C.R. 296/S.R. 686/I-275

INTERCHANGE JUSTIFICATION REPORT

Prepared For:

FLORIDA DEPARTMENT OF TRANSPORTATION

Prepared By:

GREINER, INC.

SEPTEMBER 1988

COUNTY PROJECT
NO PROJECT NUMBER

C.R. 296/S.R. 686/I-275
INTERCHANGE JUSTIFICATION REPORT

Prepared For:

FLORIDA DEPARTMENT OF TRANSPORTATION

Prepared By:

GREINER, INC.

SEPTEMBER 1988

TABLE OF CONTENTS

LIST OF TABLES

LIST OF EXHIBITS

INTRODUCTION

Pinellas County is requesting modifications to the Roosevelt Boulevard (S.R. 686) interchange with I-275 in Pinellas County, Florida. The modifications to the interchange will provide full access from the extension of C.R. 296 (118th Avenue) to I-275. The interchange modifications are an integral part of the Pinellas County Year 2010 Long Range Highway Plan as recently amended.

Greiner, Inc. has been requested by the Florida Department of Transportation (FDOT) to analyze the impact of the modified interchange on the operation and safety on I-275.

The purpose of this report is to present FDOT and the Federal Highway Administration (FHWA) with documentation to justify the proposed modifications to the existing interchange. To accomplish this, the report discusses the need for the project and the project's relationship to the area's transportation system, as well as the traffic operations, safety, and capacity impacts of the interchange modifications. The costs for the proposed modifications to the interchange are also addressed.

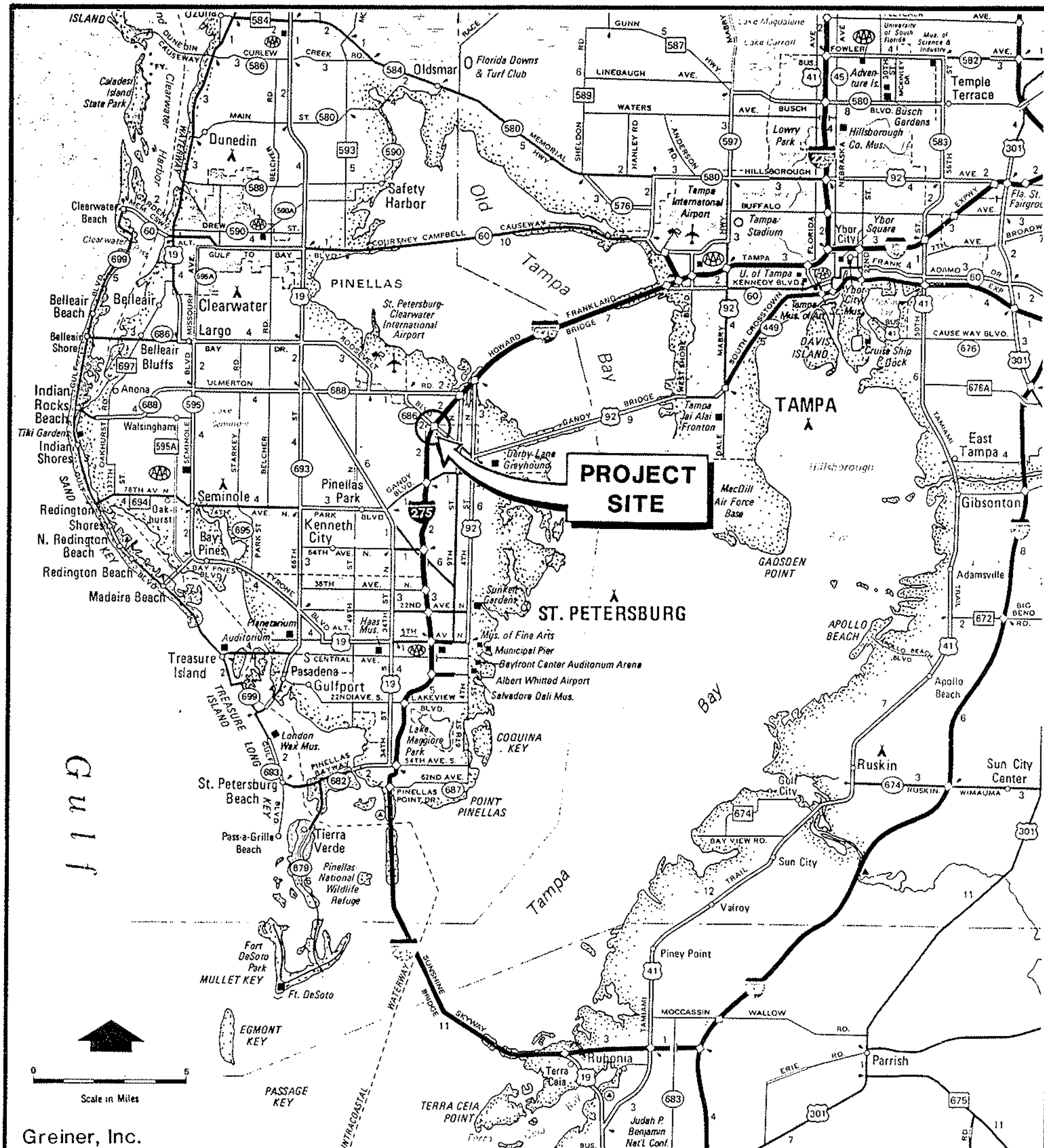
The appendices of this document contain support documentation for the traffic operations calculations and a conceptual plan for the interchange modification.

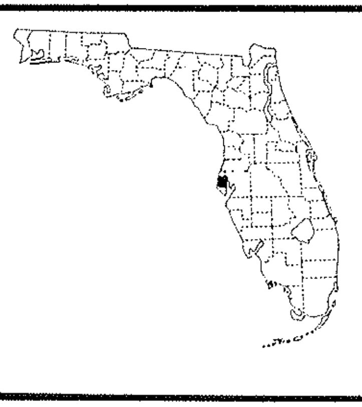
DESCRIPTION OF THE PROPOSED ACTION

The I-275 and Roosevelt Boulevard (S.R. 686) interchange is located in St. Petersburg, Florida. Exhibit 1 illustrates the project location.

The proposed modification of the I-275 and Roosevelt Boulevard (S.R. 686) interchange is in conjunction with the improvements to 49th Street and C.R. 296 proposed by Pinellas County. The recommended alternative alignment for C.R. 296 (118th Avenue) approved by the Pinellas County Board of County Commissioners (BOCC) included a six-lane expressway section with frontage roads from U.S. 19 to I-275. The improvements to C.R. 296 and the interchange modifications will alleviate existing capacity deficiencies in the system. This proposed section of 118th Avenue is also part of an effort to accelerate construction of a major north-south/east-west expressway from Pasco County to I-275. All the movements for the existing interchange will be retained. Directional ramp connections to I-275 from both Roosevelt Boulevard (S.R. 686) and 118th Avenue will be provided. The proposed ramp configuration will provide access for 118th Avenue to and from the north and south of I-275.

The implementation of C.R. 296, as approved by the BOCC, required modification to the Pinellas County Year 2010 Long Range Transportation Plan. The Transportation Plan initially included 118th Avenue as a six-lane arterial terminating at 28th Street. At its April 22, 1988 meeting, the Pinellas County Metropolitan Planning Organization (MPO) amended the Long Range Transportation Plan to include 118th Avenue as a six-lane expressway from U.S. 19 to I-275, including the interchange modifications.





FLORIDA DEPARTMENT OF TRANSPORTATION

INTERCHANGE JUSTIFICATION REPORT

C.R. 296/S.R. 686/I-275
INTERCHANGE

Pinellas County, Florida

LOCATION MAP

EXHIBIT 1

The plan amendment also included upgrading 49th Street from S.R. 686 to U.S. 19 as a six-lane expressway.

Constructing 118th Avenue as a six-lane expressway with a direct connection from 49th Street to I-275 will help facilitate traffic flow in a severely congested area. The proposed expressway, with the proposed improvements on 49th Street, will act as an immediate reliever to the current traffic congestion on U.S. 19 and Ulmerton Road (S.R. 688), as well as other east-west arterials, such as Park Boulevard to the south.

JUSTIFICATION OF THE PROPOSED ACTION

Pinellas County has experienced a 54 percent population increase from 1970 to 1985 (from 522,329 to 803,700, respectively). The Pinellas County Planning Department has projected the total population in Pinellas County to increase by 16 percent between 1985-1990, and an additional 14 percent between 1990-2000. These figures represent resident population, which is the sum of permanent and seasonal residents.

The population growth projected for Pinellas County will increase the travel demand on the area's roadway system. Network traffic forecasts for the year 2010 indicate that several roadway improvements are needed to meet this travel demand. One of these improvements is a six-lane expressway facility along the C.R. 296 corridor from U.S. 19 to I-275, where a modification of the existing Roosevelt Boulevard (S.R. 686) and I-275 interchange will provide C.R. 296 with access to and from the north and the south on I-275. The conceptual design for the modification of the Roosevelt Boulevard (S.R. 686) and I-275 interchange is illustrated on aerial photography contained in Appendix A. This proposed action would also provide relief for other east-west roadways such as Ulmerton Road (S.R. 688) and Park Boulevard. C.R. 296 will carry in excess of 60,000 vehicles per day, with two-thirds of this traffic being diverted from Ulmerton Road (S.R. 688) and one-third being diverted from Park Boulevard. If a six-lane expressway with access to I-275 is not built along the C.R. 296 corridor, traffic forecasts indicate severely congested conditions for Ulmerton Road (S.R. 688) and Park Boulevard with each operating at Level of Service F by the design year (2010). With the proposed action, Ulmerton Road (S.R. 688) and Park

Boulevard will operate at an acceptable Level of Service D in the design year (2010). Details of alternative traffic operations are included in the C.R. 296 and S.R. 686 study reports.

The following sections of this report provide the engineering justification of the proposed project. The issues addressed include the existing, opening year (1993), and design year (2010) roadway improvements, traffic volumes, safety, and implementation of the proposed action. Due to the nature of the Interstate's function to carry inter-regional traffic, particular attention has been focused on what impact the proposed action will have on traffic operations on I-275.

Area Street System

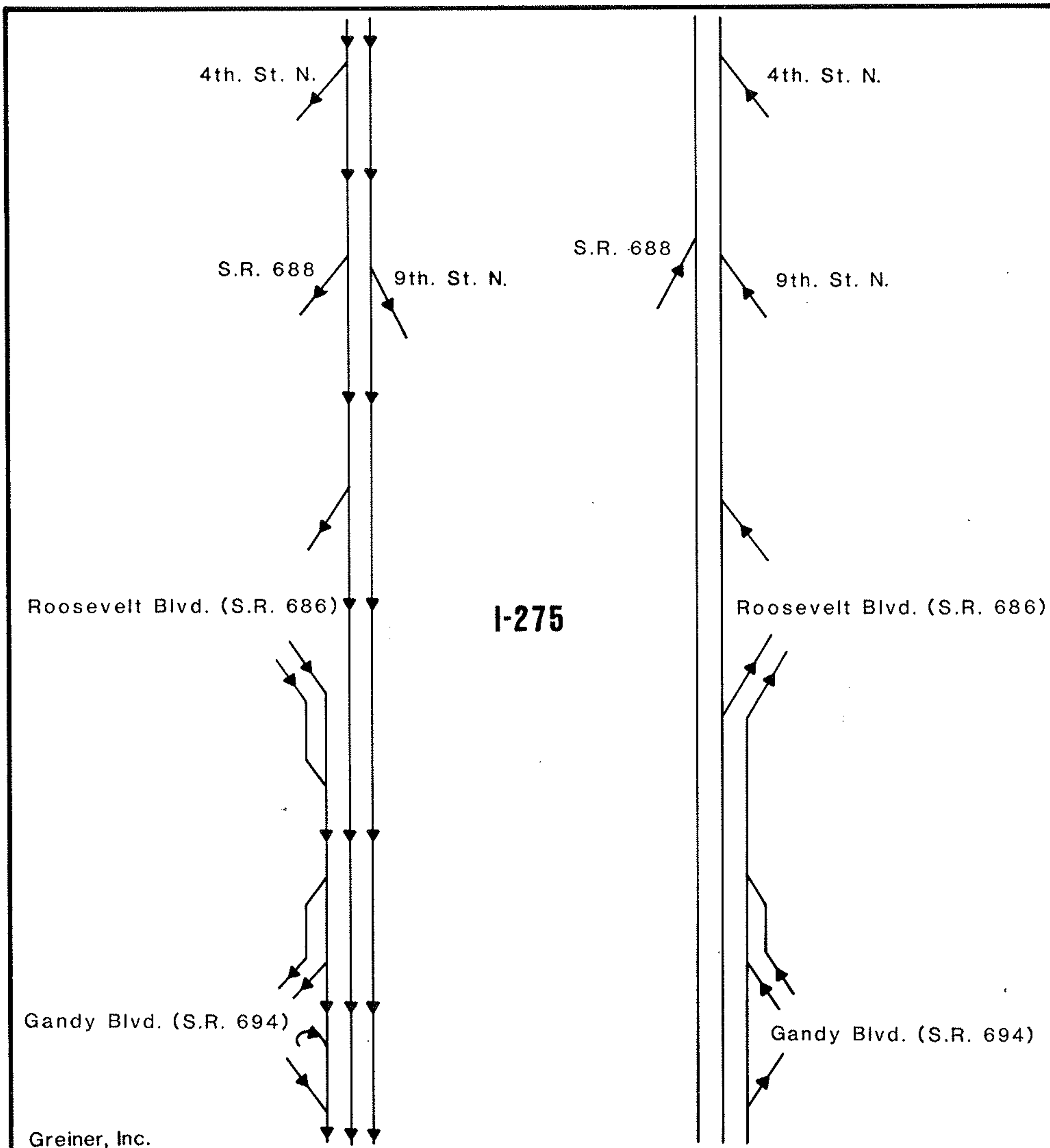
As shown previously in Exhibit 1, I-275 runs primarily north and south in the vicinity of the proposed interchange modification. I-275 interchanges with the principal east-west routes of Gandy Boulevard (S.R. 694), Roosevelt Boulevard (S.R. 686), and Ulmerton Road (S.R. 688) and the principal north-south routes of 9th Street North and 4th Street North. The following paragraphs describe the existing facilities.

Interstate 275 (I-275) runs primarily north and south in the vicinity of the proposed action. North of the site, I-275 takes a northeasterly route connecting Hillsborough and Pinellas Counties over Tampa Bay via the Howard Frankland Bridge. South of the site, I-275 takes a southerly route through St. Petersburg providing access to and from the Sarasota-Bradenton areas over Tampa Bay via the Sunshine Skyway Bridge.

I-275 is a six-lane divided controlled access freeway south of the proposed project and a four-lane divided facility north of the proposed project on the Federal Aid Primary System. The existing laneage of the I-275 mainline facility and the configuration of the ramps are shown schematically in Exhibit 2. A lane drop northbound and a lane add-on southbound occurs on the south side of the existing Roosevelt Boulevard (S.R. 686) and I-275 interchange.

The portion of I-275 between 4th Street North and Gandy Boulevard (S.R. 694) in Pinellas County covers a distance of approximately 4.6 miles. There are five existing freeway interchanges within the study area. A full access interchange is currently provided at Roosevelt Boulevard (S.R. 686). The interchanges located at 9th Street North, Ulmerton Road (S.R. 688), and 4th Street North provide only partial access to and from the north. This section of I-275 was constructed in 1959 using design guidelines that were acceptable at that time. In order to reduce the number of grade separations required, a left-hand entrance ramp was constructed for Ulmerton Road to northbound I-275 and a left-hand exit was constructed for southbound I-275 to 9th Street North. The Gandy Boulevard (S.R. 694) interchange provides access for all movements except westbound Gandy Boulevard (S.R. 694) to northbound I-275 and the reverse movement. The interchange configurations and spacing along I-275 are illustrated in Exhibit 3.

Roosevelt Boulevard (S.R. 686) is a primary east-west, four-lane, divided arterial on the Federal Aid Urban System in Pinellas County. It extends from Gulf Boulevard (S.R. 699) on the west and to Gandy Boulevard (S.R. 694) on the east. From U.S. 19 to Gandy Boulevard (S.R. 694), Roosevelt Boulevard (S.R. 686) traverses a rapidly growing portion of Pinellas County referred to as the Gateway area. Due to



FLORIDA DEPARTMENT OF TRANSPORTATION

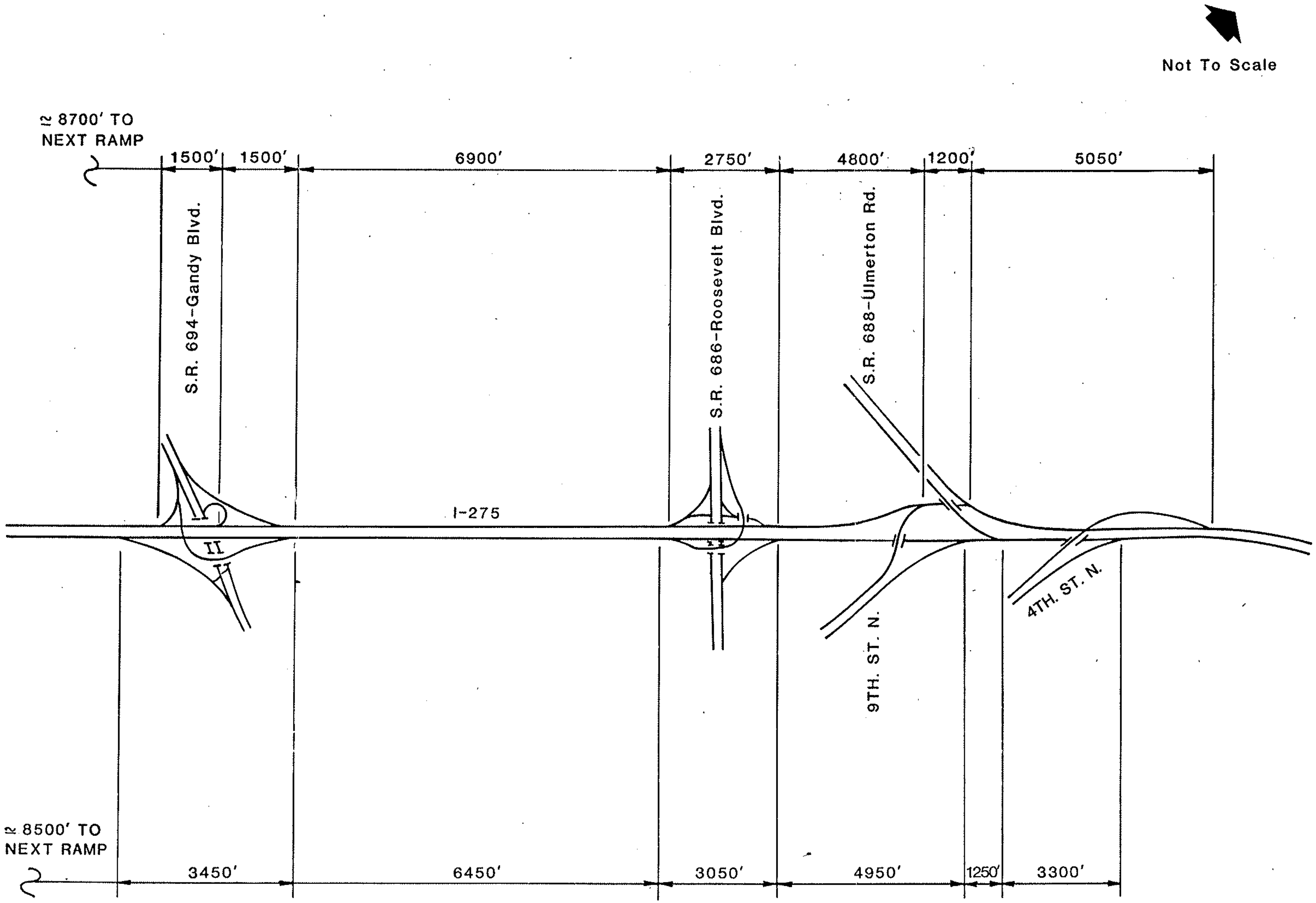
INTERCHANGE JUSTIFICATION REPORT

C.R. 296/S.R. 686/I-275
INTERCHANGE

Pinellas County, Florida

MAINLINE AND RAMP LANEAGE EXISTING CONDITIONS

EXHIBIT 2



Greiner, Inc.

FLORIDA DEPARTMENT OF TRANSPORTATION

INTERCHANGE JUSTIFICATION REPORT

C.R. 296/S.R. 686/I-275
INTERCHANGE

Pinellas County, Florida

INTERCHANGE LOCATIONS AND SPACING ON I-275

EXHIBIT 3

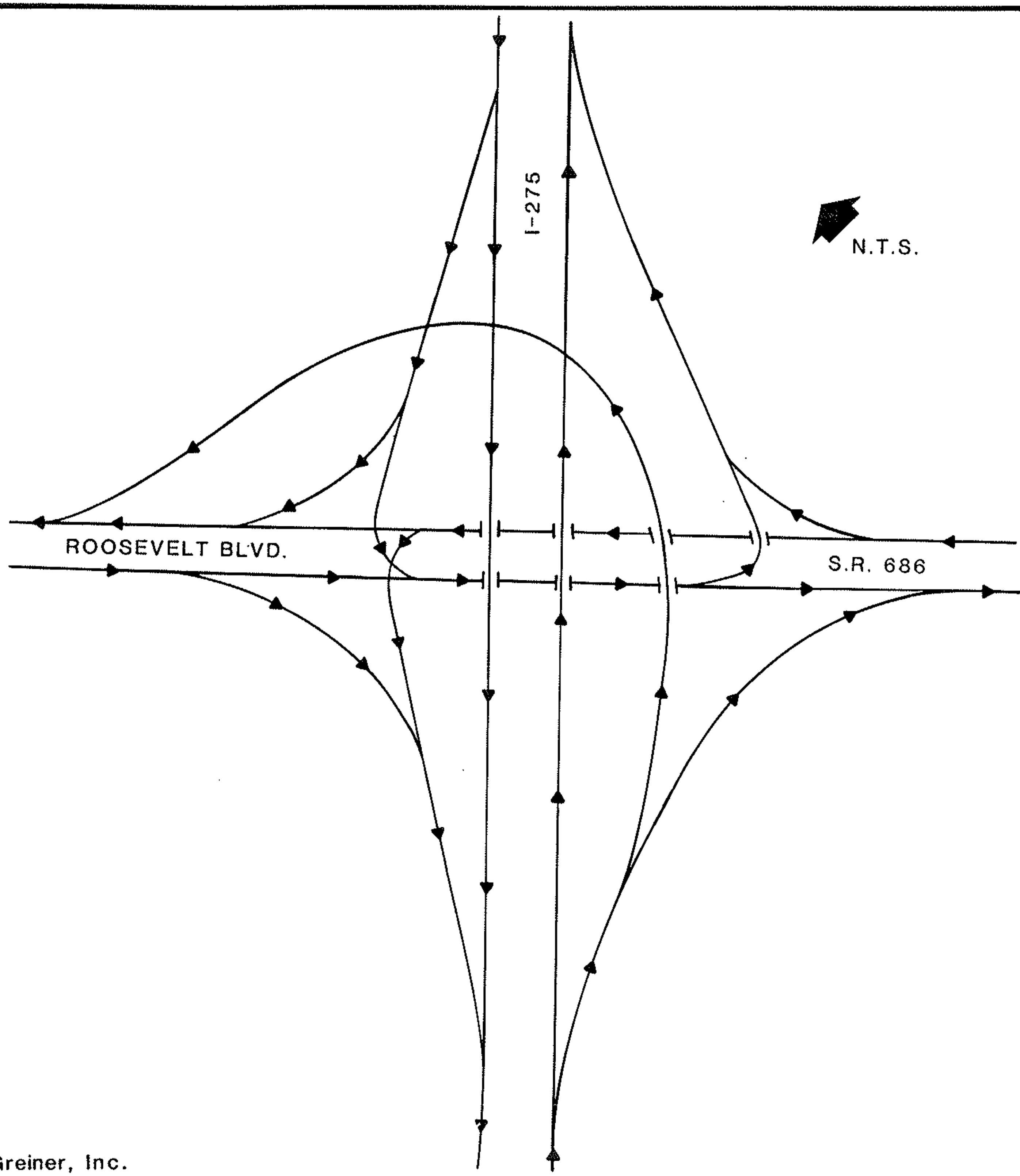
development locations and geographic constraints, S.R. 686 carries both north-south and east-west traffic from U.S. 19 to the interchange of I-275, which is shown on Exhibit 4. In addition, a segment of S.R. 686 is co-located with Ulmerton Road (S.R. 688). This existing roadway configuration focuses traffic in the eastern portion of the county through this co-located segment, severely restricting the available capacity of the system. The proposed action will alleviate this capacity restriction by providing an alternative major east-west route to I-275.

Ulmerton Road (S.R. 688) is an east-west principal arterial on the Federal Aid Urban System traversing the entire width of the Pinellas County peninsula. Ulmerton Road's eastern terminus occurs at its interchange with I-275. Immediately west of I-275, Ulmerton Road is a four-lane divided roadway carrying approximately 21,000 vpd.

9th Street North is a north-south arterial serving the St. Petersburg area allowing vehicles to access I-275 from the south. Its northern terminus occurs at its interchange with I-275. In this area, 9th Street North is a four-lane divided roadway carrying approximately 2,800 vpd.

4th Street North is a north-south arterial paralleling 9th Street North to the east. At its interchange with I-275 it is a four-lane divided roadway carrying approximately 7,400 vpd.

118th Avenue is a two-lane east-west arterial that has its eastern terminus at 28th Street.



Greiner, Inc.

FLORIDA DEPARTMENT OF TRANSPORTATION

INTERCHANGE JUSTIFICATION REPORT

C.R. 296/S.R. 686/I-275
INTERCHANGE

Pinellas County, Florida

EXISTING INTERCHANGE CONFIGURATION

EXHIBIT 4

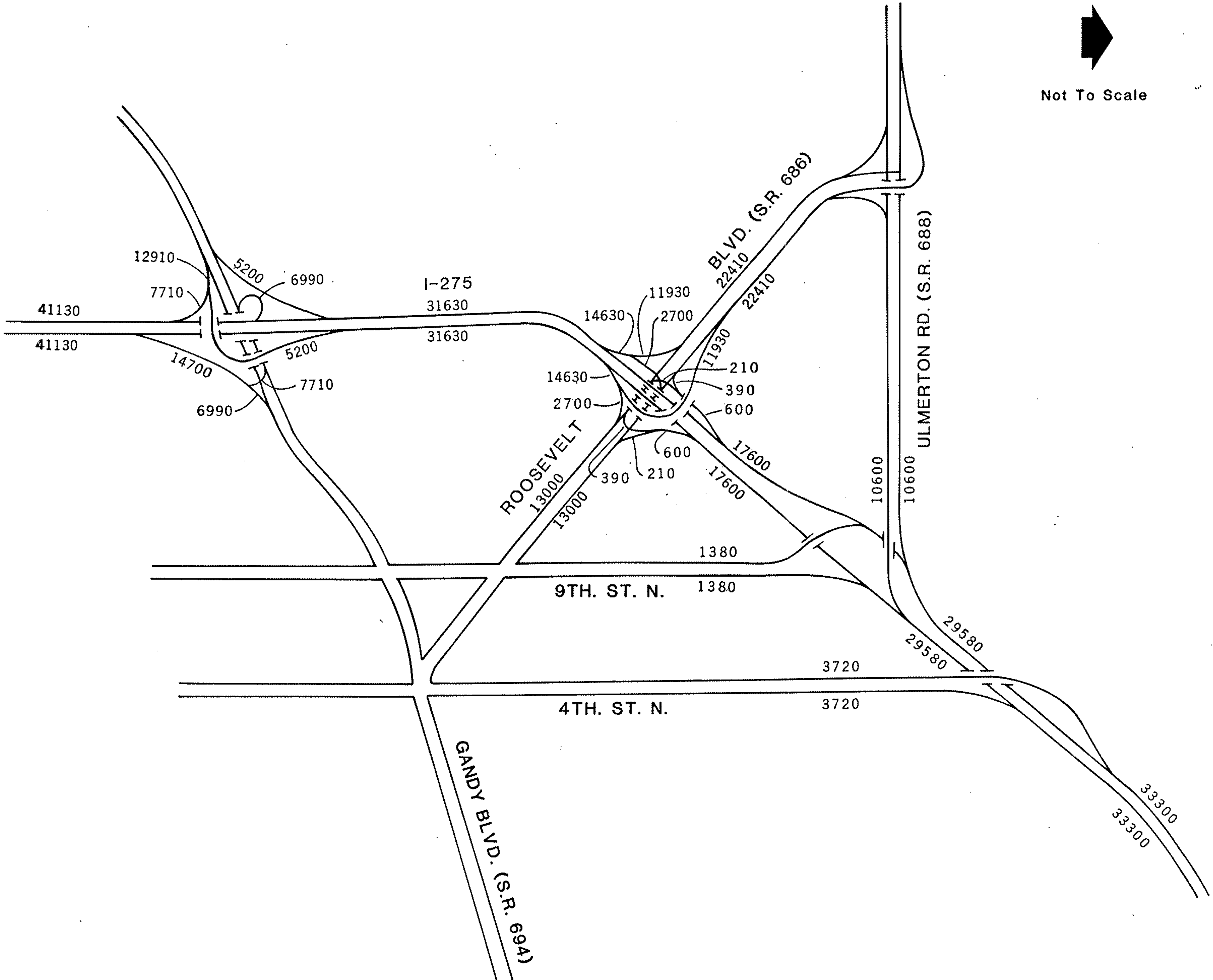
28th Street is a two-lane north-south arterial that has its northern terminus at Roosevelt Boulevard (S.R. 686).

Traffic Volumes

The existing average daily traffic (ADT) and peak-hour (AM and PM) volumes were obtained from various on-going or recently completed studies within the area including the C.R. 296 Corridor Study, the S.R. 686 (East Bay Drive/Roosevelt Boulevard) Project Development and Environmental (PD&E) Study, and the Howard Frankland Bridge Study. In addition, Greiner, Inc. conducted existing traffic counts on the I-275/Gandy Boulevard interchange ramps. The existing ADT's and peak-hour (AM and PM) traffic volumes are illustrated in Exhibits 5 and 6, respectively.

To assess the impact of the proposed project, traffic volumes were projected to 2010, the design year for the proposed interchange modification. Sources for the design year traffic volumes included the projections by the MPO based on the PATS travel demand model for the S.R. 686 PD&E study and the intercounty travel projections developed for the Howard Frankland Bridge Study. The design year 2010 traffic volumes were then backed down by a straight-line percentage of 2.5 per year to obtain the opening year (1993) traffic volumes.

The ADTs were then converted to directional design hourly volumes (DDHV's) using a "K" factor of 8 percent and a "D" factor of 55 percent. The "K" and "D" conversion factors were determined based on other studies (previously mentioned) being conducted in the area. For opening year (1993), the lane configuration for the I-275



Greiner, Inc.

FLORIDA DEPARTMENT OF TRANSPORTATION

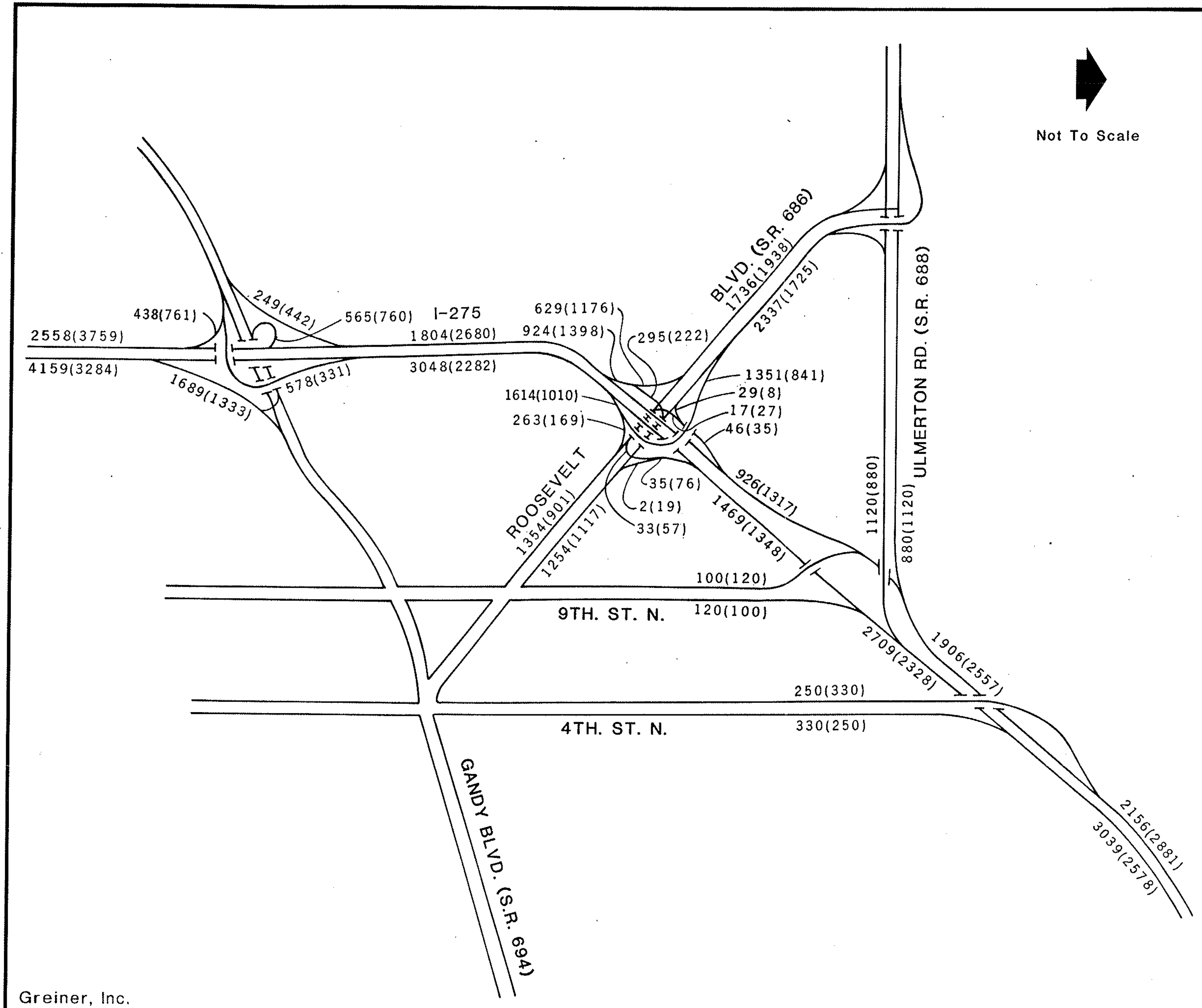
INTERCHANGE JUSTIFICATION REPORT

C.R. 296/S.R. 686/I-275 INTERCHANGE

Pinellas County, Florida

EXISTING (1988) DAILY TRAFFIC VOLUMES

EXHIBIT 5



LEGEND

XX - A.M. Peak Hour
(XX) - P.M. Peak Hour

FLORIDA DEPARTMENT OF TRANSPORTATION

INTERCHANGE JUSTIFICATION REPORT

C.R. 296/S.R. 686/I-275 INTERCHANGE

Pinellas County, Florida

EXISTING (1988) A.M. & P.M. PEAK HOUR TRAFFIC VOLUMES

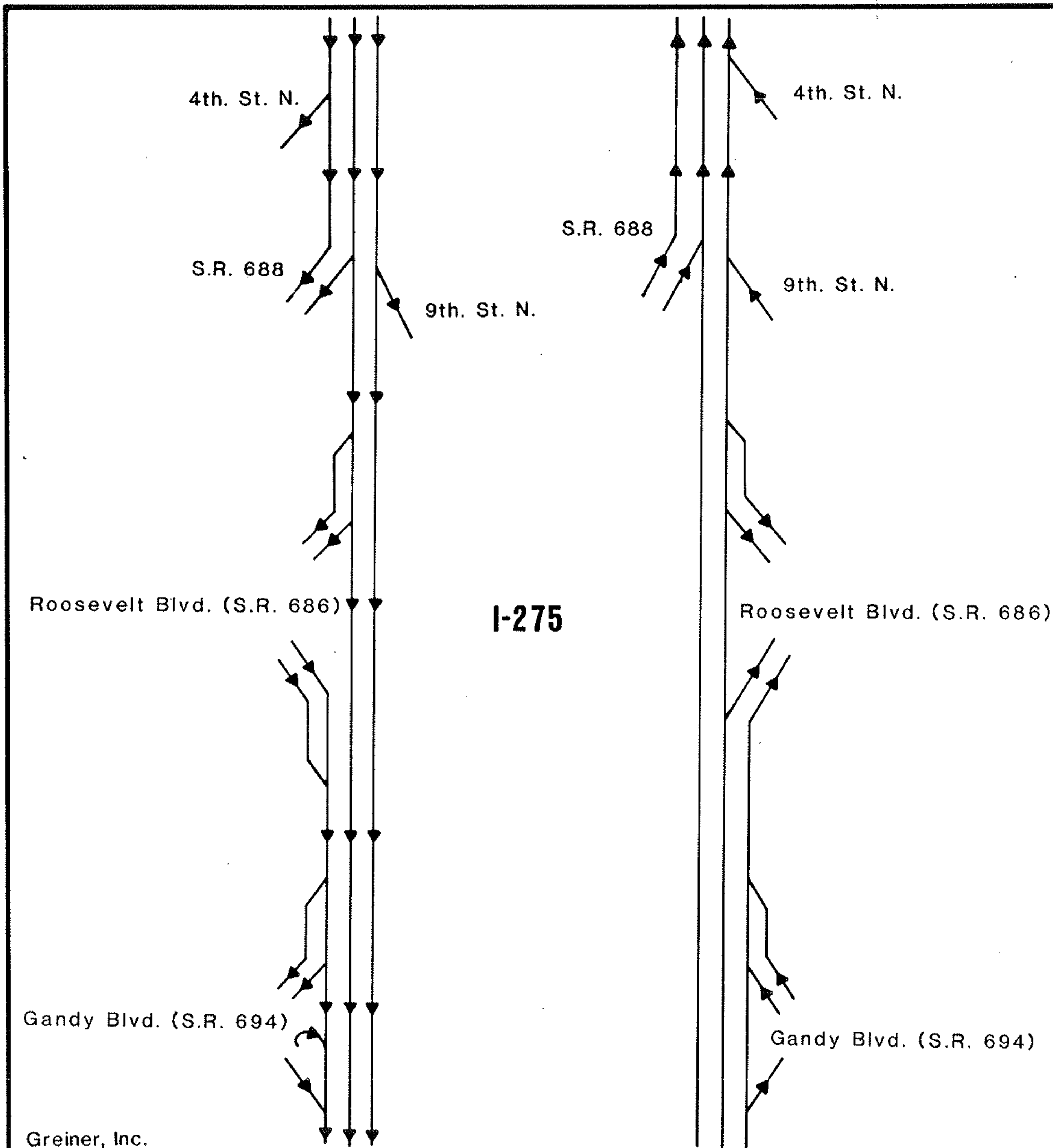
EXHIBIT 6

mainline and ramps is illustrated in Exhibit 7 and the 1993 ADT's and DDHV's are shown in Exhibits 8 and 9, respectively. For the design year (2010), the lane configuration for the I-275 mainline and ramps is illustrated in Exhibit 10 and the 2010 ADT's and DDHV's are shown in Exhibits 11 and 12.

Existing Traffic Operations

Utilizing the existing peak-hour volumes, traffic operation analyses were conducted for the mainline of I-275 for the Roosevelt Boulevard (S.R. 686) interchange (interchange proposed to be modified) and the adjacent interchanges. The distances between the freeway ramps (as illustrated in Exhibit 3) are such that they are beyond the realm of weaving as defined in the 1985 Highway Capacity Manual. In addition, no auxiliary lanes are provided between interchanges. Therefore, the ramp junction merge and diverge capacities were evaluated using the methodology described in Chapter 5, Ramps and Ramp Junctions, of the 1985 Highway Capacity Manual. The capacity calculations for the ramp junctions are contained in Appendix B.

Table 1 summarizes the level of service for existing conditions on I-275. As seen in the table, the existing operating conditions for the mainline and ramp junctions of I-275 include two areas operating at an unacceptable level of service (below LOS D). The northbound off ramp at Gandy Boulevard (S.R. 694) operates at LOS F in the AM peak-hour. This is due to a high diverge volume of 2,035 pcph which proceeds easterly on Gandy Boulevard to gain access to the Gandy Bridge over Tampa Bay to the City of Tampa. Dual off-ramps would mitigate this deficiency and enable the I-275 northbound off-ramp at Gandy Boulevard to provide an acceptable Level of



FLORIDA DEPARTMENT OF TRANSPORTATION

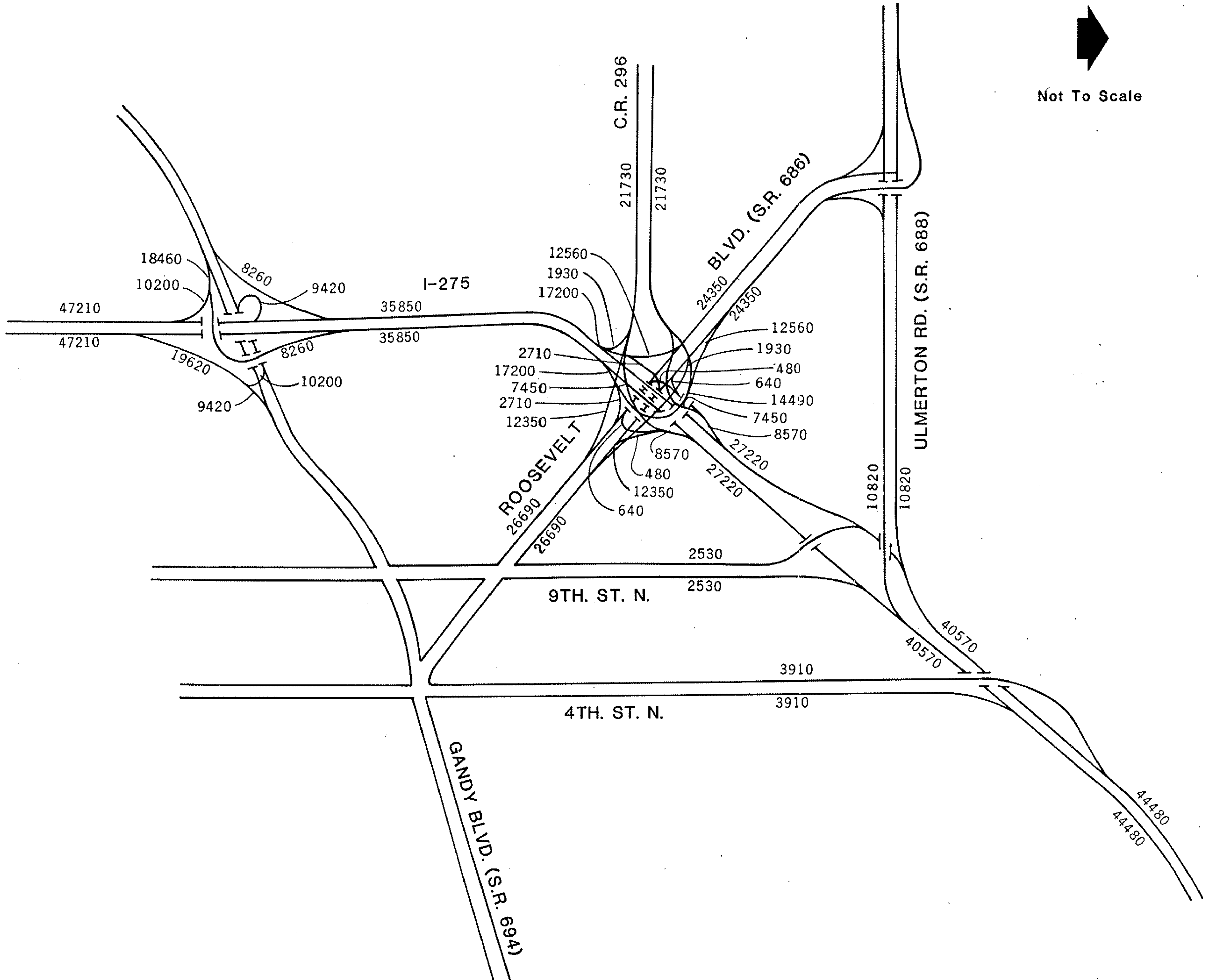
INTERCHANGE JUSTIFICATION REPORT

C.R. 296/S.R. 686/I-275 INTERCHANGE

Pinellas County, Florida

MAINLINE AND RAMP LANEAGE OPENING YEAR (1993)

EXHIBIT 7



Greiner, Inc.

FLORIDA DEPARTMENT OF TRANSPORTATION

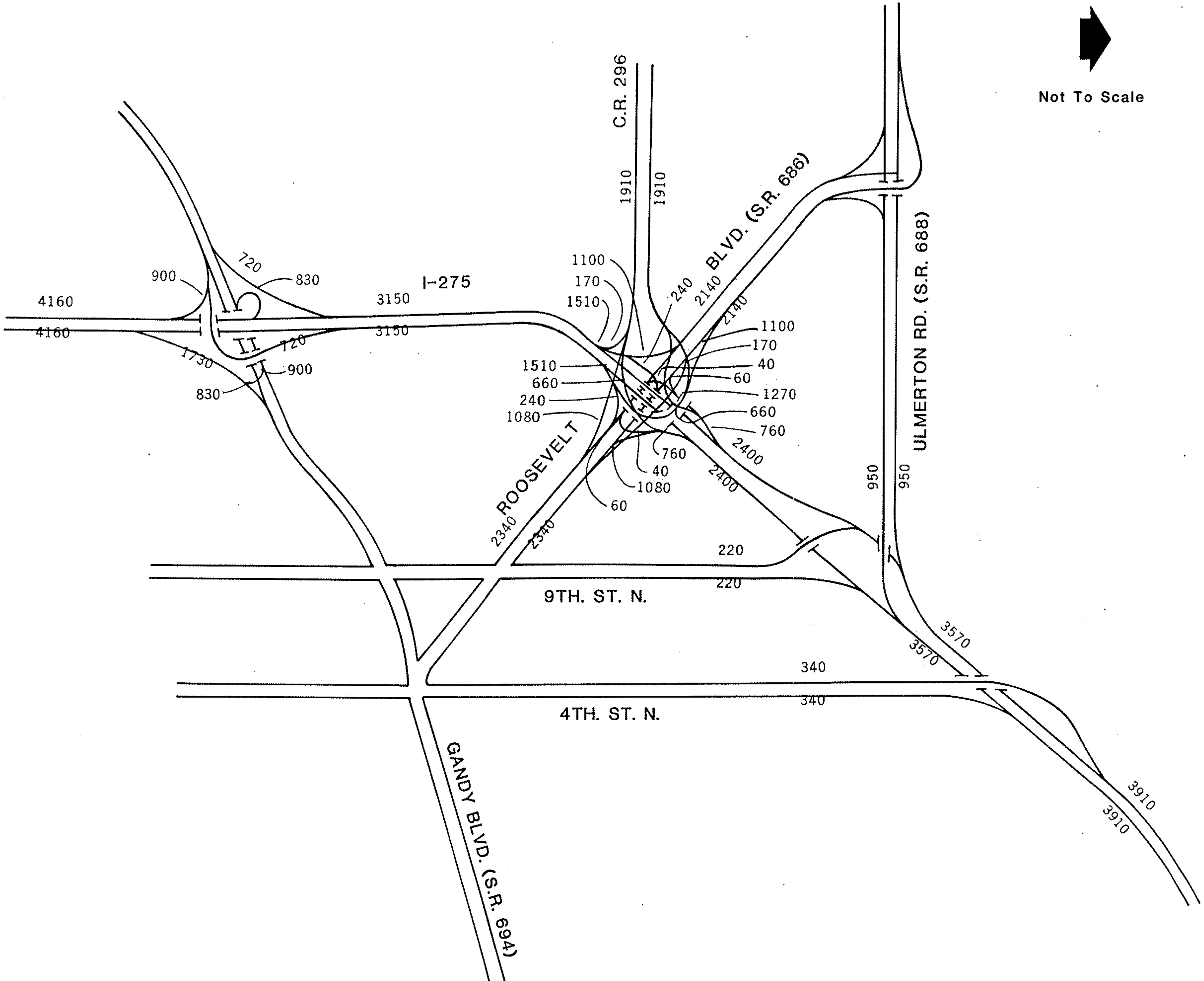
INTERCHANGE JUSTIFICATION REPORT

C.R. 296/S.R. 686/I-275 INTERCHANGE

Pinellas County, Florida

OPENING YEAR (1993) DAILY TRAFFIC VOLUMES

EXHIBIT 8



Greiner, Inc.

FLORIDA DEPARTMENT OF TRANSPORTATION

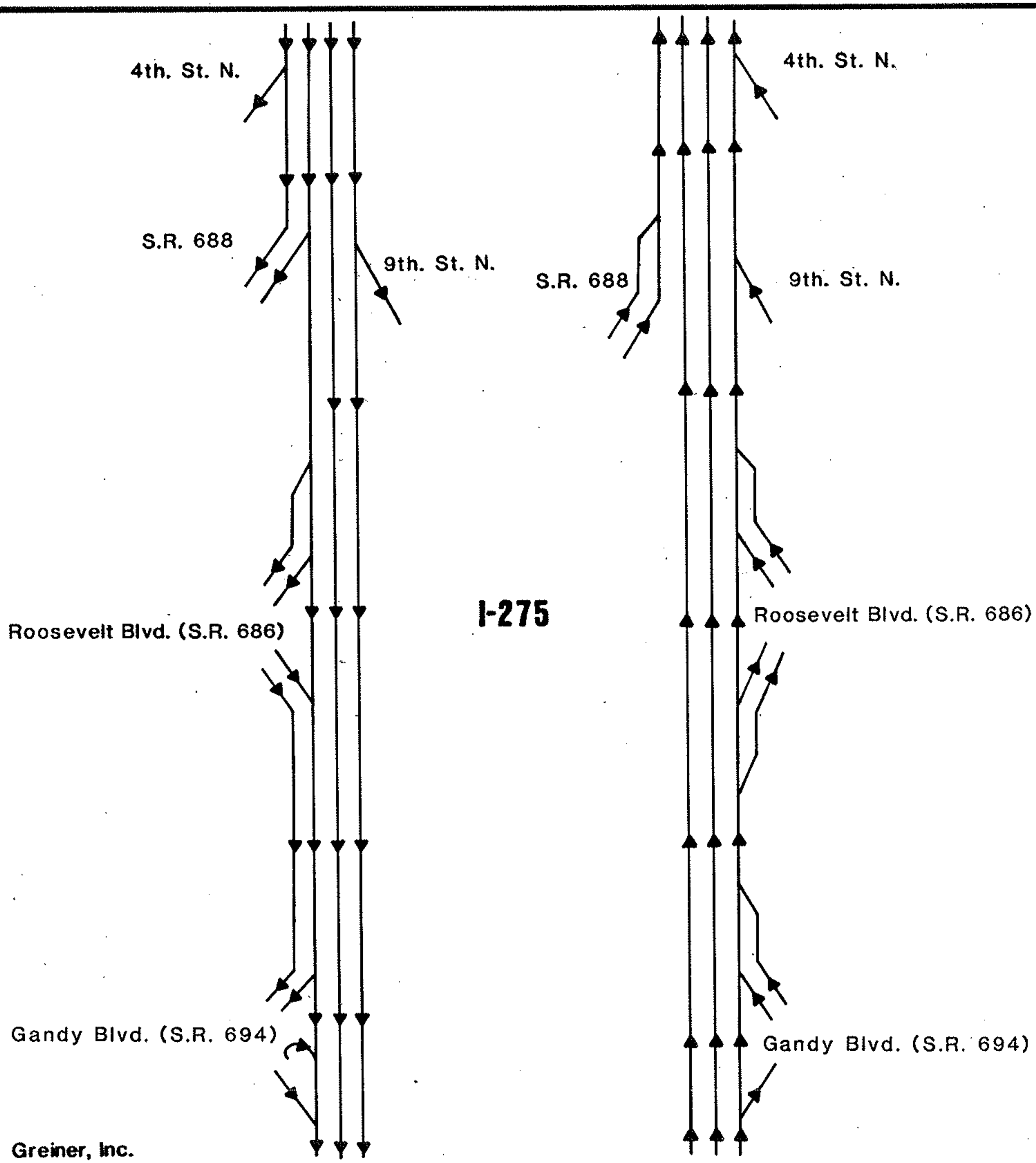
INTERCHANGE JUSTIFICATION REPORT

C.R. 296/S.R. 686/I-275 INTERCHANGE

Pinellas County, Florida

OPENING YEAR (1993) DIRECTIONAL DESIGN HOURLY VEHICLES

EXHIBIT 9



Greiner, Inc.

FLORIDA DEPARTMENT OF TRANSPORTATION

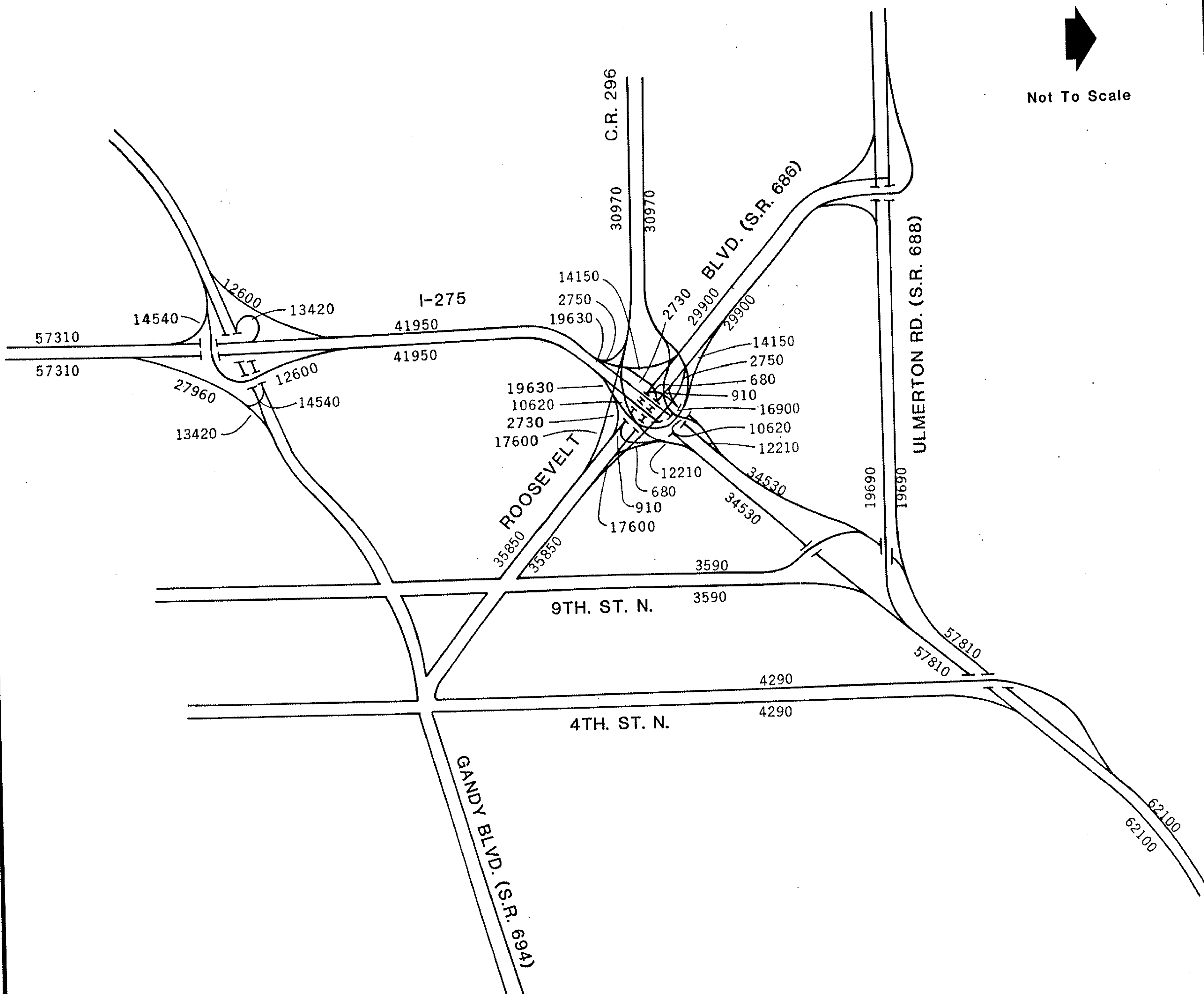
INTERCHANGE JUSTIFICATION REPORT

C.R. 296/S.R. 686/I-275 INTERCHANGE

Pinellas County, Florida

MAINLINE AND RAMP LANEAGE DESIGN YEAR (2010)

EXHIBIT 10



FLORIDA DEPARTMENT OF TRANSPORTATION

INTERCHANGE JUSTIFICATION REPORT

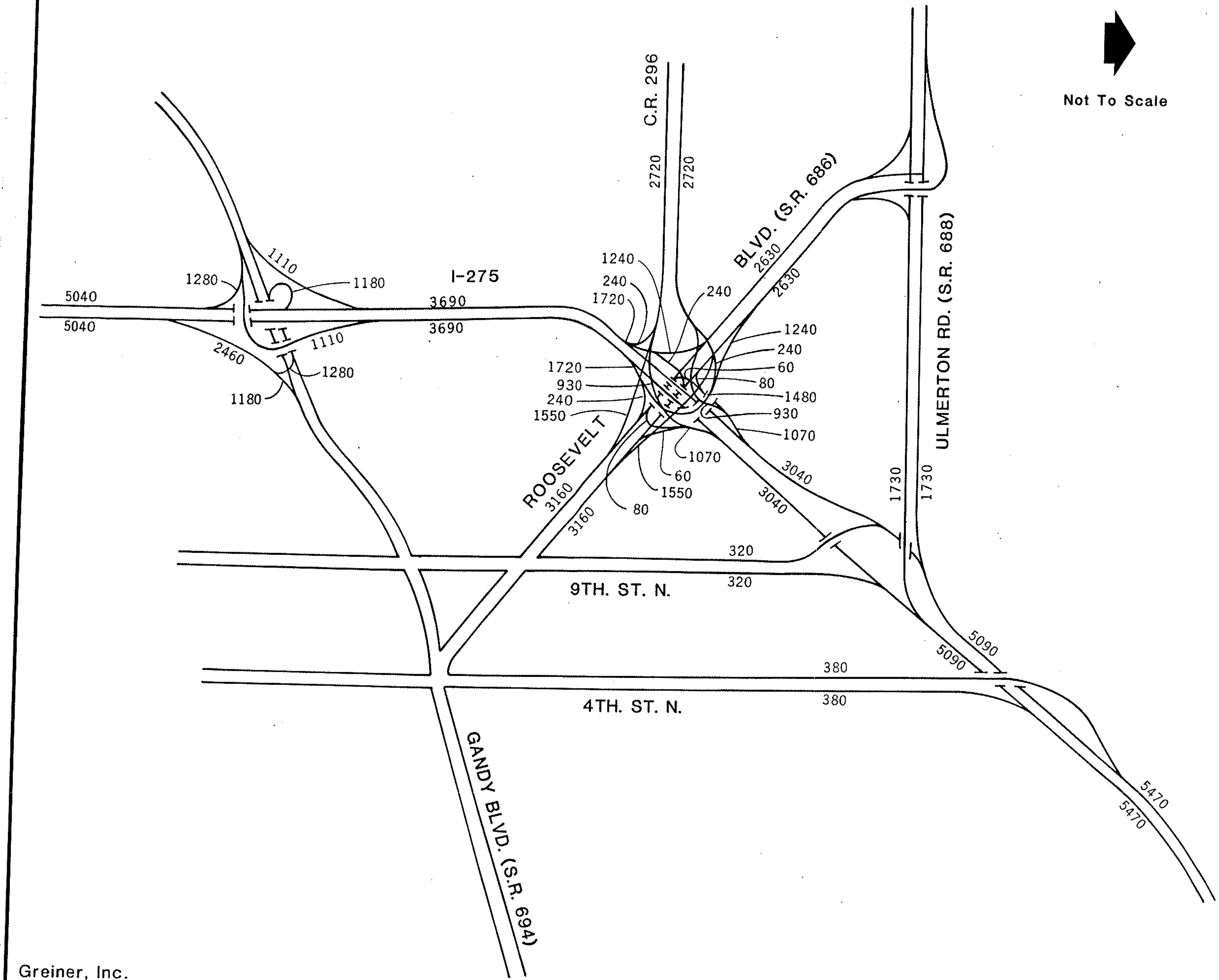
C.R. 296/S.R. 686/I-275 INTERCHANGE

Pinellas County, Florida

DESIGN YEAR (2010) DAILY TRAFFIC VOLUMES

EXHIBIT 11

Greiner, Inc.



FLORIDA DEPARTMENT OF TRANSPORTATION

INTERCHANGE JUSTIFICATION REPORT

C.R. 296/S.R. 686/I-275
INTERCHANGE

Pinellas County, Florida

DESIGN YEAR (2010)
DIRECTIONAL HOURLY VOLUMES

EXHIBIT 12

TABLE 1

EXISTING I-275 FREEWAY OPERATIONS
C.R. 296 Interchange

Roadway	Segement	Direction	Freeway[1] Volume (in VPH)	Number[2] of Lanes	Freeway LOS[3]	Merge Area: Ramp Volume (in VPH)	Merge Area: Merge Volume (in PCPH)	Merge Area: Merge LOS	Diverge Area: Ramp Volume (in VPH)	Diverge Area: Diverge Volume (in PCPH)	Diverge Area: Diverge LOS
I-275	@ 4th Street N.	NB	3,039 [2,578]	2	D [C]	330 [250]	1,515 [1,279]	D [C]	-- --	-- --	-- --
		SB	2,156 [2,881]	2	C [D]	-- --	-- --	-- --	250 [330]	1,151 [1,475]	C [C]
	@ Ulmerton Road (S.R. 688)	NB	2,709 [2,328]	2	D [C]	1,120 [880]	1,960 [1,673]	E [D]	-- --	-- --	-- --
		SB	1,906 [2,557]	2	C [C]	-- --	-- --	-- --	880 [1,120]	1,389 [1,769]	C [D]
	@ 9th Street N.	NB	1,598 [1,448]	2	B [B]	120 [100]	827 [763]	B [B]	-- --	-- --	-- --
		SB	1,026 [1,437]	2	B [B]	-- --	-- --	-- --	100 [120]	675 [854]	B [B]
	@ Roosevelt Boulevard (S.R. 686) north side of Interchange	NB	1,469 [1,348]	2	B [B]	35 [76]	377 [709]	A [B]	-- --	-- --	-- --
		SB	926 [1,317]	2	B [B]	-- --	-- --	-- --	46 [35]	260 [340]	A [A]
	Roosevelt Boulevard to Gandy Boulevard	NB	3,048 [2,282]	3	C [B]	578 [331]	831 [522]	B [B]	484 [303]	1,182 [950]	C [B]
		SB	1,804 [2,680]	3	B [B]	278 [419]	759 [1,049]	B [C]	249 [442]	270 [533]	A [A]
	@ Gandy Boulevard Loop Ramp	SB	2,120 [2,998]	3	B [C]	565 [760]	744 [1,008]	B [C]	-- --	-- --	-- --
	@ Gandy Boulevard south side of Interchange	NB	4,159 [3,284]	3	D [C]	-- --	-- --	-- --	1,689 [1,333]	2,035 [1,612]	F [D]
		SB	2,558 [3,759]	3	B [C]	438 [761]	793 [1,255]	B [C]	-- --	-- --	-- --

[1]Refers to the Freeway Volume that occurs after merge and before diverge (see Exhibit 6).
[2]Per Direction.
[3]LOS = Level of Service

xx = AM Peak Hour
[xx] = PM Peak Hour

Service C for the AM and PM peak hours. The other existing deficiency occurs at the Ulmerton Road (S.R. 688) on-ramp in the AM peak-hour. This ramp junction operates at a Level of Service F due to a high merge volume proceeding northeasterly to gain access to the Howard Frankland Bridge. With dual on-ramps, the Ulmerton Road on-ramp junction would provide an acceptable level of service.

The levels of service for the two unsignalized intersections at the I-275 ramp terminals with Roosevelt Boulevard (S.R. 686) are shown in Table 2. The intersection capacity analyses are contained in Appendix C.

As illustrated in Table 2, both of the intersections are operating at deficient levels of service. The southbound and westbound left-turns cause the intersection on the west side of I-275 to operate at LOS F. The southbound left-turn volume is moderate (17 vph in AM, 27 vph in PM); however, because of the heavy volumes on Roosevelt Boulevard, there are not enough gaps in the opposing flow of traffic to provide the left-turning vehicles with an efficient traffic flow. The westbound left-turns are heavier (295 vph in AM, 222 vph in PM); however, the left-turns are opposed by a substantial number of eastbound vehicles.

The eastbound left-turning traffic is the limiting factor for the intersection of the northbound I-275 on-ramp. The intersection operates at an acceptable Level of Service D in the AM and PM peak-hours. In order to maintain (east side) and achieve (west side) an adequate level of service in the future, both of the I-275 ramp intersections with Roosevelt Boulevard (S.R. 686) will require signalization. The traffic signals, when installed, should also provide coordinated signal operations between the two intersections.

TABLE 2

EXISTING INTERSECTION CAPACITY ANALYSIS
C.R. 296 Interchange

Intersection	AM Peak Hour LOS	PM Peak Hour LOS
Roosevelt Blvd @ I-275 Ramps (west side)	F	F
Roosevelt Blvd @ I-275 Ramps (east side)	D	D

Projected Traffic Operations

Evaluation of opening year (1993) and design year (2010) operating conditions were based on directional design hourly traffic volumes. The analyses were conducted based on the following assumptions:

K =	8%	Buses/RV's =	0%
D =	55%	Population Factor =	1.0
PHF =	0.95	Terrain =	Level
Trucks =	5%	Design Speed =	60 mph

Table 3 summarizes the I-275 main line and ramp junction levels of service for opening year (1993) conditions. The northbound off-ramp at Gandy Boulevard (S.R. 694) is projected to operate at Level of Service F, the same level of service as for existing conditions. With the dual off-ramp improvement, the northbound off-ramp will operate at Level of Service C. The Ulmerton Road (S.R. 688) on-ramp improves from Level of Service E (existing AM) to Level of Service D with the add-lane included in the interim plan at this ramp junction. The add-lane produces a six-lane section on I-275 from the Ulmerton Road (S.R. 688) junction across Tampa Bay via the Howard Frankland Bridge to the City of Tampa. All other I-275 ramp junctions and mainline sections operate at an adequate level of service.

The I-275 ramp and Roosevelt Boulevard (S.R. 686) intersections (east and west) were analyzed as signalized intersections for opening year (1993). The intersection to the west of I-275 operates at Level of Service B, and the east side intersection operates at Level of Service A.

TABLE 3

I-275 FREEWAY OPERATIONS - OPENING YEAR (1993)
C.R. 296 Interchange

Roadway Segement	Direction	Freeway[1] Volume (in DDHV)	Number[2] of Lanes	Freeway LOS[3]	Merge Area Ramp Volume (in DDHV)	Merge Area Merge Volume (in PCPH)	Merge Area Merge LOS	Diverge Area Ramp Volume (in DDHV)	Diverge Area Diverge Volume (in PCPH)	Diverge Area Diverge LOS
Howard Frankland Bridge	NB	3,910	3	D	340	1,228	C	--	--	-
to 4th Street N.	SB	3,910	3	D	--	--	-	340	1,299	C
4th Street N. to Ulmerton	NB	3,570	2	D	950[4]	1,661	D	--	--	-
Road (S.R. 688)	SB	3,570	2	D	--	--	-	950[4]	1,465	C
Ulmerton Road to 9th Street N.	NB	2,620	2	D	220	1,279	C	--	--	-
	SB	2,620	2	D	--	--	-	220	1,397	C
9th Street N. to Roosevelt	NB	2,400	2	B	760[5]	959	B	--	--	-
Boulevard	SB	2,400	2	B	--	--	-	760[5]	535	A
Roosevelt Boulevard to	NB	3,150	3	C	720[5]	983	B	1,510[4]	1,231	C
Gandy Boulevard	SB	3,150	3	C	1,510[4]	1,212	C	720[5]	579	A
@ Gandy Boulevard Loop Ramp	SB	2,430	3	C	830	1,388	C	--	--	-
South of Gandy Boulevard	NB	4,160	3	D	--	--	-	1,730	2,056	F
Interchange	SB	4,160	3	D	900	1,449	C	--	--	-

[1]Refers to the Freeway Volume that occurs after merge and before diverge (see Exhibit 9).
[2]Per Direction.
[3]LOS = Level of Service
[4]Two-lane ramp with add lane for on-ramp and drop lane for off-ramp; analyzed as an add lane and a merge or a drop lane and a diverge.
[5]Two-lane ramp; analyzed as two adjacent ramps 400 feet apart.

Table 4 summarizes the levels of service for design year 2010 conditions. All mainline sections and ramp junctions maintain an acceptable level of service except the south side of the Gandy Boulevard and I-275 interchange and the southbound on-ramp at the Roosevelt Boulevard (S.R. 686) and I-275 interchange. South of the Gandy Boulevard (S.R. 694) and I-275 interchange, the mainline of the freeway is projected to operate at Level of Service E both northbound and southbound. The Gandy Boulevard (S.R. 694) interchange southbound on-ramp is projected to operate at Level of Service E and the northbound off-ramp is projected to operate at Level of Service F. With the dual off-ramp improvement, the northbound off-ramp will operate at Level of Service D. The southbound on-ramp and northbound off-ramp will require two lanes to provide an acceptable level of service. The mainline section is just into the Level of Service E range. If the section of I-275 south of Gandy Boulevard is analyzed as a 70 mph design speed facility (instead of the 60 mph design speed assumed in this analysis), it will provide Level of Service D in the peak hour.

The Roosevelt Boulevard (S.R. 686) and I-275 interchange southbound on-ramp will require an add-lane. The add-lane will be an auxiliary lane and will terminate at the Gandy Boulevard (S.R. 694) and I-275 interchange southbound off-ramp. With this improvement, the Roosevelt Boulevard (S.R. 686) southbound on-ramp will operate at Level of Service C during the design year.

Traffic Safety

Accident data was obtained from FDOT for a five-year period (1981 to 1985). Both detailed and summary accident data were reviewed. The accident data for each of the

TABLE 4

I-275 FREEWAY OPERATIONS - DESIGN YEAR (2010)
C.R. 296 Interchange

					Merge Area			Diverge Area		
Roadway Segement	Direction	Freeway[1] Volume (in DDHV)	Number[2] of Lanes	Freeway LOS[3]	Ramp Volume (in DDHV)	Merge Volume (in PCPH)	Merge LOS	Ramp Volume (in DDHV)	Diverge Volume (in PCPH)	Diverge LOS
Howard Frankland Bridge	NB	5,470	4	D	380	1,300	C	--	--	-
to 4th Street N.	SB	5,470	4	D	--	--	-	380	980	B
4th Street N. to Ulmerton	NB	5,090	3	D	1,730[4]	1,583	D	--	--	-
Road (S.R. 688)	SB	5,090	3	D	--	--	-	1,730[4]	1,397	C
Ulmerton Road to 9th Street N.	NB	3,360	3	C	320	1,059	C	--	--	-
	SB	3,360	3	C	--	--	-	320	1,197	C
9th Street to Roosevelt Boulevard	NB	3,040	3	C	1,070[5]	1,328	C	--	--	-
	SB	3,040	3	C	--	--	-	1,070[5]	724	B
Roosevelt Boulevard to Gandy	NB	3,690	3	C	1,110[5]	1,559	D	1,720[5]	1,234	C
Boulevard	SB	3,690	3	C	1,720[4]	812	B	1,110[5]	899	B
@ Gandy Boulevard Loop Ramp	SB	2,580	3	C	1,180	1,493	D	--	--	-
South of Gandy Boulevard	NB	5,040	3	E	--	--	-	2,460	2,867	F
	SB	5,040	3	E	1,280	1,991	E	--	--	-

[1]Refers to the Freeway Volume that occurs after merge and before diverge (see Exhibit 12).
[2]Per Direction.
[3]LOS = Level of Service
[4]Two-lane ramp with add lane for on-ramp and drop lane for off-ramp; analyzed as an add lane and a merge or a drop lane and a diverge.
[5]Two-lane ramp; analyzed as two ramps 400 feet apart.

major roadway segments in the study area are summarized in Tables 5-A through 7-C. The three major roadways analyzed were I-275 (Tables 5A-5G), S.R. 688/Ulmerton Road (Tables 6A-6C), and S.R. 686/Roosevelt Boulevard (Tables 7A-7C).

The tables provide a listing, by year, of the number of accidents (total accidents as well as fatalities, injuries, and property damage), traffic volumes, actual accident rate, critical accident rate, safety ratio, economic loss, and property loss. The safety ratio, the ratio of the actual accident rate to critical accident rate, is the criteria used to identify safety problems and/or high accident locations. The critical accident rate is the statewide average accident rate for a similar facility. Thus, a safety ratio greater than 1.00 indicates that the facility is experiencing more accidents than would be anticipated on this type of facility.

As seen in the tables, there are only a few roadway segments that experience a safety ratio in excess of 1.00. This occurs on I-275 at the 4th Street North interchange. The high safety ratio in this area is primarily due to the heavy traffic volumes from the Howard Frankland Bridge. The 4th Street North interchange is the first decision point vehicles reach after the Howard Frankland Bridge. Therefore, a substantial amount of lane changes may be occurring in this area, adding to the potential for accidents. To the south of the 4th Street North interchange, the traffic volumes are slightly lower and the accident ratios are all well below 1.00. The future lane expansion of I-275 in this area will increase the roadway capacity which will increase the distances between vehicles and reduce the number of conflicts between vehicles entering, exiting, or crossing the traffic flow. All other roadway segments in the study area experience a low to moderate safety ratio.

TABLE 5-A
ACCIDENT SUMMARY
I-275 through Gandy Boulevard (S.R. 694) Interchange

MILE POST MARKER 10.140 TO 11.000

Year	Roadway Type	ADT[a]	Accidents	Actual[b] Accident Rate	Critical[b] Accident Rate	Safety Ratio	Fatality	Injury	Property	Economic Loss	Property Loss
1981	6LD	49,130	10	0.648	2.682	0.241	0	9	4	$76,000	$32,980
1982	6LD	52,230	10	0.609	2.554	0.229	0	6	5	$53,000	$24,320
1983	6LD	52,231	8	0.487	2.751	0.177	0	6	4	$63,800	------
1984	6LD	55,576	15	0.859	1.811	0.474	0	13	7	$134,900	------
1985	6LD	55,918	9	0.512	1.881	0.272	1	8	3	$300,400	------
TOTAL			52				1	42	23	$571,100	$57,300

Source: Data supplied by the Florida Department of Transportation

[a]Average Volume

[b]Accidents per million vehicle miles

TABLE 5-B
ACCIDENT SUMMARY
I-275 from S.R. 694 (Gandy Blvd.) Interchange to S.R. 686 (Roosevelt Blvd.) Interchange

MILE POST MARKER 11.000 to 12.030

Year	Roadway Type	ADT[a]	Accidents	Actual[b] Accident Rate	Critical[b] Accident Rate	Safety Ratio	Fatality	Injury	Property	Economic Loss	Property Loss
1981	6LD	49,130	2	0.108	2.592	0.041	0	0	2	$2,000	$1,460
1982	6LD	52,230	3	0.152	2.566	0.059	0	1	2	$10,000	$5,790
1983	6LD	52,231	2	0.101	2.666	0.037	0	0	2	$4,000	------
1984	6LD	53,892	3	0.148	1.759	0.084	0	4	1	$39,200	------
1985	6LD	55,400	12	0.575	1.817	0.316	0	6	8	$71,800	------
TOTAL			22				0	11	15	$127,000	$7,250

Source: Data supplied by the Florida Department of Transportation

[a]Average Volume

[b]Accidents per million vehicle miles

TABLE 5-C
ACCIDENT SUMMARY
I-275 at S.R. 686 (Roosevelt Blvd.) Interchange

MILE POST MARKER 12.030 TO 12.780

Year	Roadway Type	ADT[a]	Accidents	Actual[b] Accident Rate	Critical[b] Accident Rate	Safety Ratio	Fatality	Injury	Property	Economic Loss	Property Loss
1981	6LD	49,130	11	0.817	2.755	0.296	0	4	8	$40,000	$16,570
1982	6LD	52,230	22	1.538	2.720	0.565	0	13	11	$115,000	$61,380
1983	4LD	52,231	10	0.699	2.826	0.247	0	5	6	$58,500	------
1984	4LD	40,195	10	0.908	2.004	0.453	1	19	1	$398,700	------
1985	6LD	43,726	12	1.002	2.042	0.490	0	15	4	$147,500	------
TOTAL			65				1	56	30	$759,700	$77,950

Source: Data supplied by the Florida Department of Transportation

[a]Average Volume

[b]Accidents per million vehicle miles

TABLE 5-D
ACCIDENT SUMMARY
I-275 from S.R. 686 (Roosevelt Blvd.) Interchange to 9th St. Interchange

MILE POST MARKER 12.780 to 13.450

Year	Roadway Type	ADT[a]	Accidents	Actual[b] Accident Rate	Critical[b] Accident Rate	Safety Ratio	Fatality	Injury	Property	Economic Loss	Property Loss
1981	4LD	49,130	1	0.083	2.816	0.029	0	0	1	$1,000	$1,100
1982	4LD	52,230	9	0.704	2.781	0.253	0	8	4	$68,000	$29,580
1983	4LD	52,231	3	0.234	2.886	0.081	0	5	2	$50,500	------
1984	4LD	36,771	5	0.556	2.101	0.264	0	4	2	$41,200	------
1985	4LD	35,331	4	0.462	2.201	0.209	0	2	2	$22,600	------
TOTAL			22				0	19	11	$183,300	$30,680

Source: Data supplied by the Florida Department of Transportation

[a]Average Volume

[b]Accidents per million vehicle miles

TABLE 5-E
ACCIDENT SUMMARY
I-275 from 9th St. Interchange to S.R. 688 (Ulmerton Rd.) Interchange

MILE POST MARKER 13.450 to 14.000

Year	Roadway Type	ADT[a]	Accidents	Actual[b] Accident Rate	Critical[b] Accident Rate	Safety Ratio	Fatality	Injury	Property	Economic Loss	Property Loss
1981	4LD	49,130	7	0.709	2.934	0.241	0	6	2	$50,000	$19,860
1982	4LD	52,230	11	1.049	2.896	0.362	1	4	6	$238,000	$44,770
1983	4LD	52,231	16	1.525	3.006	0.507	1	7	10	$305,100	------
1984	4LD	36,771	8	1.083	2.204	0.491	0	9	2	$87,700	------
1985	4LD	35,331	8	1.127	2.307	0.488	0	5	5	$56,500	------
TOTAL			50				2	31	25	$527,300	$64,630

Source: Data supplied by the Florida Department of Transportation

[a]Average Volume

[b]Accidents per million vehicle miles

TABLE 5-F
ACCIDENT SUMMARY
I-275 from S.R. 688 (Ulmerton Rd.) Interchange to 4th St. Interchange

MILE POST MARKER 14.000 to 14.240

Year	Roadway Type	ADT[a]	Accidents	Actual[b] Accident Rate	Critical[b] Accident Rate	Safety Ratio	Fatality	Injury	Property	Economic Loss	Property Loss
1981	4LD	49,130	3	0.697	3.558	0.195	0	3	2	$26,000	$11,600
1982	4LD	52,230	7	1.530	3.505	0.436	0	4	5	$37,000	$11,630
1983	4LD	52,231	9	1.967	3.626	0.542	0	3	6	$39,900	------
1984	4LD	36,771	9	2.794	2.752	1.015	0	4	6	$49,200	------
1985	4LD	35,331	8	2.584	2.882	0.896	0	5	4	$54,500	------
TOTAL			36				0	19	23	$206,600	$23,230

Source: Data supplied by the Florida Department of Transportation

[a]Average Volume1

[b]Accidents per million vehicle miles

TABLE 5-G
ACCIDENT SUMMARY
I-275 at 4th St. Interchange

MILE POST MARKER 14.240 to 15.000

Year	Roadway Type	ADT[a]	Accidents	Actual[b] Accident Rate	Critical[b] Accident Rate	Safety Ratio	Fatality	Injury	Property	Economic Loss	Property Loss
1981	4LD	49,130	10	0.733	2.747	0.266	0	5	8	$48,000	$42,170
1982	4LD	52,230	19	1.311	2.715	0.482	1	10	9	$289.000	$38,650
1983	4LD	52,231	34	2.346	2.816	0.833	0	21	19	$233,300	------
1984	4LD	41,781	31	2.674	1.979	1.351	2	29	9	$727,700	------
1985	4LD	40,543	27	2.400	2.066	1.161	1	11	16	$354,300	------
TOTAL			121				4	76	61	$1,652,300	$80,820

Source: Data supplied by the Florida Department of Transportation

[a]Average Volume

[b]Accidents per million vehicle miles

TABLE 6-A
ACCIDENT SUMMARY
S.R. 688 (Ulmerton Road) West of I-275 Interchange

MILE POST MARKER 12.910 to 13.080

Year	Roadway Type	ADT[a]	Accidents	Actual[b] Accident Rate	Critical[b] Accident Rate	Safety Ratio	Fatality	Injury	Property	Economic Loss	Property Loss
1981	4LD	20,000	1	0.805	10.923	0.073	0	0	1	$1,000	$2,300
1982	4LD	20,530	1	0.785	10.849	0.072	0	0	1	$1.000	$1,300
1983	4LD			No		Accidents		Recorded			
1984	4LD	23,518	1	0.685	8.752	0.078	0	1	0	$9,300	------
1985	4LD			No		Accidents		Recorded			
TOTAL			3				0	1	2	$11,300	$3,600

Source: Data supplied by the Florida Department of Transportation

[a]Average Volume

[b]Accidents per million vehicle miles

TABLE 6-B
ACCIDENT SUMMARY
S.R. 688 (Ulmerton Road) at Westbound I-275 Off-Ramp

MILE POST MARKER 13.080 to 13.300

Year	Roadway Type	ADT[a]	Accidents	Actual[b] Accident Rate	Critical[b] Accident Rate	Safety Ratio	Fatality	Injury	Property	Economic Loss	Property Loss
1981	4LD	20,000	2	1.245	10.229	0.121	0	3	1	$25,000	$4,150
1982	4LD	20,530	2	1.213	10.163	0.119	0	1	1	$9.000	$760
1983	4LD	20,534	1	0.606	11.898	0.050	0	1	0	$9,300	------
1984	4LD			No		Accidents		Recorded			
1985	4LD			No		Accidents		Recorded			
TOTAL			5				0	5	2	$43,300	$4,910

Source: Data supplied by the Florida Department of Transportation

[a]Average Volume

[b]Accidents per million vehicle miles

TABLE 6-C
ACCIDENT SUMMARY
S.R. 688 (Ulmerton Road) at Eastbound I-275 On-Ramp

MILE POST MARKER 13.300 to 13.500

Year	Roadway Type	ADT[a]	Accidents	Actual[b] Accident Rate	Critical[b] Accident Rate	Safety Ratio	Fatality	Injury	Property	Economic Loss	Property Loss
1981	4LD			No		Accidents		Recorded			
1982	4LD	20,530	1	0.667	10.408	0.064	0	3	0	$24,000	$2,100
1983	4LD	20,534	2	1.334	12.173	0.109	0	2	1	$20,600	------
1984	4LD			No		Accidents		Recorded			
1985	4LD	22,140	2	1.237	8.252	0.149	0	0	2	$4,000	------
TOTAL			5				0	5	3	$48,600	$2,100

Source: Data supplied by the Florida Department of Transportation

[a]Average Volume

[b]Accidents per million vehicle miles

TABLE 7-A
ACCIDENT SUMMARY
S.R. 686 (Roosevelt Boulveard) West of I-275 Interchange

MILE POST MARKER 7.617 to 8.950

Year	Roadway Type	ADT[a]	Accidents	Actual[b] Accident Rate	Critical[b] Accident Rate	Safety Ratio	Fatality	Injury	Property	Economic Loss	Property Loss
1981	4LD	31,640	3	0.194	7.515	0.025	0	1	2	$10,000	$7,720
1982	4LD	29,840	2	0.137	7.574	0.018	0	------	2	$2.000	$2,090
1983				No		Accidents		Recorded			
1984				No		Accidents		Recorded			
1985				No		Accidents		Recorded			
TOTAL			5					1	4	$12,000	$9,810

Source: Data supplied by the Florida Department of Transportation

[a]Average Volume

[b]Accidents per million vehicle miles

TABLE 7-B
ACCIDENT SUMMARY
S.R. 686 (Roosevelt Boulevard) at I-275 Interchange

MILE POST MARKER 8.951 to 9.633

Year	Roadway Type	ADT[a]	Accidents	Actual[b] Accident Rate	Critical[b] Accident Rate	Safety Ratio	Fatality	Injury	Property	Economic Loss	Property Loss
1981	6LD	31,640	4	0.507	8.275	0.061	------	3	1	$25,000	$9,750
1982	6LD	29,840	7	0.942	8.352	0.112	------	7	3	$59,000	$27,690
1983				No		Accidents		Recorded			
1984				No		Accidents		Recorded			
1985				No		Accidents		Recorded			
TOTAL			11					10	4	$84,000	$37,440

Source: Data supplied by the Florida Department of Transportation

[a]Average Volume

[b]Accidents per million vehicle miles

TABLE 7-C
ACCIDENT SUMMARY
S.R. 686 (Roosevelt Boulevard) East of I-275 Interchange

MILE POST MARKER 9.634 to 10.642

Year	Roadway Type	ADT[a]	Accidents	Actual[b] Accident Rate	Critical[b] Accident Rate	Safety Ratio	Fatality	Injury	Property	Economic Loss	Property Loss
1981	4LD	31,640	20	1.718	7.804	0.220	------	18	11	$155,000	$50,220
1982	4LD	29,810	10	0.911	7.969	0.115	------	8	6	$70,000	$33,800
1983				No		Accidents		Recorded			
1984				No		Accidents		Recorded			
1985				No		Accidents		Recorded			
TOTAL			30					26	17	$225,000	$84,020

Source: Data supplied by the Florida Department of Transportation

[a]Average Volume

[b]Accidents per million vehicle miles

Alternative Routes

The "No Build" alternative would severely impede traffic flow on the Pinellas County street system in the Gateway area. Without the C.R. 296 connection to I-275, the existing east-west arterials would have to accommodate the traffic accessing the Interstate. Under the "Build" alternative, C.R. 296 would carry a portion of this traffic. Future traffic projections, conducted for the C.R. 296 Corridor Study and S.R. 686 PD&E Study, indicate that other east-west arterials, such as Ulmerton Road (S.R. 688) and Park Boulevard/Gandy Boulevard, do not have sufficient capacity to accommodate the additional demand in the "No Build" alternative. The "No Build" alternative in this analysis includes the provision of a six-lane arterial on C.R. 296 to 28th Street. To access the Interstate, traffic on C.R. 296 would travel north on 28th Street and southeast on Roosevelt Boulevard to access I-275. Given this circuitous route, the majority of the traffic desiring to use I-275 would reroute to Ulmerton Road or Gandy Boulevard as both of these routes provide direct connections to I-275.

Ulmerton Road is a major east-west arterial traversing central Pinellas County from the barrier islands to the Howard Frankland Bridge and the City of Tampa. The available capacity of Ulmerton Road (S.R. 688) is severely restricted in the eastern portion of the County because a segment of the roadway is co-located with S.R. 686, a major east-west and north-south arterial.

The alternatives investigated in the S.R. 686 PD&E study indicated that Ulmerton Road would need to accommodate 113,800 vehicles per day if C.R. 296 did not provide a direct connection to I-275. Even with improvements on Ulmerton Road to provide an eight-lane expressway, Ulmerton Road would operate at an unacceptable Level of

Service F. The details of the traffic analyses are documented in the Traffic Memorandum published for the S.R. 686 study. The C.R. 296 Corridor Study, conducted for Pinellas County, indicated that without the extension of C.R. 296 to I-275, similar unacceptable levels of service would result on Gandy Boulevard.

Without the proposed interchange improvement, the alternative routes of the Pinellas County arterial street system will not have the ability to accommodate the vehicular flow of traffic in a safe and efficient manner. Deficient levels of service will occur on several roadway segments and severe congestion will result, particularly in the critical segment of Ulmerton Road (S.R. 688) co-located with Roosevelt Boulevard (S.R. 686).

Cost-Effectiveness Analysis

A cost-effectiveness analysis has been accomplished for the C.R. 296/S.R. 686/I-275 interchange modification project in order to define, in economic terms, the net benefits which can be expected to be gained if the proposed interchange improvements are implemented. Basically, the analysis compares the costs of implementing the improvements to the road user benefits. Costs include costs for engineering design, right-of-way acquisition, construction, and maintenance of the modified facility. Benefits include the reduction in road user expenditures which would be expected to result from a safer and more efficient facility. The specific components of benefits and costs as identified in the study are discussed in detail in later pages.

The methodology used in this analysis follows guidelines written in the American Association of Highway and Transportation Officials (AASHTO) publication, A Manual On User Benefit Analysis Of Highway and Bus-Transit Improvements, 1977 [1], hereinafter referred to as the "AASHTO Manual." The AASHTO Manual is the nationally accepted handbook for methodologies appropriate to transportation project cost-effectiveness analyses. The procedures used in the present study are those traditionally used in analyses for major federally funded projects such as additions or modifications to the federal interstate highway system. It should be understood by the reader that the AASHTO procedure emphasizes road user benefits and highway agency costs and that secondary costs and benefits, which are difficult or impossible to quantify, are not included. More on this subject is included in the final paragraphs of this report section.

Present Value

The AASHTO Manual methodology prescribes the computation of "present value" (PV) for the periodic costs and benefits for a "No Improvement" alternative and for the improved condition over a specific time period in order to identify incremental costs and benefits attributable to the project. To paraphrase the AASHTO Manual, "Present Value" is an economic concept representing the translation of costs and/or benefits occurring over time into a single amount at a single instant (usually the present). Present value is also called "Present Worth." "Net Present Value" refers to the net cumulative present value of a series of costs and benefits occurring over time, and is derived by applying to each cost or benefit in the series an appropriate discount factor which converts each cost or benefit to a present value. All costs, benefits, and other values presented in monetary terms herein are expressed in constant 1988 dollars.

Discount Rate

The assumption as to the appropriate "discount rate" to use in computing present value of future costs and benefits is an important one, and deserves some discussion here. Perhaps the most lucid and concise guidance to discount rate selection is found in the following passage from the AASHTO Manual:

> "The discount rate for performing present value calculations on public projects should represent the opportunity cost of capital to the taxpayer, i.e., the estimated average market rate of return. However, the common practice of calculating benefits in constant dollars (usually at prices prevailing when the economy study is made) and discounting benefits at market rates of interest is in error, because the market or nominal rate of return includes (1) an allowance for expected inflation as well as (2) a return that represents the real cost of capital. Thus, if future benefits or costs are in constant dollars, they will be understated in relation to a market rate of return. Hence, if future benefits and costs are calculated in constant dollars, only the real cost of capital should be represented in the discount rate used. The real cost of capital has been estimated at about 4 percent in recent years for low-risk investments."

Based on the AASHTO Manual recommendation, the authors of the present study have selected 4 percent as the discount rate for this analysis. However, the sensitivity of the analysis to increases in the discount rate has been examined by testing also for 7 and 10 percent discount rates. The results are discussed in later pages of this report section.

Time Period of the Analysis

Another important study feature is the selection of an analysis period. For the present study, the years 1991 through 2010 were used. Ideally, costs and benefits for investments should be analyzed over their entire economic lifetime which ranges from about five years for some traffic signals to more than 50 years for earthwork and some bridges [1]. However, road user benefits (an important study component) can only be computed based on traffic volume projections which are rarely available for more than 20 to 25 years into the future. In the present analysis, traffic data as estimated for the study are available only through the year 2010. Therefore, the year 2010 has been set as the final analysis year.

The middle of the first year, 1991, is estimated to be the time during which a two-year construction expenditure period would begin. The facility is assumed by the analysis to be opened to traffic in mid-1993 and benefits and costs for the project are calculated for a period from that date to the final year, 2010. These assumptions are appropriately conservative for the economic analysis being undertaken, since benefits in years beyond 2010 will certainly be realized as a result of the initial investment, but cannot be quantified for lack of official traffic volume projections for those future years. The important point to be made is that benefits will most likely be more than those identified in the analysis. Therefore, if the project is found cost-effective using these conservative assumptions, project sponsors can be confident in its economic desirability.

Measures of Economic Desirability

The output of this analysis consists of several indices of economic feasibility and desirability. They are:

* Net Present Value (NPV) - The difference between the present value of the total periodic benefits and the present value of total periodic costs.

* Benefit/Cost (B/C) Ratio - The ratio of the present value of the total periodic benefits to the present value of the total periodic costs.

* Payback Period - That length of time required for the present value of accumulated benefits to overtake the present value of accumulated costs.

* Internal Rate of Return (ROR) - A measure of the profitability of the project. ROR is equal to that discount rate for which NPV = 0 and B/C = 1.0.

The NPV and B/C are calculated with equations (1) and (2) respectively:

$$NPV = PV(\Delta U) - [PV(\Delta I) + PV(\Delta M) - PV(\Delta R)] \quad (1)$$

$$B/C = PV(\Delta U) \div [PV(\Delta I) + PV(\Delta M) - PV(\Delta R)] \quad (2)$$

Where:

PV = the present value of the associated parenthetical amount or series of amounts over time, discounted at the selected discount rate.

ΔU = reduction in the series of annual highway user expenses due to the investment (user expenses without the improvement less user expenses with the improvement); also termed "User Benefit."

ΔI = increased investment costs due to the construction of the improvement.

ΔM = increase in series of annual maintenance and operating costs due to the construction of the improvement.

ΔR = residual value of the facility due to the project at the end of the analysis period.

The "packback period" and "internal rate of return" measures are derived from the NPV and B/C calculations. The study results are summarized in Tables 8, 9, and 10 at the end of this report section, and receive further introduction and explanation during later pages. The determination of the values used in the intermediate calculations are discussed below.

Determination of Values of Benefits

In this section, the evaluation of user benefits, as introduced in equations (1) and (2) above, is explained and discussed in detail.

The AASHTO Manual prescribes the computation of total road user expenditures ("U") for the condition with the improvement and for a "no improvement" condition, the difference between them ("ΔU") representing changes attributable to the improvement. If "ΔU" represents a reduction in road user expenditures, then that value is a "benefit" and can be used as such in a benefit/cost (B/C) calculation.

For each condition studied, "U" is a summarization of three separate items: 1) vehicle operating expenses, including fuel (gasoline) costs, lubricating oil costs, tire wear costs, auto maintenance (and repair) costs, and depreciation (new car) costs; 2) vehicle travel time expenses, or the cumulative dollar value of the vehicle occupants' time as it moves along a highway at a given speed; and 3) vehicle accident expenses, based on a historic average of the total dollar value of all fatality accidents, injury accidents, and property damage accidents which occur on the various roadway types.

The AASHTO Manual provides tables, nomographs, charts, and formulas for computing or determining the values of the various components of "U" and prescribes that future users of the information should index the prices to values prevailing at the time of the study using the Consumer Price Index [1].

Since the publishing of the AASHTO Manual, the State of Alabama Highway Department Bureau of Urban Planning has undertaken to aggregate and consolidate the AASHTO Manual procedures for determining "U" into a more readily usable format. The result has been a very straightforward, concise handbook entitled Road User Costs (1980) [2]. Repeated references to the handbook will be made throughout the following explanation of the calculation of "U" for this analysis.

(1) Vehicle Operating Expenses

Values for the various vehicle operating expense components are provided in the Road User Costs document by road type and by traveling speed. Since changes in these costs are most sensitive to fuel prices, the values are provided for various fuel price levels. For the present study, the authors have chosen to use road user cost values based on fuel prices at $1.00/gallon, the price prevailing in the project area at the time of this writing.

(2) Vehicle Travel Time Expenses

To evaluate vehicle travel time expenses, the AASHTO Manual used two studies from the University of Chicago and Stanford Research Institute [3,4] which established the value of commuter travel time in the late 1960's to be approximately $2.80 per hour. From that basis, the manual used more recent findings of a Highway Research Record study [5] which showed that time value is sensitive to trip purpose, traveler's income levels, and the amount of time saved during a trip type. In the Road User Cost document, the time value utilized from the AASHTO Manual was for a 5- to 15-minute work trip [2].

(3) Vehicle Accident Expenses

Accident expenses per vehicle mile of travel were computed in the Road User Cost document using actual historic vehicle accident statistics for the State of Alabama and accident costs by type of accident as obtained from the National Safety Council [2]. The accident cost per vehicle mile calculated for Alabama agrees closely with the AASHTO Manual-reported average accident cost for a mix of freeway and non-freeway facilities. Therefore, it was deemed appropriate that the Alabama accident cost values be used intact in the present analysis.

Total Road User Expenses ("U") and Benefits ("ΔU")

Total road user expenses ("U") for any given scenario are found from information in the tables contained in the Road User Costs document as described above. Assumptions are required as to facility type and assumed average speed for vehicles on the facility. The Road User Costs tables provide a "cost-per-vehicle-mile-traveled" rate which can be multiplied times the total vehicle-miles-traveled for the improved condition and the "No Improvement condition" for any given year or years.

In the present study, the traffic volumes and average vehicle operating speeds on each of the major roadway links in the project vicinity were determined for the condition with and without ("no improvement") the project. In the "No Improvement" alternative, the traffic which would use the modified interchange access if it were in place in future years was assumed to use other available routes and access points to make this travel.

Annual road user expenses ("U") for the conditions with and without the interchange modification were found by applying the cost-per-vehicle-mile-traveled to the VMT data. The difference ("ΔU") between the annual road user expenses for the "No Improvement" alternative and the annual road user expenses for the condition with the improvements in place can be considered a "benefit" of implementing the project and is used as such in the B/C ratio calculation. "ΔU" for the opening year (1993) and each succeeding year to the final analysis year (2010) are summarized in Tables 8, 9, and 10 at the end of this section.

Determination of Values of Costs

In the following paragraphs, evaluation of costs, as introduced in equations (1) and (2), is explained and discussed in detail.

(1) "ΔI" Investment Costs

As mentioned previously, "ΔI" includes costs for engineering design, right-of-way acquisition, and construction of the facility. It is estimated these costs for the interchange modification would be approximately \$36.2 million. For this analysis, it is assumed the right-of-way/construction expenditure would begin in mid-1991 and would span 24 months. The entire first phase of the project, including the modified interchange access, is expected to be completed in mid-1993. In 1999-2000, an additional expenditure would be required for the second phase, completing the freeway section. This is estimated at approximately \$44.2 million.

(2) "ΔM" Maintenance and Operating Costs

Maintenance costs include routine or periodic upkeep of the facility (patching, striping, drainage cleanout, landscaping) and replacements (pavement resurfacing, crash barrier replacement) [1]. This analysis assigns maintenance costs based on the additional travel lanes anticipated with the improvement at a rate of \$2,500.00/lane mile. In the present project, the early construction would not create a measurable increment of lane miles over and above the conditions which would be created in the "no improvement" alternative. Therefore, the "ΔM" for the early years is zero. After the year 2000, when additional lanes have been added to accommodate expected volumes of traffic, the "ΔM" is calculated to reach \$45,000.00 per year.

(3) "ΔR" Residual Value

The residual value of the project at the end of the analysis period is calculated by finding the product of the proportion of the remaining life of the facility and its cost [1]. In the present analysis, the life of the project is presumed to be 25 years. The study period covers only the first 17 years of the expected life of those improvements constructed in 1993 and only the first 10 years of those constructed in the year 2000. Residual value (ΔR) is the product of the improvements' estimated construction costs and a factor which represents the portion of its remaining useful life at the end of the analysis period. The total value of "ΔR" is added in the final year of the analysis (2010).

Conclusions of the Cost-Effectiveness Analysis

As discussed previously, outputs of the analysis include:

* Benefit/Cost Ratio (B/C)
* Net Present Value (NPV)
* Payback Period
* Internal Rate of Return (ROR)

Tables 8 through 10 provide the results of the computations of these indices of cost-effectiveness for the proposed interchange modification improvements based on assumed discount rates of 4, 7, and 10 percent, respectively. The format of the tables provides the reader with information concerning year-by-year benefits and costs as assumed in the analysis and a "running computation" of NPV and B/C. The payback period is indicated by that year in which the NPV becomes a positive number and the B/C ratio becomes a number equal to or larger than 1.0. The ROR is indicated by a note at the bottom of the table.

As indicated in Table 8, assuming a 4 percent discount rate, NPV is equal to approximately $120 million, the B/C ratio is more than 3.4, the Payback Period is seven years, and the ROR is greater than 24 percent.

Generally speaking, economic desirability of a project is indicated by a NPV which is greater than zero, a B/C ratio greater than 1.0, and an ROR greater than the discount rate. It can be seen from Table 8 that the proposed project meets and well exceeds these criteria. Therefore, it can be assumed that the project will provide road user benefits which would exceed project construction, maintenance, and operating costs.

Tables 9 and 10, in the same format as Table 8, show results with assumptions as to the discount rate changed in order to provide the reader with information concerning the sensitivity of the analysis to such changed assumptions. It can be seen from Tables 9 and 10 that the project would exceed traditionally held criteria for cost-effectiveness even at the high 7 and 10 percent discount rates.

Previous sections of this report section have used only road user benefits to represent "benefits" and have used facility construction, maintenance, and operation costs only to represent "costs." That is to say, no attempt has been made to quantify and include indirect benefits which may result. One such instance includes the stimulation of business activity as a result of the project. Also, no attempt has been made to identify secondary "benefits" which may accrue from increased property values along the facility or secondary "costs" which may accrue from deflated property values. Additionally, no attempt has been made to quantify and include environmental costs except to include the cost of measures to minimize air, water, and noise pollution during construction.

TABLE 8

Alternative: COUNTY ROAD 296
COST EFFECTIVENESS ANALYSIS
NET PRESENT VALUE AND BENEFIT/COST RATIO
(CONSTANT 1988 DOLLARS)

YEAR	COMPOUND INTEREST FACTOR * (PV)	USER BENEFITS (ΔU)	INVESTMENT COSTS (ΔI)	MAINTENANCE COSTS (ΔM)	RESIDUAL VALUE (ΔR)	NET PRESENT VALUE ** (NPV)	BENEFIT/COST RATIO *** (B/C)
1991	1.0000	0	9,048,900	0	0	(9,048,900)	0.00
1992	0.9615	0	18,097,800	0	0	(26,450,631)	0.00
1993	0.9246	4,782,933	9,048,900	0	0	(30,354,757)	0.13
1994	0.8890	10,040,331	0	0	0	(21,468,939)	0.35
1995	0.8548	10,538,331	0	0	0	(12,460,730)	0.54
1996	0.8219	11,061,032	0	0	0	(3,369,368)	0.90
1997	0.7903	11,609,659	0	0	0	5,805,914	1.17
1998	0.7599	12,185,498	0	0	0	15,065,891	1.43
1999	0.7307	12,789,898	22,064,750	0	0	8,288,845	1.16
2000	0.7026	13,424,276	22,064,750	45,000	0	2,186,549	1.03
2001	0.6756	14,090,120	0	45,000	0	11,674,929	1.18
2002	0.6496	14,788,990	0	45,000	0	21,252,344	1.32
2003	0.6246	15,522,523	0	45,000	0	30,919,559	1.46
2004	0.6006	16,292,244	0	45,000	0	40,677,232	1.61
2005	0.5775	17,100,545	0	45,000	0	50,526,385	1.75
2006	0.5553	17,948,732	0	45,000	0	60,467,692	1.91
2007	0.5339	18,838,989	0	45,000	0	70,501,956	2.06
2008	0.5134	19,773,402	0	45,000	0	80,629,990	2.21
2009	0.4936	20,754,162	0	45,000	0	90,852,614	2.36
2010	0.4746	21,783,568	0	45,000	38,060,292	119,235,690	3.45

* ASSUMES DISCOUNT RATE = 4 %   NOTE : INTERNAL RATE OF RETURN = 23.5 %

** NPV = PV(ΔU) - [PV(ΔI) + PV(ΔM) - PV(ΔR)]

*** B/C = PV(ΔU) ÷ [PV(ΔI) + PV(ΔM) - PV(ΔR)]

TABLE 9

Alternative: COUNTY ROAD 296
COST EFFECTIVENESS ANALYSIS
NET PRESENT VALUE AND BENEFIT/COST RATIO
(CONSTANT 1988 DOLLARS)

YEAR	COMPOUND INTEREST FACTOR * (PV)	USER BENEFITS (ΔU)	INVESTMENT COSTS (ΔI)	MAINTENANCE COSTS (ΔM)	RESIDUAL VALUE (ΔR)	NET PRESENT VALUE ** (NPV)	BENEFIT/COST RATIO *** (B/C)
1991	1.0000	0	9,043,900	0	0	(9,043,900)	0.00
1992	0.9346	0	18,097,800	0	0	(25,962,732)	0.00
1993	0.8734	4,782,933	9,048,900	0	0	(29,683,793)	0.12
1994	0.8163	10,040,331	0	0	0	(21,492,892)	0.37
1995	0.7629	10,538,331	0	0	0	(13,453,249)	0.60
1996	0.7130	11,061,032	0	0	0	(5,566,886)	0.84
1997	0.6663	11,605,659	0	0	0	2,169.120	1.05
1998	0.6227	12,185,498	0	0	0	9,757.635	1.25
1999	0.5820	12,789,898	22,064,750	0	0	4,359,567	1.05
2000	0.5439	13,424,276	22,064,750	45,000	0	(364,735)	0.95
2001	0.5083	14,090,120	0	45,000	0	6,775,091	1.12
2002	0.4751	14,788,990	0	45,000	0	13,775,855	1.23
2003	0.4440	15,522,523	0	45,000	0	20,652,060	1.35
2004	0.4150	16,292,244	0	45,000	0	27,394,089	1.47
2005	0.3878	17,100,545	0	45,000	0	34,008,523	1.58
2006	0.3624	17,948,732	0	45,000	0	40,497,660	1.69
2007	0.3387	18,838,989	0	45,000	0	46,863,834	1.80
2008	0.3166	19,773,402	0	45,000	0	53,109,341	1.90
2009	0.2959	20,754,162	0	45,000	0	59,236,434	2.01
2010	0.2765	21,783,568	0	45,000	38,060,292	75,771,318	2.57

* ASSUMES DISCOUNT RATE = 7 % NOTE : INTERNAL RATE OF RETURN = 23.5 %

** NPV = PV(ΔU) - [PV(ΔI) + PV(ΔM) - PV(ΔR)]

*** B/C = PV(ΔU) ÷ [PV(ΔI) + PV(ΔM) - PV(ΔR)]

TABLE 10

Alternative: COUNTY ROAD 296
COST EFFECTIVENESS ANALYSIS
NET PRESENT VALUE AND BENEFIT/COST RATIO
(CONSTANT 1988 DOLLARS)

YEAR	COMPOUND INTEREST FACTOR * (PV)	USER BENEFITS (ΔU)	INVESTMENT COSTS (ΔI)	MAINTENANCE COSTS (ΔM)	RESIDUAL VALUE (ΔR)	NET PRESENT VALUE ** (NPV)	BENEFIT/COST RATIO *** (B/C)
1991	1.0000	0	9,048,900	0	0	(9,048,900)	0.00
1992	0.9091	0	18,097,800	0	0	(25,501,445)	0.00
1993	0.8264	4,782,933	9,048,900	0	0	(29,027,036)	0.12
1994	0.7513	10,040,331	0	0	0	(21,483,589)	0.35
1995	0.6830	10,533,331	0	0	0	(14,265,767)	0.57
1996	0.6209	11,061,032	0	0	0	(7,417,736)	0.75
1997	0.5645	11,609,659	0	0	0	(864,356)	0.97
1998	0.5132	12,185,498	0	0	0	5,388,701	1.16
1999	0.4665	12,789,898	22,064,750	0	0	1,051,914	1.02
2000	0.4241	13,424,276	22,064,750	45,000	0	(2,621,575)	0.95
2001	0.3855	14,090,120	0	45,000	0	2,793,427	1.05
2002	0.3505	14,788,990	0	45,000	0	7,961,105	1.15
2003	0.3186	15,522,523	0	45,000	0	12,892,721	1.24
2004	0.2897	16,292,244	0	45,000	0	17,596,969	1.33
2005	0.2633	17,100,545	0	45,000	0	22,090,227	1.42
2006	0.2394	17,948,732	0	45,000	0	26,376,236	1.50
2007	0.2176	18,838,989	0	45,000	0	30,466,356	1.58
2008	0.1978	19,773,402	0	45,000	0	34,369,517	1.65
2009	0.1799	20,754,162	0	45,000	0	38,094,242	1.72
2010	0.1635	21,783,568	0	45,000	38,060,292	47,871,833	2.03

* ASSUMES DISCOUNT RATE = 10 %   NOTE : INTERNAL RATE OF RETURN = 23.5 %

** NPV = PV(ΔU) - [PV(ΔI) + PV(ΔM) - PV(ΔR)]

*** B/C = PV(ΔU) ÷ [PV(ΔI) + PV(ΔM) - PV(ΔR)]

SUMMARY AND ACTION

The proposed modification of the I-275 access ramps at the Roosevelt Boulevard (S.R. 686) interchange are justified to provide safe and efficient access to the Interstate highway. As documented herein, traffic operations along mainline I-275 will maintain an acceptable level of service with the proposed improvement. Furthermore, the existing arterial street system is grossly inadequate to accommodate projected traffic volumes safely and efficiently without the proposed project.

The need for the modification of the interchange resulted from extensive analysis of various alternatives to enable the arterial street system to obtain a satisfactory level of service in the future. C.R. 296 as a six-lane expressway providing direct access to I-275 will divert a substantial number of vehicles from Ulmerton Road (S.R. 688) and Park Boulevard enabling these roadways to attain an acceptable level of service for the future.

In view of the facts presented in this report, it is proposed and recommended that the I-275 and Roosevelt Boulevard interchange modification be undertaken, as it is vital to the transportation needs of Pinellas County. It is further proposed and recommended that the justification contained herein provides the necessary data and evaluations for FDOT to recommend approval to the FHWA.

LIST OF REFERENCES

1. American Association of State Highway and Transportation Officials (AASHTO), A Manual on User Benefit Analysis of Highway and Bus-Transit Improvements 1977 (1978).

2. Bureau of Urban Planning, State of Alabama Highway Department, Road User Costs 1980 (October 1980).

3. T. Lisco, "The Value of Commuter's Travel Time, A Study in Urban Transportation," University of Chicago Press, Chicago, Illinois (1967).

4. T.C. Thomas, "The Value of Time for Passenger Cars," Volume II: An Experimental Study of Consumer's Values, Stanford Research Institute (March 1967), PB 175731 (summarized in Highway Research Record No. 245).

5. T.C. Thomas and G.I. Thompson, "The Value of Time Saved by Trip Purpose," Highway Research Record No. 369 (1971), pp. 104-117.

APPENDICES

PHOTO DATE: JULY 1987

Revisions	
Dates	Descriptions

Project No.	Names	Dates
Designed By		
Checked By		
Quantities By		

GREINER ENGINEERING SCIENCES, INC.
Consulting Engineers
Tampa, Florida — Orlando, Florida

COUNTY ROAD 296
PINELLAS COUNTY
DEPT. OF PUBLIC WORKS
PINELLAS COUNTY, FLA.

Approved by:

Drawing No.

Index No.

APPENDIX B

I-275 RAMP ANALYSES

(Under Separate Cover)

APPENDIX C

INTERSECTION CAPACITY ANALYSIS

(Under Separate Cover)