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16. Abstract

This report presents the results of an analysis of strategic arterials and their effect on the travel demands of an urban region. The Texas travel demand models were used to macroscopically estimate potential demands for, and the magnitude of any reduction in travel demand on other parts of the regional transportation system due to the implementation of a system of strategic arterials. Two strategic arterial systems, one consisting of 600 miles of strategic arterials and the other composed of 350 miles of strategic arterials were delineated for the evaluation. In order to gauge any "shifts" in travel demand a base system (without strategic arterials) was analyzed as well. To accommodate what was initially a key parameter in estimating strategic arterial demands, the strategic arterials were tested at two different speed advantages over "normal" arterials. Two different types of assignments were performed with each of the strategic arterial systems in each speed advantage conditions. The first set of assignments focused on the potential for travel path diversion resulting from the implementation of a strategic arterial system and a second set of assignments was directed toward travel pattern diversion. The results of these analyses have shown that while speed does play a role in the demand on and diversion of traffic to strategic arterials, the overwhelming controlling factor involves the capacity of the strategic arterials. The travel demand modeling analyses show that demand on strategic arterials matches capacity in areas which are otherwise congested. Analysis results of proposed strategic arterial systems in the Dallas/Fort Worth region are also presented and were found to be comparable to those from the Houston region in terms of the effectiveness of strategic arterial systems in reducing demand on freeway systems.

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AN ANALYSIS OF THE POTENTIAL FOR TRAFFIC DIVERSION TO A STRATEGIC ARTERIAL SYSTEM

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Research Report 1107-2

Research Study No. 2/3-8/10-88-1107
The Role of the Arterial Street System
in Urban Mobility

Sponsored by

Texas State Department of Highways and Public Transportation
in cooperation with the
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Texas Transportation Institute
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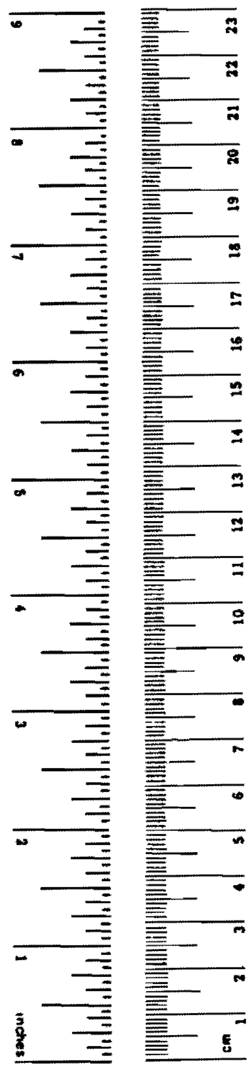
METRIC (SI*) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	2.54	millimetres	mm
ft	feet	0.3048	metres	m
yd	yards	0.914	metres	m
mi	miles	1.61	kilometres	km
		AREA		
in^2	square inches	645.2	millimetres squared	mm^2
ft^2	square feet	0.0929	metres squared	m^2
yd^2	square yards	0.836	metres squared	m^2
mi^2	square miles	2.59	kilometres squared	km^2
ac	acres	0.395	hectares	ha
		MASS (weight)		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
		VOLUME		
fl oz	fluid ounces	29.57	millilitres	mL
gal	gallons	3.785	litres	L
ft^3	cubic feet	0.0328	metres cubed	m^3
yd^3	cubic yards	0.0765	metres cubed	m^3

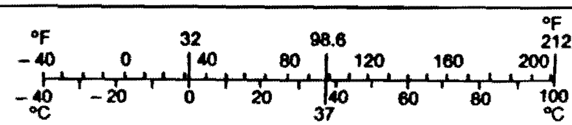
NOTE: Volumes greater than 1000 L shall be shown in m^3.

Symbol	When You Know	Multiply By	To Find	Symbol
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimetres	0.039	inches	in
m	metres	3.28	feet	ft
m	metres	1.09	yards	yd
km	kilometres	0.621	miles	mi
		AREA		
mm^2	millimetres squared	0.0016	square inches	in^2
m^2	metres squared	10.764	square feet	ft^2
km^2	kilometres squared	0.39	square miles	mi^2
ha	hectores (10 000 m^2)	2.53	acres	ac
		MASS (weight)		
g	grams	0.0353	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams (1 000 kg)	1.103	short tons	T
		VOLUME		
mL	millilitres	0.034	fluid ounces	fl oz
L	litres	0.264	gallons	gal
m^3	metres cubed	35.315	cubic feet	ft^3
m^3	metres cubed	1.308	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



These factors conform to the requirement of FHWA Order 5190.1A.

* SI is the symbol for the International System of Measurements

ABSTRACT

This report presents the results of an analysis of strategic arterials and their effect on the travel demands of an urban region. The Texas travel demand models were used to macroscopically estimate potential demands for, and the magnitude of any reduction in travel demand on other parts of the regional transportation system due to the implementation of a system of strategic arterials. Two strategic arterial systems, one consisting of 600 miles of strategic arterials and the other composed of 350 miles of strategic arterials were delineated for the evaluation. In order to gauge any "shifts" in travel demand a base system (without strategic arterials) was analyzed as well. To accommodate what was initially a key parameter in estimating strategic arterial demands, the strategic arterials were tested at two different speed advantages over "normal" arterials. Two different types of assignments were performed with each of the strategic arterial systems in each speed advantage conditions. The first set of assignments focused on the potential for travel path diversion resulting from the implementation of a strategic arterial system and a second set of assignments was directed toward travel pattern diversion. The results of these analyses have shown that while speed does play a role in the demand on and diversion of traffic to strategic arterials, the overwhelming controlling factor involves the capacity of the strategic arterials. The travel demand modeling analyses show that demand on strategic arterials matches capacity in areas which are otherwise congested. Analysis results of proposed strategic arterial systems in the Dallas/Fort Worth region are also presented and were found to be comparable to those from the Houston region in terms of the effectiveness of strategic arterial systems in reducing demand on freeway systems.

Keywords : strategic arterials, super streets, strategic thoroughfares, travel demand modeling, travel path diversion, travel pattern diversion.

IMPLEMENTATION STATEMENT

The goals of this research study are to assist the Texas State Department of Highway and Public Transportation (SDHPT) in assessing the potential demands for a system of enhanced regional arterials and the degree to which any shift in demand could effect the State's highway system. The results of this study will be useful to SDHPT and other transportation planners and policy analysts in answering the question of whether or not such a system of "enhanced" regional arterials provides substantial benefit in reducing demands on highway and freeway systems in urban areas.

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the opinions, findings and conclusions presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration, U.S. Department of Transportation or of the Texas State Department of Highways and Public Transportation. This report does not constitute a standard, specification or regulation.

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I. INTRODUCTION

In many urban areas in Texas, traffic demand on the State's freeway and highway system has reached or exceeded the capacities of these facilities. It is also evident that many segments of these facilities cannot realistically be expected to be improved in capacity (because of right-of-way constraints and other reasons) or that planned improvements will not be able to keep up with anticipated increases in the traffic demands on these facilities. Therefore, more and more attention is being focused on the role arterial streets should play in enhancing urban mobility and the potential role for "strategic arterials" (often referred to as "super arterials" or "strategic thoroughfares"). Indeed, the implementation of a system of "strategic arterials" may provide alternatively desirable travel routes for many of the trips which would ordinarily consider the use of the State's system as the preferred route. The study entitled "The Role of the Arterial Street System in Urban Mobility" is directed toward this re-evaluation of the arterial street system with emphasis on the potential for "strategic arterials" in addressing these needs. The analyses of the potential for traffic diversion to strategic arterial systems using regional travel demand models were conducted as a part of this study. The purpose of this report is to summarize the analyses and findings from this investigation.

Research Objectives

The basic objectives of the analyses of the potential diversion of traffic to a strategic arterial system using travel demand models were three-fold:

(1) To demonstrate the use of regional travel demand models for evaluating such systems;

(2) To assess, at a macroscopic level, both the potential demand on a proposed system of strategic arterials and the magnitude of the reduction in travel demand on the freeway system and the other portions of the normal arterial system; and,

(3) To assess the sensitivity of the Texas travel demand models to input parameters describing the strategic arterials.

These work efforts were programmed under tasks 6 and 7 of the overall study design for Project 1107.

Research Approach

The general approach was to use the regional travel demand models for a large metropolitan area to perform a macroscopic system level analysis to assess the potential shifts in travel demands which could result from superimposing a system of strategic arterials upon the regional highway system. To do this, a base system (without strategic arterials) was employed so that the "shifts" in expected demand could be measured in terms of the changes in vehicle miles of travel by facility type relative to the base system. By measuring the "shifts" in travel demand in terms of the changes in vehicle miles of travel by facility type, it was hoped that the general nature of the "shifts" in travel demand could be observed and avoid focusing too much attention on link specific changes. Indeed, in implementing a <u>system</u> of strategic arterials, it is very likely that there will be instances where the strategic arterial system would improve the accessibility to the freeway system and, thereby, tend to increase the demand on a few of the freeway links while reducing the overall vehicle miles of travel on the freeway system. The vehicle miles of travel allows us to focus on the net changes in demand on various parts of the system.

By in large, the delineation of a system of strategic arterials will normally largely focus on the identification of "key" arterials (existing and planned) which could be operationally improved (with some extensions) to function as a system of "strategic" arterials and <u>not</u> on the definition of an entirely new system of streets. Hence, a major portion of a strategic arterial system will likely already be represented in the baseline system and carrying significant volumes. The "upgrading" of a street to a strategic arterial in the travel demand model network would generally involve redefining its operational characteristics both in terms of its capacity and speed. Since most of the strategic arterial system links already exist in the baseline network as normal arterials already carrying a portion of the region's travel demands, it is important to "flag" these links separately in the baseline network by assigning them a unique functional class code so that the amount of VMT already being carried by these facilities before their upgrade (and in some instances, their extension) to strategic arterials can be quantified and handled separately in the analyses. Hence, if more than one system of strategic arterials is to be studied, as was the case for the Houston-Galveston region, separate baseline networks differing only in terms of which links are "flagged" to be upgraded to strategic arterials in the strategic arterial network must be developed for each strategic arterial network.

The Houston-Galveston region was selected for the initial application of the travel demand models. Working with the SDHPT Houston District Office two strategic arterial systems were delineated for evaluation in conjunction with the region's Year 2010 regional mobility plan network: a 600 mile strategic arterial system and a 350 mile strategic arterial system. The 600 mile strategic arterial system, consisting of 25 individual strategic arterials, was by its nature, a very expansive system. The 350-mile system is a somewhat more conservative system composed of 16 strategic arterials primarily serving the current heavily congested portions of the Houston metropolitan area. All of the 350 mile strategic arterial system is included in the 600 mile system. The 600 mile system involves the extension of some of the 16 strategic arterials delineated in the 350 mile system as well as the addition of 9 strategic arterials. These extensions and additions in the 600 mile system are largely located in outer portions of Harris county and the surrounding seven counties.

As mentioned previously, the "upgrading" of a street in the base condition to a strategic arterial involves redefining its speed and capacity. In formulating the study approach, it was generally anticipated that the key parameter for estimating the demand on a strategic arterial would be its speed advantage over "normal" arterials in the area. Indeed, it was hoped that the travel demand modeling efforts would provide an indication of the magnitude of speed increase that would be necessary for the strategic arterial to be feasible and able to divert traffic from the freeway system.

Early on, it became clear that a wide range of design and operational strategies could be employed for strategic arterials and that these could offer speed advantages of roughly 5 to 10 mph over "normal" alternatives. For the travel demand modeling analysis, it was felt that a simplified "generic" definition of speed advantage should be employed. The deliberation quickly focused on the issue of what is a "good" generic speed advantage that might be offered by strategic arterials. A decision was made to use two speed advantages (i.e., a 5 mph and a 10 mph speed advantage over the principal arterials in an area) in the modeling analysis which would likely bound the reasonable range of significant speed advantages that might be offered by strategic arterials. This approach required the creation of four strategic arterial networks; two 350 mile strategic arterial networks differing only in terms of strategic arterial speed advantages and two 600 mile strategic arterial networks also differing in strategic arterial speed advantages.

In addition to speed, it was determined that strategic arterials should be operationally superior to principal arterials in terms of capacity. Rather than apply a standard increase in capacity for strategic arterials, a more detailed approach has been taken. Capacities of all facility types in the network are in terms of 24-hour capacities which are developed from peak hour capacities. Strategic arterial capacities are developed from the capacities of principal arterials by assuming a higher percent green time for the strategic arterial peak hour capacity. New strategic arterial capacities for all five area types have been developed.

The SDHPT districts for the Dallas/Fort Worth region were also very interested in the strategic arterial concept and supportive of this research effort. During the travel demand modeling analysis using the Houston data base, the Dallas/Fort Worth region proceeded to delineate proposed strategic arterial systems in both the Dallas and Fort Worth districts. The travel demand modeling analyses of these systems were undertaken by the North Central Texas Council of Governments (NCTCOG) in cooperation with the SDHPT's Regional Planning Office (RPO). The NCTCOG and RPO agreed to provide results of their modeling efforts for use in this study. The Dallas/Fort Worth results provide another estimate of the travel demand potential for strategic arterials.

Organization of Report

This report is organized in a fashion which follows the order of the strategic arterial analysis study. Chapter II provides descriptions of the 350 and 600 mile baseline and strategic arterial system networks and details the development of the strategic arterial networks from their corresponding baseline network. Chapter II also furnishes comparisons between the baseline system networks and the strategic arterial system networks in terms of their physical characteristics such as centerline miles and lane miles.

Chapter III details the results of the first set of assignments to the 350 and 600 mile strategic arterial system networks in both the +5 and +10 mph speed conditions which are meant to quantify the potential for travel path diversion (assignment of baseline trip tables) as a result of the strategic arterial system. Changes in VMT as well as vehicle hours of travel (VHT) for each facility type in the network for both the all-or-nothing and capacity restraint assignments are presented.

Chapter IV presents the results of the assignments to the two strategic arterial networks and details the changes to travel patterns as well as travel paths as a result of the strategic arterial systems. These assignments differ from those for which results are presented in Chapter III in that the trip tables used in the these assignments were built with skim trees which included strategic arterials. As with the results of the first set of assignments, the results of this second set of assignments are presented in terms of VMT and VHT and are disaggregated by facility type for both the all-or-nothing and capacity restraint assignments.

Chapter V presents some of the results of a traffic assignment to a Dallas/Fort Worth strategic arterial system by the North Central Texas Council of Governments. The results of the assignment are compared to the results from the Houston strategic arterial analysis effort. The comparisons focus on the effect of each strategic arterial system on the freeway facilities of the corresponding region. The results of the assignment to the 600 mile +5 mph Houston strategic arterial system are utilized in the comparison to the Dallas/Fort Worth results.

Chapter VI summarizes the results of the analyses and provides some conclusions.

II. NETWORK DESCRIPTIONS

For purposes of testing and evaluating the concept of strategic arterial streets, two separate strategic arterial systems were developed. Working with the Houston District Office of the SDHPT, an extensive system of 25 strategic arterials consisting of roughly 600 centerline miles of roadway and a reduced system of 16 strategic arterials of roughly 350 centerline miles of roadway were delineated. Figures II-A and II-B present the two strategic arterial systems as they would appear relative to the major facilities which are presently on the ground in the Houston region. The base network upon which these two systems were "superimposed" is the forecast (year 2010) network for the Houston-Galveston region.

Due to the fact that two strategic arterial networks were evaluated, two different baseline networks were developed. The two baseline networks are simply the Houston-Galveston forecast network with links representing the portions of the 350 and 600 mile strategic arterial system which exist in the baseline network "flagged" as a separate class of facility ("Facilities to be upgraded"). This is done in order to quantify and summarize analysis results for these facilities prior to their upgrade to strategic arterials (i.e. base condition). The two strategic arterial networks were developed from the baseline network.

The "upgrading" of a street to a strategic arterial included increasing its speed over the principal arterial speed by 5 mph initially and then by 10 mph. Technically speaking, this led to the creation of four separate strategic arterial networks; two 350 mile system networks which differed only in speed on strategic arterials and two 600 mile strategic arterial system networks which also differed only in terms of strategic arterial speeds. Table II-A presents the strategic arterial speeds in both the +5 and +10 mph conditions by area type. So that these speeds are put in proper perspective, Table II-A also presents principal arterial and freeway speeds by area type.

The second aspect of the "upgrading" of streets to strategic arterial facilities included increasing the 24-hour capacities by area type to reflect the higher level of operation between that of the principal arterial class and freeway class of facility. Table II-B presents the 24-hour strategic arterial capacities used in the network as well as the capacities for

FIGURE II-A
600 MILE STRATEGIC ARTERIAL SYSTEM

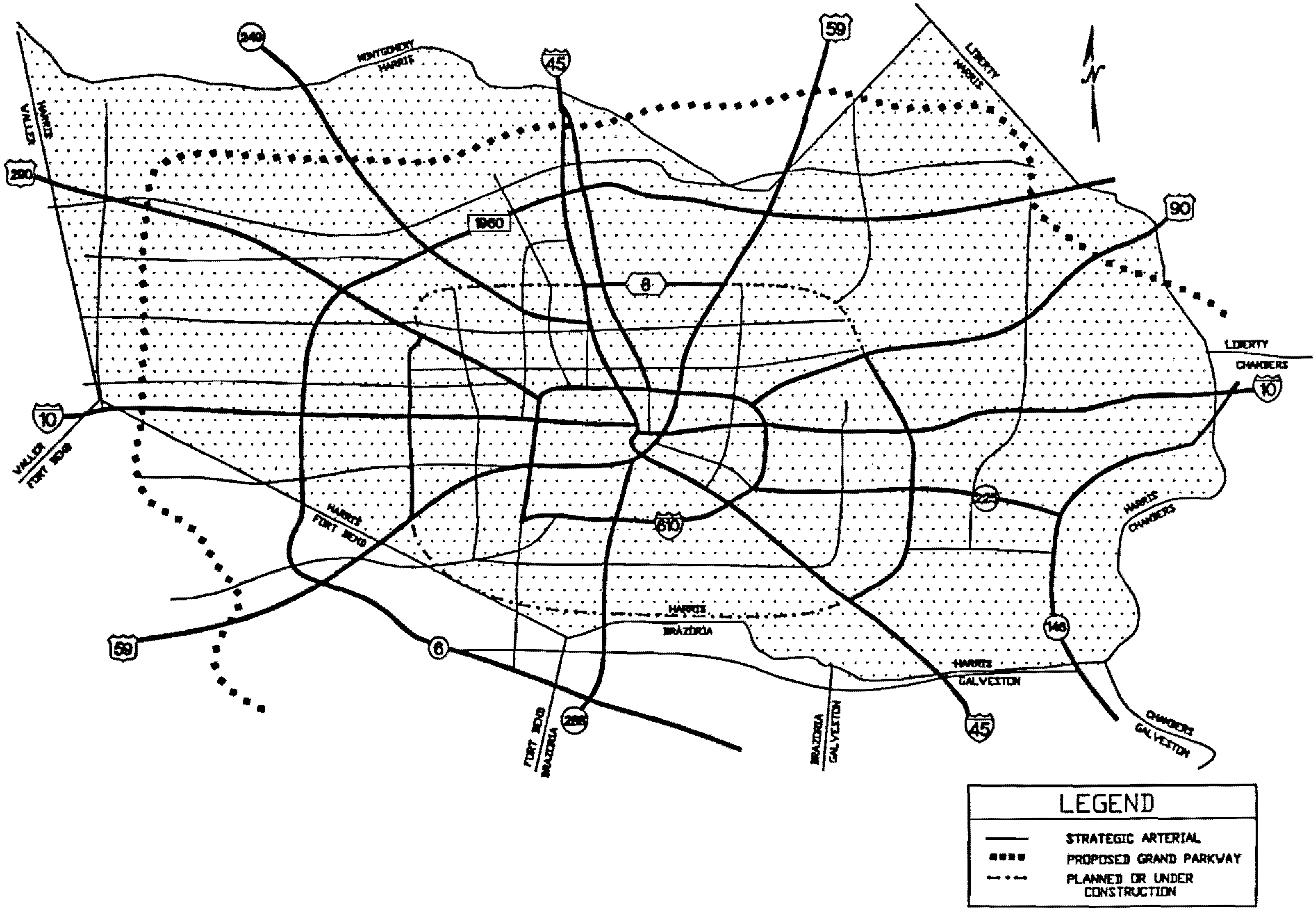
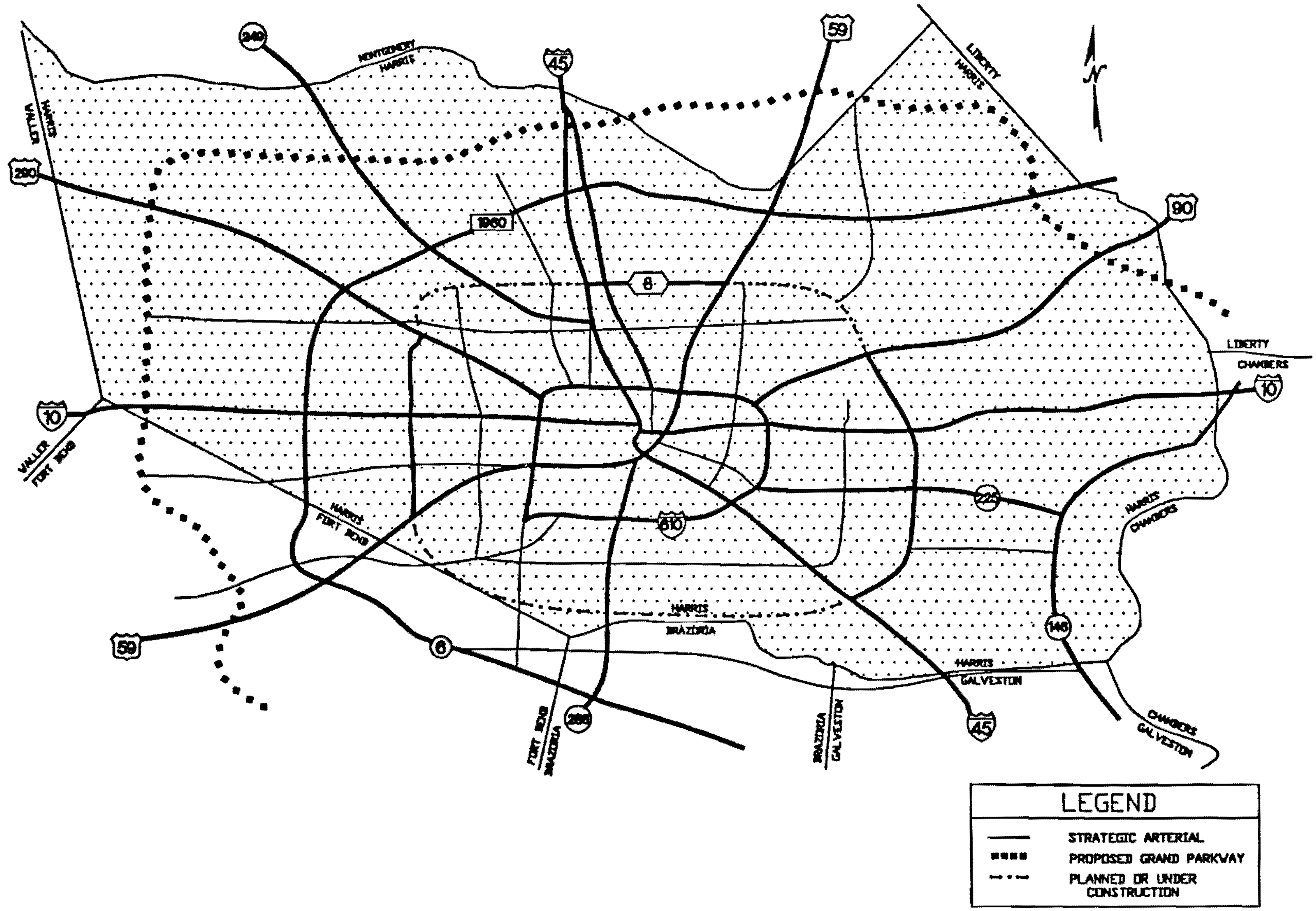


FIGURE II-B
350 MILE STRATEGIC ARTERIAL SYSTEM



principal arterials and radial freeways with frontage roads. All strategic arterials have been designated as either 6 or 8 lane roadways.

Table II-A. Assignment Input Speed of Freeways, Principal Arterials and Strategic Arterials (MPH) By Area Type

Facility Type		Area Type CBD	Urban	Suburban	Fringe Suburban	Rural
Freeway		40	45	50	55	60
Principal Arterial		20	32	37	40	57
Strategic Arterial	+5 mph	25	37	42	45	57
	+10 mph	30	42	47	50	57

Table II-B. Freeway, Principal and Strategic Arterial Capacities* By Area Type

Facility Type	Number of Lanes	Area Type CBD	Urban	Suburban	Fringe Suburban	Rural
Freeway with Frontage Roads	4	95,500	109,000	95,000	79,000	59,000
	6	132,000	155,000	136,000	113,000	82,000
	8	170,000	200,000	176,000	147,000	106,000
Principal Arterial	4	35,500	33,000	30,500	25,500	24,500
	6	50,500	47,000	43,500	36,000	35,000
	8	67,000	62,500	58,000	48,500	46,500
Strategic Arterial	6	65,500	60,500	56,000	46,500	38,500
	8	87,000	80,500	75,000	61,500	51,000

*24 hour capacity

Tables II-C through II-J provide descriptions of the 350 and 600 mile base and strategic arterial networks. The tables provide statistics for the entire 8 county region which the network represents as well as Harris County portion of the networks.

Table II-C details the 350 mile base system network for Harris County and the entire region. Table II-C shows that in Harris County, facilities which are to be upgraded to strategic arterial comprise as much of the network in terms of centerline miles and lane

TABLE II-C

SYSTEM DESCRIPTION
BASE NETWORK (W/O STRATEGIC ARTERIALS)
FOR 350 MILE STRATEGIC ARTERIAL SYSTEM

FACILITY CLASS	HARRIS COUNTY			REGION WIDE		
	TOTAL CENTERLINE MILES	TOTAL LANE MILES	CAPACITY (VMT)	TOTAL CENTERLINE MILES	TOTAL LANE MILES	CAPACITY (VMT)
FREEWAY	498.90	3,739.20**	69,391,270*	875.00	5,815.60**	98,433,420*
FACILITY TO BE UPGRADED TO STRATEGIC ARTERIAL	245.70	1,206.10	7,409,674	337.40	1,668.70	10,044,354
PRINCIPAL ARTERIAL	249.10	1,278.10	8,982,866	446.50	2,040.80	13,729,146
OTHER ARTERIAL	1,698.20	6,436.20	37,980,829	2,546.10	8,827.80	50,065,064
COLLECTOR	449.90	1,087.70	4,155,910	2,351.80	5,009.90	17,027,140
TOTAL	3,141.80	13,747.30	127,920,549	6,556.80	23,362.80	189,299,124

* : INCLUDES FRONTAGE ROAD CAPACITIES
WHICH ARE GENERALLY ESTIMATED AT 20-25% OF ADT PER CLM OF FREEWAY
** : DOES NOT INCLUDE FRONTAGE ROADS

miles as do the principal arterials. The table also shows that a majority of the arterials to be upgraded to strategic arterials in the 350 mile base system network are in Harris County. Generally speaking, both the 350 mile base and strategic arterial systems could be referred to as the Harris County base and strategic arterial systems. Another item of note is that although freeways represent only 15 percent of the total centerline miles in Harris County and less than 15 percent in the entire region, they comprise over 50 percent of the capacity, in terms of VMT, of both the region and Harris County.

Table II-D describes the 350 mile strategic arterial system network for the entire 8 county region as well as Harris County and provides statistics comparing this network to the 350 mile base system network. Although there are actually two 350 mile strategic arterial networks, the networks are identical in all aspects other than strategic arterial speed advantage. Therefore the information in Table II-D is valid for both 350 mile strategic arterial networks. The data show that although the strategic arterial system does not provide a substantial increase in the centerline miles of facility in the network, there are significant increases in the number of lane miles and capacity of the strategic arterial class as well as in total.

TABLE II-D

350 MILE
STRATEGIC ARTERIAL SYSTEM
NETWORK DESCRIPTION

		TOTAL CENTERLINE MILES	PERCENT CHANGE FROM BASE SYSTEM	TOTAL LANE MILES	PERCENT CHANGE FROM BASE SYSTEM	CAPACITY (VMT)	PERCENT CHANGE FROM BASE SYSTEM
HARRIS COUNTY	FREEWAY	498.90	.00%	3,739.20	.00%	69,391,270	.00%
	STRATEGIC ARTERIAL	254.10*	3.42%	1,560.20	29.36%	13,579,545	83.27%
	PRINCIPAL ARTERIAL	249.10	.00%	1,278.10	.00%	8,982,866	.00%
	OTHER ARTERIAL	1,698.20	.00%	6,436.20	.00%	37,980,829	.00%
	COLLECTOR	449.90	.00%	1,087.70	.00%	4,155,910	.00%
	TOTAL	3,150.20	.27%	14,101.40	2.58%	134,090,420	4.82%
REGION WIDE	FREEWAY	875.00	.00%	5,815.60	.00%	98,433,420	.00%
	STRATEGIC ARTERIAL	351.90**	4.30%	2,157.20	29.27%	17,830,725	77.52%
	PRINCIPAL ARTERIAL	446.50	.00%	2,040.80	.00%	13,729,146	.00%
	OTHER ARTERIAL	2,546.10	.00%	8,827.80	.00%	50,065,064	.00%
	COLLECTOR	2,351.70	.00%	5,009.90	.00%	17,027,140	.00%
	TOTAL	6,571.20	.22%	23,851.30	2.09%	197,085,495	4.11%

* : INCLUDES 8.4 MILES OF EXTENDED AND 245.7 MILES OF UPGRADED FACILITIES
** : INCLUDES 14.5 MILES OF EXTENDED AND 337.4 MILES OF UPGRADED FACILITIES

As one might surmise, the large changes in capacity and lane miles while holding centerline miles essentially constant are due to the upgrading of existing facilities to strategic arterial classification. Nonetheless, it is significant that the conversion of the 350 mile base system to a strategic arterial system resulted in capacity and lane miles of network increasing many times the amount of increase in centerline miles.

Table II-E presents the capacities of the various classes of facilities in the 350 mile base system network in a different perspective. It can be seen that in both Harris County and over the entire region, freeway capacity is much greater than the capacities of the other facilities. The table shows that the facilities to be upgraded have a lower capacity on both a centerline mile and lane mile basis than principal arterials. The table also shows that because facilities other than freeway dominate total centerline miles and total lane miles for both Harris County and the region, the total network capacity per centerline mile and and lane mile is on the order of magnitude of the non-freeway facilities capacities.

TABLE II-E

SYSTEM DESCRIPTION
BASE NETWORK (W/O STRATEGIC ARTERIALS)
FOR 350 MILE STRATEGIC ARTERIAL SYSTEM

FACILITY CLASS	HARRIS COUNTY CAPACITY (VMT) PER CLM	HARRIS COUNTY CAPACITY (VMT) PER LANE MILE	REGION WIDE CAPACITY (VMT) PER CLM	REGION WIDE CAPACITY (VMT) PER LANE MILE
FREEWAY	139,089	18,558	112,495	16,926
FACILITY TO BE UPGRADED TO STRATEGIC ARTERIAL	30,157	6,143	29,770	6,019
MAJOR ARTERIAL	36,061	7,028	30,748	6,727
MINOR ARTERIAL	22,365	5,901	19,663	5,671
COLLECTOR	9,237	3,821	7,240	3,399
ALL FACILITIES	40,716	9,305	28,871	8,103

Table II-F shows the capacity of the 350 mile strategic arterial system network on a centerline mile and lane mile basis and compares it to the 350 mile base system network. When viewed in this manner, the increase in capacity for the strategic arterial class is very dramatic. Capacity of the strategic arterials on a centerline mile and lane mile basis is much larger than those for the principal arterial class and approach 50 percent of the capacity of freeways on a lane mile basis.

Overall, it may appear that total system capacity has changed very little. The changes in capacity by strategic arterials are, nonetheless, significant. The 6.2 million VMT increase in capacity of Harris County strategic arterial facilities in the 350 mile strategic arterial system network over those designated to become strategic arterials in the 350 mile base system network is equivalent to adding 41 miles of 8-lane freeway or 145 miles of 6-lane arterial roadway in Harris County. The 7.8 million VMT region-wide increase in strategic arterial capacity is equivalent to adding 58 miles of 8-lane freeway or 193 miles of 6-lane arterial roadway in the 8 county region.

Table II-G provides information regarding the 600 mile base system network in Harris County and over the entire region. Similar to the 350 mile base system network, most of the facilities to be upgraded are located in Harris County. It is worth noting that

TABLE II-F

350 MILE
STRATEGIC ARTERIAL
NETWORK DESCRIPTION

	FACILITY CLASS	CAPACITY (VMT) PER CLM	PERCENT CHANGE FROM BASE SYSTEM	CAPACITY (VMT) PER LANE MILE	PERCENT CHANGE FROM BASE SYSTEM
HARRIS COUNTY	FREEWAY	139,089	.00%	18,558	.00%
	STRATEGIC ARTERIAL	53,442	77.21%	8,704	41.67%
	PRINCIPAL ARTERIAL	36,061	.00%	7,028	.00%
	OTHER ARTERIAL	22,365	.00%	5,901	.00%
	COLLECTOR	9,237	.00%	3,821	.00%
	ALL FACILITIES	42,577	4.57%	9,510	2.21%
REGION WIDE	FREEWAY	112,495	.00%	16,926	.00%
	STRATEGIC ARTERIAL	50,670	70.21%	8,266	37.32%
	PRINCIPAL ARTERIAL	30,748	.00%	6,727	.00%
	OTHER ARTERIAL	19,663	.00%	5,671	.00%
	COLLECTOR	7,240	.00%	3,399	.00%
	ALL FACILITIES	29,998	3.90%	8,264	1.99%

there are fewer centerline miles of "other" arterial and collector in the 600 mile base system network than in the 350 mile base system network. Part of the increase in centerline miles of the facility to be upgraded class of the 600 mile base system network came from the "other" arterial and collector classes of the 350 mile base system network.

Table II-H describes the 600 mile strategic arterial system network and compares it to the 600 mile base system network. As with the 350 mile system, the 600 mile strategic arterial system dramatically increases lane miles and capacity of the strategic arterial class as well as total lane miles and total capacity of the network. In fact, the increase is larger than that with the 350 mile strategic arterial system network. Some of this is due to the

TABLE II-G

SYSTEM DESCRIPTION
BASE NETWORK (W/O STRATEGIC ARTERIALS)
FOR 600 MILE STRATEGIC ARTERIAL SYSTEM

FACILITY CLASS	HARRIS COUNTY TOTAL CENTERLINE MILES	HARRIS COUNTY TOTAL LANE MILES	HARRIS COUNTY CAPACITY (VMT)	REGION WIDE TOTAL CENTERLINE MILES	REGION WIDE TOTAL LANE MILES	REGION WIDE CAPACITY (VMT)
FREEWAY	498.80	3,739.20**	69,391,270*	875.00	5,815.60**	98,433,420*
FACILITY TO BE UPGRADED TO STRATEGIC ARTERIAL	404.80	1,786.00	10,324,439	518.40	2,315.10	13,200,384
PRINCIPAL ARTERIAL	242.90	1,253.20	8,830,476	440.20	2,015.90	13,576,756
OTHER ARTERIAL	1,585.40	5,980.40	35,547,309	2,428.00	8,353.10	47,537,259
COLLECTOR	409.90	988.40	3,827,055	2,294.60	4,863.50	16,551,305
TOTAL	3,141.80	13,747.20	127,920,549	6,556.20	23,363.20	189,299,124

* : INCLUDES FRONTAGE ROAD CAPACITIES
WHICH ARE GENERALLY ESTIMATED AT 20-25% OF ADT PER CLM OF FREEWAY
** : DOES NOT INCLUDE FRONTAGE ROADS

TABLE II-H

600 MILE
STRATEGIC ARTERIAL SYSTEM
NETWORK DESCRIPTION

	FACILITY CLASS	TOTAL CENTERLINE MILES	PERCENT CHANGE FROM BASE SYSTEM	TOTAL LANE MILES	PERCENT CHANGE FROM BASE SYSTEM	CAPACITY (VMT)	PERCENT CHANGE FROM BASE SYSTEM
HARRIS COUNTY	FREEWAY	498.90	.00%	3,739.20	.00%	69,391,270	.00%
	STRATEGIC ARTERIAL	461.00*	13.88%	2,800.50	56.80%	22,977,780	122.56%
	PRINCIPAL ARTERIAL	242.90	.00%	1,253.20	.00%	8,830,476	.00%
	OTHER ARTERIAL	1,585.40	.00%	5,980.40	.00%	35,547,309	.00%
	COLLECTOR	409.90	.00%	988.40	.00%	3,827,055	.00%
	TOTAL	3,198.10	1.79%	14,761.70	7.38%	140,573,890	9.89%
REGION WIDE	FREEWAY	875.00	.00%	5,815.60	.00%	98,433,420	.00%
	STRATEGIC ARTERIAL	580.70**	12.02%	3,530.30	52.49%	28,103,990	112.90%
	PRINCIPAL ARTERIAL	440.20	.00%	2,015.90	.00%	13,576,756	.00%
	OTHER ARTERIAL	2,428.00	.00%	8,353.10	.00%	47,537,259	.00%
	COLLECTOR	2,294.60	.00%	4,863.50	.00%	16,551,305	.00%
	TOTAL	6,618.50	.95%	24,578.40	5.20%	204,202,730	7.87%

* : INCLUDES 56.2 MILES OF EXTENDED AND 404.8 MILES OF UPGRADED FACILITIES
** : INCLUDES 62.3 MILES OF EXTENDED AND 518.4 MILES OF UPGRADED FACILITIES

significant increase in centerline miles of roadway in the strategic arterial class. Because the 600 mile strategic arterial system extends into the more rural areas of the region, a larger amount of facility extension of the base network was required. However, the fact remains that the increases in lane miles and capacity are much more dramatic than the increases in centerline miles, as is the case with the 350 mile strategic arterial system. Upgrading of existing facilities to a strategic arterial capacity is the significant aspect of the capacity increase.

Table II-I details capacity of the 600 mile base system network on a centerline mile and lane mile basis. On this basis, freeways are the dominant facility of the 600 mile base

TABLE II-I

SYSTEM DESCRIPTION
BASE NETWORK (W/O STRATEGIC ARTERIALS)
FOR 600 MILE STRATEGIC ARTERIAL SYSTEM

FACILITY CLASS	HARRIS COUNTY		REGION WIDE	
	CAPACITY (VMT) PER CLM	CAPACITY (VMT) PER LANE MILE	CAPACITY (VMT) PER CLM	CAPACITY (VMT) PER LANE MILE
FREEWAY	139,089	18,558	112,495	16,926
FACILITY TO BE UPGRADED TO STRATEGIC ARTERIAL	25,505	5,781	25,464	5,702
PRINCIPAL ARTERIAL	36,354	7,046	30,842	6,735
OTHER ARTERIAL	22,422	5,944	19,579	5,691
COLLECTOR	9,337	3,872	7,213	3,403
ALL FACILITIES	40,716	9,305	28,873	8,102

system network in Harris County and on a regional basis. The capacity of the facilities in the base system network which are to be upgraded to strategic arterial is significantly less than principal arterial capacity and are of similar magnitude to "other" arterial capacity on a centerline mile and lane mile basis.

Table II-J shows that the 600 mile strategic arterial system network dramatically increases the capacity of the strategic arterial class as well as the entire network on a centerline mile and lane mile basis. The increase is more than that in the case of the 350 mile strategic arterial system network because of the greater amount of facility extensions in the 600 mile strategic arterial system network. The increase in capacity of strategic arterials in the 600 mile strategic arterial system network over that in the base system network is dramatic.

TABLE II-J

600 MILE
STRATEGIC ARTERIAL SYSTEM
NETWORK DESCRIPTION

	FACILITY CLASS	CAPACITY (VMT) PER CLM	PERCENT CHANGE FROM BASE SYSTEM	CAPACITY (VMT) PER LANE MILE	PERCENT CHANGE FROM BASE SYSTEM
HARRIS COUNTY	FREEWAY	139,089	.00%	18,558	.00%
	STRATEGIC ARTERIAL	49,843	95.43%	8,205	41.93%
	PRINCIPAL ARTERIAL	36,354	.00%	7,046	.00%
	OTHER ARTERIAL	22,422	.00%	5,944	.00%
	COLLECTOR	9,337	.00%	3,872	.00%
	ALL FACILITIES	43,967	7.98%	9,524	2.35%
REGION WIDE	FREEWAY	112,495	.00%	16,926	.00%
	STRATEGIC ARTERIAL	48,397	90.06%	7,961	39.62%
	PRINCIPAL ARTERIAL	30,842	.00%	6,735	.00%
	OTHER ARTERIAL	19,579	.00%	5,691	.00%
	COLLECTOR	7,213	.00%	3,403	.00%
	ALL FACILITES	30,859	6.88%	8,309	2.55%

The increase in strategic arterial capacity on a region-wide basis of 14.9 million VMT is equivalent to adding 110 miles of 8-lane freeway or 369 miles of 6-lane arterial roadway in the 8 county region. In Harris County, the 12.6 million VMT increase in strategic arterial capacity is equivalent to 85 miles of 8-lane freeway or 300 miles of 6-lane arterial roadway being added in Harris County.

III. TRAVEL PATH DIVERSION

As part of the speed sensitivity testing and evaluation process, assignments to each of the two base system networks as well as four assignments to the strategic arterial system networks, one each on networks containing the 350 mile and 600 mile systems in the +5 mph and +10 mph condition, were performed. This group of assignments was executed with trip tables developed without strategic arterial speeds. These are referred to as assignments with the "trip table held constant" and are the focus of this section.

All-or-Nothing Assignments

In order to assess what the demand on the strategic arterial system would be purely from a desire sense, it is necessary to review the results of the initial loading of trips on the network. This initial loading is an all-or-nothing assignment, meaning that only the minimum travel time path is considered when assigning traffic to the network. Capacity of the facilities in the network is not a factor in this initial loading. Therefore, the volumes on the network indicate how traffic would move if the desire to minimize travel time from origin zone to destination zone was the only criteria considered. This gives an indication, purely from a desire perspective, what magnitude of diversion of traffic, particularly freeway traffic, takes place when a strategic arterial system is implemented.

Table III-A presents results from the all-or-nothing assignment with trip table held constant to networks containing the 350 mile and 600 mile base and strategic arterial systems for that part of the networks in Harris County. The results show that over 3 million vehicle miles of travel (VMT) daily is diverted off the freeways by implementation of the 350 mile strategic arterial +5 mph system. Another 3 million VMT is diverted from the "other" arterial facilities. Much of the diverted VMT from these facilities is redirected to the strategic arterials, although not all of it. The results show that implementing the 350 mile strategic arterial +5 mph system led to a net reduction of over 485,000 VMT in total on the system. Not only are significant reductions in freeway VMT achieved, so are reductions in freeway vehicle hours of travel (VHT); by almost 60,000 on a daily basis. As there is in terms of VMT, the reduction in VHT on "other" arterials is also significant.

TABLE III-A

HARRIS COUNTY
CHANGE DUE TO DESIRED PATHS
ALL-OR-NOTHING --- TRIP TABLE CONSTANT

CATEGORY	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
ASSIGNED FRWY VMT	54,514,090	51,481,090	48,089,483	54,513,919	50,303,835	46,033,410
STRATEGIC ARTERIAL ASSIGNED VMT	6,335,577*	12,752,272	18,210,378	8,438,062*	16,796,576	22,928,118
PRINCIPAL ARTERIAL ASSIGNED VMT	6,494,888	5,512,345	4,996,299	6,413,431	5,404,729	4,896,748
OTHER ARTERIAL ASSIGNED VMT	23,845,865	20,999,675	19,607,082	22,044,016	18,673,654	17,495,450
COLLECTOR ASSIGNED VMT	2,157,932	2,116,389	2,072,724	1,938,436	1,650,950	1,602,147
TOTAL ASSIGNED VMT	93,348,352	92,861,771	92,975,966	93,347,864	92,829,744	92,955,873
ASSIGNED FRWY VHT	1,076,279	1,017,498	950,889	1,076,275	995,194	910,145
STRATEGIC ARTERIAL ASSIGNED VHT	174,456**	301,146	386,446	233,590**	389,930	481,805
PRINCIPAL ARTERIAL ASSIGNED VHT	190,852	162,392	148,427	188,523	159,761	145,445
OTHER ARTERIAL ASSIGNED VHT	718,438	634,392	594,200	667,288	568,128	533,999
COLLECTOR ASSIGNED VHT	65,869	64,185	62,596	60,206	52,166	50,610
TOTAL ASSIGNED VHT	2,225,894	2,179,613	2,142,558	2,225,882	2,165,179	2,122,004
FRWY WTD AVG SPEED	46	46	46	46	47	46
STRATEGIC ARTERIAL WTD AVG SPEED	36	42	47	36	43	48
PRINCIPAL ARTERIAL WTD AVG SPEED	34	34	34	34	34	34
OTHER ARTERIAL WTD AVG SPEED	33	33	33	33	33	33
COLLECTOR WTD AVG SPEED	33	33	33	32	32	32
TOTAL WTD AVG SPEED	40	41	41	40	41	42

* : VMT FOR FACILITIES TO BE UPGRADED TO STRATEGIC ARTERIAL
** : VHT FOR FACILITIES TO BE UPGRADED TO STRATEGIC ARTERIAL

Increasing the speeds on the strategic arterials of the 350 mile system by an additional 5 mph (10 mph over base speeds) resulted in a diversion of an additional 3.4 million VMT, a slightly larger amount of diversion than with the initial 5 mph speed increase. The same holds true with respect to the reduction of freeway VHT. The increase of VMT on strategic arterial facilities is slightly less for the additional 5 mph increase relative to the initial speed increase of 5 mph. This is due to the fact that less VMT is diverted from the non-strategic arterial facilities. Total VMT did not decrease as much in the +10 mph condition relative to the base condition as it did in the +5 mph condition. Nonetheless, a reduction in total system VMT relative to base conditions is achieved by increasing speeds on the strategic arterials by 10 mph. Total VHT is also not reduced as much by the additional speed increase as it is by the initial speed increase.

The effect of the speed increase of strategic arterial facilities on freeway VMT is more dramatic in the 600 mile strategic arterial system than in the 350 mile system. A 5 mph increase in strategic arterial speeds diverted over 4 million VMT daily from freeways and reduced daily freeway VHT by 81,000. As in the 350 mile system, roughly half of the increase in strategic arterial VMT is diverted from freeways and the remaining half from arterial streets.

Increasing speeds on the 600 mile strategic arterial system by an additional 5 mph over the base system resulted in diversion of daily freeway VMT of an additional 4.3 million, which is of similar magnitude as the first 5 mph increase. Reduction in freeway VHT of 85,000 is also of similar magnitude as the reduction corresponding to the initial 5 mph speed increase. Although strategic arterial VMT did increase by over 6 million on a daily basis in the +10 mph condition compared to the +5 mph condition, the increase is not of the same size as the increase of 8.4 million VMT between the base and +5 MPH conditions. In terms of total VMT, the +10 mph condition reduced daily VMT relative to base conditions by 392,000. However, this did not match the reduction in total VMT by the +5 mph 600 mile system of 518,000 relative to base conditions.

Strategic arterials experienced a larger increase in VMT in the 600 mile +5 mph system than in the 350 mile +5 mph system. Total VMT and total VHT are each reduced by 20,000 per day more by the 600 mile strategic arterial system than the 350 mile strategic arterial system in both the +5 mph and +10 mph condition. All other things being equal, from a minimum travel time point of view, the 600 mile strategic arterial system is slightly more effective in reducing total system VMT and VHT than the 350 mile system.

Table III-B presents information from the same assignment as was presented in

Table III-A. In order to gain a better understanding of the magnitude and characteristics of the diversion of VMT as a result of the implementation of the strategic arterial systems the results are presented relative to the centerline miles and lane miles of system.

TABLE III-B

HARRIS COUNTY
CHANGE DUE TO DESIRED PATHS
ALL-OR-NOTHING --- TRIP TABLE CONSTANT

CATEGORY	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
FRWY VMT/CLM	109,269	103,189	96,391	109,268	100,829	92,270
STRATEGIC ARTERIAL VMT/CLM	25,786	50,186	71,666	20,845	36,435	49,736
PRINCIPAL ARTERIAL VMT/CLM	26,073	22,129	20,057	26,404	22,251	20,160
OTHER ARTERIAL VMT/CLM	14,042	12,366	11,546	13,904	11,779	11,035
COLLECTOR VMT/CLM	4,796	4,704	4,607	4,729	4,028	3,909
TOTAL VMT/CLM	29,712	29,478	29,514	29,712	29,027	29,066
CHANGE FRWY VMT/CLM	----	-6,080	-12,878	----	-8,439	-16,998
CHANGE STRATEGIC ARTERIAL VMT/CLM	----	24,400	45,880	----	15,590	28,891
CHANGE PRIN ART VMT/CLM	----	-3,944	-6,016	----	-4,153	-6,244
CHANGE OTH ART VMT/CLM	----	-1,676	-2,496	----	-2,125	-2,869
CHANGE COLLECTOR VMT/CLM	----	-92	-189	----	-701	-820
CHANGE TOTAL VMT/CLM	----	-234	-198	----	-685	-646
FRWY VMT/LANE MILE	14,579	13,761	12,855	14,579	13,447	12,305
STRATEGIC ARTERIAL VMT/LANE MILE	5,253	8,173	11,672	4,725	5,998	8,187
PRINCIPAL ARTERIAL VMT/LANE MILE	5,082	4,313	3,909	5,118	4,313	3,907
OTHER ARTERIAL VMT/LANE MILE	3,705	3,263	3,046	3,686	3,122	2,925
COLLECTOR VMT/LANE MILE	1,984	1,946	1,906	1,961	1,670	1,621
TOTAL VMT/LANE MILE	6,790	6,584	6,593	6,790	6,288	6,296

TABLE III-B (cont.)

HARRIS COUNTY
CHANGE DUE TO DESIRED PATHS
ALL-OR-NOTHING --- TRIP TABLE CONSTANT

CATEGORY	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
CHANGE FRWY VMT/LANE MILE	----	-818	-1,724	----	-1,132	-2,274
CHANGE STRAT ART VMT/LANE MILE	----	2,920	6,419	----	1,273	3,462
CHANGE PRIN ART VMT/LANE MILE	----	-769	-1,173	----	-805	-1,211
CHANGE OTH ART VMT/LANE MILE	----	-442	-659	----	-564	-761
CHANGE COLLECT. VMT/LANE MILE	----	-38	-78	----	-291	-340
CHANGE TOTAL VMT/LANE MILE	----	-206	-197	----	-502	-494

One can see that on both a centerline mile and lane mile basis, diversion of freeway VMT is the most significant change in VMT next to the increase in strategic arterial VMT. The reduction in Harris County freeway VMT on a daily basis by the 350 mile strategic arterial system with speeds increased by 5 mph over the base condition is equivalent to the amount of traffic on 20 miles of 8-lane freeway. By increasing speeds to 10 mph over base conditions, freeway VMT equivalent to 43 miles of 8-lane freeway is diverted off Harris County freeways. The reduction of freeway VMT on the 600 mile system network is even more dramatic. With strategic arterial speeds increased by 5 mph on the 600 mile strategic arterial system, VMT equivalent to 28 miles of 8-lane freeway is removed from freeway facilities on a daily basis. VMT equivalent to 57 miles of 8-lane freeway is diverted from freeways by the 600 mile system with strategic arterial speeds increased by 10 mph.

This data confirms that in both the 350 mile and 600 mile strategic arterial systems, the +10 mph condition is more effective at diverting VMT from the freeways as well as the non-strategic arterial facilities. It could be surmised that if speeds on the strategic arterials are increased by larger amounts, the diversion of freeway VMT would be at least as significant as it is between the +5 mph condition and the base condition. These results appear to indicate that the speed of the strategic arterial facilities appears to be very important in the diversion of VMT, particularly freeway VMT.

Tables III-C and III-D present the same information as Tables III-A and III-B, but for the entire 8 county region. For the most part, region-wide changes in VMT as well as VHT of facilities region-wide parallel VMT and VHT changes in Harris County, but on a slightly larger scale. Freeway VMT is reduced by roughly 3.5 million in the +5 mph condition and over 7 million in the +10 mph condition in the 350 mile strategic arterial system relative to the base condition. VHT on freeways is reduced by 66,000 and 138,000 by the +5 mph 350 mile strategic arterial system and the +10 mph 350 mile strategic arterial system, respectively. As was the case in Harris County, the 600 mile strategic arterial systems reduced non-strategic arterial VMT and VHT by larger amounts than the 350 mile systems. The VMT reduction on freeways in the region by the 350 mile +5 mph system is equivalent to the amount of traffic on 25 miles of 8-lane freeway. By increasing strategic arterial speeds an additional 5 mph, this number grows to 53 miles of 8-lane freeway. The 600 mile strategic arterial system reduces freeway VMT by an amount equal to the amount of traffic which could be carried on 35 and 69 miles of 8-lane freeway in the +5 and +10 mph conditions, respectively. Table III-D shows that on a centerline mile and lane mile basis VMT changes for the 8 county region reflect the changes in Harris County for both the 350 mile and 600 mile strategic arterial systems.

TABLE III-C

REGION WIDE
CHANGE DUE TO DESIRED PATHS
ALL-OR-NOTHING --- TRIP TABLE CONSTANT

CATEGORY	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
ASSIGNED FRWY VMT	69,954,210	66,509,627	62,824,236	69,954,238	65,253,506	60,596,867
STRATEGIC ARTERIAL ASSIGNED VMT	8,119,172*	15,453,055	21,487,809	10,487,368*	19,835,502	26,553,016
PRINCIPAL ARTERIAL ASSIGNED VMT	10,034,900	9,068,486	8,553,052	9,953,444	8,960,676	8,454,117
OTHER ARTERIAL ASSIGNED VMT	31,650,485	28,692,467	27,239,201	29,763,287	26,249,764	25,008,917
COLLECTOR ASSIGNED VMT	9,162,341	9,010,419	8,925,756	8,766,352	8,312,774	8,243,193
TOTAL ASSIGNED VMT	128,921,108	128,734,054	129,030,054	128,924,689	128,612,222	128,856,110
ASSIGNED FRWY VHT	1,341,937	1,275,770	1,204,048	1,341,937	1,252,104	1,160,386
STRATEGIC ARTERIAL ASSIGNED VHT	214,490**	355,365	448,550	279,675**	450,302	550,173
PRINCIPAL ARTERIAL ASSIGNED VHT	270,867	243,253	228,692	268,538	240,115	225,773
OTHER ARTERIAL ASSIGNED VHT	893,242	806,243	764,315	840,115	737,390	701,499
COLLECTOR ASSIGNED VHT	228,331	224,006	221,309	218,681	206,790	204,527
TOTAL ASSIGNED VHT	2,948,867	2,904,637	2,866,914	2,948,946	2,886,701	2,842,358

* : VMT FOR FACILITIES TO BE UPGRADED TO STRATEGIC ARTERIAL
** : VHT FOR FACILITIES TO BE UPGRADED TO STRATEGIC ARTERIAL

TABLE III-C (cont.)

REGION WIDE
CHANGE DUE TO DESIRED PATHS
ALL-OR-NOTHING --- TRIP TABLE CONSTANT

CATEGORY	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
FRWY WTD AVG SPEED	52	52	52	52	52	52
STRATEGIC ARTERIAL WTD AVG SPEED	38	43	48	38	44	48
PRINCIPAL ARTERIAL WTD AVG SPEED	37	37	37	37	37	37
OTHER ARTERIAL WTD AVG SPEED	35	36	36	35	36	36
COLLECTOR WTD AVG SPEED	40	40	40	40	40	40
TOTAL WTD AVG SPEED	44	44	45	44	44	45

TABLE III-D

REGION WIDE
CHANGE DUE TO DESIRED PATHS
ALL-OR-NOTHING --- TRIP TABLE CONSTANT

	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
FRWY VMT/CLM	79,948	76,011	71,799	79,948	74,575	69,254
STRATEGIC ARTERIAL VMT/CLM	24,064	43,913	61,062	20,230	34,158	45,727
PRINCIPAL ARTERIAL VMT/CLM	22,475	20,310	19,156	22,611	20,356	19,205
OTHER ARTERIAL VMT/CLM	12,431	11,269	10,698	12,258	10,811	10,300
COLLECTOR VMT/CLM	3,896	3,831	3,795	3,820	3,623	3,592
TOTAL VMT/CLM	19,662	19,634	19,679	19,665	19,432	19,469
CHANGE FRWY VMT/CLM	----	-3,937	-8,149	----	-5,373	-10,694
CHANGE STRATEGIC ARTERIAL VMT/CLM	----	19,849	36,998	----	13,928	25,497
CHANGE PRIN ART VMT/CLM	----	-2,165	-3,319	----	-2,255	-3,406
CHANGE OTH ART VMT/CLM	----	-1,162	-1,733	----	-1,447	-1,958
CHANGE COLLECTOR VMT/CLM	----	-65	-101	----	-197	-228
CHANGE TOTAL VMT/CLM	----	-28	17	----	-233	-196

TABLE III-D (cont.)

REGION WIDE
CHANGE DUE TO DESIRED PATHS
ALL-OR-NOTHING --- TRIP TABLE CONSTANT

	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
FRWY VMT/LANE MILE	12,029	11,433	10,800	12,029	11,217	10,417
STRATEGIC ARTERIAL VMT/LANE MILE	4,866	7,163	9,961	4,530	5,619	7,522
PRINCIPAL ARTERIAL VMT/LANE MILE	4,917	4,444	4,191	4,937	4,445	4,194
OTHER ARTERIAL VMT/LANE MILE	3,585	3,250	3,086	3,563	3,143	2,994
COLLECTOR VMT/LANE MILE	1,829	1,799	1,782	1,802	1,709	1,695
TOTAL VMT/LANE MILE	5,518	5,397	5,409	5,518	5,232	5,242
CHANGE FRWY VMT/LANE MILE	----	-596	-1,229	----	-812	-1,612
CHANGE STRAT ART VMT/LANE MILE	----	2,297	5,095	----	1,089	2,992
CHANGE PRIN ART VMT/LANE MILE	----	-473	-726	----	-492	-743
CHANGE OTH ART VMT/LANE MILE	----	-335	-499	----	-420	-569
CHANGE COLLECT. VMT/LANE MILE	----	-30	-47	----	-93	-107
CHANGE TOTAL VMT/LANE MILE	----	-121	-109	----	-286	-276

Capacity Restraint Assignments

In order to understand what true impact the strategic arterial system would have on the entire network, it is necessary to look at the "final" results of the assignments with the "trip table held constant." These "final" results are actually the results of each of the iterative assignment of trips to a network weighted into a final statistic. The results reflect the initial all-or-nothing loading as well as the five iterative loadings of trips to the network using a capacity restraint model. Contrary to the all-or-nothing assignments, the capacity of the strategic arterial facilities as well as the other facilities influences the final five iterative assignments and hence, the final results. Tables III-E through III-H present the capacity restrained assignment results for Harris County and the entire 8 county region.

Tables III-E and III-F show that in both Harris County and the region as a whole, significant amounts of VMT, 2.7 million and 3.2 million, respectively, are diverted from the freeways by the 350 mile strategic arterial +5 mph system on a daily basis. Strategic arterial VMT increases by 4.9 million in Harris County and 5.9 million for the region. There is also some diversion of VMT from principal and "other" arterials. Although strategic arterial VMT increases by a relatively large amount, the decrease in VMT on other facilities resulted in a reduction in total VMT of over 650,000 in Harris County and 500,000 in the region. These data also show that daily freeway VHT is reduced by roughly 80,000 in both Harris County and region-wide. The increase in strategic arterial VHT of 96,000 reflects the diversion of VMT to the strategic arterial facilities. Total system VHT is reduced by over 100,000 in both Harris County and the 8 county region by the 350 mile +5 mph strategic arterial system.

TABLE III-E

HARRIS COUNTY
CHANGE DUE TO CAPACITY RESTRAINT
CAPACITY RESTRAINT --- TRIP TABLE CONSTANT

CATEGORY	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
ASSIGNED FRWY VMT	55,425,883	52,654,986	51,860,441	55,426,790	50,798,247	49,583,869
STRATEGIC ARTERIAL ASSIGNED VMT	5,830,715*	10,826,806	12,347,958	7,939,074*	15,729,193	17,899,516
PRINCIPAL ARTERIAL ASSIGNED VMT	6,347,145	5,737,126	5,752,765	6,254,989	5,598,216	5,567,590
OTHER ARTERIAL ASSIGNED VMT	25,689,517	23,522,886	22,950,695	23,871,855	20,715,796	20,126,276
COLLECTOR ASSIGNED VMT	2,131,975	2,019,345	1,984,097	1,934,142	1,610,188	1,577,896
TOTAL ASSIGNED VMT	95,425,235	94,761,149	94,895,956	95,426,850	94,451,640	94,755,147
ASSIGNED FRWY VHT	1,152,321	1,074,638	1,046,788	1,152,335	1,034,311	998,464
STRATEGIC ARTERIAL ASSIGNED VHT	191,618**	288,142	331,329	257,818**	389,183	436,453
PRINCIPAL ARTERIAL ASSIGNED VHT	205,935	183,317	182,008	203,388	179,108	176,248
OTHER ARTERIAL ASSIGNED VHT	881,865	783,224	756,937	823,933	692,062	667,726
COLLECTOR ASSIGNED VHT	77,045	72,581	70,560	71,305	60,283	59,082
TOTAL ASSIGNED VHT	2,508,784	2,401,902	2,387,622	2,508,779	2,354,947	2,337,973

* : VMT FOR FACILITIES TO BE UPGRADED TO STRATEGIC ARTERIAL
** : VHT FOR FACILITIES TO BE UPGRADED TO STRATEGIC ARTERIAL

TABLE III-E (cont.)

HARRIS COUNTY
CHANGE DUE TO CAPACITY RESTRAINT
CAPACITY RESTRAINT --- TRIP TABLE CONSTANT

CATEGORY	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
FRWY WTD AVG SPEED	43	43	44	43	44	45
STRATEGIC ARTERIAL WTD AVG SPEED	30	38	37	31	40	41
PRINCIPAL ARTERIAL WTD AVG SPEED	31	31	32	31	31	32
OTHER ARTERIAL WTD AVG SPEED	29	30	30	29	30	30
COLLECTOR WTD AVG SPEED	28	28	28	27	27	27
TOTAL WTD AVG SPEED	35	37	37	35	38	38

TABLE III-F

REGION WIDE
CHANGE DUE TO CAPACITY RESTRAINT
CAPACITY RESTRAINT --- TRIP TABLE CONSTANT

CATEGORY	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
ASSIGNED FRWY VMT	72,054,142	68,886,080	67,886,661	72,056,398	66,728,601	65,269,252
STRATEGIC ARTERIAL ASSIGNED VMT	7,878,995*	13,755,484	15,576,475	10,172,464*	19,064,896	21,514,562
PRINCIPAL ARTERIAL ASSIGNED VMT	9,823,801	9,188,269	9,210,633	9,731,642	9,052,612	9,022,664
OTHER ARTERIAL ASSIGNED VMT	33,318,687	31,028,973	30,416,677	31,418,179	28,157,860	27,546,432
COLLECTOR ASSIGNED VMT	8,684,632	8,409,055	8,361,953	8,382,183	7,856,738	7,800,436
TOTAL ASSIGNED VMT	131,760,257	131,267,861	131,452,399	131,760,866	130,860,707	131,153,346
ASSIGNED FRWY VHT	1,443,613	1,357,926	1,326,248	1,443,645	1,311,684	1,271,495
STRATEGIC ARTERIAL ASSIGNED VHT	240,961**	349,405	397,366	312,161**	457,024	507,891
PRINCIPAL ARTERIAL ASSIGNED VHT	292,357	269,462	268,343	289,810	265,289	262,595
MINOR ARTERIAL ASSIGNED VHT	1,070,957	967,654	940,378	1,010,757	874,439	849,635
COLLECTOR ASSIGNED VHT	260,152	249,801	247,287	251,665	233,548	230,678
TOTAL ASSIGNED VHT	3,308,040	3,194,248	3,179,622	3,308,038	3,141,984	3,122,294

* : VMT FOR FACILITIES TO BE UPGRADED TO STRATEGIC ARTERIAL
** : VHT FOR FACILITIES TO BE UPGRADED TO STRATEGIC ARTERIAL

TABLE III-F (cont.)

REGION WIDE
CHANGE DUE TO CAPACITY RESTRAINT
CAPACITY RESTRAINT --- TRIP TABLE CONSTANT

CATEGORY	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
FRWY WTD AVG SPEED	50	51	51	50	51	51
STRATEGIC ARTERIAL WTD AVG SPEED	33	39	39	33	42	42
PRINCIPAL ARTERIAL WTD AVG SPEED	34	34	34	34	34	34
OTHER ARTERIAL WTD AVG SPEED	31	32	32	31	32	32
COLLECTOR WTD AVG SPEED	33	34	34	33	34	34
TOTAL WTD AVG SPEED	40	41	41	40	41	42

The 600 mile strategic arterial system caused larger reductions in freeway VMT, 4.6 million in Harris County and 5.3 million in the region, than the 350 mile strategic arterial system. Strategic arterial VMT experienced an increase of 7.8 million in Harris County and 8.9 million over the entire region with the 600 mile +5 mph system. Both of these increases are larger than those by the 350 +5 mph mile strategic arterial system. Principal and "other" arterial VMT diversion is also larger with the 600 mile strategic arterial system. Total VMT declined by a larger amount, over 900,000 in both Harris County and the region, than in the 350 mile strategic arterial system. As would be expected, the larger diversions in VMT off the freeways and arterials by the 600 mile strategic arterial system are matched by reductions in VHT for those facilities. Strategic arterial VHT increased by over 130,000 in Harris County and over 140,000 region wide.

Table III-G details the effect of diversion on freeway VMT by the strategic arterial systems by quantifying the changes in VMT on the 1,042 links or network segments representing freeways in the region. The change in VMT on the freeway links is classified into five categories generally representing large decreases, small decreases, relatively little change, small increases and large increases and are relative to the corresponding base system (i.e., the 350 mile base system for the 350 mile strategic arterial systems and the 600 mile base system for the 600 mile strategic arterial systems). This data represents the final weighted result of the five iteration assignment. The portion of total freeway links in each level of change is also indicated. The manner in which the freeway network has been coded (i.e., many short links or fewer longer links) could influence the share of links in each category of VMT change. Therefore, the links have also been proportioned relative to the total number of miles of freeway links.

TABLE III-G

CHANGE IN VMT OF FREEWAYS
(RELATIVE TO BASE CONDITIONS)
CAPACITY RESTRAINT --- TRIP TABLE CONSTANT

	350 MILE SYSTEM		600 MILE SYSTEM	
	+ 5 MPH	+ 10 MPH	+ 5 MPH	+ 10 MPH
NO. FREEWAY LINKS DECREASE > 30,000	17	23	23	55
DECREASE 10,000 - 30,000	173	269	287	335
± 10,000	846	738	730	645
INCREASE 10,000 - 30,000	6	12	2	7
INCREASE > 30,000	0	0	0	0
TOTAL	1,042	1,042	1,042	1,042
% TOT FWY LINKS DECREASE > 30,000	1.6%	2.2%	2.2%	5.3%
% TOT FWY LINKS DECREASE 10,000 - 30,000	16.6%	25.8%	27.5%	32.1%
% TOT FWY LINKS ± 10,000	81.2%	70.8%	70.1%	61.9%
% TOT FWY LINKS INCREASE 10,000 - 30,000	.6%	1.2%	.2%	.7%
% TOT FWY LINKS INCREASE > 30,000	.0%	.0%	.0%	.0%
TOTAL	100.0%	100.0%	100.0%	100.0%
% TOT FWY MILES DECREASE > 30,000	1.0%	1.3%	1.4%	3.1%
% TOT FWY MILES DECREASE 10,000 - 30,000	11.4%	18.0%	23.2%	27.5%
% TOT FWY MILES ± 10,000	87.3%	80.0%	75.3%	69.1%
% TOT FWY MILES INCREASE 10,000 - 30,000	.3%	.7%	.1%	.3%
% TOT FWY MILES INCREASE > 30,000	.0%	.0%	.0%	.0%
TOTAL	100.0%	100.0%	100.0%	100.0%

Table III-G shows that a majority of freeway links remain relatively unchanged in all the assignments. However, the percentage of freeway links in the ± 10,000 change category decreases from 81.2% in the 350 +5 mph assignment to 70.8% in the 350 +10 mph assignment as strategic arterial speeds are increased. Not surprisingly, as the strategic arterial system is expanded, the portion of freeway links in the ± 10,000 VMT change category is further reduced; 61.2% of the freeway links in the 600 +10 mph system changes by ± 10,000 VMT relative to base conditions. Additionally, the percentage of freeway links experiencing small decreases (10,000 - 30,000) in VMT increases as strategic arterial speed and system size increase. The proportion of links with volumes decreasing by 30,000 or more VMT relative to the base shows a similar but less pronounced pattern.

The results also seem to indicate that the strategic arterial systems do not significantly enhance the accessibility of the freeway system. The proportion of freeway links which experience an increase of more than 10,000 VMT is no more than 1% of total freeway segments in any one strategic arterial system.

When viewing only the results of the capacity restraint assignments the 350 mile and 600 mile strategic arterial systems in the +5 mph condition appear to be effective in diverting VMT off other facilities. However, when comparing the capacity restraint results with the corresponding all-or-nothing assignment results (Tables III-A and III-B), the importance of speed in diversion of VMT is brought into question. The first item of note is that the capacity restraint assignment diverts over 1 million less VMT in Harris County and over 2.3 million less region wide than the all-or-nothing assignment to the 350 mile strategic arterial +5 mph system. The difference is even larger when reviewing the 600 mile +5 mph capacity restraint and all-or-nothing assignments. Equally as significant is that the strategic arterial facilities in the 350 mile and 600 mile strategic arterial +5 mph systems have over 1.4 million VMT and 600,000 VMT less of an increase relative to base conditions as do the strategic arterials in the all-or-nothing assignment. A comparison of the all-or-nothing and capacity restrained assignments to the 350 and 600 mile base networks show that the capacity restrained assignments assign less traffic to the strategic arterials and more traffic to the freeway and other facilities than does the all-or-nothing assignment.

The results of the capacity restraint assignments to both the 350 and 600 mile strategic arterial networks in the +10 mph condition shows that relatively little additional diversion of VMT from freeways or other facilities is achieved by increasing strategic arterial speeds an additional 5 mph. A small amount of VMT is added to strategic arterials by increasing their speed by another 5 mph relative to the increase in VMT between the base condition and the +5 mph condition. Contrary to the 350 mile strategic arterial system, the 600 mile strategic arterial system causes a moderately significant increase in VMT diversion between the +5 mph and +10 mph conditions as well as a significant increase in strategic arterial VMT. Obviously, this is due to the larger capacity of the 600 mile strategic arterial system. Generally speaking, however, most of the additional diversion of VMT from freeways and other facilities to strategic arterials which is achieved in the all-or-nothing assignments by increasing strategic arterial speeds by 10 mph is diverted back to the freeways because the demand for the strategic arterials results in large v/c ratios and thus significant capacity restraint effects on these facilities.

Tables III-H and III-I present VMT data from the capacity restraint assignments on a centerline mile and lane mile basis for Harris County and for the 8 county region. The effect of capacity restraint on VMT of the strategic arterial networks is particularly evident when viewed in terms of centerline miles and lane miles of system.

Although freeway VMT per centerline mile and lane mile is significantly reduced relative to the base condition, the reduction is not as large as that achieved in the all-or-nothing assignment. Interestingly, the capacity restrained assignments actually cause more of a reduction in total VMT per centerline mile and lane mile in both the 350 and 600 strategic arterial systems than do the all-or-nothing assignments. This is due to the fact that the capacity restraint causes strategic arterial VMT to increase less than it does in the all-or-nothing assignment on both a centerline mile and lane mile basis.

These observations indicate that the initial (all-or-nothing) loading or assignment of trips to the network result in the strategic arterial facilities (or those facilities designated to become strategic arterials in the base condition) being loaded to such a degree that the

TABLE III-H

HARRIS COUNTY
CHANGE DUE TO CAPACITY RESTRAINT
CAPACITY RESTRAINT --- TRIP TABLE CONSTANT

	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
FRWY VMT/CLM	111,096	105,542	103,950	111,098	101,820	99,386
STRATEGIC ARTERIAL VMT/CLM	23,731	42,608	48,595	19,612	34,120	38,828
PRINCIPAL ARTERIAL VMT/CLM	25,480	23,031	23,094	25,751	23,047	22,921
OTHER ARTERIAL VMT/CLM	15,127	13,852	13,515	15,057	13,067	12,695
COLLECTOR VMT/CLM	4,739	4,488	4,410	4,719	3,928	3,849
TOTAL VMT/CLM	30,373	30,081	30,124	30,373	29,534	29,629
CHANGE FRWY VMT/CLM	----	-5,554	-7,146	----	-9,278	-11,712
CHANGE STRATEGIC ARTERIAL VMT/CLM	----	18,877	24,864	----	14,508	19,216
CHANGE PRIN ART VMT/CLM	----	-2,449	-2,386	----	-2,704	-2,830
CHANGE OTH ART VMT/CLM	----	-1,275	-1,612	----	-1,990	-2,362
CHANGE COLLECTOR VMT/CLM	----	-251	-329	----	-791	-870
CHANGE TOTAL VMT/CLM	----	-292	-249	----	-839	-744
FRWY VMT/LANE MILE	14,823	14,075	13,863	14,823	13,579	13,254
STRATEGIC ARTERIAL VMT/LANE MILE	4,834	6,939	7,914	4,445	5,617	6,392
PRINCIPAL ARTERIAL VMT/LANE MILE	4,966	4,489	4,501	4,991	4,467	4,443
OTHER ARTERIAL VMT/LANE MILE	3,991	3,655	3,566	3,992	3,464	3,365
COLLECTOR VMT/LANE MILE	1,960	1,857	1,824	1,957	1,629	1,596
TOTAL VMT/LANE MILE	6,941	6,719	6,729	6,942	6,398	6,418
CHANGE FRWY VMT/LANE MILE	----	-748	-960	----	-1,244	-1,569
CHANGE STRAT ART VMT/LANE MILE	----	2,105	3,080	----	1,172	1,947
CHANGE PRIN ART VMT/LANE MILE	----	-477	-465	----	-524	-548
CHANGE OTH ART VMT/LANE MILE	----	-336	-425	----	-528	-627
CHANGE COLLECT. VMT/LANE MILE	----	-103	-136	----	-328	-361
CHANGE TOTAL VMT/LANE MILE	----	-222	-212	----	-544	-524

TABLE III-I

REGION WIDE
CHANGE DUE TO CAPACITY RESTRAINT
CAPACITY RESTRAINT --- TRIP TABLE CONSTANT

	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
FRWY VMT/CLM	82,348	78,727	77,585	82,350	76,261	74,593
STRATEGIC ARTERIAL VMT/CLM	23,352	39,089	44,264	19,623	32,831	37,049
PRINCIPAL ARTERIAL VMT/CLM	22,002	20,578	20,629	22,107	20,565	20,497
OTHER ARTERIAL VMT/CLM	13,086	12,187	11,946	12,940	11,597	11,345
COLLECTOR VMT/CLM	3,693	3,576	3,556	3,653	3,424	3,399
TOTAL VMT/CLM	20,095	20,020	20,048	20,097	19,772	19,816
CHANGE FRWY VMT/CLM	----	-3,621	-4,763	----	-6,089	-7,757
CHANGE STRATEGIC ARTERIAL VMT/CLM	----	15,737	20,912	----	13,208	17,426
CHANGE PRIN ART VMT/CLM	----	-1,424	-1,373	----	-1,542	-1,610
CHANGE OTH ART VMT/CLM	----	-899	-1,140	----	-1,343	-1,595
CHANGE COLLECTOR VMT/CLM	----	-117	-137	----	-229	-254
CHANGE TOTAL VMT/CLM	----	-75	-47	----	-325	-281
FRWY VMT/LANE MILE	12,390	11,842	11,670	12,390	11,471	11,220
STRATEGIC ARTERIAL VMT/LANE MILE	4,722	6,377	7,221	4,394	5,400	6,094
PRINCIPAL ARTERIAL VMT/LANE MILE	4,814	4,502	4,513	4,827	4,491	4,476
OTHER ARTERIAL VMT/LANE MILE	3,774	3,515	3,446	3,761	3,371	3,298
COLLECTOR VMT/LANE MILE	1,733	1,678	1,669	1,723	1,615	1,604
TOTAL VMT/LANE MILE	5,640	5,503	5,511	5,640	5,324	5,336
CHANGE FRWY VMT/LANE MILE	----	-548	-720	----	-919	-1,170
CHANGE STRAT ART VMT/LANE MILE	----	1,655	2,499	----	1,006	1,700
CHANGE PRIN ART VMT/LANE MILE	----	-312	-301	----	-336	-351
CHANGE OTH ART VMT/LANE MILE	----	-259	-328	----	-390	-463
CHANGE COLLECT. VMT/LANE MILE	----	-55	-64	----	-108	-119
CHANGE TOTAL VMT/LANE MILE	----	-137	-129	----	-316	-304

capacity restraint begins to reallocate traffic on the network. Although particularly evident in the strategic arterial network assignments, this characteristic is also present in the assignments to the base networks. This means that even when no strategic arterial speed or capacity increase has been incorporated into the network (i.e., base condition), more demand is placed on the facilities by the all-or-nothing assignment than their capacity can accommodate. When the subsequent iterative capacity restrained assignments are performed, the capacity restraint model lowers the speed of facilities with a large volume to capacity (v/c) ratio and increases the speed of facilities which have a relatively low v/c ratio. The end result is that trips are redistributed on the network relative to the all-or-nothing loading to facilities with available capacity. In this case, the redistribution results in trips being diverted **from** strategic arterials **to** other facilities, particularly freeways.

This explains why freeway VMT and VHT increase and strategic arterial VMT and VHT decrease between the all-or-nothing and capacity restrained assignment of trips to the same network with the same speeds. Apparently, the number of trips desiring to use the strategic arterial facilities in Harris County as well as region wide are more than their capacity, particularly in the strategic arterial configuration, can practically accommodate.

IV. TRAVEL PATH AND PATTERN CHANGES

The initial analysis of the strategic arterial speed sensitivity testing process focused on the general path diversion effects of the strategic arterial systems. A second set of analyses was performed, which dealt with both travel path and travel pattern diversion effects of the strategic arterial systems. The effects of travel pattern change were able to be isolated because the travel path changes had already been quantified in the initial analyses. In order to conduct the second set of analyses, it was necessary to make four sets of trip distribution runs, one with each strategic arterial system in each speed condition. The resulting trip tables were then assigned to the four strategic arterial networks used in their development. These are referred to as assignments with "different" trip tables. As was the case in the travel path change ("constant" trip table) analyses, it is necessary to review the results of both the all-or-nothing and capacity restraint assignment results to the strategic arterial systems in both the +5 mph and +10 mph conditions.

All-or-Nothing Assignments

Tables IV-A and IV-B present the results of the four assignments to the four strategic arterial networks. The results presented are those for the portions of the networks within Harris County. The base figures are the same as those presented in the "constant" trip table assignment results (i.e. Tables III-A and III-B).

Many of the trends seen in the "constant" trip table all-or-nothing assignment results are found in the trip distribution all-or-nothing assignment results. For example, strategic arterial VMT more than doubles between the base condition and the +5 mph condition in both the 350 and 600 mile strategic arterial systems. Additionally, the increase in strategic arterial VMT between the +10 mph condition and the +5 mph condition is slightly less than the increase between the +5 mph condition and the base condition. Also, the +10 mph condition diverts slightly more VMT from freeways relative to the +5 mph condition than the +5 mph condition does relative to the base condition. These facts indicate that, as was the case in the "constant" trip table assignment, increasing strategic arterial speeds by 5 mph diverted roughly similar amounts of VMT from freeways and arterials to strategic arterials. The diversion of VMT associated with the additional 5 mph speed increase is

TABLE IV-A

HARRIS COUNTY
CHANGE DUE TO TRAVEL PATH AND PATTERN CHANGE
ALL-OR-NOTHING --- DIFFERENT TRIP TABLE

CATEGORY	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
ASSIGNED FRWY VMT	54,514,090	52,015,581	48,992,935	54,513,919	51,037,483	47,194,289
STRATEGIC ARTERIAL ASSIGNED VMT	6,335,577*	13,759,501	20,391,586	8,438,062	18,268,964	25,844,697
PRINCIPAL ARTERIAL ASSIGNED VMT	6,494,888	5,506,634	4,979,701	6,413,431	5,397,987	4,879,455
OTHER ARTERIAL ASSIGNED VMT	23,845,865	20,971,976	19,552,975	22,044,016	18,646,263	17,452,683
COLLECTOR ASSIGNED VMT	2,157,932	2,128,135	2,090,056	1,938,436	1,663,431	1,618,894
TOTAL ASSIGNED VMT	93,348,352	94,381,827	96,007,253	93,347,864	95,014,128	96,990,018
ASSIGNED FRWY VHT	1,076,279	1,027,783	968,236	1,076,275	1,009,296	932,425
STRATEGIC ARTERIAL ASSIGNED VHT	174,456**	324,598	432,069	233,590	423,474	542,228
PRINCIPAL ARTERIAL ASSIGNED VHT	190,852	162,766	147,948	188,523	159,551	144,935
OTHER ARTERIAL ASSIGNED VHT	718,438	633,520	592,505	667,288	567,172	532,538
COLLECTOR ASSIGNED VHT	65,869	64,477	63,013	60,206	52,439	50,994
TOTAL ASSIGNED VHT	2,225,894	2,213,144	2,203,771	2,225,882	2,211,932	2,203,120
FRWY WTD AVG SPEED	46	46	46	46	46	46
STRATEGIC ARTERIAL WTD AVG SPEED	36	42	47	36	43	48
PRINCIPAL ARTERIAL WTD AVG SPEED	34	34	34	34	34	34
OTHER ARTERIAL WTD AVG SPEED	33	33	33	33	33	33
COLLECTOR WTD AVG SPEED	33	33	33	32	32	32
TOTAL WTD AVG SPEED	40	41	42	40	41	42

* : VMT FOR FACILITIES TO BE UPGRADED TO STRATEGIC ARTERIAL
** : VHT FOR FACILITIES TO BE UPGRADED TO STRATEGIC ARTERIAL

largely from freeways as most of the trips on arterial facilities in the base system are diverted from those facilities by the initial 5 mph speed increase. The fact that relatively few trips are diverted from arterials to strategic arterials by the second 5 mph speed increase indicates that remaining trips on the arterials would have to have gone out of their way to access the strategic arterials and because the all-or-nothing assignment is a minimum time path assignment, this does not occur. It appears that the +10 mph strategic arterial systems are competing with essentially only freeways. Freeways are the only facility class in which the magnitude of VMT diversion is as great in the +10 mph strategic arterial systems as in the +5 mph strategic arterial systems.

The all-or-nothing assignment results also provide insight into the impacts of and differences created by trip distribution. When holding the trip table constant, the all-or-nothing assignment indicated a 5.5% reduction in the region's vehicle hours of travel with the +5 mph strategic arterial system (i.e. 0.5% reduction in VMT) due to the use of more efficient paths for the same interchange volumes. Similarly, in the +10 mph system with the trip table constant, the all-or-nothing assignment showed a 11.6% reduction in the region's vehicle hours of travel (i.e. 0.3% reduction in VMT).

When new trip distributions were run for the +5 mph and +10 mph systems, the vehicle hours of travel remained relatively constant. This fact combined with the faster systems, resulted in an increase rather than a decrease in VMT. With the +5 mph 350 mile system, the all-or-nothing assignment increase VMT by 1.0 million over the base (i.e. a 1.1% increase). Similarly, the +10 mph 350 mile system increased by 2.7 million VMT or 2.8% over the base.

Another difference between the "constant" trip table all-or-nothing assignment results and the "different" trip table assignment results which is immediately apparent is that strategic arterial VMT increases by a larger amount between the base and + 5 mph conditions as well as the +5 mph and +10 mph conditions in the "different" trip table assignments. Travel pattern changes cause strategic arterial VMT to increase 7.4 million between the base and +5 mph conditions. Travel path diversion only resulted in a 6.4 million VMT increase between the base and +5 mph conditions. Between the +10 mph and +5 mph conditions, travel pattern changes resulted in a 6.6 million VMT increase while travel path changes caused a 5.5 million increase in strategic arterial VMT.

Further differences between the two sets of assignments are found in freeway VMT. Changes in travel patterns caused the 350 mile +5 mph strategic arterial system to divert approximately 500,000 less VMT from the freeways than is diverted when only travel path changes are considered. This reduction in the level of VMT diversion between the two assignments is even greater in the 600 mile strategic arterial system in the +5 mph condition. Comparing the two sets of assignment results for the +10 mph condition reveals that travel pattern changes result in over 900,000 and 1.0 million less VMT diverted in the 350 and 600 mile systems, respectively compared to the total VMT reductions resulting from travel path changes. The effects of travel pattern changes has resulted in a net increase in total VMT relative to the base condition, whereas, travel path changes caused total system VMT to decline with both strategic arterial systems relative to the base system.

Table IV-B presents the assignment results from Table IV-A on a centerline mile and lane mile basis. The data in this table reflect the VMT changes shown in Table IV-A. Freeway VMT per centerline mile and lane mile are reduced relative to the base system, but not as much as the reduction caused by the travel path changes alone (Table III-B). Total VMT per centerline mile increases relative to the base system. This is due to the fact that total system VMT increased by a much larger amount relative to the base system than did total centerline miles of system. Apparently, when strategic arterial speeds are 10 mph faster than the principal arterial speeds in the area, they are an attractive enough facility to result in trips traveling longer distances in order to access the travel time advantage of the strategic arterial. This results in an increase in VMT on the network. Interestingly, although total VMT and total VMT per centerline mile increased relative to the base system in both the 350 mile and 600 mile systems in the +5 mph and +10 mph conditions, total VMT per lane mile decreases relative to the base system in the 350 mile strategic arterial system in the +5 mph condition and the 600 mile system in both speed conditions. In these cases, total lane miles increased relatively more than total VMT.

Tables IV-C and IV-D present the all-or-nothing assignment results for the entire region. The tables show that the impacts of trip distribution are present on a regional basis. The characteristics of these differences are the same as those that were seen in the Harris County results.

TABLE IV-B

HARRIS COUNTY
CHANGE DUE TO TRAVEL PATH AND PATTERN CHANGE
ALL-OR-NOTHING --- DIFFERENT TRIP TABLE

	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
FRWY VMT/CLM	109,269	104,261	98,202	109,268	102,300	94,597
STRATEGIC ARTERIAL VMT/CLM	25,786	54,150	80,250	20,845*	39,629	56,062
PRINCIPAL ARTERIAL VMT/CLM	26,073	22,106	19,991	26,404	22,223	20,088
OTHER ARTERIAL VMT/CLM	14,042	12,350	11,514	13,904	11,761	11,008
COLLECTOR VMT/CLM	4,796	4,730	4,646	4,729	4,058	3,949
TOTAL VMT/CLM	29,712	29,961	30,477	29,712	29,710	30,327
CHANGE FRWY VMT/CLM	----	-5,008	-11,067	----	-6,968	-14,671
CHANGE STRATEGIC ARTERIAL VMT/CLM	----	28,364	54,464	----	18,784	35,217
CHANGE PRIN ART VMT/CLM	----	-3,967	-6,082	----	-4,181	-6,316
CHANGE OTH ART VMT/CLM	----	-1,692	-2,528	----	-2,143	-2,896
CHANGE COLLECTOR VMT/CLM	----	-66	-150	----	-671	-780
CHANGE TOTAL VMT/CLM	----	249	765	----	-2	615
FRWY VMT/LANE MILE	14,579	13,904	13,096	14,579	13,643	12,615
STRATEGIC ARTERIAL VMT/LANE MILE	5,253	8,819	13,070	4,725	6,523	9,229
PRINCIPAL ARTERIAL VMT/LANE MILE	5,082	4,308	3,896	5,118	4,307	3,894
OTHER ARTERIAL VMT/LANE MILE	3,705	3,258	3,038	3,686	3,118	2,918
COLLECTOR VMT/LANE MILE	1,984	1,957	1,922	1,961	1,683	1,638
TOTAL VMT/LANE MILE	6,790	6,692	6,807	6,790	6,436	6,570
CHANGE FRWY VMT/LANE MILE	----	-675	-1,483	----	-936	-1,964
CHANGE STRAT ART VMT/LANE MILE	----	3,566	7,817	----	1,798	4,504
CHANGE PRIN ART VMT/LANE MILE	----	-774	-1,186	----	-811	-1,224
CHANGE OTH ART VMT/LANE MILE	----	-447	-667	----	-568	-768
CHANGE COLLECT. VMT/LANE MILE	----	-27	-62	----	-278	-323
CHANGE TOTAL VMT/LANE MILE	----	-98	17	----	-354	-220

TABLE IV-C

REGION WIDE
CHANGE DUE TO TRAVEL PATH AND PATTERN CHANGE
ALL-OR-NOTHING --- DIFFERENT TRIP TABLE

CATEGORY	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
ASSIGNED FRWY VMT	69,954,210	67,250,367	64,109,487	69,954,238	66,298,349	62,269,644
STRATEGIC ARTERIAL ASSIGNED VMT	8,119,172*	16,655,510	24,038,926	10,487,368	21,558,966	29,916,510
PRINCIPAL ARTERIAL ASSIGNED VMT	10,034,900	9,086,504	8,576,193	9,953,444	8,989,433	8,491,809
OTHER ARTERIAL ASSIGNED VMT	31,650,485	28,693,054	27,238,020	29,763,287	26,269,386	25,036,186
COLLECTOR ASSIGNED VMT	9,162,341	9,076,940	9,044,215	8,766,352	8,440,506	8,424,387
TOTAL ASSIGNED VMT	128,921,108	130,762,375	133,006,841	128,924,689	131,556,640	134,138,536
ASSIGNED FRWY VHT	1,341,937	1,289,580	1,227,931	1,341,937	1,271,524	1,191,431
STRATEGIC ARTERIAL ASSIGNED VHT	214,490**	382,778	501,227	279,675	488,825	619,060
PRINCIPAL ARTERIAL ASSIGNED VHT	270,867	243,574	229,017	268,538	240,643	226,394
OTHER ARTERIAL ASSIGNED VHT	893,242	805,873	763,561	840,115	737,272	701,276
COLLECTOR ASSIGNED VHT	228,331	225,518	223,981	218,681	209,638	208,589
TOTAL ASSIGNED VHT	2,948,867	2,947,323	2,945,717	2,948,946	2,947,902	2,946,750
FRWY WTD AVG SPEED	52	52	52	52	52	52
STRATEGIC ARTERIAL WTD AVG SPEED	38	44	48	38	44	48
PRINCIPAL ARTERIAL WTD AVG SPEED	37	37	37	37	37	38
OTHER ARTERIAL WTD AVG SPEED	35	36	36	35	36	36
COLLECTOR WTD AVG SPEED	40	40	40	40	40	40
TOTAL WTD AVG SPEED	44	44	45	44	44	45

* : VMT FOR FACILITIES TO BE UPGRADED TO STRATEGIC ARTERIAL
** : VHT FOR FACILITIES TO BE UPGRADED TO STRATEGIC ARTERIAL

TABLE IV-D

REGION WIDE
CHANGE DUE TO TRAVEL PATH AND PATTERN CHANGE
ALL-OR-NOTHING --- DIFFERENT TRIP TABLE

	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
FRWY VMT/CLM	79,948	76,858	73,268	79,948	75,770	71,165
STRATEGIC ARTERIAL VMT/CLM	24,064	47,330	68,312	20,230*	37,126	51,518
PRINCIPAL ARTERIAL VMT/CLM	22,475	20,351	19,208	22,611	20,421	19,291
OTHER ARTERIAL VMT/CLM	12,431	11,269	10,698	12,258	10,819	10,311
COLLECTOR VMT/CLM	3,896	3,860	3,846	3,820	3,678	3,671
TOTAL VMT/CLM	19,662	19,943	20,285	19,665	19,877	20,267
CHANGE FRWY VMT/CLM	----	-3,090	-6,680	----	-4,178	-8,783
CHANGE STRATEGIC ARTERIAL VMT/CLM	----	23,266	44,248	----	16,896	31,288
CHANGE PRIN ART VMT/CLM	----	-2,124	-3,267	----	-2,190	-3,320
CHANGE OTH ART VMT/CLM	----	-1,162	-1,733	----	-1,439	-1,947
CHANGE COLLECTOR VMT/CLM	----	-36	-50	----	-142	-149
CHANGE TOTAL VMT/CLM	----	281	623	----	212	602
FRWY VMT/LANE MILE	12,029	11,560	11,020	12,029	11,397	10,704
STRATEGIC ARTERIAL VMT/LANE MILE	4,866	7,721	11,144	4,530	6,107	8,474
PRINCIPAL ARTERIAL VMT/LANE MILE	4,917	4,452	4,202	4,937	4,459	4,212
OTHER ARTERIAL VMT/LANE MILE	3,585	3,250	3,085	3,563	3,145	2,997
COLLECTOR VMT/LANE MILE	1,829	1,812	1,805	1,802	1,735	1,732
TOTAL VMT/LANE MILE	5,518	5,482	5,576	5,518	5,352	5,457
CHANGE FRWY VMT/LANE MILE	----	-469	-1,009	----	-632	-1,325
CHANGE STRAT ART VMT/LANE MILE	----	2,855	6,278	----	1,577	3,944
CHANGE PRIN ART VMT/LANE MILE	----	-465	-715	----	-478	-725
CHANGE OTH ART VMT/LANE MILE	----	-335	-500	----	-418	-566
CHANGE COLLECT. VMT/LANE MILE	----	-17	-24	----	-67	-70
CHANGE TOTAL VMT/LANE MILE	----	-36	58	----	-166	-61

Capacity Restraint Assignments

Although the impacts of trip distribution are certainly present in the capacity restraint assignment results, the influence of trip distribution has combined with the effects of capacity restraint. The outcome of this has been an unclear view of the effects of trip distribution. The results of the "constant" trip table analysis have shown that the results of capacity restraint assignments are not effective measures of the strategic arterial system impacts. As was the case in the "constant" trip table assignments, capacity restraint removes a portion of the VMT that was diverted to strategic arterials back to other facilities, particularly freeways. Therefore, little analysis of the capacity restraint results for the trip distribution assignment is presented. Tables IV-E through IV-H present the results of the capacity restraint assignments for both Harris County and the entire region. Relative to the "constant" trip table capacity restraint assignment, VMT on freeways, strategic arterials as well as the entire region is higher in the trip distribution capacity restraint assignment. This is linked to the much higher levels of VMT from the all-or-nothing trip distribution assignment relative to the "constant" trip table assignment. Generally speaking, however, capacity restraint had the same effect on VMT and VHT of the all-or-nothing trip distribution assignment as it did on the all-or-nothing "constant" trip table assignment.

TABLE IV-E

HARRIS COUNTY
CHANGE DUE TO CAPACITY RESTRAINT, TRAVEL PATH AND PATTERN CHANGE
CAPACITY RESTRAINT --- DIFFERENT TRIP TABLE

CATEGORY	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
ASSIGNED FRWY VMT	55,425,883	53,583,313	53,522,653	55,426,790	52,003,904	51,591,830
STRATEGIC ARTERIAL ASSIGNED VMT	5,830,715*	11,091,311	12,939,664	7,939,074	16,508,103	19,252,877
PRINCIPAL ARTERIAL ASSIGNED VMT	6,347,145	5,832,368	5,923,444	6,254,989	5,624,768	5,712,442
OTHER ARTERIAL ASSIGNED VMT	25,689,517	23,875,462	23,752,214	23,871,855	21,071,020	20,945,129
COLLECTOR ASSIGNED VMT	2,131,975	2,039,985	2,048,668	1,934,142	1,640,189	1,618,156
TOTAL ASSIGNED VMT	95,425,235	96,422,439	98,186,643	95,426,850	96,847,984	99,120,434

* : VMT FOR FACILITIES TO BE UPGRADED TO STRATEGIC ARTERIAL

TABLE IV-E (cont.)

HARRIS COUNTY
CHANGE DUE TO CAPACITY RESTRAINT, TRAVEL PATH AND PATTERN CHANGE
CAPACITY RESTRAINT --- DIFFERENT TRIP TABLE

CATEGORY	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
ASSIGNED FRWY VHT	1,152,321	1,098,075	1,089,202	1,152,335	1,063,318	1,047,041
STRATEGIC ARTERIAL ASSIGNED VHT	191,618**	301,218	360,389	257,818	414,823	486,320
PRINCIPAL ARTERIAL ASSIGNED VHT	205,935	187,201	189,406	203,388	180,678	182,868
OTHER ARTERIAL ASSIGNED VHT	881,865	799,536	791,738	823,933	708,812	703,107
COLLECTOR ASSIGNED VHT	77,045	73,508	72,849	71,305	61,531	60,459
TOTAL ASSIGNED VHT	2,508,784	2,459,538	2,503,584	2,508,779	2,429,162	2,479,795
FRWY WTD AVG SPEED	43	43	43	43	44	46
STRATEGIC ARTERIAL WTD AVG SPEED	30	37	36	31	40	48
PRINCIPAL ARTERIAL WTD AVG SPEED	31	31	31	31	31	34
OTHER ARTERIAL WTD AVG SPEED	29	30	30	29	30	33
COLLECTOR WTD AVG SPEED	28	28	28	27	27	32
TOTAL WTD AVG SPEED	35	37	37	35	37	42

** : VHT FOR FACILITIES TO BE UPGRADED TO STRATEGIC ARTERIAL

TABLE IV-F

HARRIS COUNTY
CHANGE DUE TO CAPACITY RESTRAINT, TRAVEL PATH AND PATTERN CHANGE
CAPACITY RESTRAINT --- DIFFERENT TRIP TABLE

	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
FRWY VMT/CLM	111,096	107,403	107,281	111,098	104,237	103,411
STRATEGIC ARTERIAL VMT/CLM	23,731	43,649	50,924	19,612*	35,809	41,763
PRINCIPAL ARTERIAL VMT/CLM	25,480	23,414	23,779	25,751	23,157	23,518
OTHER ARTERIAL VMT/CLM	15,127	14,059	13,987	15,057	13,291	13,211
COLLECTOR VMT/CLM	4,739	4,534	4,554	4,719	4,001	3,948
TOTAL VMT/CLM	30,373	30,608	31,168	30,373	30,283	30,994

TABLE IV-F (cont.)

HARRIS COUNTY
CHANGE DUE TO CAPACITY RESTRAINT, TRAVEL PATH AND PATTERN CHANGE
CAPACITY RESTRAINT --- DIFFERENT TRIP TABLE

	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
CHANGE FRWY VMT/CLM	----	-3,693	-3,815	----	-6,861	-7,687
CHANGE STRATEGIC ARTERIAL VMT/CLM	----	19,918	27,193	----	16,197	22,151
CHANGE PRIN ART VMT/CLM	----	-2,066	-1,701	----	-2,594	-2,233
CHANGE OTH ART VMT/CLM	----	-1,068	-1,140	----	-1,766	-1,846
CHANGE COLLECTOR VMT/CLM	----	-205	-185	----	-718	-771
CHANGE TOTAL VMT/CLM	----	235	795	----	-90	621
FRWY VMT/LANE MILE	14,823	14,323	14,307	14,823	13,901	13,791
STRATEGIC ARTERIAL VMT/LANE MILE	4,834	7,109	8,294	4,445	5,895	6,875
PRINCIPAL ARTERIAL VMT/LANE MILE	4,966	4,563	4,635	4,991	4,488	4,558
OTHER ARTERIAL VMT/LANE MILE	3,991	3,710	3,690	3,992	3,523	3,502
COLLECTOR VMT/LANE MILE	1,960	1,876	1,883	1,957	1,659	1,637
TOTAL VMT/LANE MILE	6,941	6,837	6,962	6,942	6,560	6,714
CHANGE FRWY VMT/LANE MILE	----	-500	-516	----	-922	-1,032
CHANGE STRAT ART VMT/LANE MILE	----	2,275	3,460	----	1,450	2,430
CHANGE PRIN ART VMT/LANE MILE	----	-403	-331	----	-503	-433
CHANGE OTH ART VMT/LANE MILE	----	-281	-301	----	-469	-490
CHANGE COLLECT. VMT/LANE MILE	----	-84	-77	----	-298	-320
CHANGE TOTAL VMT/LANE MILE	----	-104	21	----	-382	-228

TABLE IV-G

REGION WIDE
CHANGE DUE TO CAPACITY RESTRAINT, TRAVEL PATH AND PATTERN CHANGE
CAPACITY RESTRAINT --- DIFFERENT TRIP TABLE

CATEGORY	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
ASSIGNED FRWY VMT	72,054,142	70,081,564	70,045,751	72,056,398	68,301,484	67,947,780
STRATEGIC ARTERIAL ASSIGNED VMT	7,878,995*	14,155,452	16,410,836	10,172,464	20,044,900	23,158,572
PRINCIPAL ARTERIAL ASSIGNED VMT	9,823,801	9,303,502	9,447,096	9,731,642	9,127,149	9,247,283
OTHER ARTERIAL ASSIGNED VMT	33,318,687	31,412,037	31,316,925	31,418,179	28,572,141	28,465,527
COLLECTOR ASSIGNED VMT	8,684,632	8,502,792	8,544,945	8,382,183	7,992,999	8,016,598
TOTAL ASSIGNED VMT	131,760,257	133,455,347	135,765,553	131,760,866	134,038,673	136,835,760
ASSIGNED FRWY VHT	1,443,613	1,387,434	1,379,518	1,443,645	1,349,483	1,334,990
STRATEGIC ARTERIAL ASSIGNED VHT	240,961**	365,783	433,347	312,161	487,414	566,414
PRINCIPAL ARTERIAL ASSIGNED VHT	292,357	274,012	277,974	289,810	268,490	271,948
OTHER ARTERIAL ASSIGNED VHT	1,070,957	985,362	979,635	1,010,757	893,384	890,259
COLLECTOR ASSIGNED VHT	260,152	253,370	254,088	251,665	238,571	238,954
TOTAL ASSIGNED VHT	3,308,040	3,265,961	3,324,562	3,308,038	3,237,342	3,302,565
FRWY WTD AVG SPEED	50	51	51	50	51	51
STRATEGIC ARTERIAL WTD AVG SPEED	33	39	38	33	41	41
PRINCIPAL ARTERIAL WTD AVG SPEED	----	54	56	----	57	58
OTHER ARTERIAL WTD AVG SPEED	34	34	34	34	34	34
COLLECTOR WTD AVG SPEED	31	32	32	31	32	32
TOTAL WTD AVG SPEED						

* : VMT FOR FACILITIES TO BE UPGRADED TO STRATEGIC ARTERIAL
** : VHT FOR FACILITIES TO BE UPGRADED TO STRATEGIC ARTERIAL

TABLE IV-H

REGION WIDE
CHANGE DUE TO CAPACITY RESTRAINT, TRAVEL PATH AND PATTERN CHANGE
CAPACITY RESTRAINT --- DIFFERENT TRIP TABLE

	350 MILE SYSTEM			600 MILE SYSTEM		
	BASE	+ 5 MPH	+ 10 MPH	BASE	+ 5 MPH	+ 10 MPH
FRWY VMT/CLM	82,348	80,093	80,052	82,350	78,059	77,655
STRATEGIC ARTERIAL VMT/CLM	23,352	40,226	46,635	19,623*	34,519	39,880
PRINCIPAL ARTERIAL VMT/CLM	22,002	20,837	21,158	22,107	20,734	21,007
MINOR ARTERIAL VMT/CLM	13,086	12,337	12,300	12,940	11,768	11,724
COLLECTOR VMT/CLM	3,693	3,615	3,633	3,653	3,483	3,494
TOTAL VMT/CLM	20,095	20,354	20,706	20,097	20,252	20,675
CHANGE FRWY VMT/CLM	----	-2,255	-2,296	----	-4,291	-4,695
CHANGE STRATEGIC ARTERIAL VMT/CLM	----	16,874	23,283	----	14,896	20,257
CHANGE PRIN ART VMT/CLM	----	-1,165	-844	----	-1,373	-1,100
CHANGE OTH ART VMT/CLM	----	-749	-786	----	-1,172	-1,216
CHANGE COLLECTOR VMT/CLM	----	-78	-60	----	-170	-159
CHANGE TOTAL VMT/CLM	----	259	611	----	155	578
FRWY VMT/LANE MILE	12,390	12,047	12,041	12,390	11,741	11,680
STRATEGIC ARTERIAL VMT/LANE MILE	4,722	6,562	7,607	4,394	5,678	6,560
PRINCIPAL ARTERIAL VMT/LANE MILE	4,814	4,559	4,629	4,827	4,528	4,587
OTHER ARTERIAL VMT/LANE MILE	3,774	3,558	3,548	3,761	3,421	3,408
COLLECTOR VMT/LANE MILE	1,733	1,697	1,706	1,723	1,643	1,648
TOTAL VMT/LANE MILE	5,640	5,595	5,692	5,640	5,453	5,567
CHANGE FRWY VMT/LANE MILE	----	-343	-349	----	-649	-710
CHANGE STRAT ART VMT/LANE MILE	----	1,840	2,885	----	1,284	2,166
CHANGE PRIN ART VMT/LANE MILE	----	-255	-185	----	-299	-240
CHANGE OTH ART VMT/LANE MILE	----	-216	-226	----	-340	-353
CHANGE COLLECT. VMT/LANE MILE	----	-36	-27	----	-80	-75
CHANGE TOTAL VMT/LANE MILE	----	-45	52	----	-187	-73

In order to gauge the freeway diversion effects of the strategic arterial systems, Table IV-I has been created. Table IV-I presents the magnitude of VMT change relative to base conditions on the 1,042 links of freeway facilities in the regional network in terms of five categories of change. The results in this table are the final weighted statistic from the five iteration assignments. The proportion of freeway links in each level of change is presented both in terms of percent of total freeway links and total freeway miles due to the fact that the portion of total freeway links in each category is influenced by the manner in which the freeway network has been coded.

TABLE IV-I

CHANGE IN VMT OF FREEWAYS
(RELATIVE TO BASE CONDITIONS)
CAPACITY RESTRAINT --- DIFFERENT TRIP TABLE

	350 MILE SYSTEM		600 MILE SYSTEM	
	+ 5 MPH	+ 10 MPH	+ 5 MPH	+ 10 MPH
NO. FREEWAY LINKS DECREASE > 30,000	7	12	19	27
DECREASE 10,000 - 30,000	127	195	231	274
± 10,000	888	811	778	720
INCREASE 10,000 - 30,000	20	24	14	21
INCREASE > 30,000	0	0	0	0
TOTAL	1,042	1,042	1,042	1,042
% TOT FWY LINKS DECREASE > 30,000	.7%	1.2%	1.8%	2.6%
% TOT FWY LINKS DECREASE 10,000 - 30,000	12.2%	18.7%	22.2%	26.3%
% TOT FWY LINKS ± 10,000	85.2%	77.8%	74.7%	69.1%
% TOT FWY LINKS INCREASE 10,000 - 30,000	1.9%	2.3%	1.3%	2.0%
% TOT FWY LINKS INCREASE > 30,000	.0%	.0%	.0%	.0%
TOTAL	100.0%	100.0%	100.0%	100.0%

TABLE IV-I (cont.)

CHANGE IN VMT OF FREEWAYS
(RELATIVE TO BASE CONDITIONS)
CAPACITY RESTRAINT --- DIFFERENT TRIP TABLE

	350 MILE SYSTEM		600 MILE SYSTEM	
	+ 5 MPH	+ 10 MPH	+ 5 MPH	+ 10 MPH
% TOT FWY MILES DECREASE > 30,000	.4%	.6%	1.2%	1.8%
% TOT FWY MILES DECREASE 10,000 - 30,000	7.6%	12.2%	17.8%	21.6%
% TOT FWY MILES ± 10,000	90.9%	85.9%	80.2%	75.4%
% TOT FWY MILES INCREASE 10,000 - 30,000	1.1%	1.3%	.8%	1.2%
% TOT FWY MILES INCREASE > 30,000	.0%	.0%	.0%	.0%
TOTAL	100.0%	100.0%	100.0%	100.0%

V. DALLAS/FORT WORTH STRATEGIC ARTERIAL ASSIGNMENT RESULTS

The North Central Texas Council of Governments (NCTCOG) in a cooperative effort with the SDHPT's Regional Planning Office (RPO) has recently completed initial traffic projections for proposed strategic arterials in the Dallas/Fort Worth region and has provided the results of their work to this study effort. NCTCOG has actually been evaluating two strategic arterial system alternatives as part of their Mobility 2010 Regional Transportation Plan. One system consists of roughly 1000 miles of facilities submitted by local governments and the second is a 600 mile system of grade-separated arterials provided to NCTCOG by the SDHPT. The results of assignments to both strategic arterial systems have been provided to this study so that they can be compared to the results from the strategic arterial analyses using the Houston data base. Additionally, the results of a non-strategic arterial or "baseline" assignment from the Dallas/Fort Worth region has been provided so that changes from "baseline" conditions resulting from strategic arterial systems can be quantified. This allows comparison of the travel demand effects of the Houston and Dallas/Fort Worth strategic arterial systems. The Houston 600 mile +5 mph strategic arterial system is the most comparable system to one of the Dallas/Fort Worth systems. All comparisons between Houston and Dallas/Fort Worth results are made on this basis.

Table V-A provides some of the characteristics of the strategic arterials from the Dallas/Fort Worth system along with similar characteristics from the Houston system. The strategic arterials of the 600 mile +5 mph Houston strategic arterial system are comparable to those in the Dallas/Fort Worth system in terms of the typical number of lanes. Most of the strategic arterials in the Houston system are 6-lane with only those which were more than 6-lane in their baseline condition being more than 6-lane. The free speed of the Dallas/Fort Worth strategic arterials is comparable to the average speed of the strategic arterials of the Houston system from the all-or-nothing assignment.

TABLE V-A.
COMPARISON OF STRATEGIC ARTERIAL CHARACTERISTICS
FROM DALLAS/FORT WORTH AND HOUSTON SYSTEMS

Characteristic	Dallas/Fort Worth Strategic Arterials	600 Mile + 5 MPH Houston Strategic Arterials
Lanes (Typical)	6	6
Speed	44 MPH*	44 MPH**
Capacity	1200 Vehicles Per Lane Per Hour	38,500-65,000***

*Free Speed
**Average Speed from all-or-nothing assignment
***Varies by area type - 24 hour capacity

Table V-B presents summary statistics from the two strategic arterial forecasts performed by the NCTCOG. For comparative purposes, the results of the baseline alternative (Alternative 1) are also presented.

The results of the Houston 600 mile +5 mph strategic arterial system assignment are comparable to those from the Dallas/Fort Worth strategic arterial forecast for the 600 mile system. The reduction of 685 VMT per lane mile on Dallas/Fort Worth area freeways represents a decrease of 7.3%. The reduction in VMT per lane mile on freeways achieved with the Houston system was 919 VMT per lane mile. This represents a reduction of 7.4% from the baseline value. It is felt, therefore, that the Houston strategic arterial system produces very comparable results to the Dallas/Fort Worth system in terms of reductions in freeway traffic, which is one of the primary focuses of the strategic arterial analyses.

TABLE V-B

DALLAS/FORT WORTH STRATEGIC ARTERIAL
ASSIGNMENT RESULTS

	ALTERNATIVE 1 BASE	ALTERNATIVE 3A 1000 MILE SYSTEM	ALTERNATIVE 3B 600 MILE SYSTEM
LANE MILES			
FREEWAYS,RAMPS AND FRONTAGE ROADS	8,316	8,316	8,316
PRINCIPALS,MINORS AND COLLECTORS	22,090	27,056	25,765
TOTAL	30,406	35,372	34,081
VMT - MILLIONS			
FREEWAYS,RAMPS AND FRONTAGE ROADS	78.4	70.7	72.7
PRINCIPALS,MINORS AND COLLECTORS	45.9	52.5	51.0
TOTAL	124.3	123.2	123.7
VMT PER LANE MILE			
FREEWAYS,RAMPS AND FRONTAGE ROADS	9,428	8,502	8,742
PRINCIPALS,MINORS AND COLLECTORS	2,078	1,940	1,979
TOTAL	4,088	3,483	3,630
CHANGE VMT PER LANE MILE (RELATIVE TO BASE)			
FREEWAYS,RAMPS AND FRONTAGE ROADS	---	-926(-9.8%)	-685(-7.3%)
PRINCIPALS,MINORS AND COLLECTORS	---	-137(-6.6%)	-98(-4.7%)
TOTAL	---	-605(-14.8%)	-458(-11.2%)

Table V-C presents data which quantify the diversion impacts of the strategic arterial system on freeways. The diversion impacts on freeways from the Houston strategic arterial analysis are presented alongside the data from the Dallas/Fort Worth analysis for comparative purposes. Again, the Houston data are from the 600 mile +5 mph system.

The data show that the proportion of total freeway segments which realized VMT increases of more than 10,000 relative to base conditions in the Houston system is slightly less than in the Dallas/Fort Worth system. However, the proportion of total freeway

TABLE V-C

CHANGE IN FREEWAY VOLUMES (Vehicle Miles of Travel)

DALLAS/FORT WORTH AND HOUSTON STRATEGIC ARTERIAL SYSTEMS

	Number of Freeway Segments (Two-Way)		Percent of Freeway Segments	
	Dallas/Ft. Worth	Houston	Dallas/Ft. Worth	Houston
Decrease > 30,000	60	23	3.7%	2.2%
Decrease 12,000 to 30,000	350	287	21.6%	27.5%
± 10,000	1130	730	69.8%	70.0%
Increase 10,000 to 30,000	60	2	3.7%	0.2%
Increase > 30,000	20	0	1.2%	-
Total	1620	1042	100.0%	100.0%

segments which changed 10,000 VMT or less in the Houston system corresponded almost exactly with that from the Dallas/Fort Worth system. The Dallas/Fort Worth strategic arterial system resulted in roughly 25% of the freeway segments having VMT reduced by more than 10,000 relative to base conditions. The proportion of total freeway segments which had a reduction of more than 10,000 or more VMT in the Houston system was roughly 30%. This value corresponds to the 25% of Dallas/Fort Worth system.

Upon reviewing the NCTCOG strategic arterial forecast for the Dallas/Fort Worth region alongside the results of the analysis of the 600 mile +5 mph Houston strategic arterial system, the results from the Houston analysis appear to be comparable to those from the Dallas/Fort Worth region.

VI. CONCLUSIONS

Prior to the traffic assignment analysis phase of this study, it was felt that speed sensitivity would be one of the important, if not the most important issues of the strategic arterial system evaluations. This is the reason, at least in part, for the decision to make assignments at two levels of strategic arterial speed advantage.

Upon review of the results of the all-or-nothing assignments to the strategic arterial systems with and without speed advantages, the hypothesis that speed sensitivity of the strategic arterial systems was an issue to focus on appears to have been a valid one. In assignments to both the 350 mile and 600 mile strategic arterial system networks, the +5 mph systems result in the diversion of significant amounts of VMT from freeways and other facilities to strategic arterials. The +10 mph strategic arterial speed condition resulted in a significant increase in diversion of VMT from non-strategic arterial facilities, particularly freeways, relative to the +5 mph condition. In fact, the level of increase of diversion of VMT to strategic arterials from these facilities between the +5 mph and +10 mph conditions is greater than that between the base and +5 mph conditions.

The results of the all-or-nothing assignments on a centerline mile and lane mile basis, underscore the effectiveness of strategic arterial systems in both the +5 mph and +10 mph conditions in diverting VMT from freeways. However, both the 350 and 600 mile strategic arterial systems in the +10 mph condition divert twice as much VMT per centerline mile and per lane mile from the freeway to the strategic arterials as does the strategic arterial systems in the +5 mph condition.

The capacity restraint assignment results provide a very different view of the influence of speed on VMT changes resulting from the strategic arterial system. The strategic arterials of the 350 and 600 mile +5 and +10 mph systems are made so attractive in terms of travel time by increasing their speed relative to the rest of the network that the amount of traffic desiring to use the facilities is more than could be effectively accommodated by the capacity. Therefore, capacity restraint removed VMT from the strategic arterials back to the non-strategic arterial facilities, particularly freeways. In the extreme, capacity restraint resulted in 45 percent less VMT being diverted off freeway facilities than in the assignments representing the pure desire paths (all-or-nothing). The results of the assignments seem to indicate that regardless of the level of speed increase, overloading of the strategic arterial facilities relative to effective capacity would have occurred.

It appears that the assignments to both the 600 mile and 350 mile strategic arterial systems, despite the initial speed differences are working toward a "common" solution. The results of the two all-or-nothing assignments to a strategic arterial system (one for each speed condition) are very different. The effects of strategic arterial speed advantages are most visible at this point. When capacity restraint is applied, many of the differences in the assignment results begin to diminish. With each iteration of capacity restraint, VMT is removed from strategic arterials to a level just below their capacity. When the results of each assignment is summed into a final statistic weighted by the all-or-nothing and five capacity restraint assignments, they are not very different. It is probable that given a sufficient number of capacity restraint iterations, the results of the assignments to a strategic arterial system in different speed conditions would be, for all practical purposes, the same due to the fact that the capacities of the strategic arterials are the same in each strategic arterial network used in the assignments.

Clearly, capacity and not speed is the ultimate determinant in terms of the magnitude of VMT diversion. Assuming all other characteristics to be equal, speed is very important in determining the level of VMT diversion due to a strategic arterial system. However, the results of the capacity restrained assignments show that capacity is a variable which can greatly affect and sometimes overwhelm diversion of VMT as a result of speed adjustments to the strategic arterial networks. Undoubtedly, the key issue in determining the ability of any strategic arterial facility or system to divert VMT from the freeway and other facilities to strategic arterials is not what speed the facilities will operate under but rather to what level of capacity they will be built.