio
Research Study No. 2-10-87-1186

Sponsored by

Texas State Department of Highways and Public Transportation

Texas Transportation Institute
The Texas A&M University System
College Station, Texas 77843

September 1988

ABSTRACT

This report presents the results of sensitivity analyses performed on a traffic diversion methodology developed to estimate the potential demand for an alternate route in the Austin/San Antonio corridor. Two earlier research reports present the results of an origin-destination (O-D) survey conducted to identify travel patterns in the study corridor, and the results of the use of that survey data to estimate the traffic diversion potentials of a proposed alternate route, based on the assumption that the alternate route would be a four-lane, limited access facility (i.e., comparable to I-35). This report presents an extension of the analyses described in the two earlier project reports. Specifically, the analyses presented in this report examine the traffic diversion potentials of a four-lane divided highway without access controls. The analyses were directed at: 1) Evaluating the effects of varying the assumption concerning the amount of time savings necessary to induce traffic to divert to the alternate route; and 2) Evaluating the diversion effects of varying the assumed travel speed for the alternate route. The resulting estimates of diverted traffic were evaluated and a "best estimate" of the diversion potentials of a four-lane divided highway without access controls was identified. The results of the analyses indicate that the alternate route offers only modest time savings over other roadways in the corridor. Small reductions in assumed travel speeds, or small increases in the assumed time savings necessary to induce diversion produce dramatic reductions in the estimates of alternate route traffic.

Keywords: Traffic Diversion, Sensitivity Analysis, Intercity Route/Corridor Study, Origin-Destination Surveys.

IMPLEMENTATION STATEMENT

The goal of Research Study 2-10-87-1186 is to assist the Texas State Department of Highways and Public Transportation (SDHPT) in estimating current and design year traffic that might divert from existing highways in the I-35 corridor between Austin and San Antonio to an alternate route in the corridor. The general location of the alternate route analyzed was defined by SDHPT. The results of this research should be useful to transportation planners in conducting a feasibility study for an alternate route between Austin and San Antonio. Additionally, the research procedures developed should be useful in similar studies which may be conducted in the future.

DISCLAIMER

SUMMARY OF FINDINGS

This report presents the results of sensitivity analyses performed on a traffic diversion methodology developed to estimate the potential demand for an alternate route in the Austin/San Antonio corridor. Two earlier research reports present the results of an origin-destination (O-D) survey conducted to identify travel patterns in the study corridor, and the results of the use of that survey data to estimate the traffic diversion potentials of a proposed alternate route, based on the assumption that the alternate route would be a four-lane, limited access facility (i.e., comparable to I-35). This report presents an extension of the analyses described in the two earlier project reports. Specifically, the analyses presented in this report examine the traffic diversion potentials of a four-lane divided highway without access controls. The analyses were directed at: 1) Evaluating the effects of varying the assumption concerning the amount of time savings necessary to induce traffic to divert to the alternate route; and 2) Evaluating the diversion effects of varying the assumed travel speed for the alternate route. Table S-1 summarizes the results of the sensitivity analysis.

The sensitivity analysis indicates that the alternate route, even if built to interstate standards, would offer only modest time savings over other roadways in the study corridor. These time savings can be negated by very small reductions in assumed travel speeds or small increases in the assumed time savings necessary to induce diversion to the alternate route. These changes result in dramatic reductions in the estimates of alternate route traffic volumes.

There are indications that the diversion methodology employs estimates of roadway travel speeds that may overestimate the relative attractiveness of the alternate route. Based on these considerations, the estimates of alternate route traffic shown for the 55 MPH assumption in Table S-1 should be viewed as high estimates of the potential demand for the alternate route. However, these high estimates should not be viewed as unreasonable as they may take into account, in a simplistic, corridor-level context, induced demand that might be generated as a result of building the alternate route.

The estimates of alternate route traffic shown in Table S-1 for the 53 MPH travel speed assumption appear to be reasonable low-end estimates. The final set of estimates in Table S-1 show the effects of reducing the travel speed on only one segment of the alternate route, the segment between SH 71 and SH 21. The speed reduction from 55 MPH to 54 MPH on this segment is intended to account for congestion and at-grade intersections that might be encountered in the southeast portions of the Austin urban area and represent the "best" or "most likely" estimates of alternate route traffic if a noncontrolled access facility were constructed.

Table S-1. Estimated 1987 Alternate Route Diverted Traffic By Time Savings Required for Diversion and Travel Speed

Time Saved[a] (minutes)	24-Hour[b] Diverted Traffic by Segment and Assumed Travel Speed					
	I35-US 79 (Mo-Kan)	US 79-SH 71 (Mo-Kan)	SH 71-SH 21	SH 21-SH 80	SH80-I10	I10-Loop 1604
	(55mph)	(55mph)	(55mph)	(55mph)	(55mph)	(58mph)
> 0	5800[c]/-[d]	7400/-	9300/6400	8700/6600	8900/7500	7500/6700
> 1	1400/-	2900/-	3000/1600	2300/2000	3000/2600	2600/2400
> 2	1300/-	2600/-	2900/500	2200/600	2700/1200	2400/1000
> 3	0/-	900/-	900/300	900/400	1500/900	1000/800
> 4	0/-	500/-	500/200	500/300	1000/800	900/700
> 5	0/-	500/-	500/200	500/200	1000/500	900/400
	(54mph)	(54mph)	(54mph)	(54mph)	(54mph)	(58mph)
> 0	300/-	1700/-	1900/1500	1300/1000	1500/1300	1100/1000
> 1	300/-	1700/-	1900/500	1200/600	1200/600	1000/600
> 2	0/-	500/-	500/300	600/400	600/500	600/400
> 3	0/-	500/-	500/200	500/300	500/300	500/300
> 4	0/-	500/-	500/200	500/200	500/200	500/200
> 5	0/-	500/-	500/200	500/200	500/200	500/200

Table S-1. (Cont.)

Time Saved[a] (minutes)	24-Hour[b] Diverted Traffic by Segment and Assumed Travel Speed					
	I35-US 79 (Mo-Kan)	US 79-SH 71 (Mo-Kan)	SH 71-SH 21	SH 21-SH 80	SH80-I10	I10-Loop 1604
	(53mph)	(53mph)	(53mph)	(53mph)	(53mph)	(58mph)
> 0	0/-	1100/-	1300/500	900/600	1000/1000	1000/1000
> 1	0/-	500/-	500/300	600/400	600/500	600/500
> 2	0/-	500/-	500/300	500/300	500/400	500/400
> 3	0/-	500/-	500/200	500/200	500/300	500/300
> 4	0/-	500/-	500/200	500/200	500/200	500/200
> 5	0/-	500/-	500/200	500/0	500/0	500/0
	(55mph)	(55mph)	(54mph)	(55mph)	(55mph)	(58mph)
> 0	3300/-	4800/-	5200/4300	4600/4400	5100/5000	4700/4500
> 1	1300/-	2700/-	2900/1600	2200/2000	2800/2600	2400/2300
> 2	300/-	1200/-	1400/500	1200/600	1700/1200	1400/1000
> 3	0/-	600/-	600/300	600/400	1200/900	1000/800
> 4	0/-	500/-	500/200	500/300	900/800	900/700
> 5	0/-	500/-	500/0	500/0	900/500	900/400

[a]Denotes assumed minimum travel time savings necessary to induce diversion to alternate route.
[b]Estimated by assuming survey period volume (7:00 AM - 8:00 PM) = 70% of ADT (1).
[c]Traffic with Mo-Kan.
[d]Traffic without Mo-Kan.

TABLE OF CONTENTS

Page

ABSTRACT iii

IMPLEMENTATION STATEMENT v

DISCLAIMER v

SUMMARY OF FINDINGS vii

1. BACKGROUND 1

2. TRAFFIC DIVERSION METHODOLOGY 3

2.1 Overview 3
2.2 Assumptions 3
2.3 Results 5
2.4 Discussion 9

3. SENSITIVITY ANALYSIS OF TRAFFIC DIVERSION METHODOLOGY 12

3.1 General 12
3.2 Sensitivity Analysis 12
3.3 Discussion 17
3.4 Conclusions 19

REFERENCES 21

1. BACKGROUND

As a result of current and projected growth in the I-35 corridor between Austin and San Antonio, the Texas State Department of Highways and Public Transportation (SDHPT) is undertaking an analysis of alternative corridor improvements. Included in this analysis is a feasibility study of an alternate highway route between Austin and San Antonio. The possibility of an alternate route to the east of I-35 (Figure 1), for example, has received considerable attention in recent months.

Although the SDHPT is considering a number of alternative improvements for the Austin/San Antonio corridor, this research project is limited to assessing potential traffic volumes which may divert from existing highways in the I-35 corridor to an alternate route located to the east of I-35 (see Figure 1). The diversion potentials of the alternate route were examined for configurations with and without the proposed SH 130 (Mo-Kan). The analyses used data on current travel patterns in the corridor (i.e., O-D data) to estimate how the route selection process associated with these patterns might change as a result of an alternate route in the corridor. As a result, the effects of the induced and latent travel demand components of current and future traffic were not explicitly addressed in the analyses.

Two earlier research reports (1, 2) present the results of an origin-destination (O-D) survey conducted to identify travel patterns in the study corridor, and the results of the use of that survey data to estimate the traffic diversion potentials of a proposed alternate route, based on the assumption that the alternate route would be a four-lane, limited access facility (i.e., comparable to I-35). This report presents an extension of the analyses described in the two earlier research reports. Specifically, the analyses presented in this report examine the traffic diversion potentials of a four-lane divided highway without access controls. The analyses were performed by: 1) Varying the assumption concerning the amount of time savings necessary to induce traffic to divert to the alternate route; and 2) Varying the assumed travel speed for the alternate route. The resulting estimates of diverted traffic were evaluated and a "best estimate" of the diversion potentials of a noninterstate type of facility was identified.

The discussion of the sensitivity analysis is preceded by a brief overview of the traffic diversion methodology. An in-depth discussion can be found in (1).

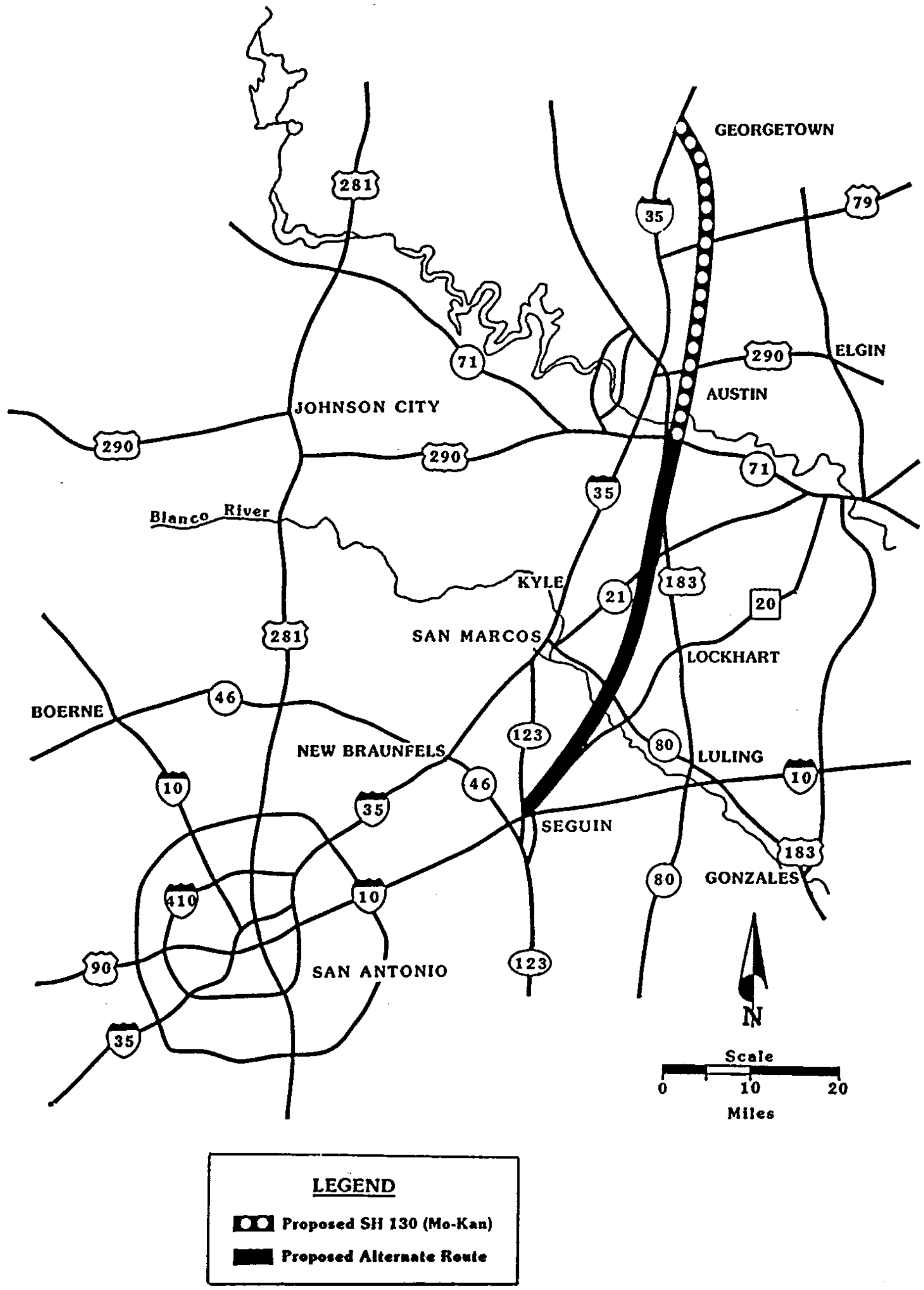


Figure 1. Austin/San Antonio Study Corridor

2. TRAFFIC DIVERSION METHODOLOGY

2.1 OVERVIEW

The procedures used to estimate traffic diversion to the proposed alternate route are based on zone-to-zone travel times for simplified highway networks with and without the proposed alternate route. The base year (1987) zone-to-zone travel paths of the origin-destination data were determined using a simplified highway network for the study area and the travel time between traffic zones. The travel time between zones was determined based upon the average travel speed and segment distance on the travel paths between the zones. The travel path between zones was selected as the path with the minimum travel time.

After travel times were determined for the existing network, the alternate route was inserted into the network. Once the alternate route was installed in the base year network, all traffic between zones was diverted to the alternate route. The travel time between zones was then determined with the alternate route in the network. The travel time between zones using the alternate route was then compared to that without the alternate route. If there was a reduction in travel time, then the traffic with a shorter travel time was diverted to the appropriate segment(s) of the alternate route. The sums of zone-to-zone traffic on the individual segments of the alternate route were then determined to obtain the total number of vehicles on the alternate route. This procedure was followed for alternate route configurations with and without the proposed SH 130 (Mo-Kan).

2.2 ASSUMPTIONS

The development of the procedure used to determine alternate route traffic required several simplifying assumptions. This was necessary in order to develop a procedure that was manageable yet responsive to the problem being studied. The assumptions used in developing the traffic diversion methodology are summarized below. An in-depth discussion of the diversion methodology can be found in (1).

1. The highway network for the study corridor was simplified in order to eliminate the large number of possible routes. With the exception of FM 20, only major (state, U.S., interstate) highways were included in the network. All zone-to-zone traffic was assumed to travel only on the highways in the simplified highway network.

2. Traffic volumes used in the analysis are 24-hour volumes obtained from SDHPT district traffic maps for 1985.

3. All traffic between any two zones was assumed to use the same travel path. This path is the one with the shortest travel time. The travel time was determined from the speed and length of the individual segments of each highway.

4. Travel speed was determined using the 1985 Highway Capacity Manual procedure for multilane and two-lane highways. The number of lanes for each segment was determined from SDHPT information and other sources. Speed calculations were based on the following assumptions:

    a. For the study period, the one direction hourly volume is 3.5% of the total 24-hour volume.

    b. Directional distribution is 50/50.

    c. All lanes are 12 feet wide.

    d. All highways have eight-foot wide shoulders on each side of the roadway.

    e. Trucks make up 11% of the total traffic (a typical mixture of trucks).

    f. Peak hour factor is 0.90.

g. Level terrain is assumed.

h. Drivers are assumed to be familiar with the roadway.

i. On two-lane highways, no-passing zones are assumed to be 40% of the total roadway length.

5. Travel speeds over the speed limit were not permitted.

6. Traffic volumes were averaged over the length of the individual segments to give an average travel speed over that segment.

7. Traffic was rerouted to the alternate route if any travel time savings was possible.

8. Major improvements to the highway network in 20 years include widening IH-35 to 6 lanes, and freeway widening in the cities of Austin and San Antonio.

9. The proposed alternate route was assumed to be a four-lane divided highway.

2.3 RESULTS

Table 1 summarizes the estimates of 1987 and year 2006, 24-hour diverted traffic volumes for the alternate route. The estimated traffic volumes shown in Table 1 are based on the roadway travel speeds shown in Table 2 and the assumption that if drivers could save any time (i.e., greater than 0 minutes), they would divert to the alternate route. The estimates of 24-hour diverted traffic were developed by assuming that traffic during the O-D survey period (7:00 A.M. - 8:00 P.M.) constitutes 70% of the daily traffic (1). The estimates are presented for alternate route configurations with and without the proposed SH 130 (Mo-Kan).

Table 1. Estimated 1987 and Year 2006 Alternate Route Diverted Traffic

Segment[a]	24-Hour Diverted Traffic[b]			
		2006[c]		
	1987	Low	Medium	High
SH 130 (Mo-Kan)				
1. I-35 to US 79	5,800[d]/-[e]	8,400[d]/-[e]	10,200/-	14,700/-
2. US 79 to SH 71	7,400/-	10,800	13,000/-	18,700/-
Austin/San Antonio				
1. SH 71 to SH 21	9,300/6,400	13,500/9,300	16,300/11,200	23,500/16,200
2. SH 21 to SH 80	8,700/6,600	12,700/9,600	15,300/11,600	22,000/16,700
3. SH 80 to I-10	8,900/7,500	13,000/10,900	15,600/13,200	22,500/19,000
4. I-10 to Loop 1604	7,500/6,700	10,900/9,800	13,200/11,700	19,000/16,900

[a]See Figure 2.

[b]Assumptions: 1) Roadway travel speeds shown in Table 2; 2) Time savings of more than 0 minutes would be sufficient to induce diversion; and 3) O-D survey period traffic volume (7:00 AM-8:00 PM) = 70% of ADT (1).

[c]Assumes following compound annual growth rates: Low = 2%; Medium = 3%; High = 5% (1).

[d]24-hour volume with Mo-Kan.

[e]24-hour volume without Mo-Kan.

The analyses suggest that if the Austin to San Antonio portion of the alternate route was in place today, diverted traffic volumes at the facility's maximum load point would be on the order of 7,500 vehicles per day (vpd). The corresponding year 2006 projections suggest diverted traffic volumes that range from a low of approximately 11,000 vpd to a high of 19,000 vpd (Figure 2).

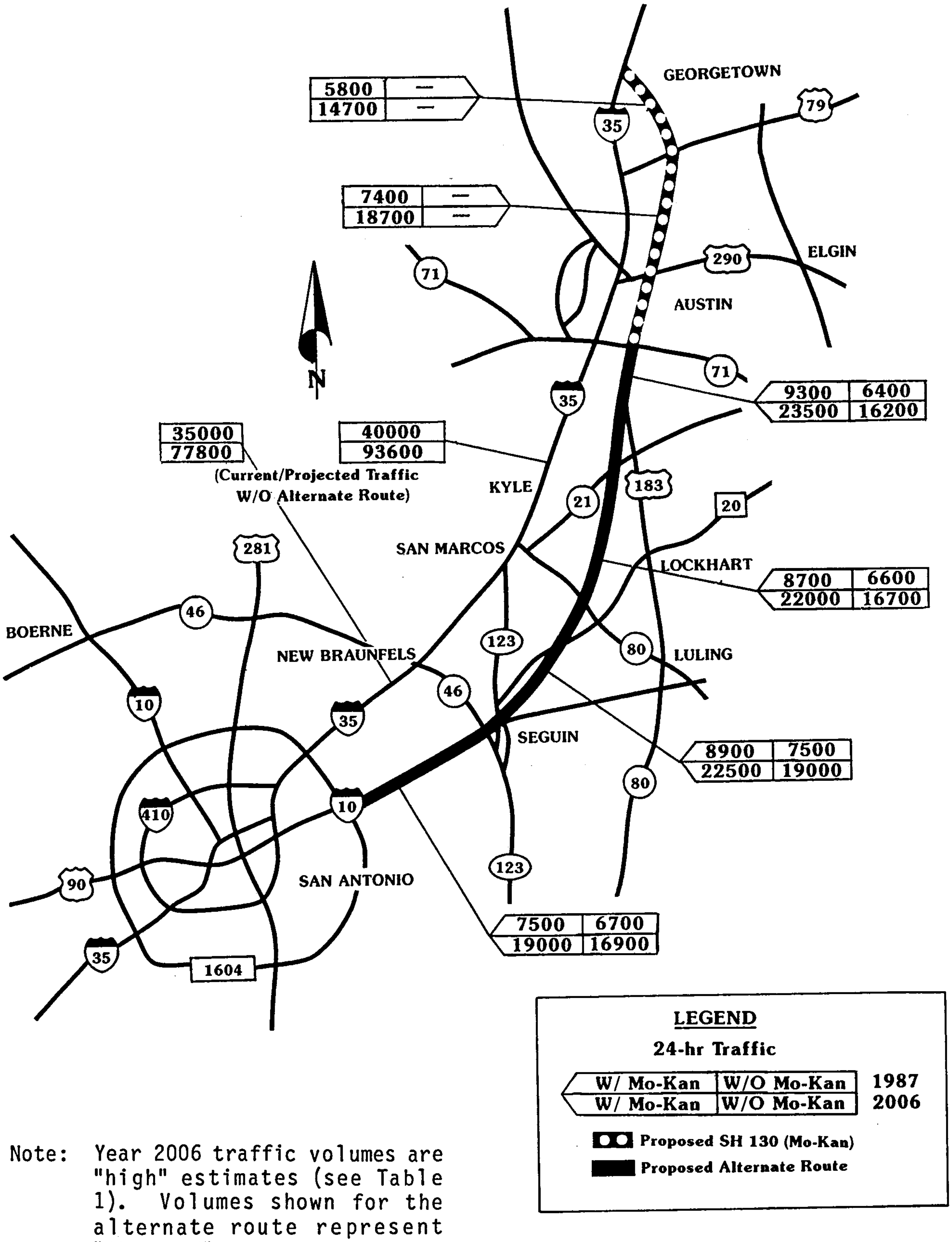
For the alternate route configuration which incorporates the proposed SH 130 (Mo-Kan), the analyses suggest that, if the Georgetown to San Antonio portion of the alternate route was in place today, diverted traffic volumes at the facility's maximum load point would be on the order of 9,300 vpd. The corresponding year 2006 projections suggest diverted traffic volumes that range from a low of 13,500 vpd to a high of 23,500 vpd.

Table 2. Estimated Travel Speeds for I-35 and the Alternate Route

Highway and Segment	Estimated Travel Speed[a] (MPH)
I-35	
San Antonio CBD to North Loop 410	45
North Loop 410 to Loop 1604	43
Loop 1604 to New Braunfels	54
New Braunfels to San Marcos	56
San Marcos to SH 71	54
SH 71 to Austin CBD	41
Austin CBD to US 183	45
US 183 to US 79	45
US 79 to SH 130 (Mo-Kan)	55
SH 130 (Mo-Kan)	
I-35 to US 79	55
US 79 to SH 71	55
Austin/San Antonio Route	
SH 71 TO SH 21	55
SH 21 TO SH 80	55
SH 80 TO I-10	55
I-10 to Loop 1604	58

[a]Speeds estimated using Highway Capacity Manual procedure outlined in Section 2.2 of this report.

The analyses also indicate that for the alternate route configuration with SH 130, the maximum load point would be farther north than for the configuration without SH 130. Specifically, the maximum load point would shift from the segment between SH 80 and I-10 to the segment between SH 71 and SH 21. This shift can be attributed to the fact that, with SH 130, travel times between the San Marcos/New Braunfels areas and areas to the north/northeast



Note: Year 2006 traffic volumes are "high" estimates (see Table 1). Volumes shown for the alternate route represent "diverted" traffic only.

Figure 2. Estimated 1987 and Year 2006 Traffic Volumes

of Austin could be reduced by accessing the alternate route from I-35 via SH 21, thereby eliminating the need to travel on I-35 through Austin.

2.4 DISCUSSION

There are several factors that should be taken into account when assessing the reasonableness of the estimates of alternate route traffic shown in Table 1. The results of the analyses suggest that the estimates of traffic diverted to the alternate route may be somewhat liberal. In fact, considering the results of the level-of-service analyses and the procedure used to forecast future traffic, the estimates of diverted traffic may have indirectly accounted for some of the effects of the induced and latent demand components of current and future traffic.

The level-of-service analyses (Table 3) indicate that, if proposed I-35 improvements are implemented, the level-of-service on the interstate will not be reduced substantially over the next 20 years. This would suggest that congestion on I-35 will not become a more significant factor in the route selection process. Specifically, the level-of-service analyses suggest that, if I-35 is up-graded to a six-lane facility, traffic congestion on the interstate in the year 2006 may not be much greater than it is today. As a result, it does not seem likely that travelers would decide not to travel, or to seek a less-congested alternate route, because of congestion on I-35. This suggests that latent (unserved) demand is not likely to make a significant contribution to future traffic demands in the corridor.

The procedure used to forecast future traffic inherently takes into account the development and growth projected for the corridor. That is, the traffic growth rates used in this study were found to take into account, in a simplistic, corridor-level context, growth that has been projected for the corridor (1). As a result, the estimates of alternate route traffic may include some traffic generated from growth and development that might occur along the alternate route. While quantification of the magnitude of this "induced" demand is beyond the scope of this study, it does seem reasonable to conclude that the demand estimates developed for the alternate route account for more than diverted demand.

Table 3. Current and Projected Levels-of-Service, Austin/San Antonio Study Corridor

Roadway	Cross-Section		Directional Peak-Hour Volume[b] (VPH)				Peak-Hour Speed (MPH)				Peak-Hour Level-of-Service						
				2006[c]				2006				2006					
												w/6 Lanes			w/4 Lanes		
	1986	2006[a]	1986	Low	Medium	High	1986	Low	Medium	High	1986	Low	Medium	High	Low	Medium	High
I-35 (New Braunfels)	4 Lanes Divided	6 Lanes Divided	1190	1650	2180	2720	56	56	54	52	A	A	B	B	B	C	D
I-35 (Kyle)	4 Lanes Divided	6 Lanes Divided	1330	1925	2600	3275	55	55	53	50	B	B	B	C	C	D	E
SH 123 (Seguin)	4 Lanes Undivided	4 Lanes Undivided	250	270	360	440	59	59	59	58	A	--	--	--	A	A	A
US 183 (Lockhart)	4 Lanes Undivided	4 Lanes Undivided	240	280	370	460	59	59	59	58	A	--	--	--	A	A	A
US 281 (San Antonio)	4 Lanes Divided	4 Lanes Divided	400	540	790	1035	59	58	57	56	A	--	--	--	A	A	A
I-35 (Georgetown)	4 Lanes Divided	6 Lanes Divided	980	1360	1780	2210	56	57	56	54	A	A	A	B	B	B	C

[a]Source: SDHPT Project Development Plans.
[b]Assumes directional peak-hour = 3.5% of AADT.
[c]Source: (1).

It should also be noted that the trip tables used to estimate traffic on the proposed alternate route were developed from samples of "peak season" travel (i.e., summer travel). Traffic volumes during other times of the year are likely to be lower than those presented in this report.

A key point that should be kept in mind is that the diversion methodology assumes that drivers who would realize any time savings by using the proposed alternate route would divert to the alternate route. Traffic diversion studies which have been conducted in urban areas suggest that there may exist some minimum (threshold) travel time savings below which drivers are indifferent when choosing among the alternative routes available to them. That is, drivers may need to perceive that they would save at least a specified, minimum amount of time (or percent of their total travel time) before they would consider switching (diverting) to another route. The point is that some drivers may not perceive the travel time savings offered by the proposed alternate route to be sufficient to justify diverting to the alternate route.

The implications of the assumption concerning the travel time savings required for drivers to divert to the alternate route are examined in the following section of this report.

3. SENSITIVITY ANALYSIS OF TRAFFIC DIVERSION METHODOLOGY

3.1 GENERAL

The traffic diversion methodology utilized in this study is a minimum time path traffic assignment procedure. The travel speeds for the highway segments in the network were determined using the Highway Capacity Manual procedures outlined in Section 2.2 of this report. The key variables in the diversion methodology are travel time savings (i.e., travel speed/time differentials between the roadways in the network), and the amount of time savings necessary to induce traffic to divert to the alternate route.

The estimates of alternate route traffic presented in the previous section of this report are based on the assumption that the alternate route would be a limited access, four-lane divided roadway. The analyses presented in this section of the report investigate the traffic diversion potential of a four-lane divided highway without access controls. The analyses were conducted by: 1) Varying the assumption concerning the amount of time savings necessary to induce traffic to divert to the alternate route; and 2) Varying the assumed travel speed for the alternate route. The resulting estimates of alternate route traffic were used to identify a "best estimate" of the diversion potentials of an alternate route without access controls.

3.2 SENSITIVITY ANALYSIS

Table 4 summarizes the results of the sensitivity analyses. The table shows the estimates of 1987 alternate route traffic that result from lowering the assumed operating speed and increasing the assumed minimum time savings necessary to induce diversion to the alternate route. The assumed time savings range from greater than 0 minutes (the assumption used to develop the estimates in Table 1) to greater than 5 minutes. With the exception of the I-10 portion of the alternate route, which was assumed to operate at 58 MPH, the assumed alternate route travel speeds range from 55 MPH (the speed used to develop the estimates in Table 1) to 53 MPH. The final set of estimates in Table 4 shows the effects of reducing the travel speed on only one segment of the alternate route, the segment between SH 71 and SH 21. The speed

Table 4. Estimated 1987 Alternate Route Diverted Traffic By Time Savings Required for Diversion and Travel Speed

Time Saved[a] (minutes)	24-Hour[b] Diverted Traffic by Segment[c] and Assumed Travel Speed					
	I35-US 79 (Mo-Kan)	US 79-SH 71 (Mo-Kan)	SH 71-SH 21	SH 21-SH 80	SH80-I10	I10-Loop 1604
	(55mph)	(55mph)	(55mph)	(55mph)	(55mph)	(58mph)
> 0	5800[d]/-[e]	7400/-	9300/6400	8700/6600	8900/7500	7500/6700
> 1	1400/-	2900/-	3000/1600	2300/2000	3000/2600	2600/2400
> 2	1300/-	2600/-	2900/500	2200/600	2700/1200	2400/1000
> 3	0/-	900/-	900/300	900/400	1500/900	1000/800
> 4	0/-	500/-	500/200	500/300	1000/800	900/700
> 5	0/-	500/-	500/200	500/200	1000/500	900/400
	(54mph)	(54mph)	(54mph)	(54mph)	(54mph)	(58mph)
> 0	300/-	1700/-	1900/1500	1300/1000	1500/1300	1100/1000
> 1	300/-	1700/-	1900/500	1200/600	1200/600	1000/600
> 2	0/-	500/-	500/300	600/400	600/500	600/400
> 3	0/-	500/-	500/200	500/300	500/300	500/300
> 4	0/-	500/-	500/200	500/200	500/200	500/200
> 5	0/-	500/-	500/200	500/200	500/200	500/200
	(53mph)	(53mph)	(53mph)	(53mph)	(53mph)	(58mph)
> 0	0/-	1100/-	1300/500	900/600	1000/1000	1000/1000
> 1	0/-	500/-	500/300	600/400	600/500	600/500
> 2	0/-	500/-	500/300	500/300	500/400	500/400
> 3	0/-	500/-	500/200	500/200	500/300	500/300
> 4	0/-	500/-	500/200	500/200	500/200	500/200
> 5	0/-	500/-	500/200	500/0	500/0	500/0

Table 4. (Cont.)

Time Saved[a] (minutes)	24-Hour[b] Diverted Traffic by Segment[c] and Assumed Travel Speed					
	I35-US 79 (Mo-Kan)	US 79-SH 71 (Mo-Kan)	SH 71-SH 21	SH 21-SH 80	SH80-I10	I10-Loop 1604
	(55mph)	(55mph)	(54mph)	(55mph)	(55mph)	(58mph)
> 0	3300/-	4800/-	5200/4300	4600/4400	5100/5000	4700/4500
> 1	1300/-	2700/-	2900/1600	2200/2000	2800/2600	2400/2300
> 2	300/-	1200/-	1400/500	1200/600	1700/1200	1400/1000
> 3	0/-	600/-	600/300	600/400	1200/900	1000/800
> 4	0/-	500/-	500/200	500/300	900/800	900/700
> 5	0/-	500/-	500/0	500/0	900/500	900/400

[a]Denotes assumed minimum travel time savings necessary to induce diversion to alternate route.
[b]Estimated by assuming survey period volume (7:00 AM - 8:00 PM) = 70% of ADT (1).
[c]See Figure 2.
[d]Traffic with Mo-Kan.
[e]Traffic without Mo-Kan.

reduction from 55 MPH to 54 MPH on this segment is intended to account for congestion and at-grade intersections that would be encountered in the southeast portions of the Austin urban area if a noncontrolled access facility were constructed.

As shown in Table 4, small increases in the assumed time savings or small decreases in travel speed produce dramatic decreases in the estimates of alternate route traffic. The analyses clearly show that the alternate route offers a very modest time savings over existing routes in the corridor. This modest time savings is quickly negated by lowering the assumed travel speed for the alternate route, or by increasing the assumed time savings necessary to induce diversion.

3.3 DISCUSSION

The validity of the traffic diversion methodology used in this study is based on determining "relative" speeds which realistically represent the travel time differentials between the roadways in the network. While care was taken to accurately estimate the travel speeds on individual roadways in the network, the overall validity of the diversion methodology must be assessed in terms of the reasonableness of the travel speed/time "differentials" between roadways in the network. Additionally, in assessing the overall validity of the methodology, the general philosophy behind the diversion analyses should be kept in mind. The guiding philosophy in conducting the diversion analyses was to develop estimates of alternate route traffic that represent the high side of the potential demand. A discussion of some of the "liberalizing factors" incorporated into the methodology was presented in Section 2.4 of this report. The information presented in Table 4 illustrates the effects of two of these factors (i.e., travel speed and time savings required to induce diversion).

It has been argued that basing the diversion methodology on the assumption that any time savings (i.e., greater than 0 minutes), would be sufficient to induce diversion may not be a realistic representation of the route choice process. However, the lack of documentation on an appropriate "threshold value", precludes the determination of what might be a more realistic value. The use of the "greater than 0 minutes" criterion is, however, consistent with the general philosophy of the analyses.

The issue of the reasonableness of the estimated roadway travel speeds used in the analyses also needs to be addressed in terms of the general philosophy of the analyses. Table 2 summarized the estimated speeds used in the diversion methodology. As shown in Table 2 (and the level of service analysis in Table 3), the diversion methodology assumes that travel speeds on the alternate route are higher than on I-35 (55 MPH for the alternate route versus an overall average of 53 MPH on I-35).

An examination of spot speed data (Table 5) for selected roadway types across the state provides an indication of the reasonableness of the estimated travel speeds used in the diversion analyses. If one assumes that the segments of I-35 considered in this study represent a combination of urban and rural conditions, an average spot speed of approximate 57 MPH (average of urban and rural interstate spot speeds in Table 5) does not seem unreasonable. While it is recognized that spot speeds may not be representative of overall travel (running) speeds, the data presented in Table 5 suggest that average speeds may not differ substantially between rural arterials and interstate highways operating in a mix of urban and rural environments. These generalizations suggest that the travel speeds used in the diversion analysis may have overestimated the travel speed differentials between I-35 and the alternate route. Since the diversion methodology assumes travel speeds on the alternate route would be slightly higher than on I-35, the methodology would tend to overestimate the attractiveness of the alternate route.

The information in Table 4 can be used to assess the potential magnitude of this overestimation. For example, if it is assumed that the travel speeds on I-35 and the alternate route would not differ substantially, the traffic volumes shown in Table 4 for an assumed alternate route travel speed of 53 MPH would appear to be reasonable low-end estimates.

Table 5. Summary of Statewide Spot Speeds

Roadway Type	Quarterly Average Spot Speed (MPH)			
	Oct-Dec 1986	Jan-Mar 1987	Apr-June 1987	Average
Urban Interstate	55.0(115978)[a]	55.8(118528)	56.7(71539)	55.7
Rural Interstate	61.6(35770)	61.4(26458)	-	61.5
Rural Arterial	56.9(17139)	58.3(13062)	57.4(18398)	57.5

[a](XXXXXX) denotes sample size.

Source: Quarterly Speed Reports, SDHPT.

3.4 CONCLUSIONS

The sensitivity analysis indicates that the alternate route, even if built to interstate standards, would offer only modest time savings over other roadways in the study corridor. These time savings can be negated by very small reductions in assumed travel speeds or by small increases in the assumed time savings necessary to induce diversion to the alternate route. These changes result in dramatic reductions in the estimates of alternate route traffic volumes.

There are indications that the diversion methodology employs estimates of roadway travel speeds that may overestimate the relative attractiveness of the alternate route. Based on these considerations, the estimates of alternate route traffic shown in Table 1 should be viewed as high estimates of the potential demand for the alternate route. However, these high estimates should not be viewed as unreasonable as they may take into account, in a simplistic, corridor-level context, induced demand that might be generated as a result of building the alternate route. The estimates of alternate route traffic shown in Table 4 for the 53 MPH travel speed assumption appear to be reasonable low-end estimates. The estimates of diverted traffic that result from reducing the travel speed from 55 MPH to 54 MPH on the segment of the alternate route between SH 71 and SH 21, represent the "best" or "most likely" estimates of alternate route traffic if the facility were constructed as a four-lane highway without access controls.

The range between the high and low estimates suggested by the analyses is considerable. This range indicates that even if the alternate route were built to interstate standards, the alternate route would offer minimal time savings over other roadways in the corridor. Therefore, any design or geometric factors that reduce these time savings could dramatically reduce traffic volumes on the alternate route.

REFERENCES

1. Stokes, R.W., D.E. Morris, G. Hawkins and W.M. Hinshaw. Austin/San Antonio Origin-Destination Study, Vol. II: Technical Appendices. Research Report 1186-2 (II), Texas Transportation Institute (February 1988).

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