HILLSBOROUGH AVE. (S.R. 580/600)

EISENHOWER BLVD. (S.R. 589)
to
NEBRASKA AVE. (S.R. 45/US 41)

PRELIMINARY ENGINEERING REPORT

PREPARED
FOR

FLORIDA DEPARTMENT OF TRANSPORTATION
DISTRICT 7

BY
DSA GROUP, INC.

JUNE 1989
WPA NO. 7113334
STATE PROJ. NO. 10150-1522
FAP NO. F-212-1(12)

DSA CM NO. 84077-F

PROFESSIONAL ENGINEER CERTIFICATE

I hereby certify that I am a Registered Professional Engineer in the State of Florida practicing with DSA Group, Inc., a corporation authorized to operate as an engineering business, EB# 0000590, by the State of Florida Department of Professional Regulation, Board of Professional Engineers, and that I have reviewed and approved the evaluations, findings, opinions, conclusions, or technical advice hereby reported for:

PROJECT: Hillsborough Avenue (SR 600/580) Project Development and Environmental Study

LOCATION: Hillsborough County, Florida

CLIENT: Florida Department of Transportation

I acknowledge that the procedures and references used to develop the results contained in this Report are standard to the professional practice of Highway Design and Civil Engineering as applied through professional judgement and experience.

Signature Larry R. Weatherby
Name Larry R. Weatherby, P.E.
P.E. No. 18886
Date 6-6-89

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1. INTRODUCTION TO AND ABSTRACT OF HILLSBOROUGH AVENUE PRELIMINARY ENGINEERING REPORT

This report presents the various build and no-build alternatives considered for Hillsborough Avenue (S.R. 580/600) from Eisenhower Boulevard (S.R. 589) to the vicinity of Nebraska Avenue (S.R. 45/U.S. 41), in Tampa, Florida (Figure 1-1). The length of the project is approximately six miles. The methodology used in analyzing the proposed alternatives is discussed along with the justification for the elimination of non-viable alternatives from further study. The purpose of this report is to serve as a supplement to the environmental reports, to fully document the major alternatives considered, but not addressed at the Public Hearing for the project.

This Report incorporates all revisions made in the conceptual design subsequent to the public hearing and through April, 1989, including incorporation of Addendums Number One and Two, issued in July, 1988 and November, 1988 respectively. Previous drafts of this Report were submitted in May and November of 1986 and April, 1988. This Report also incorporates changes made as part of the preliminary design phases and coordination with community groups through May, 1989.

Table 1-1 presents a brief comparison of the various no-build and build alternatives considered. Alternatives for replacement of the existing bridge at the Hillsborough River are compared in Tables 9-1 and 9-2.
For the recommended build alternate, proposed typical sections and recommended alignment are graphically summarized in Figure 1-2. The costs and impacts for the recommended alternate are summarized in Table 10-2 in Chapter 10.

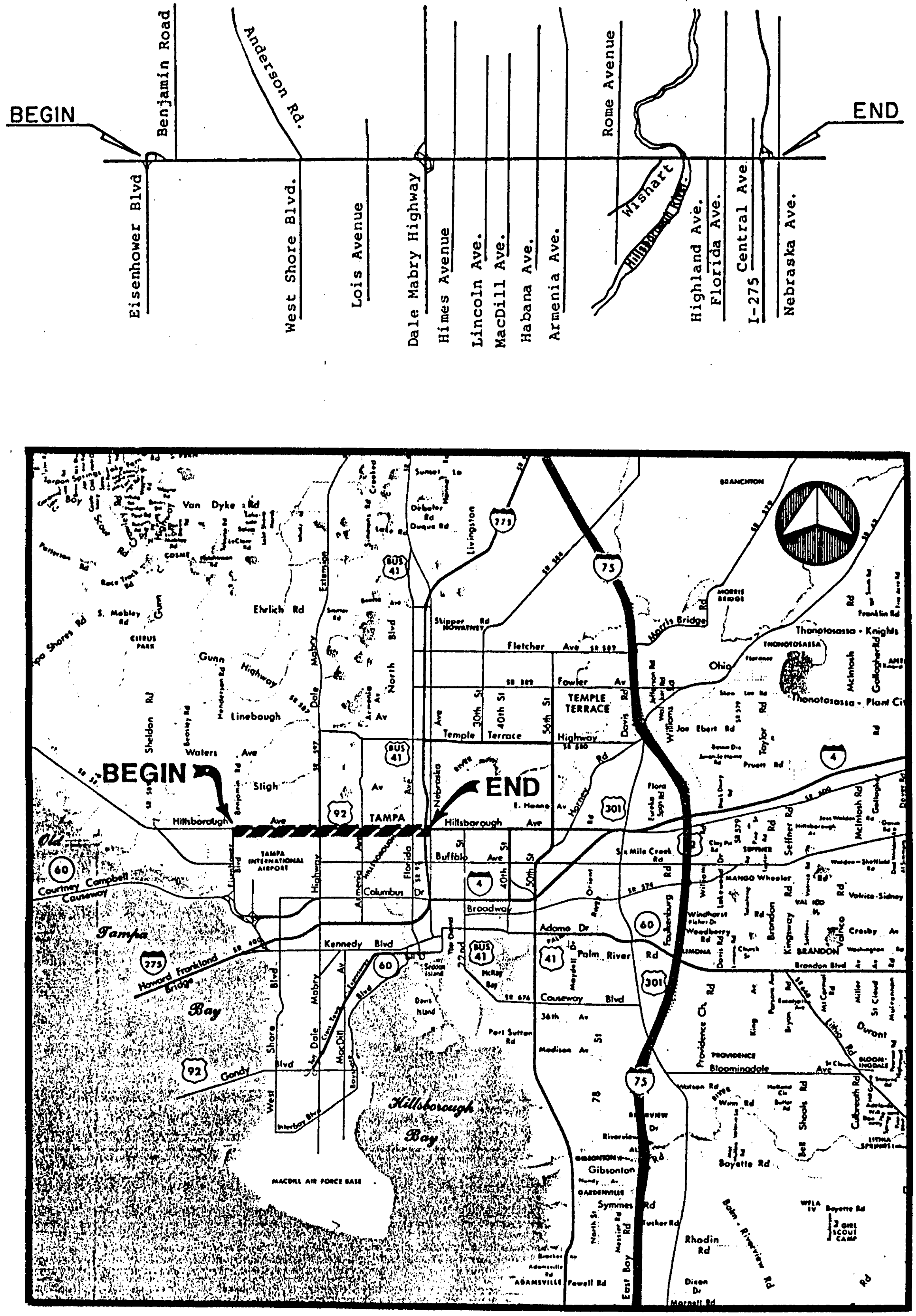

FIGURE 1-1 LOCATION MAP

TABLE 1-1 - COMPARISON OF BUILD AND NO-BUILD ALTERNATIVES

Alternate	Probable Arterial LOS & Operating Speed	Advantages	Disadvantages
No-Build	F; < 13 mph	o no displacements of businesses or residents o no impacts to wetlands o no construction or right-of-way costs o slower speeds would minimize noise impacts	o will not satisfy projected traffic demand; 15,000-20,000 Vehicles Per Day would have to divert to parallel facilities (e.g. Sligh/Buffalo Avenues) which would overload these facilities o probable impacts to residential streets as a result of traffic diversion o heavy congestion would result in high probable numbers of traffic accidents o higher fuel consumption and air pollution o slow emergency response times o Probable adverse economic impacts to businesses as a result of high congestion causing poor access
Build: **One-Way Pair** System with Two-Way Hillsborough Avenue	D; $\geq$ 17 mph	o would eliminate or postpone need to widen Hillsborough Avenue, thus saving construction and R/W costs	o would involve a major intrusion of a principal arterial into established residential neighborhoods o major shopping centers would be bisected o alignment controls at Dale Mabry (overpass), at the Hillsborough River (bridge) and at I-275 (overpass) would result in discontinuities in the one-way pair system

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TABLE 1-1 - COMPARISON OF BUILD AND NO-BUILD ALTERNATIVES

Alternate	Probable Arterial LOS & Operating Speed	Advantages	Disadvantages
Build: **8-Lane** Alternate (Himes to Armenia, inclusive)	D; ≥ 17 mph	o would reduce congestion at Himes, Habana, and Armenia Avenue intersections	o costs approx. $5 million more than the 6-lane alternate o displaces approx. 23 additional businesses o concern exists among State, County, and City technical staff regarding safety and operational effectiveness of 8-lane arterials o would violate FDOT standards for ultimate number of through lanes on arterial highways o inconsistent with MPO's year 2010 street and highway plan
Build: **6-Lane** (Recommended Alternate)	E; ≥ 13 mph F; < 13 mph	o would help satisfy future traffic demand o would reduce congestion and accidents compared to the No-Build Alternate o would generate economic activity, both direct and indirect o would correct existing deficiencies such as substandard lane widths and poor accessibility to businesses (east of Himes Avenue) o improved response time for emergency vehicles	o construction and R/W costs of $57± million o some minor wetland impacts expected o would displace 130± businesses and residences o potential impacts to historic district (currently being evaluated) o minor noise impacts expected at several locations

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Note: 45 m.p.h. design speed recommended for all segments

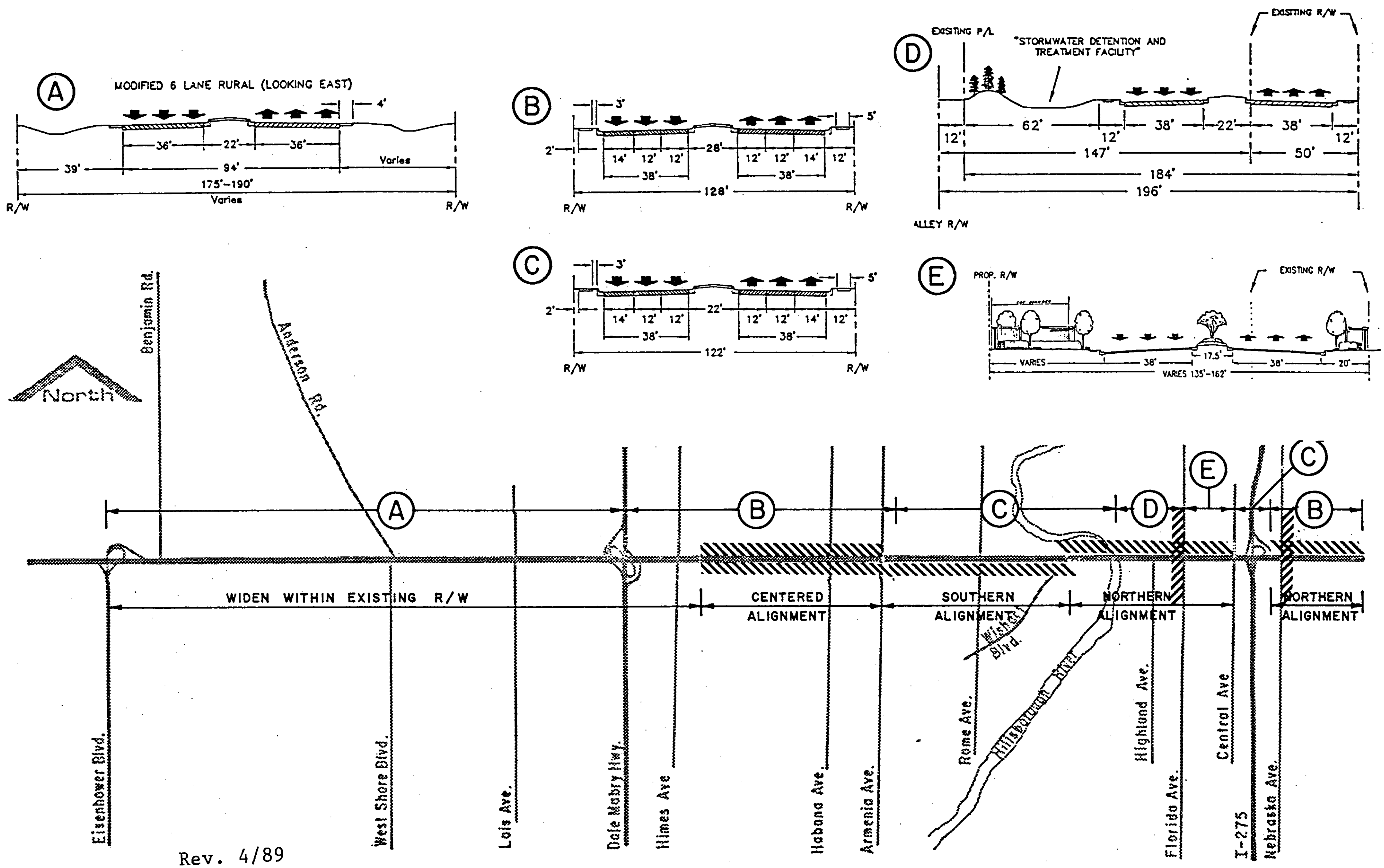


FIGURE 1-2 SUMMARY OF RECOMMENDED TYPICAL SECTIONS AND ALIGNMENT

HILLSBOROUGH AVENUE

2. EXISTING CONDITIONS

Note: Existing structural and operational conditions associated with the bridge over the Hillsborough River are discussed in Chapter 9.

EXISTING STREET AND HIGHWAY SYSTEM

Hillsborough Avenue (S.R. 580/600) is classified as an urban principal arterial within the study area. On the western end, one branch ties into S.R. 584 where it connects upper Pinellas County (Palm Harbor, Oldsmar) to Hillsborough County. It serves as a continuous east-west route through Hillsborough County, where it provides access to other north-south State Roads, including Eisenhower Boulevard, Dale Mabry Highway, Florida Avenue, I-275, Nebraska Avenue, 22nd Street, 56th Street, U.S. 301 and I-75. It also interchanges with I-4 near the U.S. 301 intersection. East of I-75, it continues south of and parallel to I-4 to Plant City and beyond.

Hillsborough Avenue is extensively used by emergency vehicles (Sheriff Dept., Tampa Police Dept., Fire Rescue and EMS, Fire Department); however, the existing congestion and narrow lanes (east of Habana avenue) hamper emergency response times and thereby reduces the usefulness of this highway as a route for emergency vehicles. Hillsborough Avenue also serves as an evacuation route serving portions of Pinellas and Hillsborough Counties.

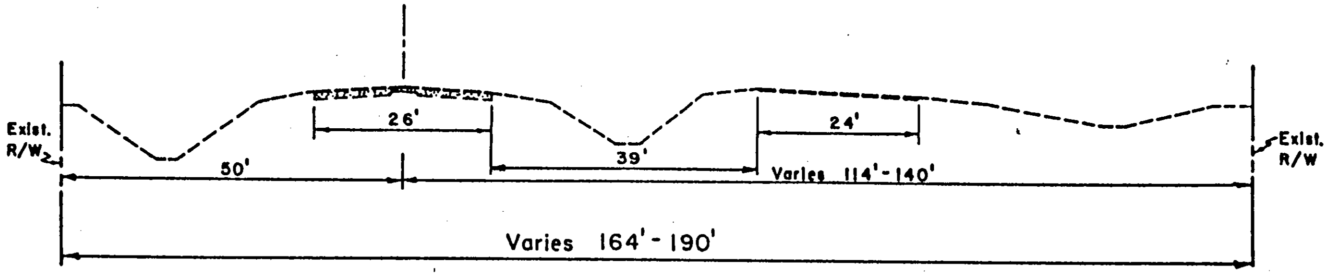
Typical Sections and Right-of-Way

Existing typical sections for Hillsborough Avenue are shown in Figure 2-1. Existing typical right-of-way widths are given in Table 2-1. The west end of Hillsborough Avenue, between Eisenhower Boulevard and Lincoln Avenue, consists of a four-lane divided, rural cross section, with existing right-of-way ranging (typically) between 150' and 190'. In the vicinity of Lincoln Avenue, the road-way transitions to an urban section. Between Lincoln and Aldana (approximately 1000' east of Lincoln), the pavement narrows to 55' (5-11' lanes, including a two-way left-turn lane) between gutter sections. Between Aldana and Habana, the roadway was widened in 1987 to include a 9' two-way left-turn lane with 4-11' through lanes (not counting gutter sections). Between Habana and Central, the pavement narrows to 33' between gutter sections except where it widens out at Armenia and at Rome to provide left-turn storage lanes. This results in average lane widths of only 8.25', excluding gutter sections. The right-of-way between MacDill and Central ranges from 50' to 80'. At Central, the pavement widens out again to form a four-lane divided facility in the interchange area at I-275, with a right-of-way of 110'. The existing bridge typical section is shown in Chapter Nine.

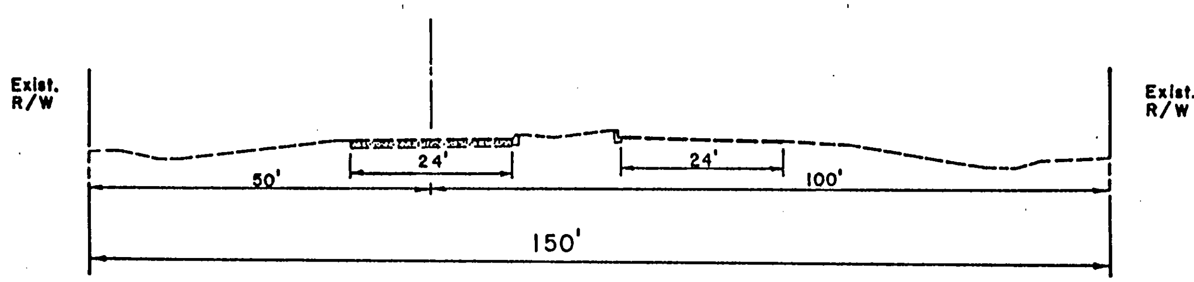
Drainage Systems

Stormwater run-off from Hillsborough Avenue is presently conveyed to both Tampa Bay and Hillsborough Bay through a variety of drainage systems. These systems are documented in FDOT drainage maps, in the

Eisenhower Blvd. to Church St.



Himes Ave. to Lincoln Ave.



Lincoln Ave. to Aldana Dr.

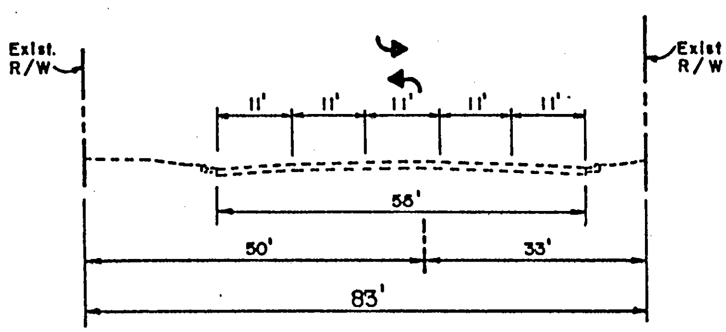


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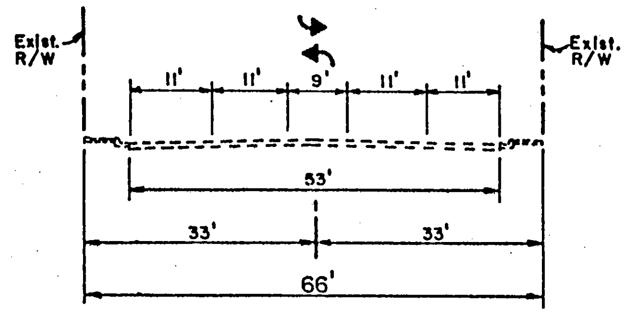
FIGURE 2-1 EXISTING TYPICAL SECTIONS

Aldana Dr. to Habana Ave.



Habana Ave. to Central Ave.

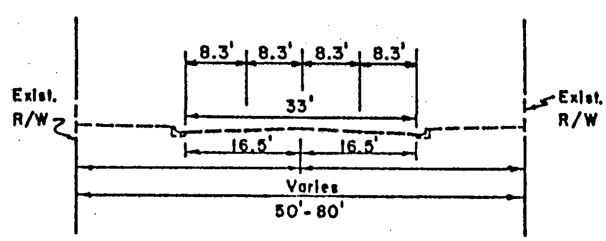


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FIGURE 2-1 CONTINUED

TABLE 2-1 - EXISTING TYPICAL RIGHT-OF-WAY WIDTHS*

Segment of Hillsborough Avenue	Existing Typical R/W Width
Eisenhower to West Shore	175'-180'
West Shore to Lois	190'
Lois to Dale Mabry	190'
Dale Mabry to Himes	190'
Himes to Lincoln	150'
Lincoln to MacDill	66'-100'
MacDill to Habana	66'
Habana to Armenia	66'
Armenia to Rome	80'
Rome to Wishart	80'
Wishart to Rivershore	80'
Rivershore to Highland	50'
Highland to Florida	50'
Florida to Central	50'
Central to I-275	110'
I-275 to Nebraska	100' min.
East of Nebraska	100'

City of Tampa drainage atlas, and in various drainage studies conducted for and by the City of Tampa Stormwater Management Division.

Rural (open ditches and swales) drainage systems convey run-off between Eisenhower Boulevard and the vicinity of Himes Avenue. A series of north-south ditches convey run-off in a northerly direction to the Henry Avenue canal which is north of and parallel to Hillsborough Avenue. The Henry Avenue canal connects to Sweetwater Creek in the Town 'n Country area where it eventually empties into Tampa Bay.

Hillsborough Avenue in the vicinity of Himes, transitions to an urban (underground pipe) system. Outfalls between Himes and the Hillsborough River include a 42" pipe at Himes (which connects to the Henry Avenue Canal), a 30" pipe on the south side of Hillsborough at Jamaica Street (which serves a drainage area between Matanzas and Armenia), a 42" or larger pipe at Forest Hills Drive which outfalls to the Hillsborough River, and a 24" outfall on the south side of Hillsborough Avenue at the west bank of the River.

The area of Hillsborough Avenue east of the river is included in the "Hillsborough Avenue Basin". Outfalls in this area include a 7'x4' concrete box on the north side of Hillsborough Avenue, at the east bank of the river and a 7'x4' concrete box at Central which conveys run-off in a northerly direction to Commanche; this box eventually connects to the above-mentioned box outfall at the River via Ola Avenue.

According to FDOT maintenance personnel, existing drainage pipes beneath Hillsborough Avenue are in generally poor condition.

Pedestrian and Bicycle Facilities

On the existing "rural" sections (Eisenhower to Lincoln), sidewalks are virtually non-existent. On the existing urban sections (east of Lincoln), sidewalks are provided on an intermittent basis only. A segment in the vicinity of Habana reconstructed in 1987 (to provide a TWLTL) includes a 4.5' sidewalk on both sides. Continuous sidewalks are provided on both sides east of the River, except for two areas on the south side (east and west of Highland Avenue).

There is one mid-block pedestrian traffic signal located just west of Mendenhall Drive. This is a designated school crossing for Mendenhall Elementary School. Most of the intersection traffic signals include pedestrian signal indications along with push buttons.

There are currently no special provisions for bicyclists on Hillsborough Avenue; on the contrary, some areas are extremely hazardous for bicyclists due to the narrow (8.3' average) lane widths. On the rural segments, there are no paved shoulders for bicyclists to use.

Street Lighting

Existing street lighting conditions on Hillsborough Avenue are summarized in Table 2-2. The predominant type of luminaire consists

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of 250 watt high-pressure sodium (HPS) fixtures (27,500 lumen). Average spacing and arrangment of poles vary by segment as shown in the table. These lights are maintained by Tampa Electric Company for the City of Tampa. The City pays a flat monthly rate based on the type and size of luminaire, etc.

TABLE 2-2 - SUMMARY OF EXISTING STREET LIGHTING

Segment	Predominant Type of Lighting	Pole Arrangment	Average Spacing	Comments
Eisenhower to Dale Mabry	--	N/A	N/A	No street lights
Dale Mabry to Lincoln	250w HPS	staggered	135'	480 V. UG circuit
Lincoln to N Boulevard	250w HPS	south side	230'	---
N Boulevard to I-75	250w HPS	mostly s. side	163'	---
Nebraska to 13th Street	250w HPS	staggered	106'	---

Intersection Design

Existing geometry for the more major intersections along Hillsborough Avenue is illustrated in Figure 2-2. All of the major intersections west of and including Rome Avenue now have left-turn storage lanes on Hillsborough Avenue. Improvements have been made in the last several years at Habana, Armenia and Rome. Intersections between Rome and I-275 still lack left-turn refuge/storage lanes.

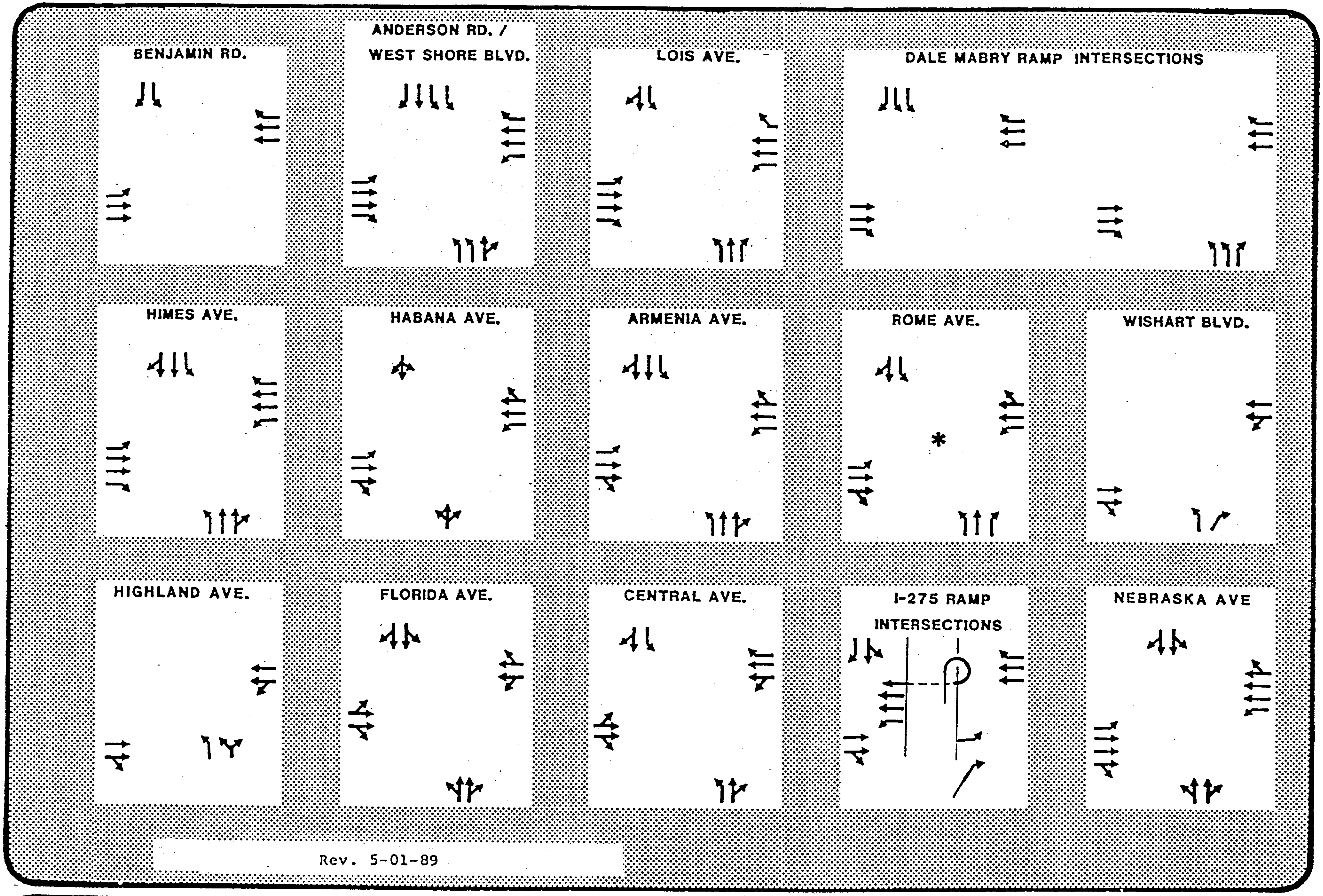


FIGURE 2-2 Existing Geometry at Major Intersections

HILLSBOROUGH AVENUE

Traffic Signal Locations

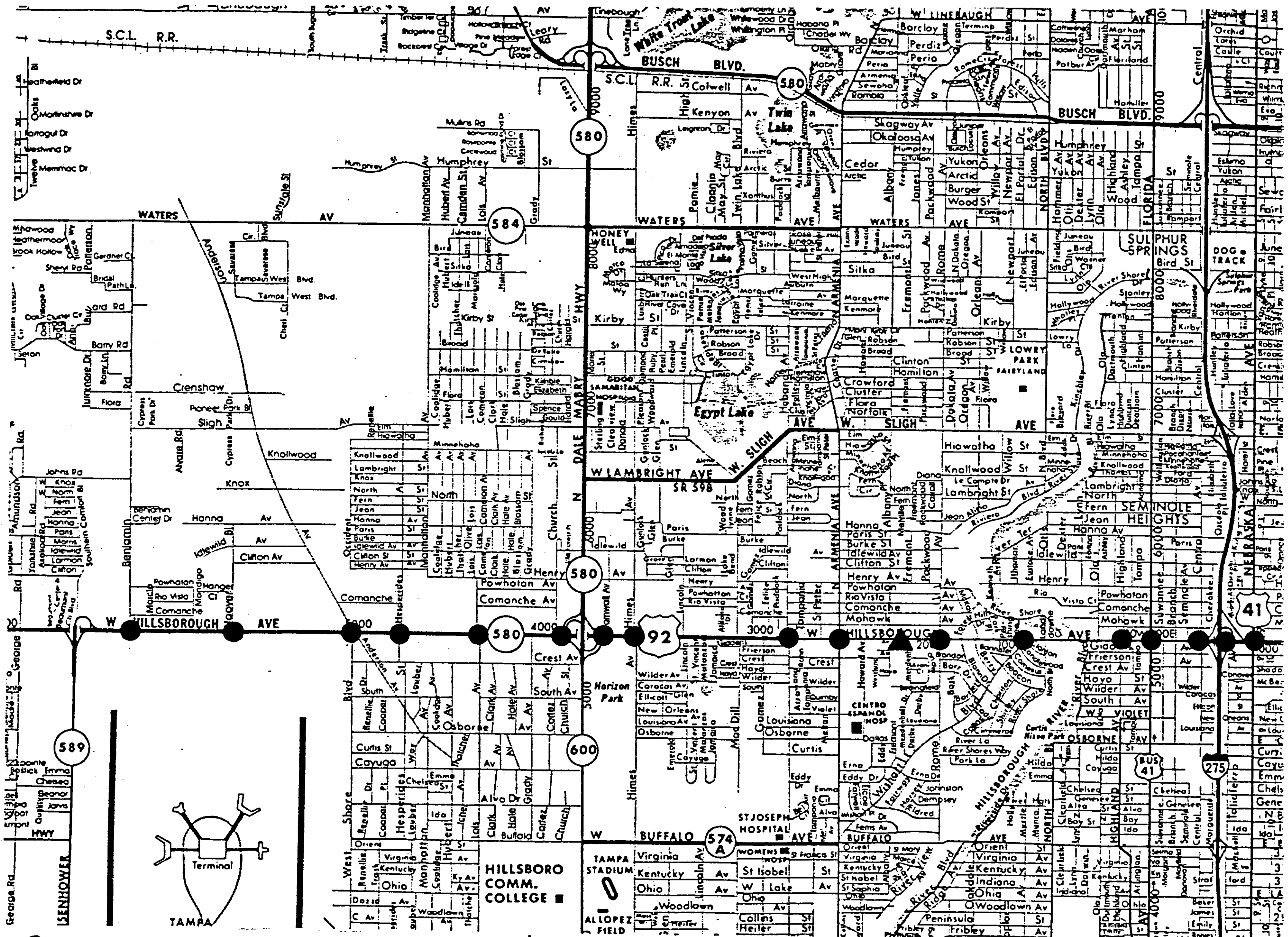
Existing traffic signal locations are illustrated in Figure 2-3 and listed in Table 2-3. At I-275 and Hillsborough Avenue, only the westernmost intersection (with I-275 SB ramps) is signalized.

The City of Tampa, in conjunction with Hillsborough County and the Florida Department of Transportation, is currently implementing an urban-areawide computerized traffic signal control system, utilizing state-of-the-art "UTCS extended" software. As of January, 1988, the system was controlling 350 traffic signals, and by early summer 1988 approximately 500 traffic signals should be under computer control. The traffic signals on Hillsborough Avenue are currently on-line, with the system. Future projects (currently in various stages of design) will connect signals along major traffic routes in unincorporated Hillsborough County.

Computer control normally operates by selection of an optimized timing pattern for a related group of signals.

Speed Limits

Existing speed limits are 45 mph between Eisenhower Boulevard and Dale Mabry and 35 mph between Dale Mabry and Nebraska. The higher speed limits are associated with the higher type design (rural



● Existing Traffic Signal ▲ Pedestrian Midblock Traffic Signal

FIGURE 2-3 EXISTING TRAFFIC SIGNAL LOCATIONS

HILLSBOROUGH AVENUE

TABLE 2-3 - EXISTING TRAFFIC SIGNAL LOCATIONS

(From West to East)

Intersection	Maintained By
Benjamin Road	Hillsborough County
Hoover Blvd.	Hillsborough County
Anderson Rd/West Shore Blvd.	City of Tampa
Hesperides Avenue	City of Tampa
Lois Avenue	City of Tampa
Dale Mabry Highway	City of Tampa
Himes Avenue	City of Tampa
Habana Avenue	City of Tampa
Armenia Avenue	City of Tampa
West of Mendenhall (Midblock signal)	City of Tampa
Rome Avenue	City of Tampa
Wishart Avenue	City of Tampa
Highland Avenue	City of Tampa
Florida Avenue	City of Tampa
Central Avenue	City of Tampa
I-275	City of Tampa
Nebraska Avenue	City of Tampa

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typical with wide median and right-of-way) and the lower speed limit is associated with the narrower urban (curb and gutter) typical sections. In addition, the lane widths drop to 8.3' average in the area between Armenia and Central Avenues.

Railroad Crossings

Prior to 1989, there was a single railroad crossing located approximately 700' west of Anderson Rd./West Shore Boulevard which consisted of a spur line serving several properties leased by the Aviation Authority. The rubberized-type crossing consisted of a single set of tracks protected by lights and gates. Service to the area south of Hillsborough Avenue was discontinued in late 1987 and, the Aviation Authority has removed the track up to the northermost right-of-way line on Hillsborough Avenue. The Aviation Authority was leasing the track north of Hillsborough Avenue from CSX Transportation.

Structural Conditions

Structural ratings for the bridge at the Hillsborough River are included in Chapter 9.

Pavement structural ratings are summarized in Table 2-4.

TABLE 2-4 - PAVEMENT STRUCTURAL RATINGS

Asphaltic Concrete Portion:

BMP	EMP	Side	Ratings: Defects	Ride	Basic
6.960	8.550	"Left"	80	86	83
6.960	8.550	"Right"	85	87	86
8.550	10.053	"Right"	85	89	87
8.550	10.053	"Left"	85	88	87
10.053	10.297	Composite	95	68	80

Concrete Portion:

BMP	EMP	Side	Ratings: Defects	Ride	Basic
10.297	12.654	Composite	16	69	33
12.654	12.875	Right	72	72	72
12.876	12.654	Left	87	70	79

Source: FDOT Rigid Pavement Condition Survey; 1/28/88 Printout (Surveyed 2/87)

The legend for the ratings is as follows: 90-100 "very good"; 80-90 "good"; 70-80 "average"; 60-70 below average "poor"; and under 60 "very poor".

Existing/Proposed Utilities

There are numerous existing utilities within the Hillsborough Avenue right-of-way. Telephone facilities include both buried and aerial cables for the entire length of the study area. In addition, there is a major telephone exchange (switching facilities) located on the southeast corner at Florida Avenue and Hillsborough Avenue.

Peoples Gas Company has transmission pressure mains running on either side in approximately seven scattered segments of Hillsborough Avenue.

The City of Tampa has both 12" and 8" water mains running down the middle (in some areas) and either side (in other areas) and both sides (in still other areas) for the entire length of the study area The City also has sanitary sewer lines which run intermittently along Hillsborough Avenue. In addition, a new interceptor line was constructed in 1986 which crosses Hillsborough Avenue near Ola Avenue.

Finally, Tampa Electric Company has numerous facilities throughout the study area. Florida Gas Transmission has no facilities in the corridor.

Soil Conditions

Predominant soil types along the project area are listed in Table 2-5 along with some of their engineering characteristics. As shown in the table, the soils are predominantly sands and fine sands, with occasional areas of loamy sands.

TABLE 2-5 - PREDOMINANT SOILS ALONG HILLSBOROUGH AVENUE

S = Sand
FS = Fine Sand
L = Loamy; M = Mucky

Area	Predominate Soil Types (Code)	Name	Engineering Index Properties: Depth (In.)	Engineering Index Properties: USDA Texture	Engineering Index Properties: AASHTO Classif.	Probable Depth to High Water Table
Eisenhower to West Shore	32	Myakka-Urban land complex	0-20	FS	A-3	0-1.0
			20-44	S;FS,LFS	A-3,A-2-4	
	29	Myakka fine sand	0-20	FS	A-3	0-1.0
			20-30	S,FS,LFS	A-3,A-2-4	
	52	Smyrna fine sand	0-12	FS	A-3,A-2-4	0-1.0
			12-20	S,FS,LFS	A-3,A-2-4	
	4	Arents, nearly level	--	--	--	--
West Shore to Dale Mabry	22	Immokalee-Urban land complex	0-5	FS	A-3	0-1.0
			5-35	FS,S	A-3	
	27	Malabar fine sand	0-12	FS	A-3	0-1.0
			12-30	S,FS	A-3,A-2-4	
(East of Hesperides)	5	Bassinger	0-7	FS	A-3	+2-1.0
			7-28	S,FS	A-3,A-2-4	
		Holopaw	0-6	MFS	A-3	+2-1.0
			6-52	S,FS	A-3	
		Samsula	0-34	Muck	--	+2-1.0
			38-80	S,FS,LS	A-3,A-2-4	
	46	St. Johns fine sand	0-12	FS	A-3	0-1.0
			12-29	S,FS	A-3	
	56	Urban land	--	--	--	--
	4*					

Source: Soil Survey Update, Hillsborough County, Florida (Interim Report, April 1987) Hillsborough Soil and Water Conservation District. (Map Nos. 30 & 31)

* Characteristics described above.

S = Sand
FS = Fine Sand
L = Loamy; M = Mucky

Area	Predominate Soil Types (Code)	Name	Engineering Index Properties: Depth (In.)	USDA Texture	AASHTO Classif.	Probable Depth to High Water Table
Dale Mabry to East of Himes	4,27,32,56*					
East of Himes to Albany	56*					
Albany to Vicinity of Hills. River	58	Wabasso-Urban land complex	0-21 21-31	FS S,FS,LFS	A-3 A-3,A-2-4	0-1.0
West Side of Hills. River	59	Winder fine sand	0-10 10-14 14-30	FS LS,SL,FSL S clay L	A-3,A-2-4 A-2-4 A-2-4,A-2-6	0-1.0
East Side of Hills. River	58*					
East of Hills. River to East Side of I-75 Interchange	55	Tavares-Urban land complex, 0 to 5% slopes	0-6 6-80	FS S,FS	A-3 A-3	3.5-6.0
East Side of I-75 Interchange to East of Nebraska	56*					

* Characteristics described above.

There is one area east of Hesperides Avenue (east of West Shore) which includes some possible muck and mucky fine sand; however, this is not expected to be a problem since the probable construction in this area consists of minor widening utilizing the existing roadway and its subgrade (combination of resurfacing, widening and overbuilding and resurfacing).

Near the west side of the Hillsborough River, there is a small area of sandy clay loam (14" - 30" deep). This area should be investigated more closely during the design stage since the new bridge and its approaches will be constructed on a new alignment directly north of the existing bridge.

Environmental Factors, Potential Section 4(f) Lands, and Cultural Features

Due to the heavily urbanized nature of the Hillsborough Avenue area, environmental factors associated with natural features are not expected to be significant factors. There are seven wetlands contiguous to Hillsborough Avenue, some of which will be impacted. Most of these are on the western half of the project and they consist of wet ditches or canals which run into the Henry Avenue Canal north of and parallel to Hillsborough Avenue. Wetland number 7 consists of the Hillsborough River where Hillsborough Avenue crosses it.

Potential hazardous wastes sites have been identified and described in separate reports. Separate reports have also been prepared describing the probable impacts on noise and air quality.

There are no known archaeological resources in the study area. The project traverses a portion of the Seminole Heights Historic District, which may be eligible for listing on the National Register of Historic Places. Extensive coordination has occured among the Department, the Seminole Heights Civic Association, the Historic Tampa/Hillsborough County Preservation Board, the State Historic Preservation Officer and FHWA regarding impacts of the proposed widening to the potentially eligible Historic District and mitigation plans.

The environmental determination "package" and the Section 4(f) Statement fully document these and other environmental impacts.

Other potential Section 4(f) lands include Horizon Park located on the south side of Hillsborough Avenue between Dale Mabry and Himes, and River Boulevard Park, an unimproved park located on the south side of Hillsborough Avenue on the east bank of the Hillsborough River (Figure 2-4).

In addition to the two parks, there are three churches contiguous to the project (Figure 2-4). These include two Baptist churches and an Assembly of God church.

OPERATIONAL CONDITIONS

Traffic Volumes

Traffic volumes for 1984 for the study area are shown in Figure 2-5 along with 1987 updated counts where available. Where 1987 counts are not available, the estimated volumes would be approximately 8.1% higher than the 1984 numbers, based on an overall average corridor growth of 2.7% per year (Reference 1). In addition to existing mid-block volumes, entering ADT's for major intersections along

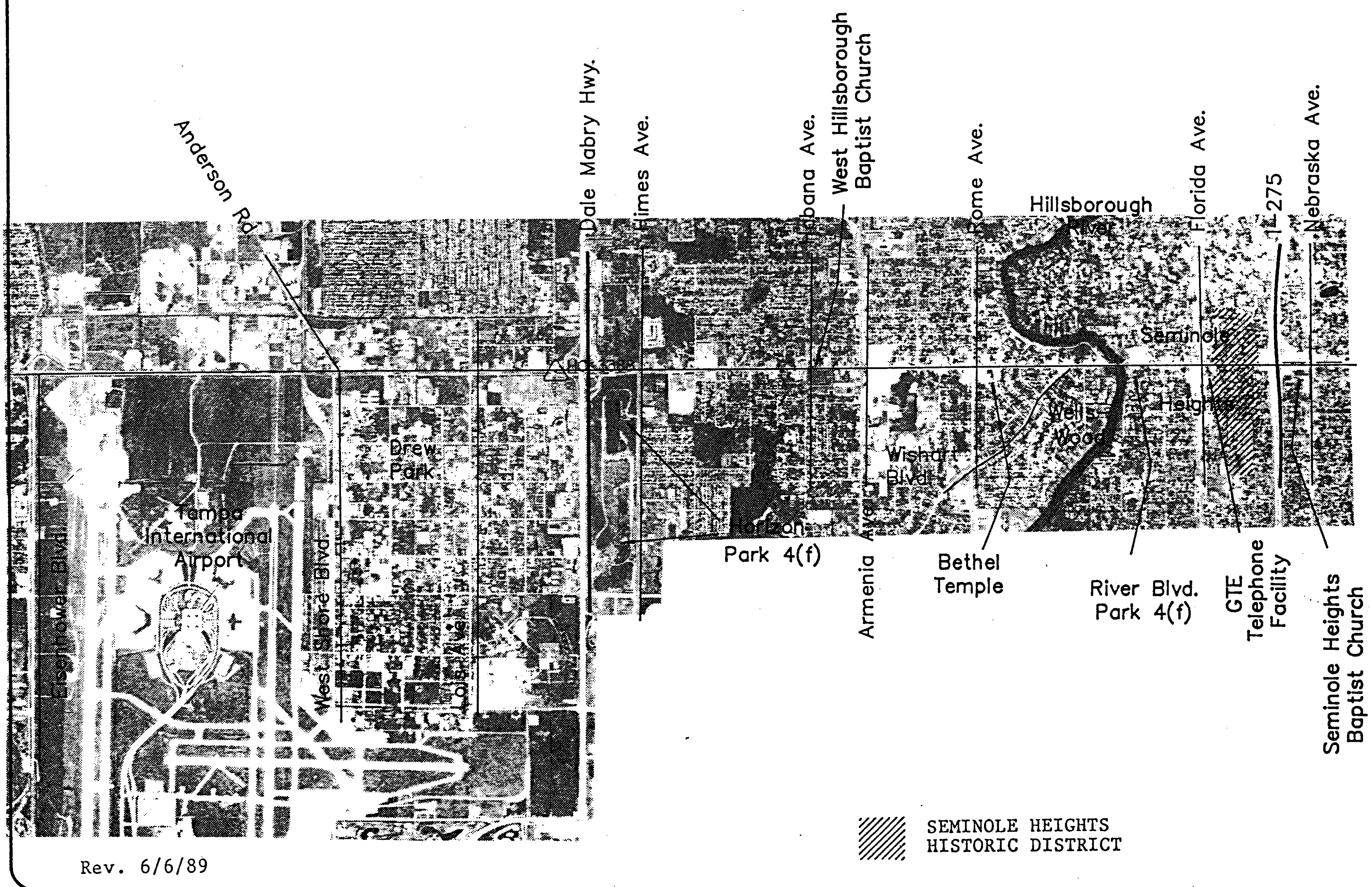
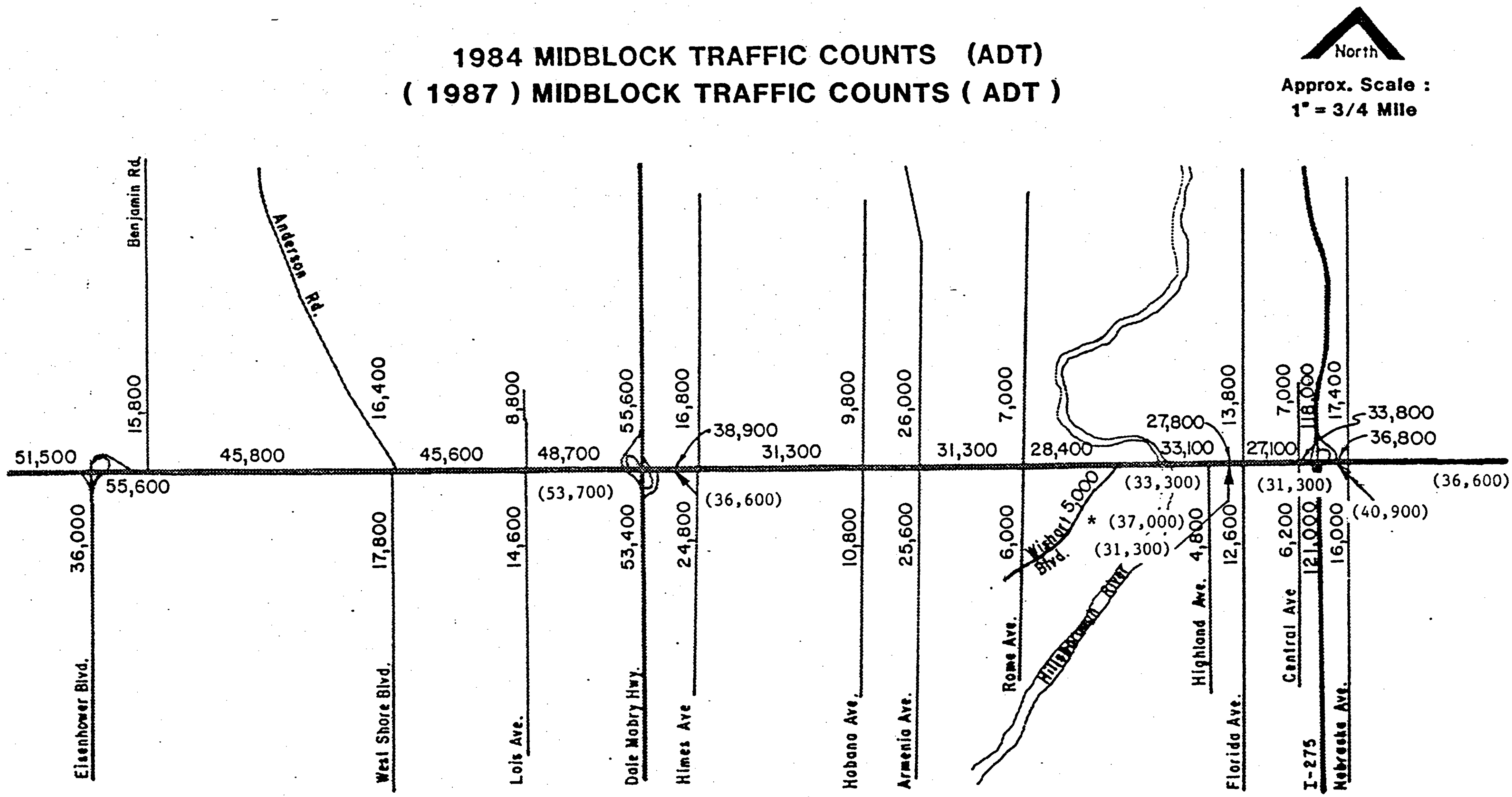


FIGURE 2-4 CULTURAL AND OTHER FEATURES

1984 MIDBLOCK TRAFFIC COUNTS (ADT)
(1987) MIDBLOCK TRAFFIC COUNTS (ADT)



SOURCES: REFERENCE 1 (FIGURE 2 and APPENDIX C) AND UPDATES FROM (FDOT) & (CITY of TAMPA)*

FIGURE 2-5 EXISTING SYSTEM ADT ESTIMATES

HILLSBOROUGH AVENUE

TABLE 2-6 - EXISTING SYSTEM ADT's FOR MAJOR INTERSECTIONS

Hillsborough at:	Est. Entering ADT's* 1984	1986**
Eisenhower Boulevard	71,300	75,200
Anderson Rd. / West Shore Blvd.	62,000	65,300
Lois Avenue	59,000	62,200
Dale Mabry Highway	98,000	103,000
Himes Avenue	57,400	60,500
Habana Avenue	41,200	43,400
Armenia Avenue	58,200	61,300
Rome Avenue	37,800	39,800
Wishart Boulevard	33,400	35,200
Highland Avenue	32,800	34,600
Florida Avenue	41,000	43,200
Central Avenue	36,800	38,800
I-275	157,000	165,000
Nebraska Avenue	53,400	56,300

* Average daily traffic entering the intersection
** 1984 ADT + 5.4%

Source: Reference 1

Hillsborough Avenue are given in Table 2-6. The two highest-volume intersections, Hillsborough at Dale Mabry and I-275, respectively, already have interchanges.

Levels of Service

Existing levels of service are given in terms of both intersections and the arterial as a whole.

Base Year (1983) intersection levels of service, estimated using mostly 1983 turning-movement counts and the critical movement analysis methodology of TRB Circular #212 (Reference 2), are given in Table 2-7.

Levels of service for the arterial as a whole have also been derived by utilizing generalized levels of service tables recently published by the FDOT based on the 1985 Highway Capacity Manual (Reference 3). Based on these tables for principal arterials (group 2 -- 2.6 to 5.0 signalized intersections per mile), the arterial level of service in 1987 was F.

One existing condition which significantly affects the existing intersection capacities and running speeds between intersections is the substandard lane widths. As previously mentioned, the existing lane widths on the narrow section of Hillsborough Avenue average 8.3' not counting the gutter sections. Normal design standards usually call for 11' or 12' lanes. These existing substandard lane widths, along with the lack of medial separation, are likely significant factors in the high accident rate for Hillsborough Avenue.

TABLE 2-7 - EXISTING SYSTEM INTERSECTION LEVELS OF SERVICE

Hillsborough Avenue at:	Base Year (1983) Level of Service (AM, PM)
Eisenhower Boulevard	--
Benjamin Road	F, E
Westshore / Anderson	C, F
Hesperides Avenue	C, D
Lois Avenue	E, E
Dale Mabry Highway	F, F (west side ramps)
Himes Avenue	F, F
Habana Avenue	C, C*
Armenia Avenue	C, E
Rome Avenue	A, A
Wishart Boulevard	B, D
Highland Avenue	A, A
Florida Avenue	D, D
Central Avenue	B, C
I-275	--
Nebraska Avenue	B, C

* Up until 1987, left turns were prohibited during peak traffic hours on all approaches; therefore, the level of service would be worse if left turns were allowed.

Traffic Accidents

Accident statistics were obtained for 1983 through 1985 for Hillsborough Avenue between Eisenhower and Nebraska. A summary of the data is included in Table 2-8:

TABLE 2-8 - ACCIDENT SUMMARY STATISTICS

	1983	1984	1985
Reported No. of Accidents	844	430	422
Reported No. of Injuries	341	345	377
Reported No. of Fatalities	4	3	2
Economic Loss ($ millions)	5.3	4.3	4.3

The drop in reported accidents between 1983 and 1984 is apparently due to the implementation in Florida of the short accident form, beginning in January of 1984. All accidents with no injuries and only minor property damage are coded on the short form, which does not go into FDOT's accident records data base in Tallahassee.

As shown in Table 2-9, a comparison with Statewide average accident rates for similar type roadways shows that the accident rate for the western section of the project area (4-lane divided, rural typical section) exceeded the Statewide average in 1983 by 16% and was 32% less than the Statewide rate in 1984. For the eastern section of Hillsborough Avenue (4-lane undivided, urban typical section), the accident rate exceeded the Statewide averages for 1983 and 1984 by 41% and 8.1%, respectively.

TABLE 2-9 - ACCIDENT RATE COMPARISONS

Section of Hillsborough Avenue	1983 Accident Rates		1984 Accident Rates	
	Actual	Statewide Average	Actual	Statewide Average
Benjamin Rd. - Church	6.91	5.95[1]	2.59	3.79[1]
E. of Himes - E. of Central	13.40	9.49[2]	6.43	5.95[2]

1 Statewide rates for 4-L Divided "Urban" Area Type
2 Statewide rates for 4-L Undivided "Urban" Area Type

The highest accident sections in 1983 included Hillsborough between Himes and Tampania with 104 accidents and Hillsborough between Howard and River Shore, with 110 accidents reported. Of these 214 total accidents, 18% were rear-end; 28% were right-angle, and 24% were sideswipe. Engineering-related factors which are likely contributing to the rear-end and sideswipe accidents include the substandard lane widths and lack of left-turn storage lanes. Widening the roadway to provide left-turn lanes and adequate lane widths would be expected to reduce these types of accidents.

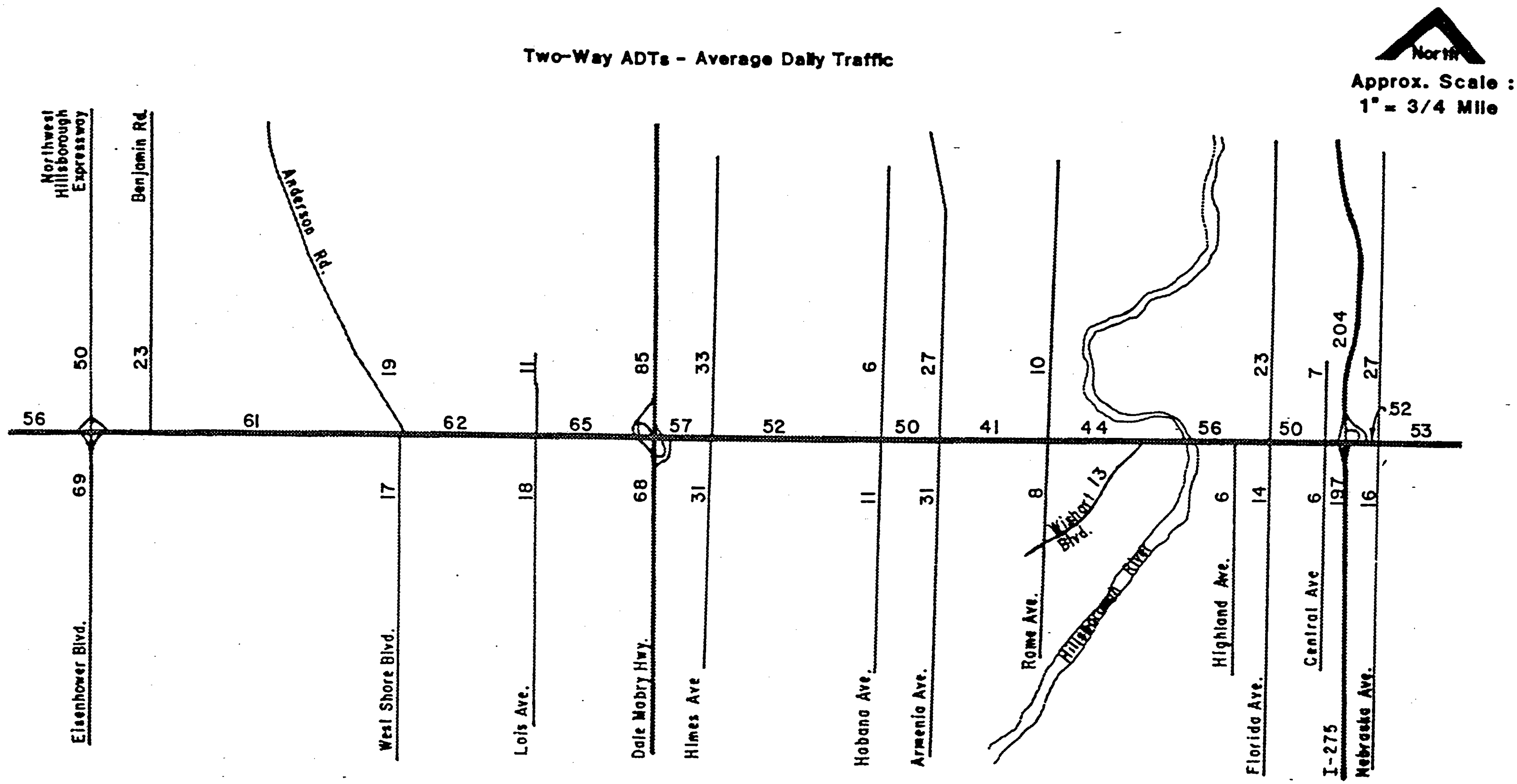
Additional data with respect to fatal accidents and pedestrian accidents is included in Appendix C.

3. PROJECTED CONDITIONS (YEAR 2010)

Future Traffic Demand

Projected travel demand for the design year of 2010 is shown in Figure 3-1. Estimated demand for intermediate years as well as the sources of and methodology used to develop the estimated demand are contained in the Design Traffic Technical Memorandum (Reference 1). The Design Traffic report also includes projected intersection turning movements for future years. Projected ADT's for major intersections are included in Table 3-1 along with a comparison with 1984 ADT's. The given volumes are based on the assumption that the proposed Northwest Hillsborough Expressway will be built during the 1990's or sometime thereafter. For Hillsborough Avenue, the differences in projected volumes "with" and "without" the proposed expressway are small. The largest differences are projected to occur directly adjacent to the expressway, where the volumes would be 3000-6000 VPD higher on Hillsborough Avenue <u>with</u> the expressway (Reference 1).

A comparison of 1984 volumes with 2010 demand shows a projected overall average increase of 48% for mainline volumes and a 50% increase for intersection ADT's over this 26-year period (Reference 1).



XXX = TWO-WAY ADT (1000,s of VPD)
SOURCE: DERIVED FROM APPENDIX "C" REFERENCE 1

FIGURE 3-1 YEAR 2010 ESTIMATED TRAFFIC DEMAND

TABLE 3-1 - INTERSECTION ADT's FOR 1984 AND 2010

Hillsborough at:	Est. Entering ADT's* 1984	2010	% Increase
Eisenhower / NWH Expressway	71,300	118,000	65%
Anderson Rd. / West Shore Blvd.	62,000	79,800	29%
Lois Avenue	59,000	76,000	29%
Dale Mabry Highway	98,000	138,200	41%
Himes Avenue	57,400	86,000	50%
Habana Avenue	41,200	59,800	45%
Armenia Avenue	58,200	73,600	26%
Rome Avenue	37,800	52,200	38%
Wishart Boulevard	33,400	56,400	69%
Highland Avenue	32,800	58,200	77%
Florida Avenue	41,000	71,000	73%
Central Avenue	36,800	58,600	59%
I-275	157,000	251,400	60%
Nebraska Avenue	53,400	74,200	39%
Averages	60,000	90,000	

Overall
Average Growth = 50% ÷ 26 years = 1.9%/year
(Compounded annual growth rate = 1.6%)

* Average Daily Traffic entering the intersection.

Subsequent to the publishing of the Design Traffic Technical Memorandum, a revision was made in the "K-factor" (percentage of AADT represented by the two-way traffic volume in the design hour) as explained in Appendix A.

Future Street and Highway Network

The year 2010 transportation network from the Tampa Urban Area Transportation Study (TUATS) (Reference 4) is reproduced in Figure 3-2 for the study area only. This figure shows the planned new and improved facilities which are intended to be in place by the year 2010. These intended improvements were assumed to be in place for purposes of estimating year 2010 signalized intersection capacities. The TUATS plan shows Hillsborough Avenue as a six-lane divided arterial between Eisenhower Boulevard and Nebraska Avenue. This is also consistent with the Florida Transportation Plan which generally discourages construction of arterial highways with more than six through lanes (Reference 5).

At the present time there are several studies under way which will impact Hillsborough Avenue; the major ones include the I-275/I-4 project development study and financial feasibility studies for the proposed Northwest Hillsborough Expressway.

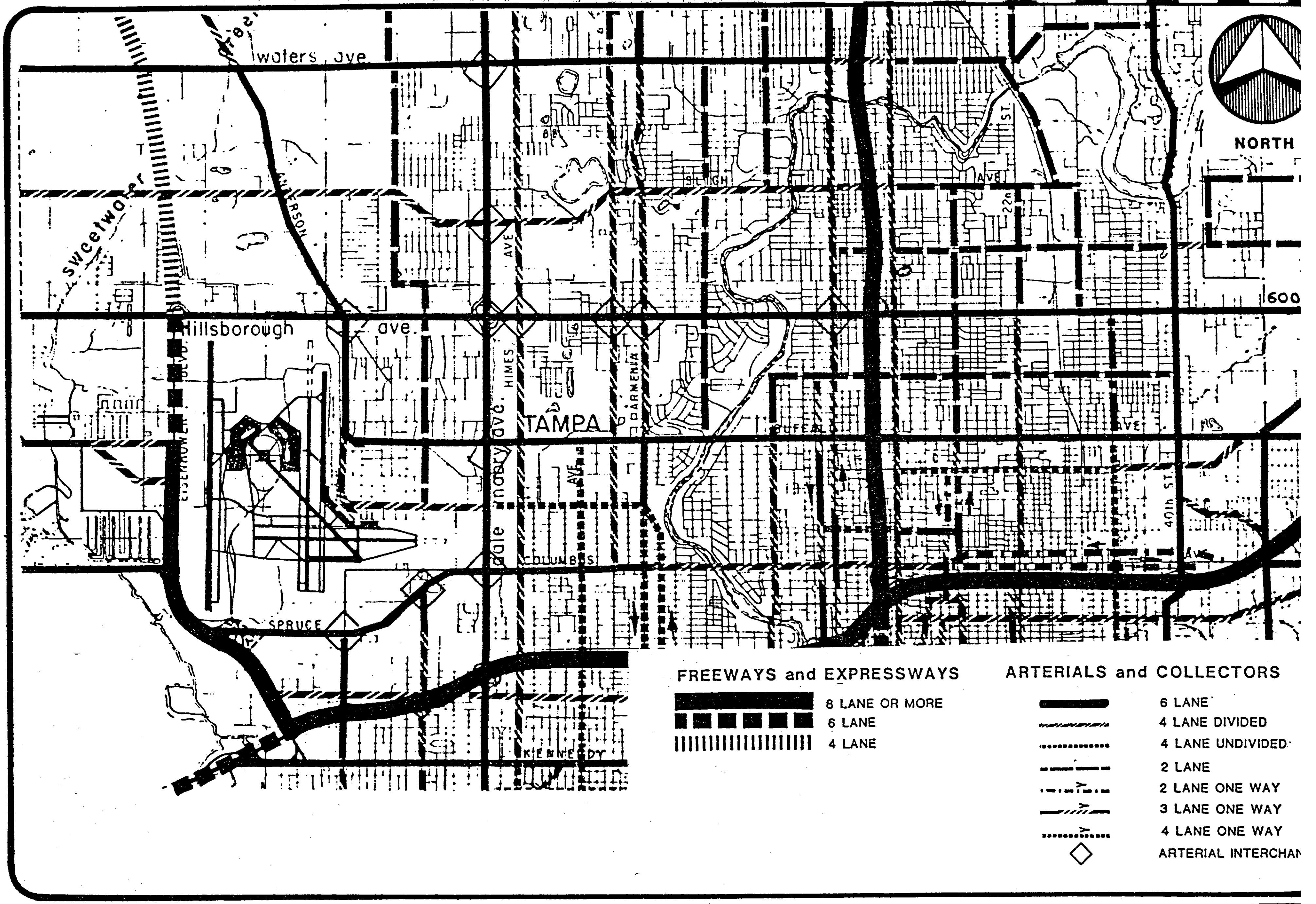


FIGURE 3-2 YEAR 2010 TUATS STREET NETWORK

HILLSBOROUGH AVENUE

4. NO-PROJECT ALTERNATIVES

The following sections introduce the no-project alternatives, which include the no improvement alternate, postponing the action, upgrading the existing facility, transit as an alternative mode, and upgrading facilities in other corridors.

No Improvement Alternate

A substantial transportation demand along Hillsborough Avenue in the study area can currently be observed, and it is projected to significantly increase over the next 25 years. Traffic demands in the west end of the project corridor are estimated to be approximately 57,000 vehicles per day by 2000 and about 63,000 by the year 2010. Maximum capacity of an ideal four-lane divided arterial highway would be approximately 36,000 vehicles per day. Therefore, approximately 27,000 vehicles per day would have to be diverted to unplanned parallel facilities. Moreover, at maximum capacity, Hillsborough Avenue traffic would be operating at speeds equal to or less than 15 miles per hour. Congestion would increase travel times for motorists, resulting in increased fuel consumption, higher levels of air pollutants, and greater delays for emergency services.

Conversely, if the project is not constructed, there would be no displacement of families or businesses, no wetland impacts would occur, construction impacts would not occur, right-of-way would not have to be acquired, and funds would not have to be expended. However, these seemingly beneficial attributes of not constructing a build alternate would be only at the expense of increased adverse impacts resulting from congestion and spillover onto parallel roadways, including in some cases, local residential streets not designed or intended to carry heavy traffic volumes.

Postponing the Action

Postponing the upgrading of Hillsborough Avenue would, depending on the length of postponement, have impacts similar to the no-improvement alternative.

Postponing the action may also jeopardize the future economic feasibility of the project. Based on current escalation of construction costs, project costs would double within 15 years of project delay.

Upgrading the Existing Facility

The existing four-lane divided section between Eisenhower and Dale Mabry is already constructed of a high-type design with deceleration lanes and adequate recovery areas, and most of the signalized intersections already have left-turn storage lanes on all approaches. Little could be done to increase the capacity of the roadway other than by adding additional lanes at intersections.

The existing substandard four-lane undivided urban section, east of MacDill Avenue, could be upgraded by widening to a four-lane divided section with minimum 11- foot lanes; this would increase the capacity, particularly at those signalized intersections where left turns from Hillsborough are not now prohibited. The construction cost would be high since this would involve curb and gutter with underground drainage and some additional right-of-way acquisition. The increase in capacity, however would be insignificant and far short of that required to serve the year 2010 traffic demand (estimated to range between 42,000 and 56,000 vehicles per day in this section of Hillsborough Avenue), making this an unreasonable and non cost-effective alternative.

Transit as an Alternative Mode

The Tampa Urban Area Transportation Study has indicated that 4.2 percent of the person trips within a one-half mile service area of transit routes in Hillsborough County will be using mass transit by the year 2000. This indicates that transit usage would not be sufficient to serve as an alternative to upgrading and improving this section of Hillsborough Avenue.

Alternative Corridors

Due to existing patterns of development both north and south of Hillsborough Avenue, there are no feasible alternative corridors, other than those which would utilize existing residential streets and, in turn, have an adverse impact on neighborhoods in the area. To the south of Hillsborough Avenue, both Tampa International Airport and Horizon Park present obstacles to any potential alternative corridors. To the north of Hillsborough Avenue, any other corridors south of Sligh Avenue would heavily impact residential areas due to most of these areas having already been developed.

Any new corridor between Buffalo Avenue and Sligh Avenue, in addition to adversely impacting (bisecting) residential neighborhoods, would require the construction of an additional bridge across the Hillsborough River. In addition, Hillsborough Avenue interchanges with I-275 midway between the Sligh Avenue interchange and the Buffalo Avenue interchanges; any additional corridor would not provide this important connection with I-275.

Buffalo Avenue (parallel to and one mile south of Hillsborough Avenue) is already scheduled to be six-laned as part of the MPO's long range transportation plan due to forecasted increases in traffic demand.

Sligh Avenue (parallel to and one mile north of Hillsborough Avenue) is scheduled to be widened from 4-lanes to "4-lane divided" in the MPO's long range transportation plan. However, Sligh Avenue lacks the important route continuity which Hillsborough Avenue has; it is of less functional importance than Hillsborough Avenue. Widening Sligh Avenue to six-lanes as an alternative to widening Hillsborough Avenue would not be feasible due to its distance from Hillsborough Avenue as well as its lack of route continuity.

Buffalo Avenue is already proposed to be six-laned, and it is doubtful that many of the trips projected for Hillsborough Avenue could be shifted to Buffalo Avenue due to capacity constraints. One alternative to improving Hillsborough Avenue would be to six-lane Lambright/Sligh Avenue. However, Lambright and Sligh Avenues lack the route and alignment continuity of Hillsborough Avenue; therefore, only a small portion of the 23,000± vehicles/day increase forecasted for Hillsborough Avenue could be expected to transfer to an improved Lambright/Sligh Avenue.

5. CAPACITY ANALYSIS FOR YEAR 2010 DEMAND

Methodology and Assumptions

Capacity analyses for signalized intersections were performed for projected year 2010 design hour volumes, using the planning analysis methodology (critical movement analysis) of Transportation Research Board Circular #212 (Reference 3). The following assumptions generally apply:

- o The number of lanes for the cross streets is as shown in the TUATS year 2010 plan.
- o K-factor of 8% was used (see Appendix A).
- o A peak-hour directional factor of 55% was used.
- o An exclusive right-turn lane was shown where the design hour volume (DHV) in either the AM or PM exceeds 300 vehicles/hour (vph).
- o Dual left turn lanes were shown where the peak hour volume exceeded 300 vph.
- o In most cases, where dual left turn lanes are warranted on one approach, they were also added on the opposite approach, for reason of alignment as much as capacity considerations.

The planning analysis methodology was used to provide a basic assessment of whether or not capacity was likely to be exceeded for 25-year forecast mainline volumes and turning movements.

Probable Intersection Levels of Service for a Six-Lane Arterial

The results of the capacity analyses are presented in Table 5-1. The intersection geometric configurations which correspond to the capacity analyses are shown in Figure 5-1. The results indicate that a six-lane arterial would be required to adequately handle the year 2010 DHV. By 2010, three of the intersections will likely be operating at LOS E or F: Hillsborough at Himes (assuming that Himes is still four-lane divided north and south of Hillsborough); Hillsborough at Armenia; and Hillsborough at I-275. In addition, Hillsborough at Florida will likely be near LOS E in the PM peak period. For these major intersections, additional options were considered to increase the intersection capacities as explained in the next section. For Hillsborough at I-275, major widening on Hillsborough Avenue is infeasible due to bridge pier constraints. Widening under the I-275 structure will depend on future I-275 improvements.

West Shore Blvd./Anderson Ave. and Lois Avenue are parallel north-south facilities on the TUATS 2010 Plan. However, according to the Plan, West Shore/Anderson will be six-lanes while Lois will remain two lanes. Assigned design year volumes on both facilities were reviewed from a north-south corridor perspective. Study volumes were brought into closer conformance with TUATS 2010 traffic assignments by diverting some peak through volumes from Lois to West Shore/Anderson. This traffic adjustment resulted in both intersections operating at LOS D.

TABLE 5-1 - YEAR 2010 PROBABLE INTERSECTION CAPACITIES

FOR A SIX-LANE HILLSBOROUGH AVENUE

Hillsborough Avenue at:	Critical Volume Sum and Probable Level of Service			
	AM Peak		PM Peak	
Benjamin Road (4)	1090	C	1120	C
West Shore / Anderson (6)	1225	D	1170	D
Lois Avenue (2)	1224	D	1220	D
Dale Mabry Ramps	1070	C	950	B
Himes Avenue (4)	1290	E	1380	F
(6)	1130	D	1210	D
Habana Avenue (4)	1120	D	1040	C
(4) w/dual lefts*	1040	C	990	C
Armenia Avenue (4)	1330	E	1380	F
(4) w/dual lefts*	1280	E	1290	E
(6)	1150	D	1230	E
(6) w/dual lefts*	1090	C	1140	D
Rome Avenue (2)	1040	C	1000	B
Wishart Avenue (4 transition to 2)	900	B	820	A
Highland Avenue (2)	1010	C	930	B
Florida Avenue (4)	1110	D	1290	E
Central Avenue (2)	1180	D	1150	D
I-275 Ramps	1410	E	1390	E
Nebraska Avenue (4)	1180	D	1160	D

* on Hillsborough Avenue

(X) - Number of through lanes assumed

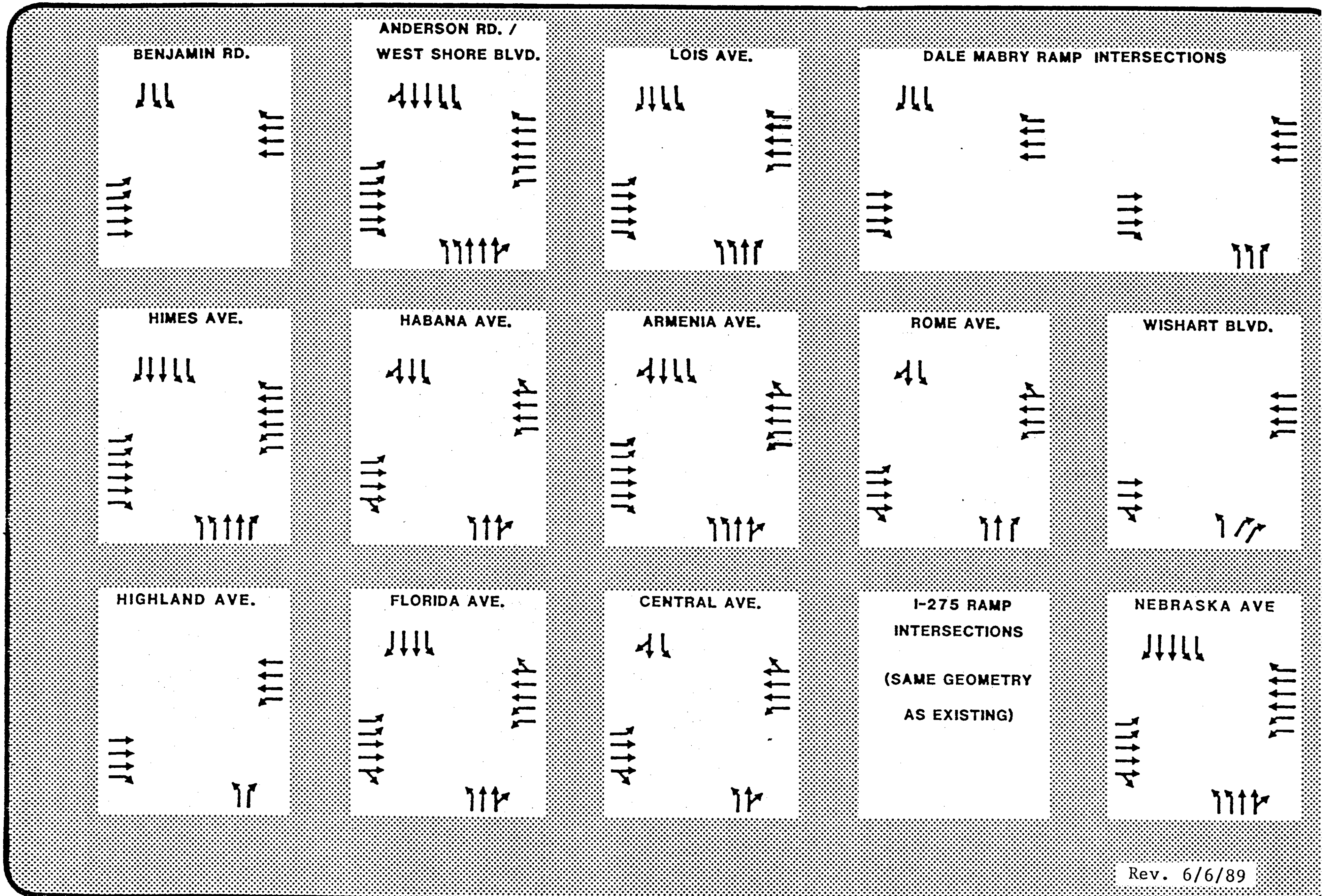


FIGURE 5-1 YEAR 2010 RECOMMENDED INTERSECTION GEOMETRY

As a result of a coordination meeting held with FHWA on October 20, 1987, dual left turns were added on Hillsborough Avenue approaches at both Habana and Armenia Avenues in order to improve the future levels of service for these two intersections. These changes resulted in a slight reduction in the sum of critical volumes as shown in Table 7 (with a corresponding improvement in the levels of service). During the design stage, the dual left turns on Hillsborough at Habana were changed back to single left turn lanes due to revised traffic projections; however, the proposed median width is sufficient to allow dual left turn lanes to be constructed in the future should they ever become warranted.

Overall Arterial Probable Level of Service

In addition to probable intersection levels of service (LOS) for Year 2010, it is possible to predict the LOS for the arterial as a whole by utilizing the latest generalized LOS tables developed by FDOT (Reference 3) based on the 1985 Highway Capacity Manual. Based on these tables (principal arterial, group 2 -- 2.6 to 5.0 signalized intersections per mile), the facility as a whole is likely to operate at LOS F, using the K factor of 9% included in the tables. Using a K factor of 8% (as recommended in the traffic report), about half of the facility as a whole is expected to operate at LOS F.

Additional Options for Major Intersections

The types of options evaluated include:

- o The "at-grade split diamond" intersection (Reference 6).
- o The "urban interchange" grade separation.
- o The partial cloverleaf interchange.

These are schematically illustrated in Figure 5-2. In addition, Figure 5-3 shows the options considered for each of the three major intersections. It also includes the TUATS Year 2010 plan with its recommended locations for interchanges. For the grade separation alternative at Himes and Hillsborough, a partial cloverleaf design was chosen instead of the urban interchange due to:

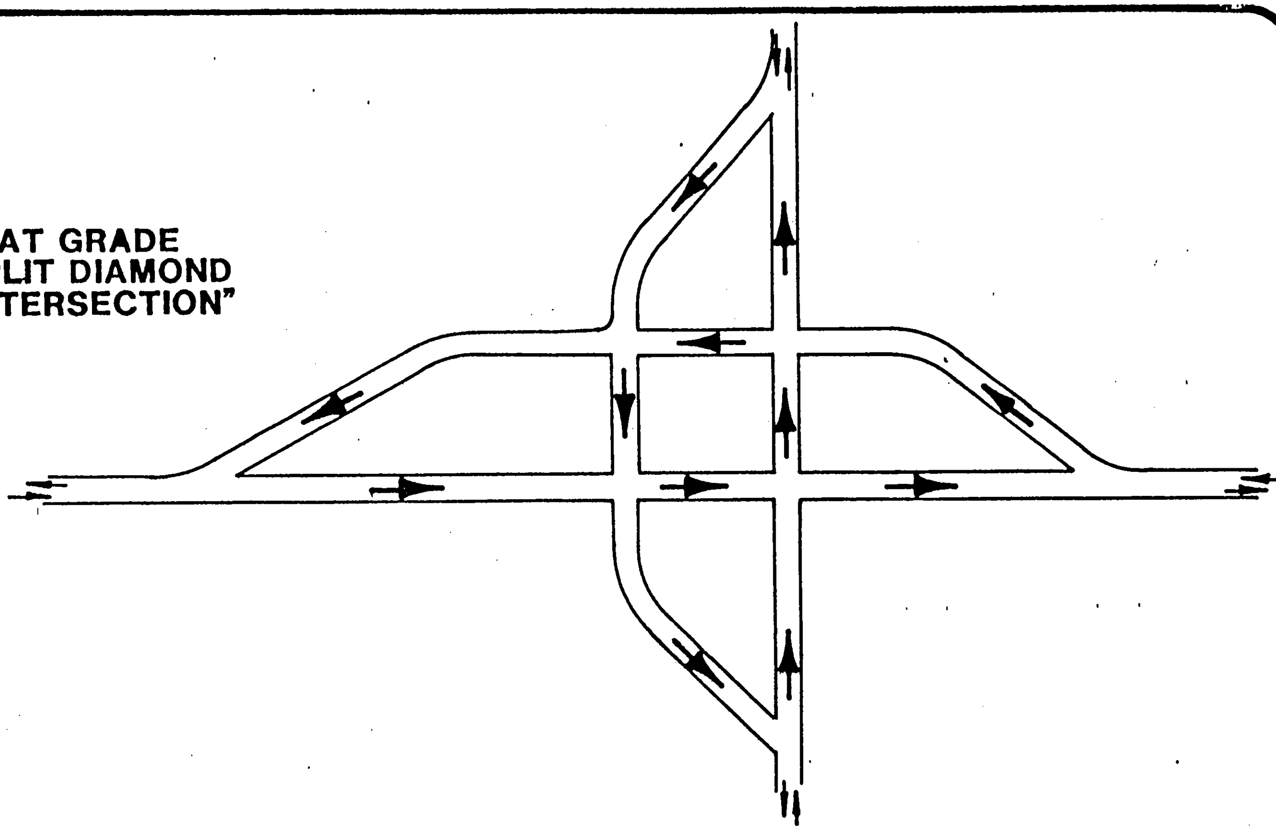
(1) the proximity of the Dale Mabry Highway interchange. (Note: the near side Dale Mabry ramps are only 0.18 miles west of Himes Avenue. An urban interchange would require altering the Dale Mabry ramp grades and create traffic operational problems due to the close spacing of the two interchanges.)

(2) the location of Horizon Park, a public park, which abuts the existing right-of-way in the southwest corner of the Hillsborough/Himes intersection.

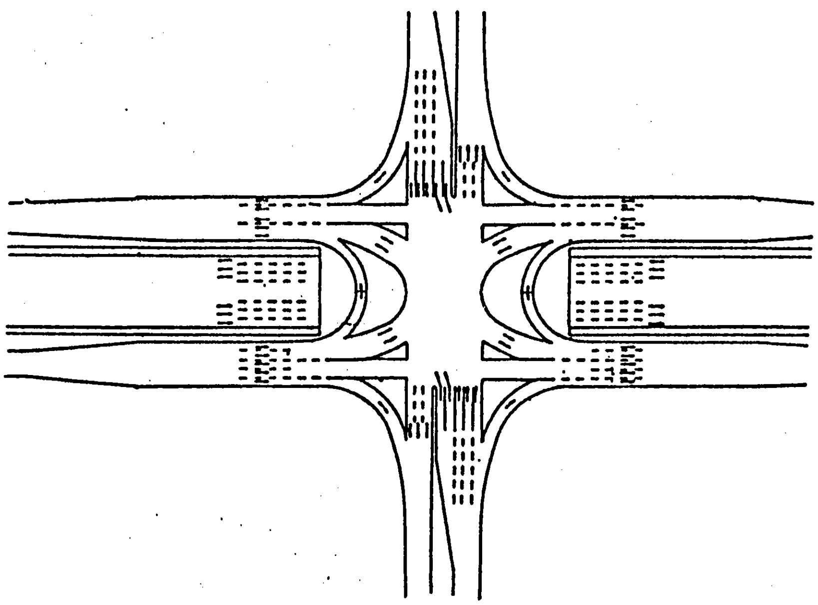
(3) the location of a shopping center in the northwest quadrant of the Hillsborough/Himes intersection.

The results of the capacity analyses for these additional major intersection options are given in Table 5-2. In addition, assumed geometric configurations used in the capacity analyses are included in Figure 5-4. These are considered minimum acceptable designs required to handle the projected design hour volumes (DHV) for year 2010. The potential costs and impacts of these other options are included in Section X.

"AT GRADE SPLIT DIAMOND INTERSECTION"



THE URBAN INTERCHANGE



PARTIAL CLOVERLEAF

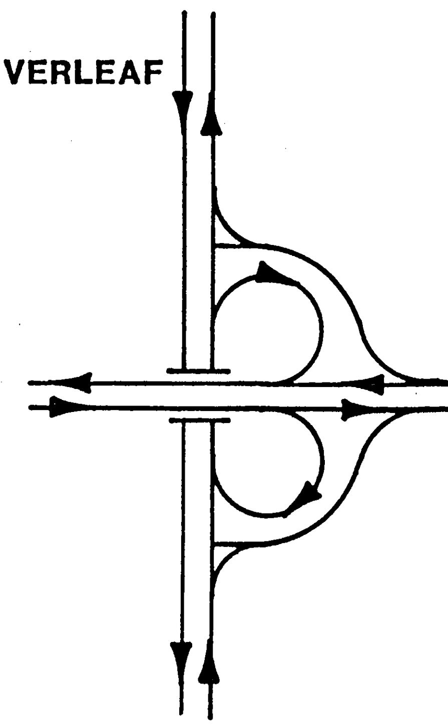


FIGURE 5-2 ADDITIONAL OPTIONS FOR MAJOR INTERSECTIONS

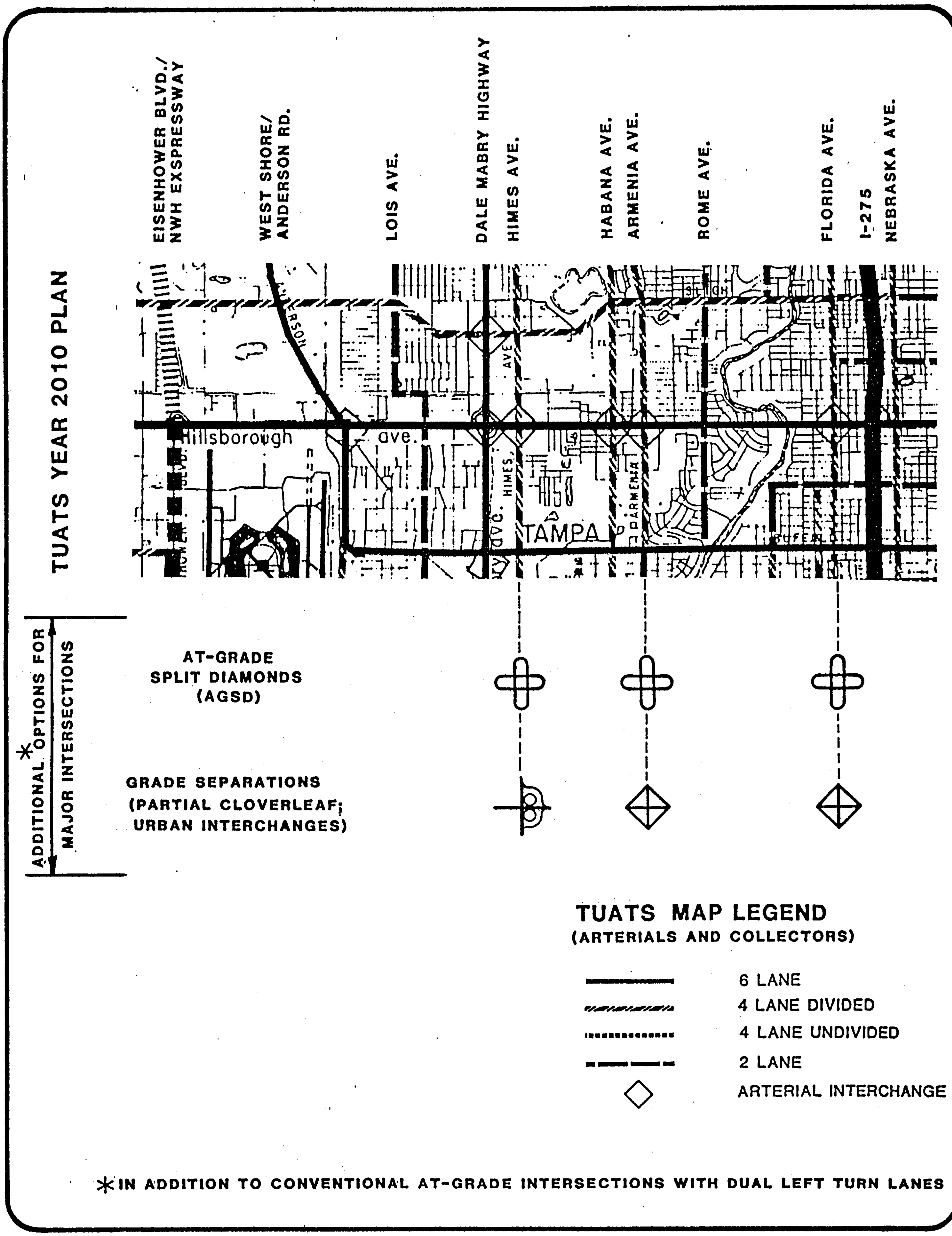


FIGURE 5-3 ADDITIONAL OPTIONS FOR SPECIFIC INTERSECTIONS

HILLSBOROUGH AVENUE

TABLE 5-2 - CAPACITY ANALYSIS RESULTS FOR MAJOR INTERSECTION OPTIONS

YEAR 2010 DHV

Hillsborough Avenue at:		Critical Volume Sum and Probable Level of Service: At-Grade Split Diamond		Grade Separation	
Himes Avenue (4)	AM	1320	D	890	B
	PM	1230	D	940	B
Armenia Avenue (4)	AM	1100	C	940	B
	PM	1150	C	910	B
Florida Avenue (4)	AM	980	B	610	A
	PM	1200	C	660	A

(X) - Number of through lanes assumed.

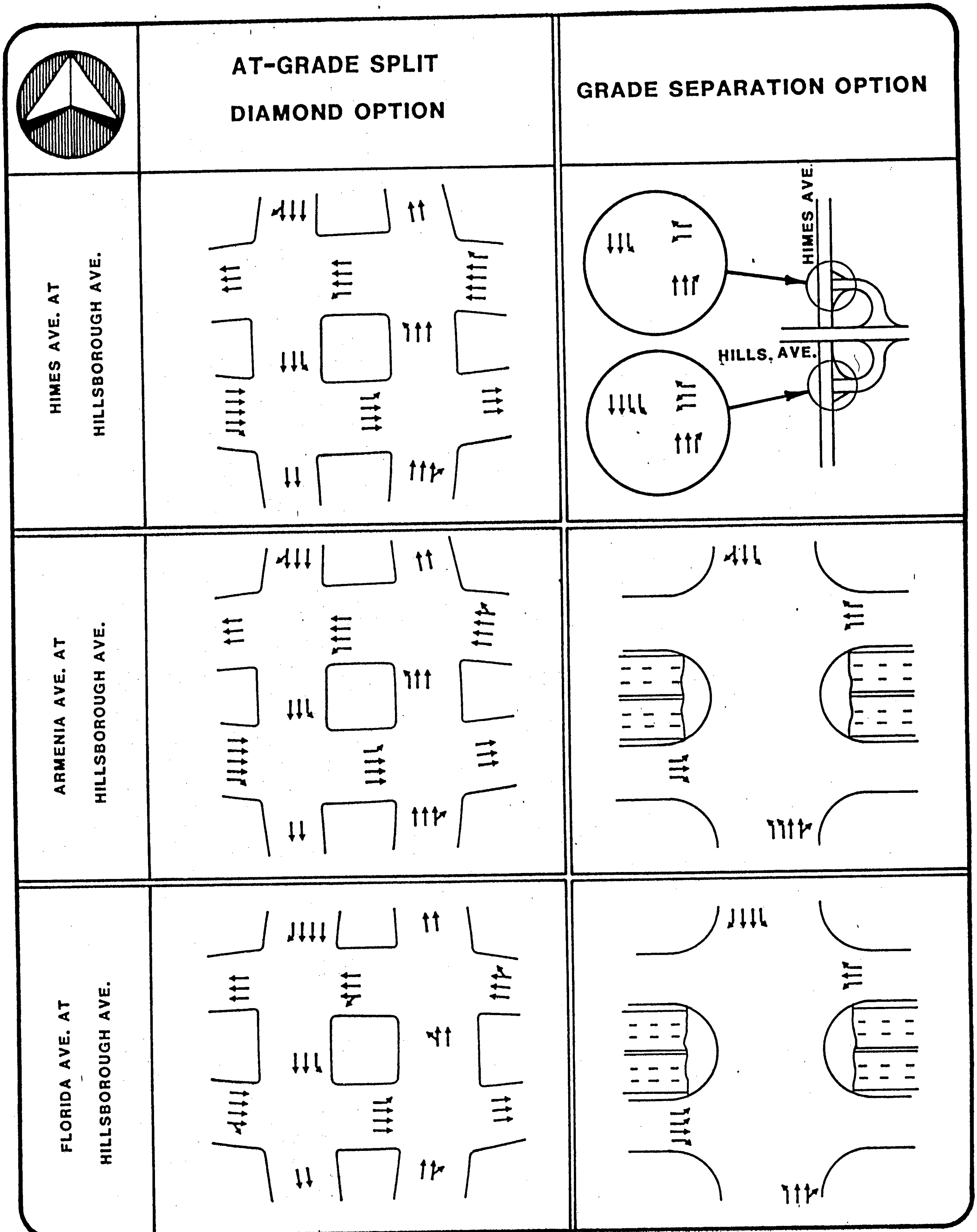


FIGURE 5-4 LANE CONFIGURATIONS FOR MAJOR INTERSECTION OPTIONS

HILLSBOROUGH AVENUE

A comparison of Tables 5-1 and 5-2 yields the following probable increases in capacity which would result from constructing either the at-grade split diamond or the grade separation option at the three major intersections:

TABLE 5-3 - COMPARISON OF TABLES 5-1 AND 5-2

	Average % Decrease in Critical Volume Sum Compared to Conventional Widened Intersection	
Intersection	At-Grade Split Diamond	Grade Separation
Himes & Hillsborough	4.5%	31%
Armenia & Hillsborough	17.0%	32%
Florida & Hillsborough	9.2%	47%

Eight-Laning Alternative

An additional alternative considered consists of eight-laning a portion of Hillsborough Avenue, between Himes and Armenia, inclusive, in order to improve the projected intersection levels of service at Himes and at Armenia. Using eight through lanes on Hillsborough and four through lanes on both Himes and Armenia (as called for in the TUATS Year 2010 Plan), the year 2010 projected critical volume sums and probable levels of service are given in Table 5-4, along with previous data from Table 7, for comparative purposes:

TABLE 5-4 - SIX LANE VERSUS EIGHT LANE COMPARISON

Intersecting Street	6-Lane Hillsborough AM Peak		6-Lane Hillsborough PM Peak		8-Lane Hillsborough AM Peak		8-Lane Hillsborough PM Peak	
Himes (4 Lane)	1290	"E"	1380	"F"	1100	"C"	1170	"D"
Armenia (4 Lane)	1330	"E"	1380	"F"	1130	"D"	1170	"D"

Starting at the western end, the two additional lanes could be added and dropped at the ramps on the east side of Dale Mabry at Hillsborough. At the eastern end, the eight-lane section would transition back to six lanes in the vicinity of Albany Avenue (two blocks east of Armenia). The additional costs and impacts associated with this eight-lane alternative as well as recommendations regarding the feasibility of eight laning are included in Section 10.

Bridge Section Versus Arterial Capacities

A valid question to consider is, "since the replacement bridge at the Hillsborough River is assumed to have a 50-year life, should it be designed to accommodate eight travel lanes, in anticipation of the potential long-range need to eight lane Hillsborough Avenue?"

The recommended answer to this question is "no", for the following reasons:

(1) The Florida Department of Transportation has adopted six lanes as the ultimate build-out standard for general access arterial highways (Florida Transportation Plan, Reference 5). Thus, it is not currently envisioned that Hillsborough Avenue will ever be eight-laned, especially the portion east of Himes Avenue where additional right-of-way would be required.

(2) From a highway capacity standpoint, utilizing the FDOT generalized capacity tables previously mentioned (based on average of three signals per mile), the LOS "E" volume for a six-lane arterial is 50,000± VPD; for an eight-lane arterial, 67,000± VPD. For a six-lane limited access bridge (with very few projected openings), the capacity would be around 100,000 VPD, which is in excess of the capacity of even an eight-lane arterial highway.

For the above reasons, a six-lane bridge is not expected to become functionally obsolete.

6. ALTERNATIVE ROADWAY DESIGNS

Engineering and Planning Criteria

To develop an improved roadway facility that is in the best overall public interest, certain engineering factors and urban development conditions must be taken into consideration. These criteria have a direct bearing on the selection of the preferred roadway design and alignment for each roadway segment.

Traffic Demand - The improved roadway facility should be designed to safely and efficiently accommodate bicycle and pedestrian traffic, as well as projected future year motor vehicle traffic.

Land Use - To minimize community impacts it is desirable that additional right-of-way taking minimize impacts on certain land uses. For Hillsborough Avenue, these include churches, schools, residences, businesses, non-profit agencies, and public parks.

Environment - Design and alignment of an improved roadway must consider sensitive environmental conditions and areas. In accordance with Executive Order 11990, wetland impacts must be avoided where practical. In addition, potential hazardous waste sites should be avoided whenever possible.

Construction Staging - Roadway alignment, particularly at bridge sections, should be placed so as to maximize the possibilities for construction staging.

Safety - The engineering design characteristics must meet applicable safety standards. Access control techniques to promote safe and efficient operation are discussed elsewhere in this section.

Median Width and Type

Hillsborough Avenue west of Dale Mabry Highway has a 39-foot depressed grass median. Future travel demand requires adding two through lanes to this 4-lane divided rural typical section. Maintaining the existing median width within a "standard" rural typical section involves costly new right-of-way acquisition. The estimated cost of right-of-way needed for a 6-lane "standard" rural typical section, with median width reduced to 22', is $2.2 Million for the segment between Eisenhower and West Shore, and $3.3 Million from West Shore to Dale Mabry. Six-lane urban, modified rural, or combination urban-rural typical sections with 22' or wider medians can be constructed within the existing R/W at an overall cost savings. A 22-ft. median affords protection to crossing passenger vehicles and allows for generally desirable treatment of median lane (Ref. #7, p. 557). At locations where dual left turns are recommended, the median would have to transition to 28' or wider. A raised median is recommended to facilitate access control, a subject discussed later in this chapter. A raised median would also afford some degree of protection to pedestrians desiring to cross Hillsborough Avenue half way at a time.

The depressed grass median west of Dale Mabry Highway extends through the Dale Mabry/Hillsborough Ave. interchange to near Himes

Avenue. Sufficient median width exists (63', varies) through this area to add the needed two additional lanes within the median and maintain a minimum 22' median width (within existing right-of-way).

East of Himes the previous divided section transitions to a narrow 5-lane section with a 9' continuous two-way left turn lane. This section extends to the vicinity of Habana Avenue.

Research by Glennon et. al. (Reference 8) found that the continuous two-way left turn lane (TWLTL) is inferior to the raised median where frequent driveways are in combination with high arterial street volumes. Hillsborough Avenue is a principal arterial with high traffic volumes (averaged over 30,000 vpd in 1984) and drive-ways >60 per mile. Applying the accident reduction factors from the above research, with the actual accident experience on the undivided section of Hillsborough Avenue, a benefit cost analysis was perform-ed for cost savings (due to the reduced number of accidents) between the 14' TWLTL and a 22' raised median for the six-lane widening alternative. The results are given in Table 6-1; the actual benefit cost analyses are included in the Appendix. (For the eight-lane alternative, a flush median (TWLTL)is not considered acceptable due to potential safety problems).

TABLE 6-1 - RESULTS OF B/C ANALYSIS FOR MEDIAN TYPE

Segment	Length	Benefit/Cost	Explanation
Himes-Lincoln	0.25	Not Applicable	Currently a transition from 4-LD to 4-L undivided.
Lincoln-Armenia	0.75	0.64	Proximity of structures to the existing right-of-way makes added R/W very expensive. Cost savings due to accident reduction using the raised median versus a continuous TWLTL, over the 25-yr. analysis period is insufficient to justify the additional R/W costs needed for a 22' raised median when this segment is considered separately from the remainder of the project.
Armenia-Wishart	0.97	2.3	Structures damaged or taken are generally damaged or taken using either median type. Raised median is more cost-effective.
Wishart-Highland	0.40	Not Applicable	Hillsborough River Bridge and approaches.
Highland-Central	0.44	3.5	Same as Armenia to Wishart. Raised median is more cost effective.
Central-Nebraska	0.25	Not Applicable	Hillsborough Ave./ I-275 interchange.
Overall (Dale Mabry-Nebraska)	3.39	2.9	Raised concrete median is more cost effective solution.

The above overall analysis shows the raised median to be the most cost effective solution from Dale Mabry to Nebraska. The 22-ft. raised median is the minimum recommended width for reasons stated above. A 22-foot median also meets the FDOT "Green Book" minimum standards for an urban type design for 45-50 MPH design speeds (Reference 9, p. III-34). The raised type of median is recommended to facilitate access control and provide pedestrian refuge. A median width of less than 22' would not provide sufficient storage to "shadow" a vehicle crossing perpendicular to Hillsborough Avenue.

On an individual segment analysis, for the segment of Hillsborough Avenue from Lincoln to Armenia, a 14' flush median (continuous TWLTL) was determined to be the most cost-effective median type. The additional width required for the generally preferred 22' raised median results in higher right-of-way costs (up to $1,000,000 higher for the segment, depending on border width). This is a relatively short segment, however, and changing the median type and width for this one segment is not recommended. Sufficient right-of-way exists between Himes and Lincoln to install the preferable 22' raised median and it is recommended this be done.

On the short, 0.25 mile, section between Central Avenue and Nebraska Avenue, a 16' raised median exists and will be retained but with a reduced width ($\geq$4') at the intersection approach to Nebraska Avenue where additional turn lanes will be required.

Lane and Border Widths

A standard lane width of 12 feet is recommended due to the high projected truck usage (9.8% daily or approximately 6,000 trucks per day on the west end), expected high traffic volumes, and high functional classification and importance of S.R. 580/600 (the only arterial parallel to the Interstate System which runs through all Hillsborough County). To accommodate bicyclists, curb lanes of 14 feet are recommended (for combined bicycle and motor vehicle traffic) for urban sections. For rural sections, a 4-foot paved shoulder would be required for bicyclists.

In accordance with a January 21, 1986, memorandum from the FDOT State Design Engineer concerning border widths for highways, a minimum border width (including the curb and gutter section) of 10-feet is to be used where sufficient right-of-way exists, or is to be acquired, unless cost prohibitive. AASHTO (Reference 7, p. 575) states "In all cases the minimum border width should be 8 ft. wide and preferably 12 ft. or more." This border width is essential to provide for utilities, sidewalks, sight distance for motorists exiting driveways and a roadside recovery area.

Hillsborough Avenue west of West Shore Boulevard currently has a rural typical section. This segment of Hillsborough Avenue is bounded on the south by Tampa International Airport. Land usage is unlikely to change on the south side. On the north side, commercial development predominates. To add needed lanes and retain a "standard" rural typical section requires additional right-of-way at an estimated cost (for right-of-way) of $2.2 million. Using an urban, combination urban/rural, or "modified rural" (ditch/swale with DBI's) typical section (Figure 6-2), a minimum 12' border can be provided within existing right-of-way. The total estimated cost (right-of-way and construction) for the "modified rural" typical section is significantly less than for the rural typical section. Thus, the "modified rural" (least costly) typical section is recommended with the AASHTO preferred 12 ft. minimum borders.

From West Shore to Dale Mabry, strip commercial development predominates on both sides of Hillsborough Avenue. Adding two through lanes to the existing rural cross section requires acquisition of new right-of-way at an estimated cost of $3.3 million. Either an urban typical or "modified rural" typical section (with border widths exceeding the AASHTO preferred 12' widths) can be constructed within existing rights-of-way. The estimated total cost (right-of-way plus construction) for the standard rural typical section is substantially more than either the urban or modified rural typical sections with 12' minimum borders; therefore, the modified rural (least costly) typical section is recommended.

The segment from the western ramps of the Dale Mabry/Hillsborough interchange to Himes Avenue is a transition section with adequate right-of-way (typically 190' east of the interchange). Grass shoulders exist with widths varying from 2' - 10'. Widening of existing borders is infeasible under the Dale Mabry bridge. East of the interchange to Himes, sufficient right-of-way exists to provide 12' or wider border widths within existing rights-of-way and this is recommended in conjunction with either six-lane or eight-lane urban typical section alternatives.

From Himes Avenue to Lincoln Avenue, the existing 150' wide right-of-way is sufficient to provide for either the six-lane or eight-lane typical urban section with border widths exceeding the preferred 12' minimum.

The existing right-of-way narrows to as little as 66 ft. east of Lincoln to Armenia Avenue. Recently constructed improvements between Aldana Drive (0.18 miles east of Lincoln) and Habana Avenue include 6.5' borders. Existing development setback between Lincoln and Armenia Avenue averages 35' - 40'. Additional right-of-way would be required to provide either two or four additional lanes needed to accommodate design-year travel demand. For the six-lane alternative, right-of-way cost estimates were completed for providing FDOT suggested 10' minimum borders (in combination with a 14' median) and 10' and 12' borders (12' is the preferred minimum AASHTO border width) in combination with a 22' median. The difference in estimated right-of-way cost was $0.8 - $1.0± million ($0.8 million more for the typical section with 22' median and 10' borders, and $1.0 million more for 12' borders with a 22' median). For the 22' median alternative, the 12' borders are recommended since the additional $0.2± million is not cost prohibitive.

Typical sections with 12' borders vs. 10' borders between Armenia and Rome yield right-of-way estimates of $3.4 million and $3.3 million respectively. The difference of $0.1± million is not cost prohibitive; therefore, 12-foot border widths are recommended between Armenia and Wishart.

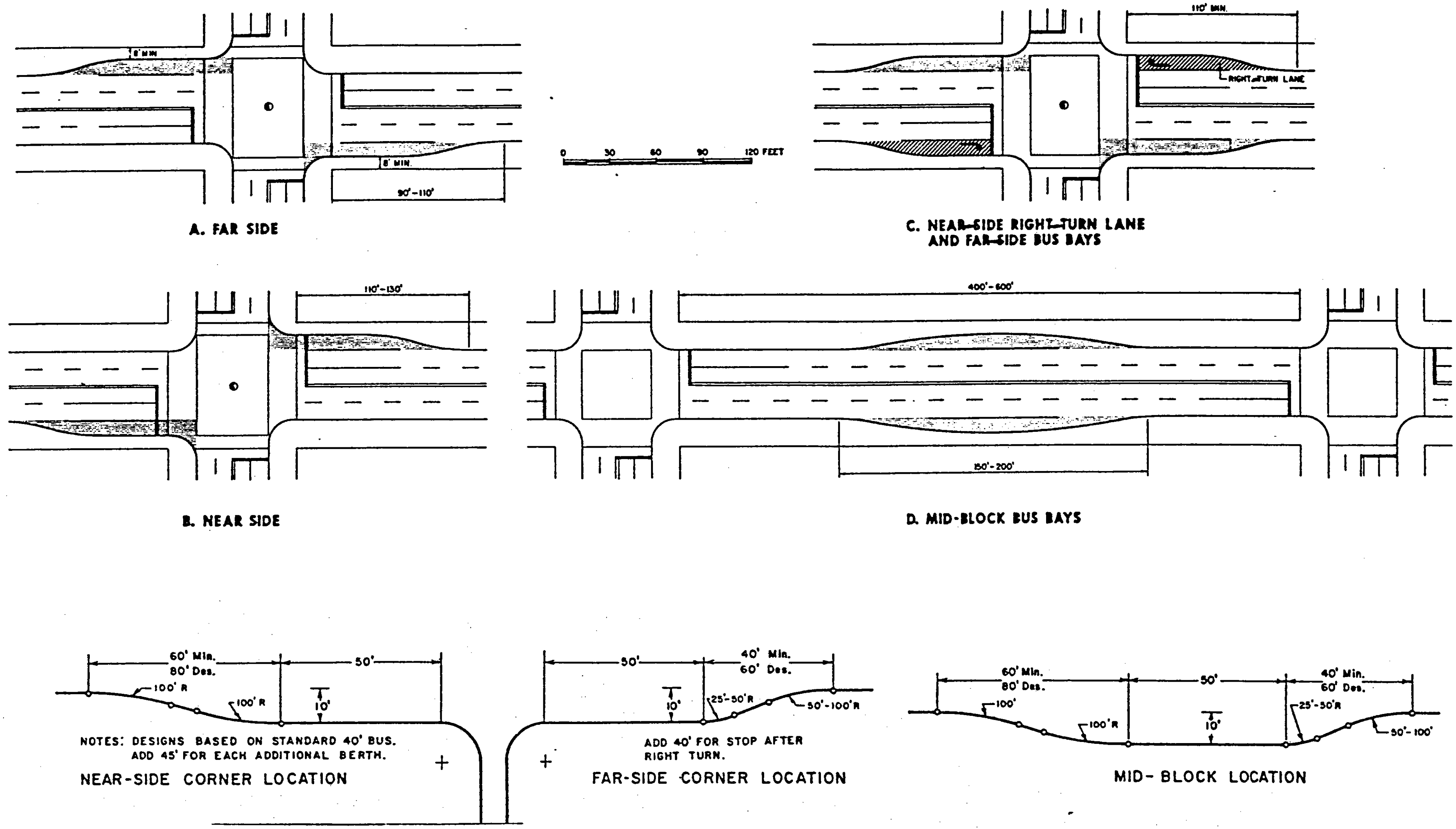
The segment between Wishart and Highland is the proposed Hillsborough Avenue over Hillsborough River replacement bridge and approaches. Border widths on the bridge roadway approaches should match the adjacent segments (12' recommended borders).

From Highland to Central, the estimated difference in right-of-way cost between six-lane urban typical sections with border widths of 10' and 12' is $0.2 million. This difference is not cost prohibitive. The AASHTO perferred 12' minimum border width is recommended.

In the remaining segment, Central Avenue to Nebraska, border widths are controlled by the I-275/Hillsborough Avenue interchange structure. No widening under the I-275 structure is proposed. For the short sections outside the interchange, where new right-of-way is to be acquired, 12' borders are recommended. The difference in right-of-way costs between 12' and 10' borders is estimated at less than $100,000.

Bus Bays (Turnouts)

The possibility of including bus bays / bus turnout lanes on Hillsborough Avenue was investigated at the request of the Department (Figure 6-1). Projected year 2010 bus volumes on Hillsborough Avenue were not available; however, bus service is expected, in general, to



Source: NCHRP Report No. 155, Bus Use of Highways -- Planning and Design Guidelines. 1975, Transportation Research Board.

FIGURE 6-1 BUS STOP TURNOUTS, ARTERIAL STREETS

double by 2010 (or average headways would be cut in half). Using this assumed doubling of service, buses would be making an average of three stops per hour at signalized intersections along most of Hillsborough Avenue (in each direction). This projected bus volume would be too low to warrant special bus bays from strictly an intersection capacity and benefit/cost analysis standpoint. However, in view of the FDOT's interest in encouraging the use of transit through the construction of HOV lanes, park 'n ride lots, etc., the cost of providing far-side bus turnouts at most of the major signalized intersections was estimated. As shown in Appendix F, the additional cost to provide 21 bus turnouts on Hillsborough Avenue only (ignoring the north-south cross streets) would be about $330,000, 92% of which would be for the additional right-of-way required. At present, far-side bus bays are proposed to be included at all signalized intersections along the project.

Typical Section Alternates

Four basic types of typical cross sections evaluated include:

- standard rural typicals with 56' ditch sections
- "modified rural" typicals with ditch on one side and swales with ditch-bottom inlets (DBI's) on the other side
- urban typicals with curb and gutter, inlets, and underground drainage pipes
- combination urban/rural typicals (ditch on one side; curb and gutter with underground drainage pipes on the opposite side)

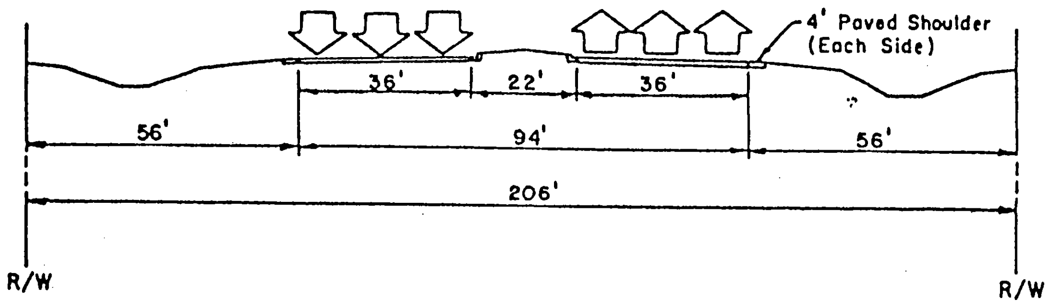
Typical section alternates meeting the above median, lane width, and border width requirements are illustrated in Figure 6-2. The cross sections shown are recommendations; wider border and median widths are preferred where right-of-way width permits; in addition, wider medians would be required at locations where dual lefts are necessary. These typical sections are briefly discussed here, in general terms, and also later with respect to specific segments along Hillsborough Avenue.

The six-lane rural design requires a recommended right-of-way of 206'' (212' where dual left turn lanes are required). Four-foot paved shoulders would be provided to facilitate bicyclists.

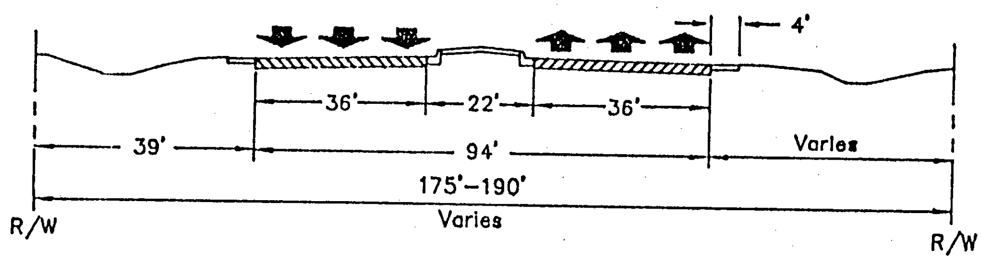
The six-lane "modified rural" could be constructed within 175' of right-of-way by utilizing a ditch section on the north side of Hillsborough and a swale on the south side with ditch bottom inlets (DBI's). Runoff on the south side would be conveyed to the north side via cross drains. The advantage of this typical is that portions of the existing pavement could be utilized in the new cross section through a combination of widening, overbuilding, and resurfacing. Minimum 4' paved shoulders would be provided to facilitate bicycle travel.

The six-lane urban design with raised medians requires a recommended right-of-way of 122' (128' where dual left turn lanes are required). The eight-lane urban requires an additional 24' of right-of-way. The outside lanes would be 14' wide to accommodate bicyclists along

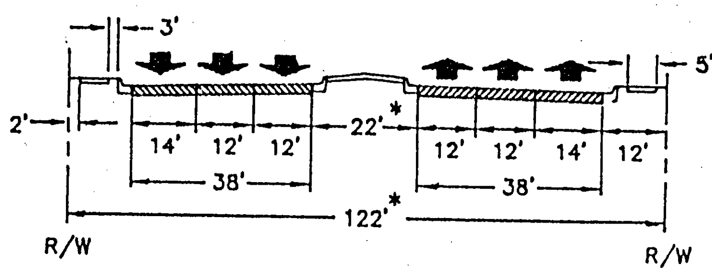
6 LANE RURAL



MODIFIED 6 LANE RURAL (LOOKING EAST)



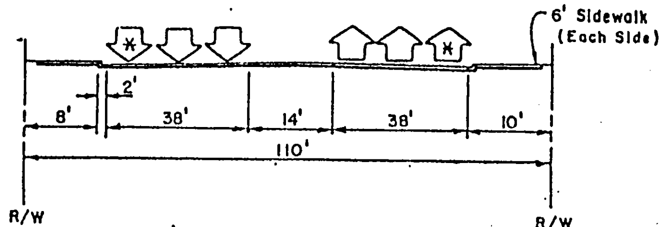
6 LANE URBAN WITH RAISED MEDIAN



* Add 6' for areas with dual left turns

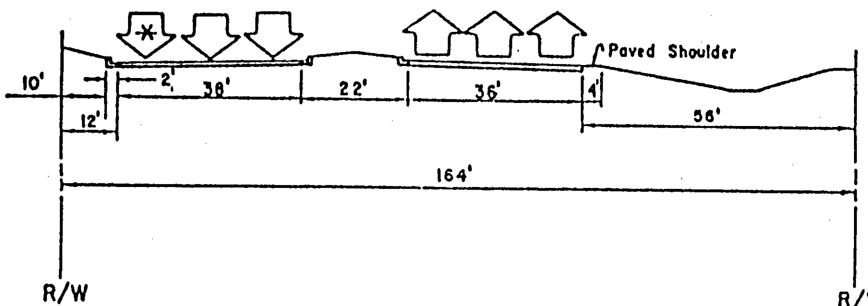
FIGURE 6-2 TYPICAL SECTIONS CONSIDERED - PART ONE

6 LANE URBAN WITH TWLTL



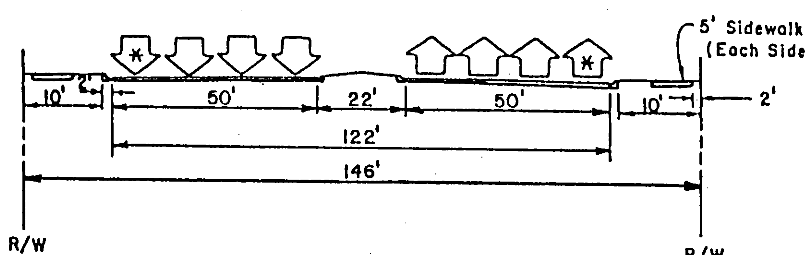
✱ 14' Lane for Bicycles and Motor Vehicles

6 LANE COMBINATION URBAN / RURAL



✱ 14' Lane for Bicycles and Motor Vehicles

8 LANE URBAN WITH RAISED MEDIAN



✱ 14' Lane for Bicycles and Motor Vehicles

FIGURE 6-2 PART TWO)

with motor vehicles. Sidewalks would typically be set back 2' or more from the right-of-way line to potentially eliminate the need for temporary construction easements.

The six-lane urban with two-way left-turn lanes (TWLTL) requires a recommended right-of-way of 110'. Wide (14') curb lanes would be provided for combined bicycle and motor vehicle traffic, and 6' sidewalks would be placed adjacent to the curb, leaving a 2' grass strip between the right-of-way line and the sidewalk (total border width of 10' including curb and gutter).

The six-lane combination typical section requires a recommended right-of-way of 164'. One side has the characteristics of the rural section (described above) and the other side has the characteristics of the urban section (described above).

<u>Alternative Alignments</u>

For those sections where additional right-of-way would be required to widen to six lanes, four different types of alignments were evaluated:

- o Northern alignment (holding the southern existing right-of-way line).
- o Centered alignment (taking additional right-of-way roughly equally from both sides).

- Southern alignment (holding the northern existing right-of-way line).
- Combination alignment (transitioning back and forth among the above alignment types to minimize community and environmental impacts).

These are discussed, as appropriate, on a segment-by-segment basis in the Plausible Alternatives section.

Due to rather intense mixed commercial/residential development and the pattern of development (lot sizes, shapes) east of Himes Avenue, public highway use of the remainder of total take properties, outside that needed for the typical section shown (Figure 10), does not appear feasible for most areas of Hillsborough Avenue. The large number of developed parcels on both sides of Hillsborough Avenue favors widening on one side. Then too, any highway use additions to roadway border widths, such as frontage roads, would need to transition to the aforementioned typical section before reaching the Hillsborough River.

Access Control Options

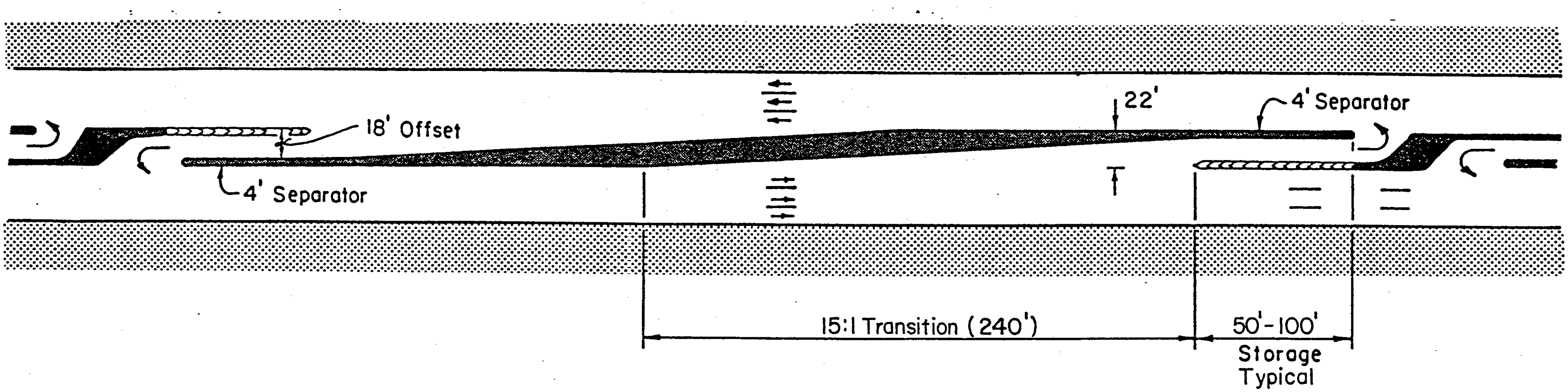
Due to the high functional classification and heavy volume of traffic projected for Hillsborough Avenue, some type of access control is recommended to protect the utility of the highway and to insure safe and efficient operation. Some of the specific control measures investigated include:

- o Conventional raised medians with deceleration lanes for left turns.
- o Median channelization to prevent left-turn ingress and/or egress movements to/from driveways.
- o Medial storage for left-turn egress vehicles.
- o Continuous right-turn lanes.

The recommended option is to use channelization provided by raised medians to prevent left-turn egress movements from driveways and minor side street approaches, similar to the design proposed for S.R. 60 in Brandon, Florida. Special back-to-back median openings are proposed to allow U-turns at regular intervals as shown in Figure 6-3. In addition, in some cases single storage bays would be provided for U-turns immediately upstream of signalized intersections. This type of design treatment would provide for safe deceleration and storage of U-turn passenger vehicles and allow access to businesses fronting Hillsborough Avenue. (Trucks with 20' or greater wheelbases would be unable to make U-turns on a six-lane arterial unless an unusually wide median of 40' or more was provided.)

Intersections with minor side streets would be channelized similar to Figure 6-4, again to prevent left-turn egress movements from minor approaches.

6-LANE ARTERIAL WITH 22' MEDIAN



(Not to Scale)

FIGURE 6-3 TYPICAL MIDBLOCK MEDIAN OPENING

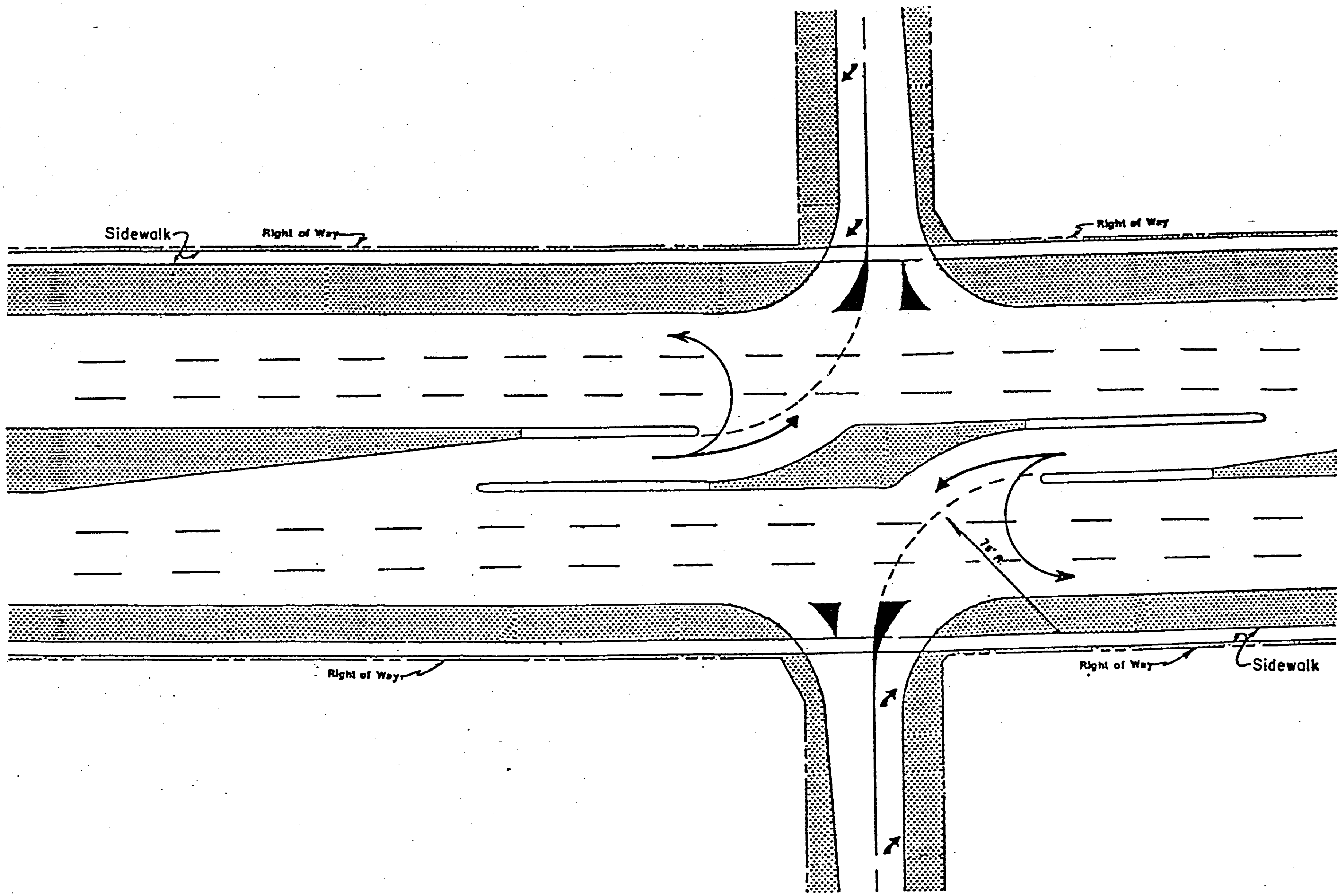


FIGURE 6-4 TYPICAL MINOR INTERSECTION

7. PLAUSIBLE ALTERNATIVES
INVOLVING CONVENTIONAL MULTI-LANING

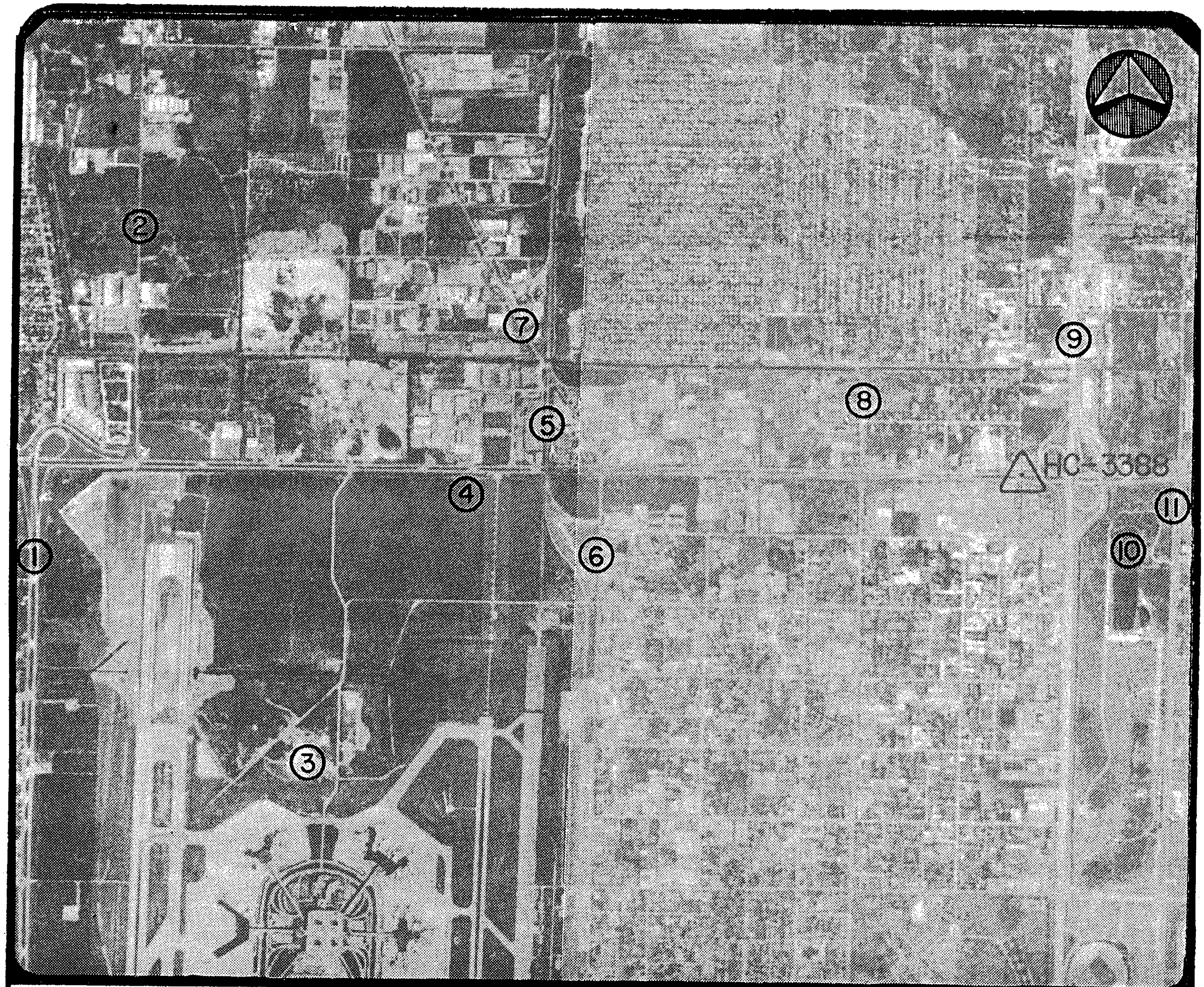
The previously presented alternative roadway designs and alignments have been applied to Hillsborough Avenue to determine the alternatives for each segment of roadway. The following sections discuss this analysis, taking into consideration relevant engineering and planning criteria in order to eliminate non-viable alternatives from further consideration.

Eisenhower Blvd. (S.R. 589) to West Shore Blvd. / Anderson Rd.

Significant physical features in this segment include, from west to east, Tampa International Airport, a "middle marker" (airport navigational lighting system facility), and a spur line railroad crossing. Land use is a mixture of undeveloped, commercial, and industrial uses (Figure 7-1).

The existing right-of-way width between the Eisenhower interchange and West Shore varies between 175 feet and 185 feet, except where it narrows to approximately 140 feet at the middle marker near the east end of Tampa International Airport.

Six-lane typical sections considered for this portion of Hillsborough Avenue include the urban section, the combination urban/rural section, and the "modified rural" section (Figure 6-2).



Legend

1. Eisenhower Boulevard
2. Benjamin Road
3. Tampa International Airport
4. Middle Marker
5. Spur Line rail road
6. West Shore Boulevard
7. Anderson Road
8. Lois Avenue
9. Dale Mabry Highway
10. Horizon Park
11. Himes Avenue

1979 Aerial Photo

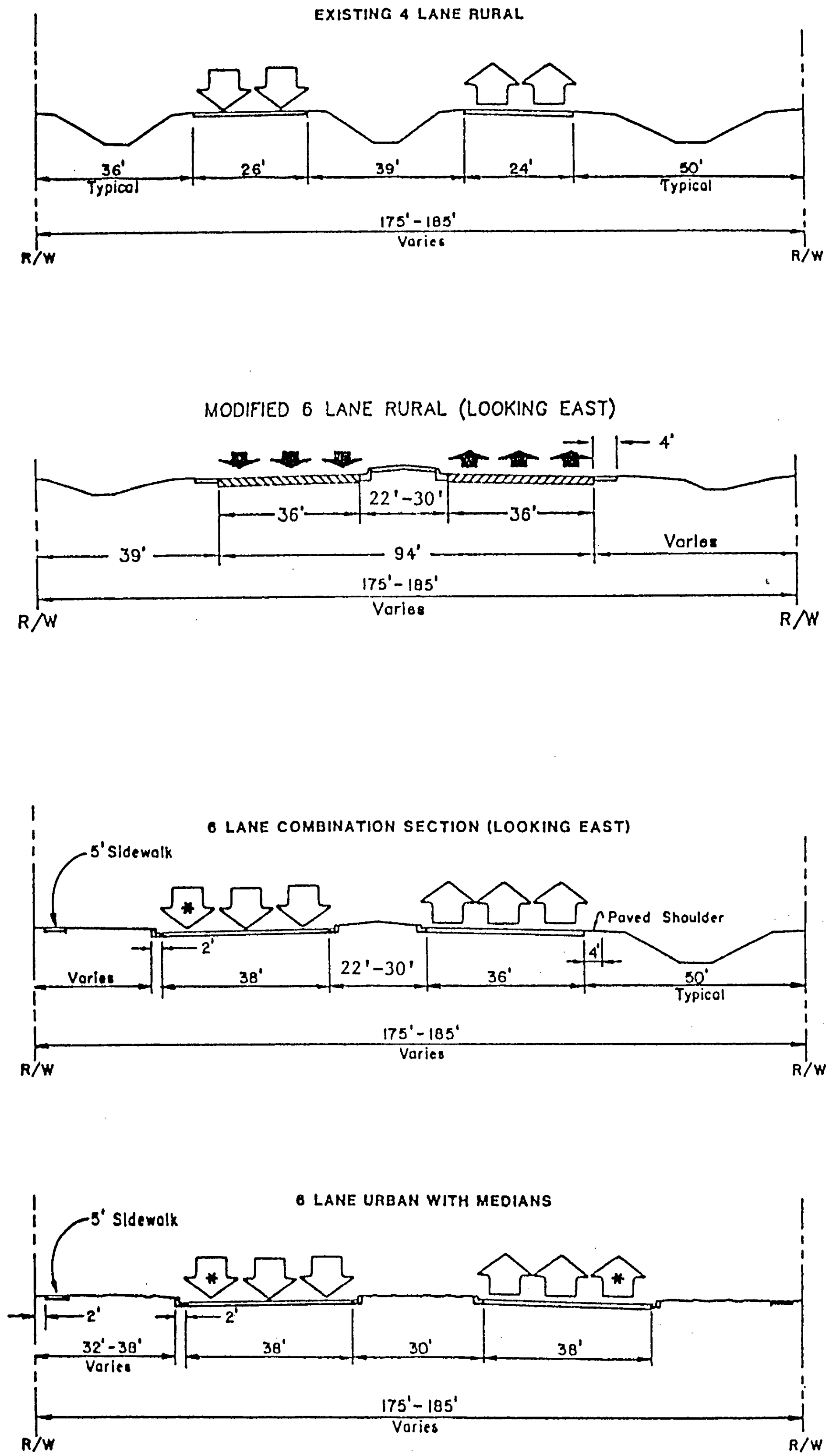
Approximate scale 1" = 2000'

FIGURE 7-1 HILLSBOROUGH AVE., EISENHOWER BLVD. TO HIMES AVE.

For the combination section, with the drainage ditch on the south side, at the middle marker the ditch would follow the existing route which runs directly south of the navigational structure. The existing typical section is compared with the three alternate sections in Figure 7-2. The six-lane standard rural typical section is not considered practical since it would require additional right-of-way and result in impacts to businesses along Hillsborough Avenue at an additional net cost of $1.8 million (considering differences in both right-of-way and construction costs).

No additional right-of-way would be required for any of the three alternates; in addition, sufficient right-of-way would exist to include exclusive right turn lanes at: Anderson/West Shore (east and west approaches) and at Benjamin Road (westbound approach). The only dual left turn required on Hillsborough Avenue in this area would be on the eastbound approach at Benjamin Road, where sufficient right-of-way already exists. Note: In early 1989, it was determined that dual left turn lanes were also warranted at Hoover and at Anderson/West Shore. Consequently, the proposed median width was revised to 29.5'.

When the proposed Northwest Hillsborough Expressway is constructed, the existing structure spanning Hillsborough Avenue at Memorial Highway will be replaced with a longer-span structure. Until that time, however, Hillsborough Avenue will be designed such that the six laning will be continuous through the entire interchange area, although the clear recovery areas will temporarily be nonstandard.



Rev. 4/89

* 14' Lane for Bicycles and Motor Vehicles

FIGURE 7-2 ALTERNATIVE TYPICALS, EISENHOWER TO WEST SHORE

HILLSBOROUGH AVENUE

Particular treatments for site-specific median openings are not detailed in this report; instead, these are illustrated on the 1" = 100' scale aerial photos (conceptual design drawings) available separately.

West Shore Blvd. / Anderson Rd. to Himes Avenue

This area is also illustrated in Figure 7-1. Land uses in this area include undeveloped parcels, commercial uses, and a public park (Horizon Park) between Dale Mabry and Himes on the south side of Hillsborough Avenue. Existing right-of-way varies between 164 feet and 190 feet, and wider in and near the Dale Mabry interchange area.

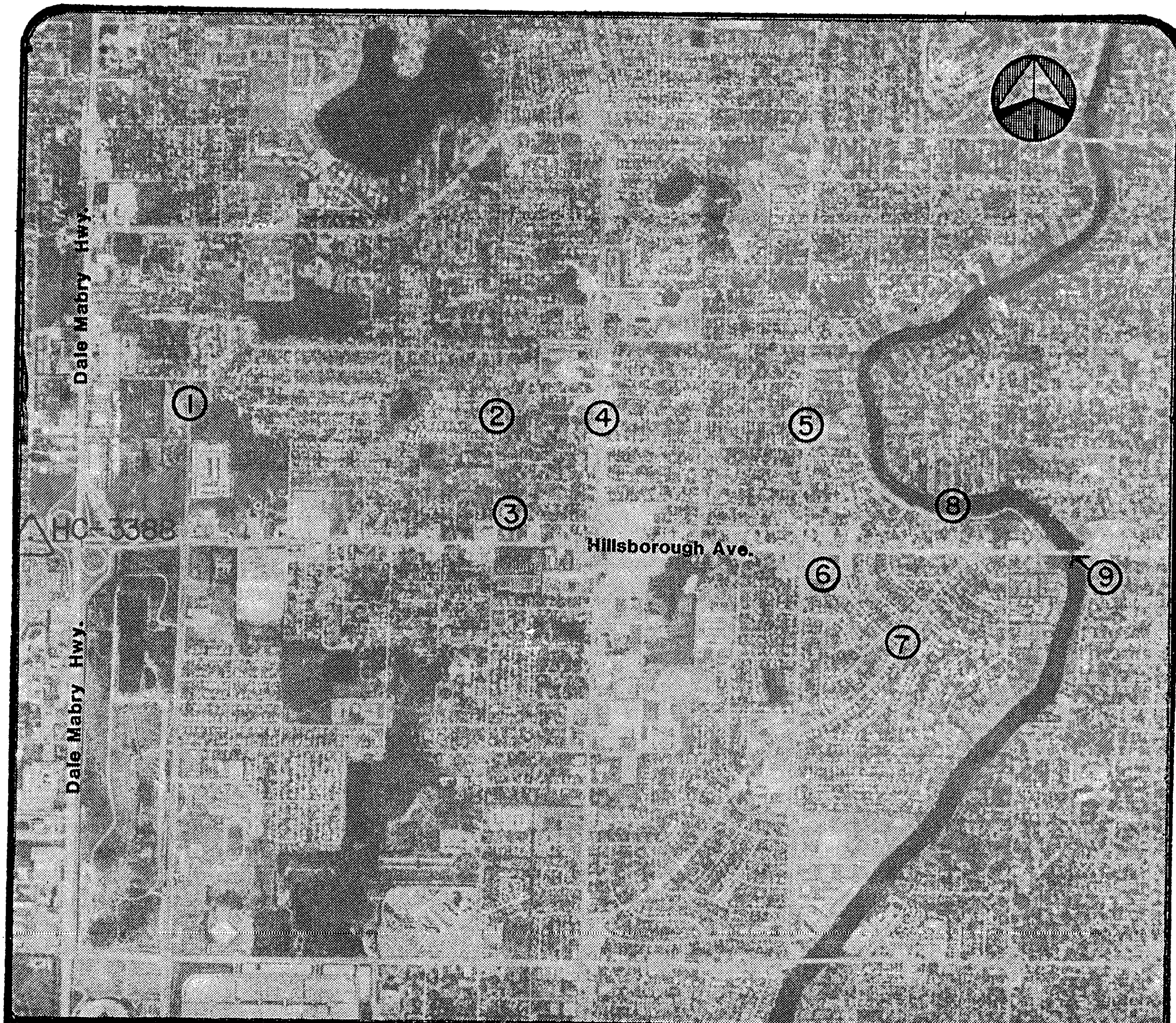
The six-lane rural typical section would require additional right-of-way and impact many businesses at an additional net cost greater than $2.7 million; it is not cost effective as previously noted. Due to the heavy development on both sides of Hillsborough Avenue in this area, the combination urban/rural is not considered practical. Practical alternatives for the segment from Westshore/Anderson to Dale Mabry include the six-lane urban and "modified rural" typical sections, illustrated previously in Figure 6-2. Either of these could be constructed within existing right-of-way with little or no impacts to businesses (except during the actual construction phase). East of Dale Mabry, the eight-lane urban typical section is a plausible alternative and both the six- and eight-lane cross sections were evaluated.

The median would be a minimum of 22 feet; in some areas, it would be wider. For example, in the Dale Mabry interchange area, the widening would be accomplished by adding in the median area two additional lanes to the existing four lanes, leaving a median approximately 40 feet wide, which includes the area occupied by the existing bridge center piers.

Himes Avenue to Hillsborough River

This area is heavily developed, and land use consists of a mixture of office, retail (shopping centers and strip commercial), multi-family and single-family residential, churches, and a small amount of vacant land. The more significant features are identified in Figure 7-3. Right-of-way in this area varies between 65 feet and 150 feet, with the widest portion near Himes on the west end of this segment. Due to the restricted right-of-way, the only feasible type typical section is the "urban" section, as previously shown in Figure 6-2. As previously mentioned in Section VI, cost-benefit analyses (Appendix E) were performed to compare two different 6-lane urban typical sections for various segments of Hillsborough Avenue. Using an individual segment analysis for the segment between Lincoln and Armenia, the 6-lane TWLTL design was found to be the most cost-effective alternative. However, when considered collectively with other segments requiring new right-of-way, the 22' raised median was found to be the most cost effective.

Due to capacity deficiencies at major intersections associated with the six-lane alternative, an eight-lane urban alternative between



Legend

1. Himes Avenue
2. Habana Avenue
3. Baptist Church
4. Armenia Avenue
5. Rome Avenue
6. Bethel Temple
7. Wishart Boulevard
8. Hillsborough River
9. Vertical lift bridge

1979 Aerial Photo

Approximate scale 1" = 2000"

FIGURE 7-3 HILLS. AVE., HIMES AVE. TO HILLSBOROUGH RIVER

Dale Mabry and Armenia was considered. A southern or combination alignment would minimize the right-of-way costs and the number of relocations. Data on costs and impacts of both the six-lane and eight-lane alternatives are included in Section 10.

For the segment between Armenia and Wishart, the 6-lane with a 22' raised median was found to be more cost-effective than the 6-lane TWLTL alternate, based on reduced accident costs versus higher right-of-way and construction costs. Either alternative would require additional right-of-way, as well as numerous relocations. Impacts were evaluated for northern, centered, and southern alignments. Various combination alignments were also considered; however, none of these offered any advantages in terms of impacts to businesses and residences for the six-lane alternative, so they were not analyzed further. In addition, a combination alignment would add difficulties with respect to maintenance of traffic during construction.

At the eastern end of this segment, all alignments studied terminate in a northern alignment due to the necessity to build any new structure north of the existing bridge, to avoid a probable 4(f) impact, as discussed in the next section.

These segments were also investigated with respect to the possibility of utilizing the existing pavement and curbs as part of the new cross section. It appears that this is an unlikely possibility. Due to the age and generally poor condition of the existing storm sewers (Reference 12), it will be necessary to install new ones, which would require removal of existing pavement. With respect to holding existing curb lines, for the segment between Lincoln and Armenia, if a centered alignment is chosen, it would be impossible to maintain either existing curb line. If a northern or southern alignment were chosen, to maintain the existing 17.5' border strip on one side would require an additional 7.5' of right-of-way to be taken from the other side to accommodate the six-lane TWLTL typical section which utilizes 10' borders. This would not be practical in terms of the additional $600,000 in right-of-way costs and impacts (an additional 5 residential relocations). For the segment between Armenia and the Hillsborough River, the existing borders are approximately 20'. To maintain one of the existing borders (with a northern or southern alignment) would require an additional 8' of right-of-way to be taken from the other side since the recommended typical section uses 12' borders. The additional $800,000 in right-of-way costs and impacts (an additional 3 business relocations) for this additional taking would not make it practical to maintain either existing curb line.

Hillsborough River to Nebraska Avenue

This area of Hillsborough Avenue is also heavily developed, and land use consists of a mixture of mostly residential and commercial uses. Some significant land uses, as shown in Figure 2-4, include a City Park (probable Section 4(f) involvement) on the south side of Hillsborough Avenue, east of the River; General Telephone Company (GTE) switching facilities on the southeast corner of Florida Avenue and Hillsborough Avenue; and a Baptist Church on the south side of

Hillsborough Avenue east of I-275. Existing right-of-way width ranges from 50 feet on the west end to 100 feet minimum on the east end, between Central Avenue and Nebraska Avenue.

The City Park ("River Boulevard Park") consists of a 4.4 acre, unimproved, fenced site, which runs along the east bank of the Hillsborough River, south of Hillsborough Avenue. At the present time, there are no plans for improvements to the park other than minor improvements such as benches (Reference 13).

The GTE facility on the southeast corner of Hillsborough and Florida consists of the Seminole Central Office, an electronic switching facility which serves approximately 17,000 GTE customers. It has a large underground vault with an extensive cable system. The cost to relocate just the cables on the north side of the building is estimated to exceed $1 million (Reference 14). Even if it were technically feasible, it would be cost prohibitive to relocate the entire central telephone exchange.

Due to the need to avoid impacts to the park and GTE facilities, as well as the need to tie into the existing alignment on Hillsborough Avenue east of Central, a six-lane facility on a northern alignment was found to be the only reasonable build alternative for this segment of Hillsborough Avenue. A cost-benefit analysis (Appendix E) indicated that the 6-lane urban typical with a 22' raised median would be more cost effective than a 6-lane with TWLTL. As previously shown in Figure 6-2, this would require a recommended 122-foot right-of-way. Subsequent to the Public Hearing held in June, 1988, additional revisions were made to the typical section and alignment through the Seminole Heights area, as described in the last section of Chapter 10.

It is not feasible to widen Hillsborough Avenue under the I-275 overpass due to the existing bridge supports. However, widening of all four intersection approaches at Hillsborough and Nebraska will be required to provide dual left-turn lanes on all approaches. In the future, as part of the reconstruction of I-4/I-275, it would be desirable to widen Hillsborough under I-275 to provide sufficient room for dual left-turn lanes for the westbound to southbound movement onto the I-275 on ramp.

As part of any widening improvements, it would not be feasible to re-use the existing storm sewer pipes due to their age and generally poor condition (Reference 14). Therefore, it is also unlikely that the existing pavement could be utilized in the new cross section. With respect to the possibility of maintaining the existing southern curb line, the existing borders west of Central Avenue are only 8.5', (including curb and gutter) which is considered substandard. The recommended typical section (122' right-of-way) utilizes 12' borders. Since substantial (minimum of 72') additional right-of-way will be required anyway as part of the six-laning, it is recommended that 12' borders be utilized on each side, thereby making it infeasible to utilize the existing curb on the south side. The estimated additional right-of-way costs incurred in utilizing 12' (preferred) vs. 10' (minimum border unless cost prohibitive) was $300,000. Additional impacts include an additional two residential relocations.

8. ONE-WAY PAIR ALTERNATIVES

Possible one-way pair alternatives parallel to a two-way Hillsborough Avenue were evaluated both west and east of Dale Mabry Highway. Sufficient right-of-way exists west of Dale Mabry for widening Hillsborough Avenue. Even so, possible one-way pair alternatives were considered. Streets considered were Crest Avenue (east of the airport) on the south and various streets on the north side of Hillsborough Avenue including Comanche, Rio Vista, Powhatan, and Henry Avenues. The widening and extension of any of these streets would involve heavy damage to existing development. The northern streets considered are all discontinuous and would damage both Pierce Junior High and Alexander Elementary Schools. Moreover, any one-way pair alternatives west of Dale Mabry would have to tie back into Hillsborough Avenue before reaching the Dale Mabry Highway/ Hillsborough Avenue interchange (or else involve impractical and cost-prohibitive bridging).

East of Dale Mabry, a one-way pair alternative was also evaluated (Figure 8-1). Streets included in this evaluation were Giddens, Frierson, and Crest Avenues on the south and Mohawk, Comanche, and Rio Vista Avenues on the north. Hillsborough Avenue rights-of-way are variable, but insufficient for widening to six lanes east of Lincoln Avenue. A one-way pair could provide sufficient capacity to handle design year traffic without major widening to Hillsborough Avenue. However, streets that could be utilized for a one-way pair are all discontinuous and serve residential neighborhoods.

Connecting discontinuous streets to form a one-way system results in

FIGURE 8-1 ONE-WAY PAIR ALTERNATIVE

adverse horizontal curvature (without heavily damaging or displacing major shopping facilities). Then too, any one-way system would need to connect back into Hillsborough Avenue before reaching the Hillsborough River (or a new replacement bridge constructed).

East of the Hillsborough River, a one-way system was evaluated using existing Hillsborough Avenue and Mohawk Avenue. Mohawk Avenue is a brick street listed in the City of Tampa maintenance policy (Mayor's Executive Order No. 82-1) as a local street in a neighborhood with local significance (i.e., existing or proposed local ordinance historic conservation districts). The maintenance policy calls for Category 1 and 2 Streets (Mohawk is Category 2) to be restored rather than resurfaced. Even if a one-way system were feasible east of the Hillsborough River, it would be less than 0.5 mile in length due to the necessity of connecting back to Hillsborough Avenue before reaching the I-275 interchange. Using a street south of Hillsborough Avenue was considered, but it was out of direction (for a northern Hillsborough River bridge location) and was disruptive to local neighborhoods. (Note: a new Hillsborough River bridge south of Hillsborough Avenue would require use of land from a City Park.)

Based on the evaluation of this alternative, the one-way pair concept has been eliminated from further discussions for the following reasons:

- It would involve a major intrusion of a principal arterial highway into established residential neighborhoods.

- An acceptable horizontal alignment would bisect major shopping facilities.
- It would only offer an alternative to Hillsborough Avenue for a relatively short section due to the need to tie back in to Hillsborough Avenue at Dale Mabry, at the Hillsborough River, and at I-275.

This section includes a discussion of bridge alternatives evaluated as well as a summary of the economic analysis of alternatives for the Hillsborough Avenue bridge at the Hillsborough River. Supplementary information is included in Appendix B on existing and projected conditions (automobile and river traffic) as well as back up documentation for the cost estimates. Bridge typical sections were revised in March, 1989, to comply with the Department's latest design and safety standards.

Existing Structure (Bridge No. 100920)

The existing bridge is a vertical-lift bridge which was constructed in 1939 (Figure 9-1). As of May 1985, it had a sufficiency rating of 32.8 (indicative of the need for replacement) with "an estimated remaining life of 8 years" (see Structure Inventory and Appraisal printout in Appendix, p. B-15). The structure was originally designed for an H-15 loading. It is currently rated to carry a maximum gross load of 30 tons.

The main span length is 94 feet and there are eight concrete approach spans at 33 feet for a total bridge length of 358 feet. The existing bridge has an out to out width of 52.5 feet. This width accommodates two five foot sidewalks and an approximate 40 foot roadway (Fig. 9-2, top right). Existing vertical navigational clearance is 10.5 feet above MHW with the lift span in the low (closed) position and 52.9 feet in the raised (open) position. The existing horizontal navigational clearance is 60' feet between fenders.*

The bridge is operated (manned) 10 hours/day. It is currently opened approximately 13 times per month for the passage of vessels and maintenance activities.

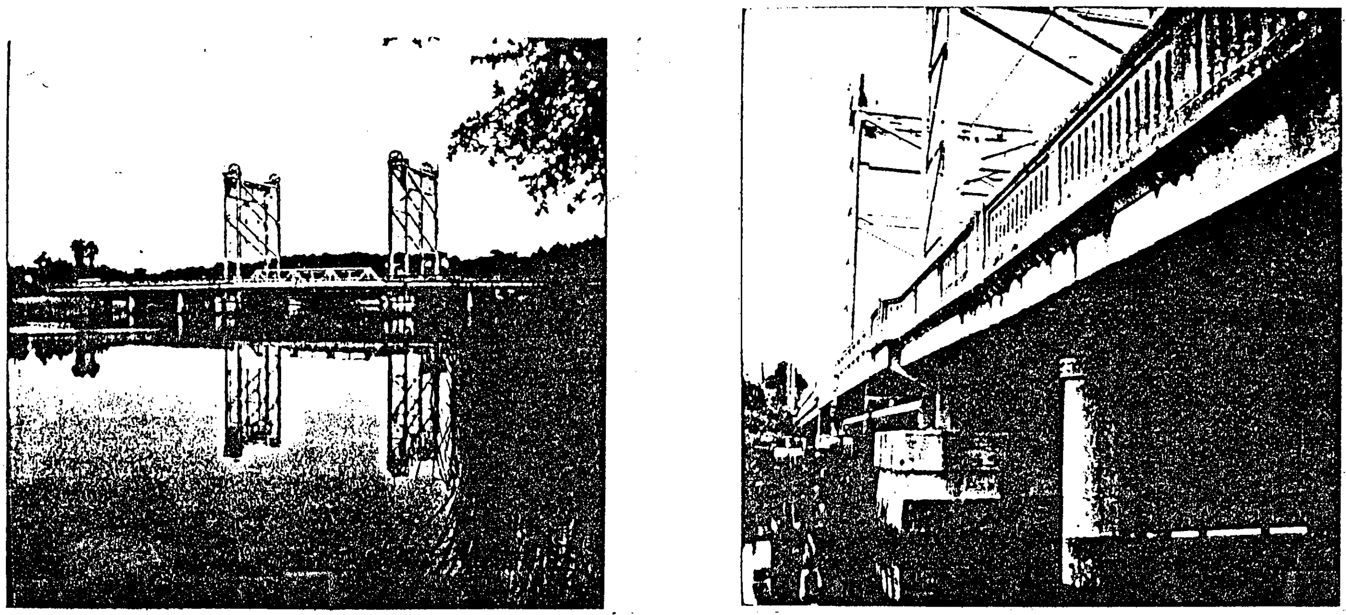


FIGURE 9-1 - EXISTING VERTICAL LIFT BRIDGE AT HILLSBOROUGH RIVER

Presently the State is evaluating all bridges in Florida to determine which structures are historically significant. If the Hillsborough Avenue bridge is determined to be significant, a separate Section 4(f) Statement will be prepared to determine the appropriate mitigation measures to be employed.

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*The above navigational clearances were reconfirmed with Ms. Zonia Reyes of the Miami USCG Office (305/536-5621) on February 26, 1987 by W. H. Riggs of DSA.

Alternatives Evaluated

In addition to the No build alternate, the following Build alternates have been evaluated:

- o Single bascule bridge -- using stage contstruction
- o Twin bascule bridge -- using stage construction
- o Mid-level fixed bridge (only coordination with the Coast Guard has been done to date)
- o High-level fixed bridge with embankment
- o High-level fixed bridge with proprietary (retaining) walls, including construction of a service road on the east side of the River.

No Build Alternate - The no build alternate is included for comparison purposes only, since the existing bridge will have to be replaced within the 17 year period used for the economic analysis due to its age, condition, and substandard design.

The existing bridge has a design loading of H-15 compared to a minimum design loading of HS-20 for all new and reconstructed bridges. Also, the 39'-10" clear roadway width on the bridge deck for four travel lanes is considered substandard.

Existing bridge operation costs averaged $44,100 per year over the following three fiscal years: 1982-83, 83-84, 84-85. Maintenance costs averaged $27,200 per year during the same period. Maintenance costs will escalate with continued deterioration of the existing 50-year old structure.

Widening the existing vertical lift bridge is considered impractical and cost prohibitive. The existing bridge needs replacing. Due to the need to maintain traffic and avoid a City park, the replacement bridge should be located immediately north of and parallel to the existing bridge (there are roadway and right-of-way considerations that also favor a northerly alignment).

Replacing the existing bridge in existing location is impractical due to the need to maintain traffic, the heavy volume of traffic and the lengthy (4.9± mile) detour involved.

Movable (Bascule) Bridge Alternates - Two six-lane bascule bridge alternates were evaluated:

- A single structure
- Twin structures

Estimated costs are summarized in Table 9-1 and more detailed cost estimates are included in Appendix B. Typical sections for each alternate are shown in Figure 9-2, and plan views are shown in Figures 9-3, 9-4, and 9-5.

Construction of bridge approaches would displace two residences and seven businesses for either bascule alternate.

In the closed position, either bascule alternate would provide a minimum 10' vertical navigational clearance above mean high water (MHW). In the open position, the vertical navigational clearance is, for all practical purposes, infinite. The minimum horizontal navigational clearance is 50 feet. The length of the movable spans varies depending on the alternate. Proposed profiles for all bridge

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TABLE 9-1 - COMPARISON OF BRIDGE ALTERNATIVES

Alternative	Public Agency Capital Costs[1] R/W ($ mill.)[2]	Constr. ($ mill.)	Total ($ mill.)	$ Millions (6)	$ Millions Total	Annual Oper. & Maint. Costs[3] ($ mill.)	No. Displacements[4] Bus.	Homes	Total	No. Local Streets Access Cut Off To[5]
1. Bascule-Single	5.4	10.1	15.5	0.76	16.3	0.082	7	2	9	1
2. Bascule-Twin	5.4	7.9	13.3	0.76	14.1	0.082	7	2	9	1
3. High-Level Fixed w/embankment	7.7	6.0	13.7	0.01	13.7	0.001	19	3	22	3
4. High-Level Fixed w/proprietary wall	6.8	7.0	13.8	0.01	13.8	0.001	19	3	22	3

---

1 All costs are expressed in 1988 dollars. Costs include all improvements between Wishart Boulevard and Highland Avenue, a distance of approximately 0.49 miles.

2 Includes relocation costs; excludes costs associated with stormwater detention ponds. R/W cost breakdown is as follows:

No.	Alternate	R/W	Relocation	Total
1,2	Bascule	$5.24	$0.19	$5.4
3	High Level	$7.41	$0.24	$7.7
4	High Level w/p. wall	$6.55	$0.24	$6.8

3 Includes routine electrical and machinery maintenance costs plus bridge tender and supervisor salaries. Costs furnished by FDOT Tallahassee bridge maintenance personnel. Bridge to be manned 10 hours per day. Does not include cost of major rehabilitation every 20-25 years at $0.5-0.75 million. Maintenance costs for fixed bridge includes minor items such as cleaning bridge scuppers, joint repair, etc.

4 Between Wishart Boulevard and Highland Avenue.

5 Does not include local streets which would be restricted to right-turn in, right-turn out; however, these would be restricted anyway under the access control scenario proposed.

(6) 1988 present worth of annual operating & maintenance costs based on i=7%, 17 year analysis period

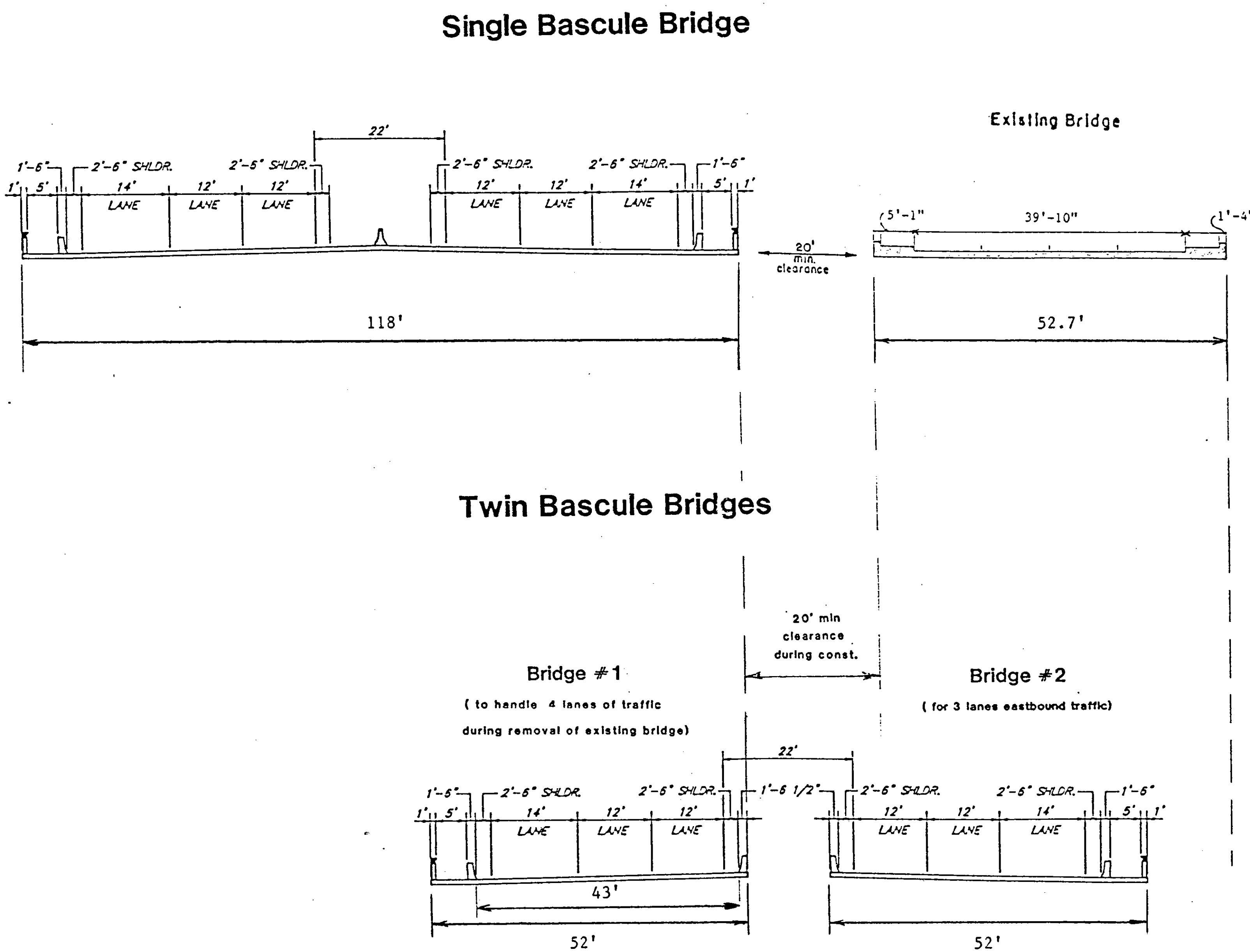

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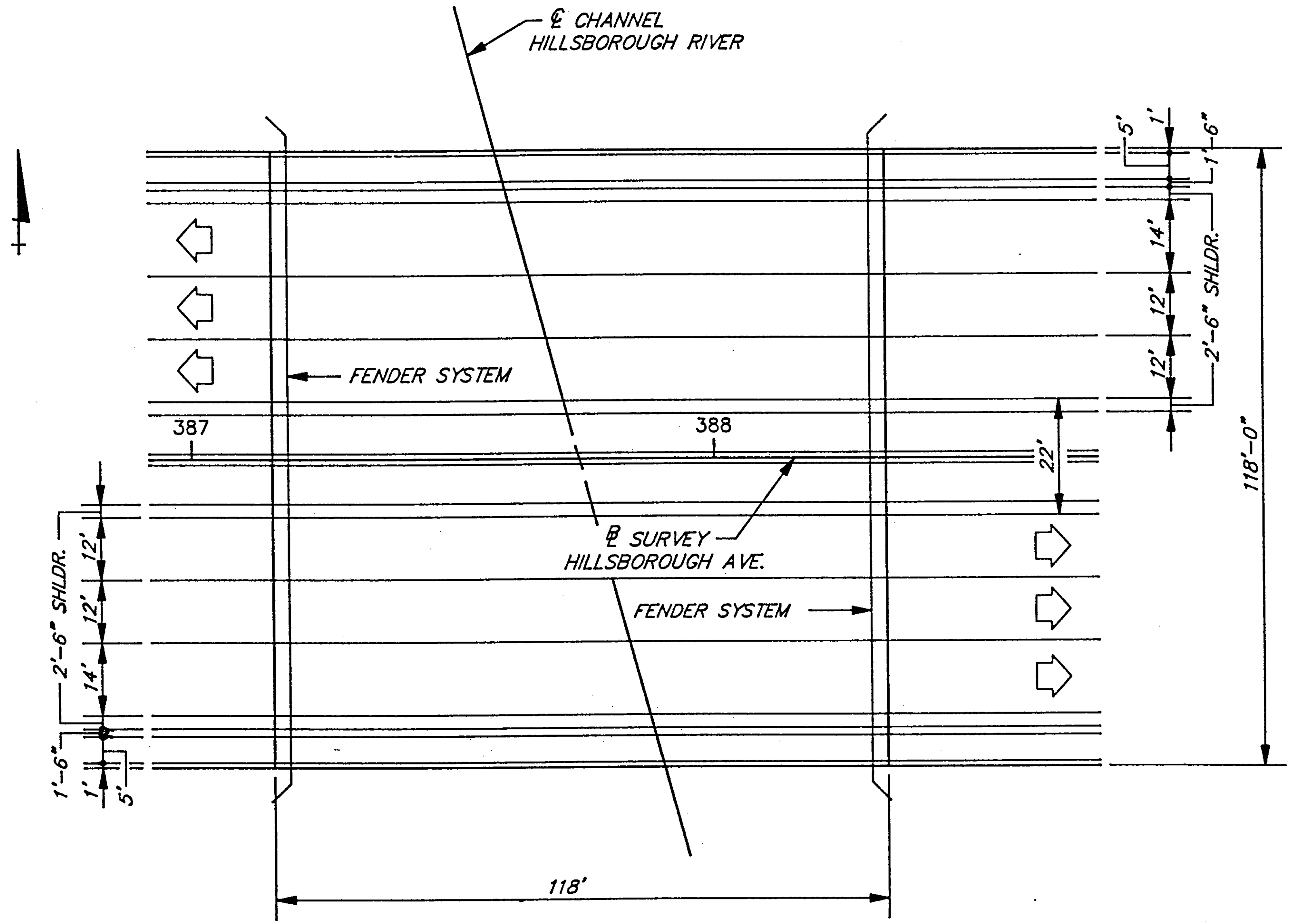
FIGURE 9-2 Bascule Bridge Alternate Typical Sections

HILLSBOROUGH AVENUE

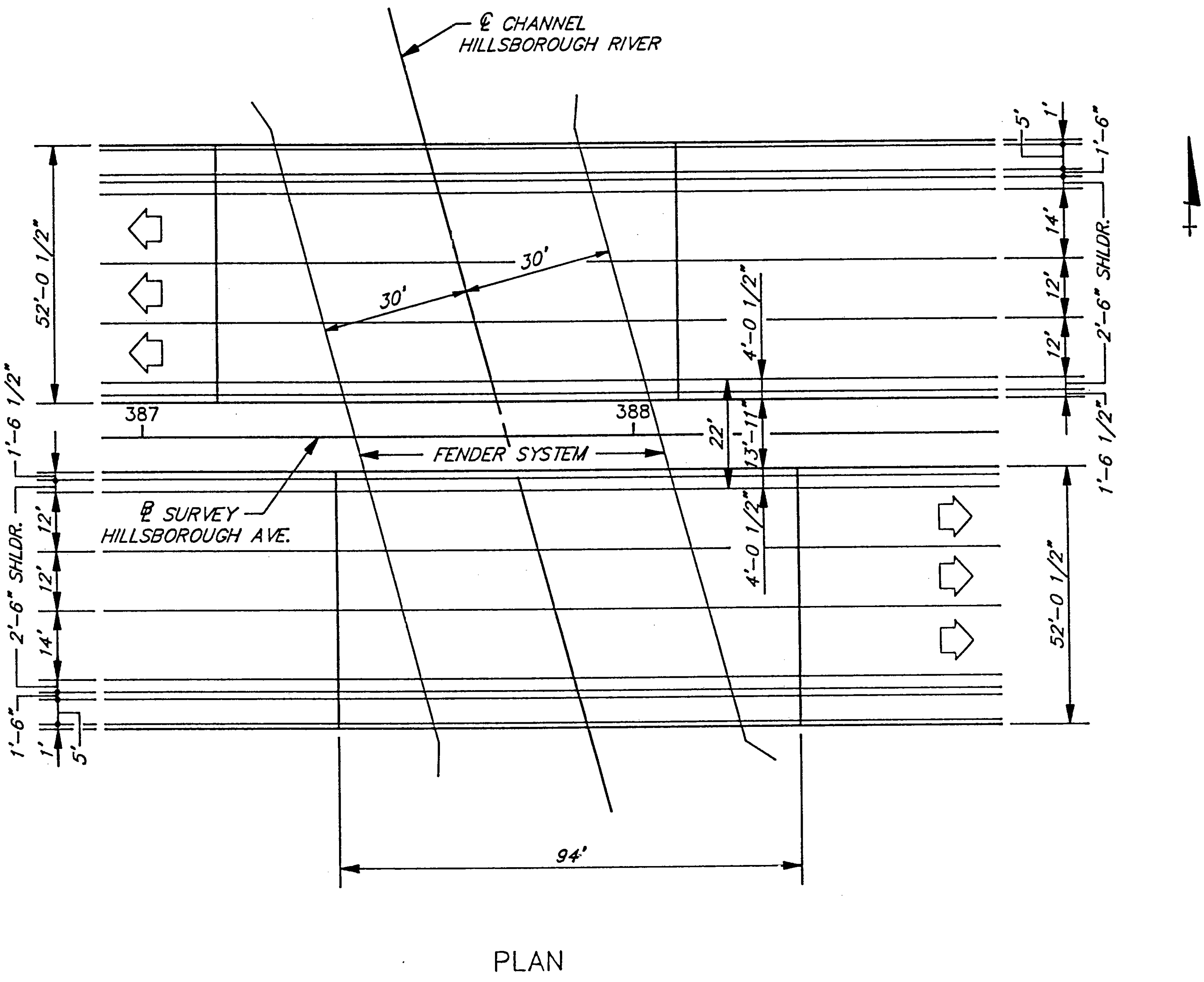


PLAN

HILLSBOROUGH AVE.

FIGURE 9-3 BASCULE SINGLE STRUCTURE PLAN VIEW

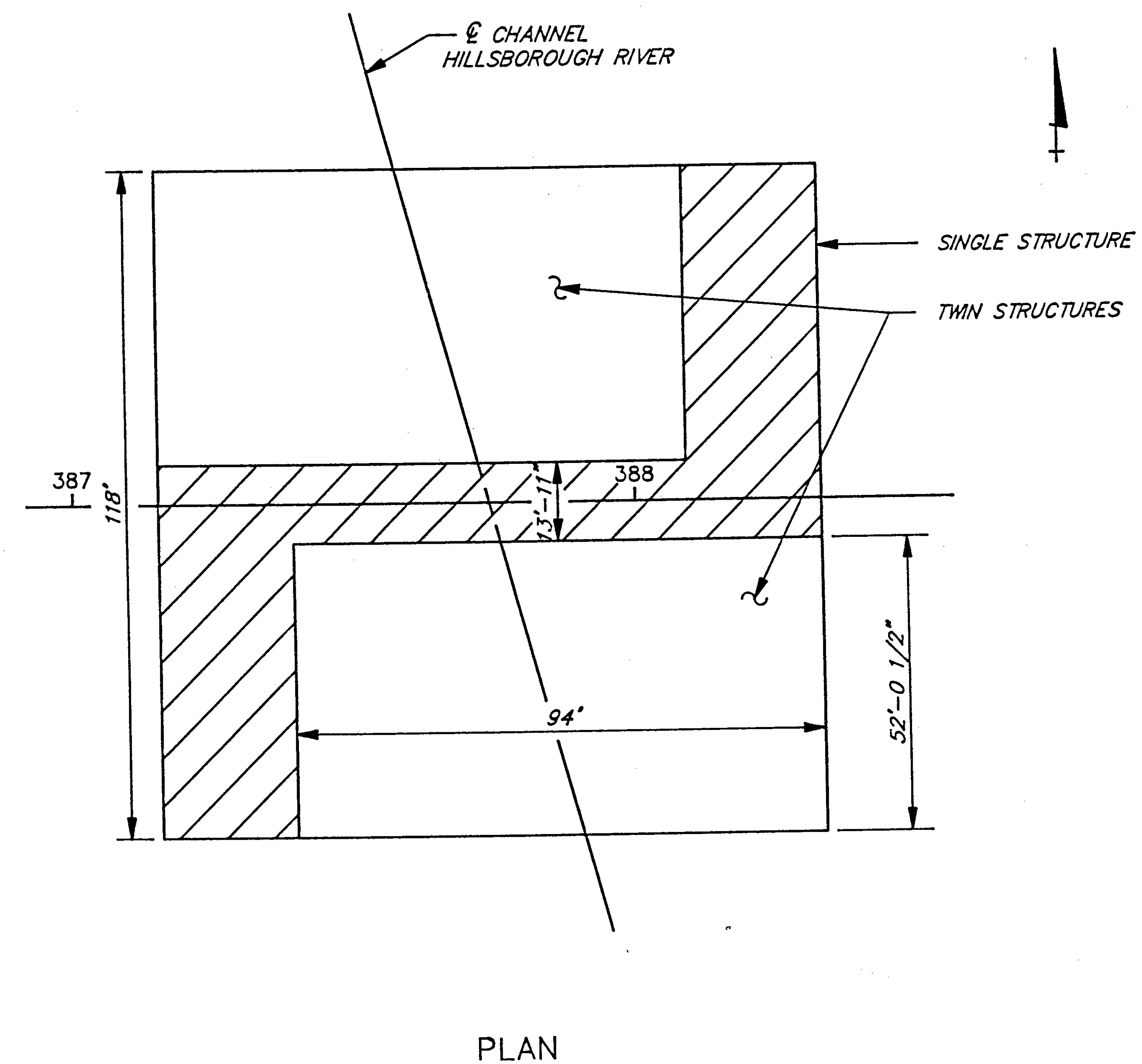
PD&E STUDY



HILLSBOROUGH AVE.

FIGURE 9-4 BASCULE TWIN STRUCTURES **PLAN VIEW**

PD&E STUDY



HILLSBOROUGH AVE.

FIGURE 9-5 BASCULE SUPERIMPOSED STRUCTURES **PLAN VIEW**

PD&E STUDY

alternates are included in Figure 9-6. The existing bridge would remain in place to maintain traffic until bridge number 1 was completed, for the twin bascule alternate.

One advantage of the twin bascule alternate is that is would reduce the amount of horizontal offset (curvature) required by about 45 feet since the southernmost bridge would be constructed in the same location as the existing bridge (Figure 9-2).

Due to the fact that the navigation channel is skewed relative to the bridge alignment, in order to maintain the existing navigation channel width with a structure more than twice as wide as the present, the span length for a single bascule bridge would have to be approximately 118 feet, while a staggered twin bascule bridge span would remain 94 feet. The use of twin structure would represent a cost savings of approximately 29 %.

Based on telephone conversations with personnel in the FDOT Tallahassee bridge maintenence section, the maintenence costs of a centrally operated twin structure would not differ much from a single bascule structure and would have significant advantages during major rehabilitations in terms of maintenance of traffic (refer to telephone memo included in Appendix B).

Mid Level Fixed Bridge Alternate - The Coast Guard was contacted regarding the possibility of a future mid-level bridge instead of the high-level structure. The proposed high level bridge is equivalent to the Buffalo Ave. (nearest downstream) bridge with vertical clearance of 36.4 feet. The Coast Guard indicated that in order to approve a mid-level bridge, they would have to send out a

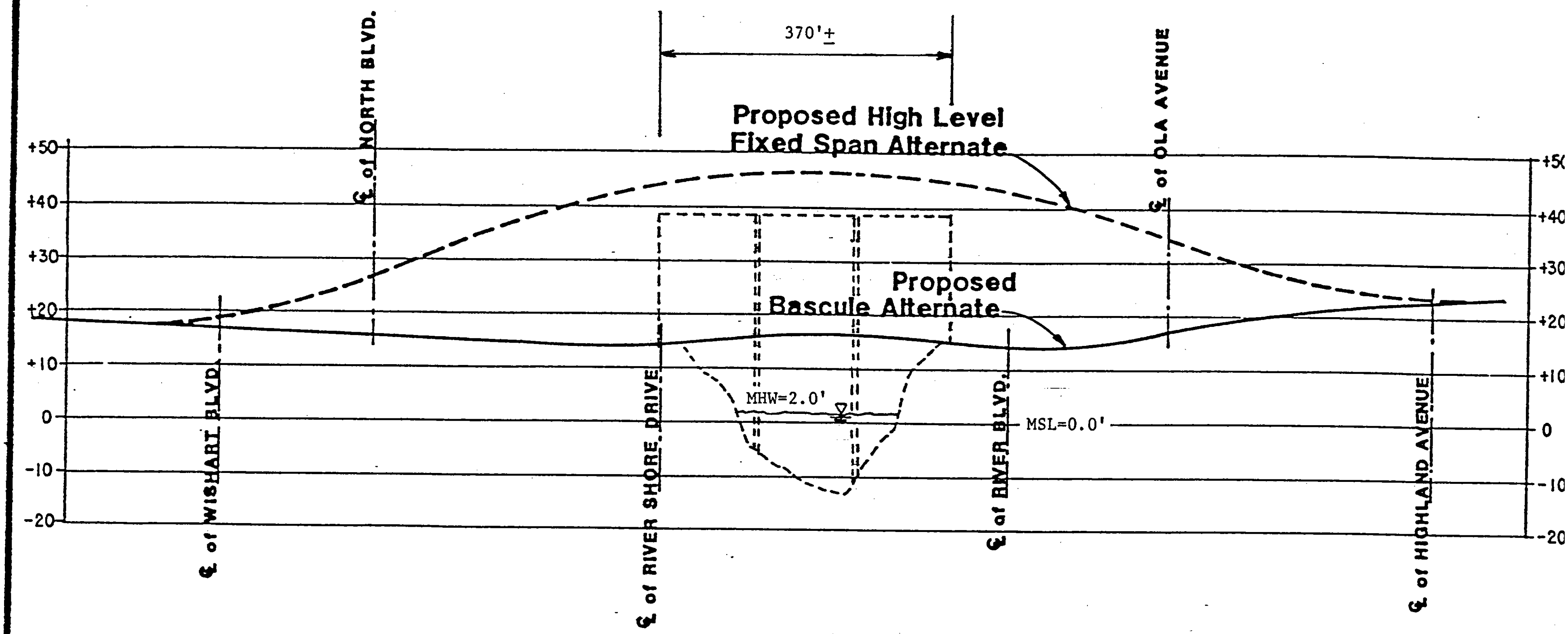


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FIGURE 9-6 Proposed Profiles for Bridge Alternates public notice to notify waterway users, waterway guide, newspapers etc. and depending on the response, a public hearing may be necessary. (See telephone memo in Appendix B.)

Fixed (high-level) Bridge Alternate - A high level bridge constructed immediately north of the existing bridge was also evaluated (Figure 9-7). The high level bridge alternative would provide six travel lanes for motorists, a 36.4-foot vertical navigational clearance (above MHW) and a 50-foot minimum horizontal navigational clearance for vessels (see letter from U.S. Coast Guard in Appendix B). Estimated costs are summarized in Table 9-1, and back up documentation is included in Appendix B. The high level bridge would be constructed on new right-of-way immediately north of and parallel to the existing bridge. Construction of bridge approaches would displace three residences and nineteen businesses. Maximum grades of four percent would be used on either approach to the bridge.

The existing bridge would remain in place until completion of four (of the proposed six) lanes on the new high-level bridge. At that time, Hillsborough Avenue traffic would be routed over the first stage (four-lane) construction on the new bridge and the existing bridge removed. Stage two construction would complete the remaining two lanes, plus sidewalk and permanent rail of the new bridge partly within existing right-of-way (Figure 9-8).

Due to the embankment required for the roadway approaches to the high-level bridge, existing streets within 600 feet of the proposed

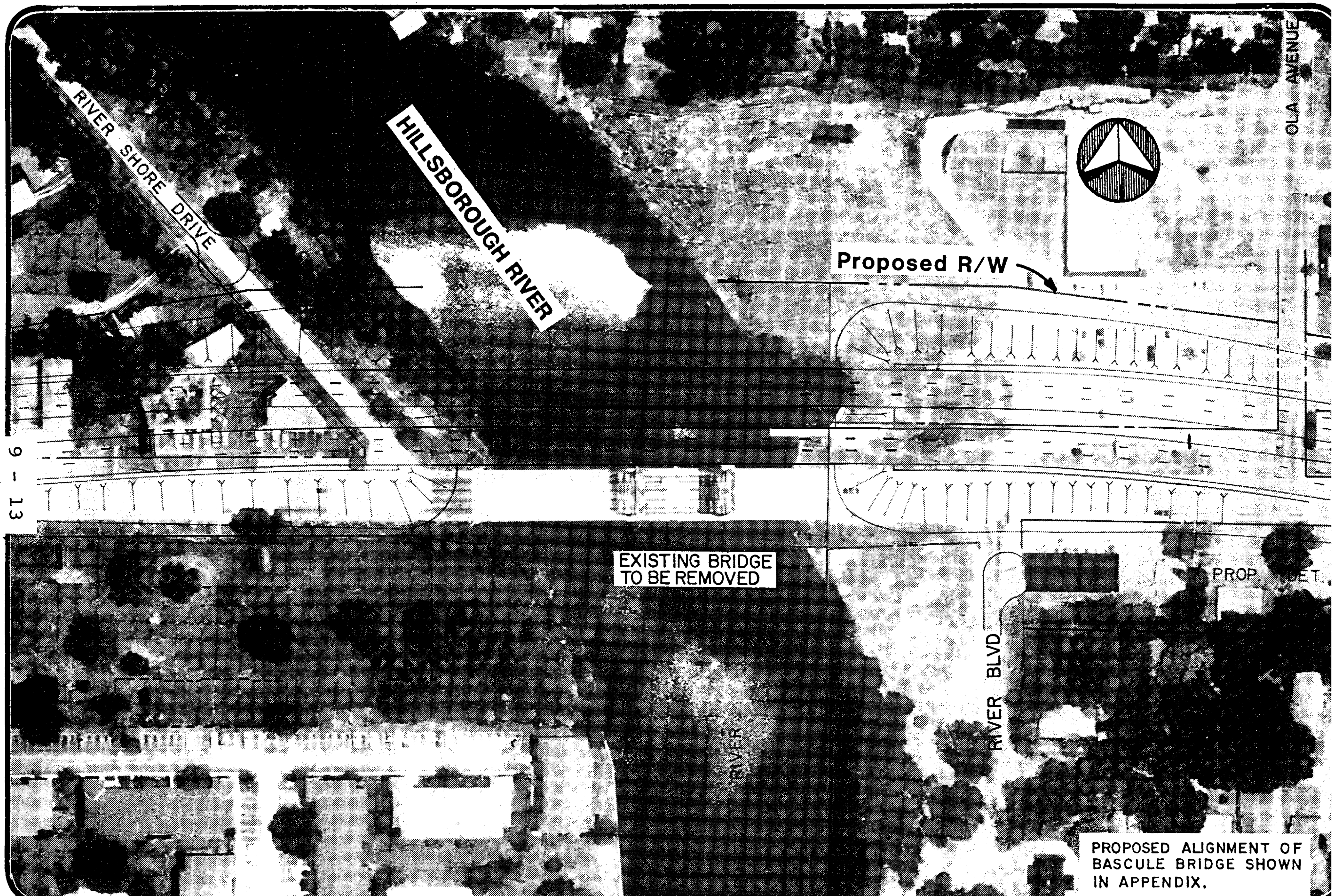

FIGURE 9-7 PLAN VIEW OF HIGH LEVEL BRIDGE ALTERNATE

HILLSBOROUGH AVENUE

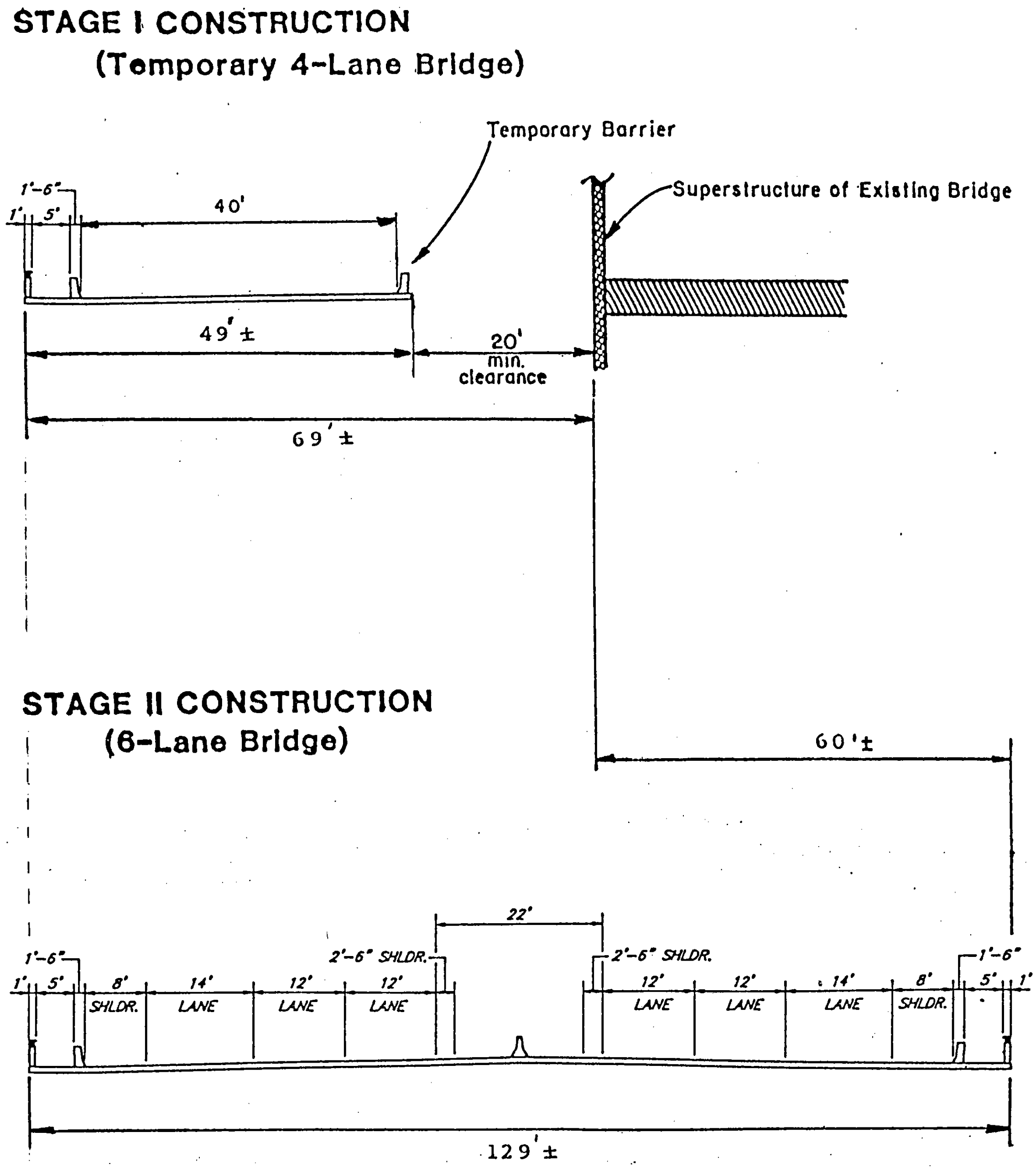

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FIGURE 9-8 - HIGH-LEVEL BRIDGE TYPICAL SECTION

river crossing which now intersect Hillsborough Avenue would be closed. Two of these streets, River Shore Drive and River Boulevard, now intersect Hillsborough Avenue within less than 200 feet of the existing bridge. Cul-de-sacs would be constructed for these two streets. Other streets affected would be North Boulevard and Ola Avenue. Access to Hillsborough Avenue from North Boulevard would be limited to right turns only. Ola Avenue would be barricaded.

In addition to the fixed bridge with embankment, an additional alternate was evaluated using proprietary (retaining) walls and including a service road on the east side of the River. The advantage of this alternate is that it would not require the relocation of businesses on the south side of Hillsborough Avenue, east of the River, due to the provision of a service road. While this alternate would result in some savings in right-of-way costs, the increased costs of construction would more than offset these savings, as shown in Table 9-1. In addition, traffic operational problems could result at the eastbound approach at Highland Avenue, where the eastbound service road would merge with eastbound traffic coming off of the bridge. A conflict would exist with eastbound-to -southbound right turns and eastbound through traffic from the service road. This would require special signal phasing or other means of traffic control.

Comparison of Alternatives

The various build alternatives are compared in Table 9-1. The right-of-way costs are based on estimates provided by the FDOT (revised January, 1989). The construction cost estimates are based on unit costs (per square feet); the basis for these cost estimates is included in Appendix B.

The annual operating and maintenance costs are based on Statewide averages supplied by the FDOT Tallahassee Bridge Maintenance Office with adjustments for the actual number of hours of operation for the existing Hillsborough Avenue bridge.

The difference in the total number of relocations ("displacements") is approximately 13; the bascule alternate displaces fewer businesses because it would not require the cutting off of access to the businesses on the south side of Hillsborough between River Blvd. and Highland Avenue as would be required with the high-level bridge alternate with embankment.

As previously explained under the description of the alternates, the high-level bridge would cut off access to three local streets due to the differences in grades required as a result of the vertical curves.

Economic Analysis

A long-term economic analysis was performed using the methodology contained in the AASHTO Manual on User Benefit Analysis (Reference 15) along with an FDOT computer program based on the AASHTO manual (Reference 16). The analysis period extends from 1994 to 2010, a period of 17 years. (Traffic demand projections were available through Year 2010 only). For both build alternates shown in Table 9-2, a 50-year life was assumed. The net present value of road user costs was determined for each of the three alternatives, using a

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TABLE 9-2 - SUMMARY OF BENEFIT COST ANALYSIS OF BRIDGE ALTERNATIVES

Comparison Using Net Present Value, in Millions of 1988 Dollars,
Using a Discount Rate of 7% and a 17-Year Analysis Period

(1) Bridge Alternative	(2) Tangent (Level) Running Costs	(3) Added Running Costs due to Grades	(4) Delay & Vehicle Operating Costs Due to Draw Open.	(5) Sum of Road User Costs	(6) "Build" Cost	(7) Cost Diff. Build vs. No Build: User	(8) Cost Diff. Build vs. No Build: Build	(9) Benefits/ Costs
No-Build (4 lane lift bridge)	$42.3	--	$0.175	$42.5	$0.298	--	--	--
Movable (6 lane Bascule)	31.2	--	0.164	31.4	12.0	11.1	11.7	0.95
High Level Fixed	31.2	.075	--	31.3	11.6	11.2	11.3	0.99

(2) Cost of operating a vehicle on straight level road, the value of time lost while traveling and average cost of accidents. Both the bascule and high level bridge have 1°± horizontal curves not included in calculations. Determined from FDOT Benefit Cost Analysis Computer Program (Version 3.1) based on the AASHTO "Red Manual", using a 17-year analysis period, from 1994-2010, inclusive. Traffic projections beyond Year 2010 not available.

(3) Calculated manually using the AASHTO Manual on User Benefit Analysis ... based on an average grade of 2% (maximum grade of 4%).

(4) Calculated manually; no-build case is a four-lane bridge; bascule case is a 6-lane bridge. Assumes an increase in number of bridge openings from 168 in 1985 to 568 in 2010 (based on historical growth trends).

(5) Equals col.(2) + col.(3) + col.(4).

(6) For the no-build case, includes operating and maintenance costs for maintaining the existing structure. For the build cases, includes present worth of capital costs (right-of-way and construction) and operating and maintenance costs for the bascule bridge alternate. See Figure 9-6 for assumed schedule. Present worths were calculated manually. Costs of roadway approaches are included in the build costs.

(9) Equals col.(7) ÷ col.(8).

discount rate of 7%. A design speed of 50 mph was used for all alternatives. The results are presented in Table 9-2.

For purposes of this study, it was assumed that construction of a replacement bridge would begin in FY 1991-92 and be complete in FY 1993-94.

The net benefit of an alternative is how much it improves service to road users. This is expressed in dollar terms by putting values on the various costs of operating a motor vehicle plus the value of time lost while traveling. By definition, a "no-build" alternative has a net benefit of zero and a build alternative has a net benefit equal to the reduction in user costs compared to the no-build alternative.

Several of the columns in Table 9-2 warrant further explanation. Column 3 costs are based on an average grade of 2% (maximum grade of 4%) over the analysis segment which includes vertical curves for the high-level alternate. The costs in Column 4 are relatively low due to the relatively low number of existing and projected bridge openings (168 openings in 1985 and 568 openings projected for 2010). Column 4 costs are higher for the no-build alternate due to fewer number of lanes being available to dissipate traffic queues (4 vs 6), therefore resulting in increased congestion.

The difference in the net present value of the sum of the road user costs (Column 5) is only $100,000, due to Columns 3 and 4 having a tendency to cancel each other out and both Columns 3 and 4 are small values relative to Column 2.

The build cost (Column 6) is also shown graphically in Figure 9-9.

Column 7 gives "benefits" which are defined in relation to the No-Build case. Column 8 gives "costs" which are also defined in relation to the No-Build case.

Column 10 is simply the difference in Columns 7 and 8 or the net benefits minus the net costs.

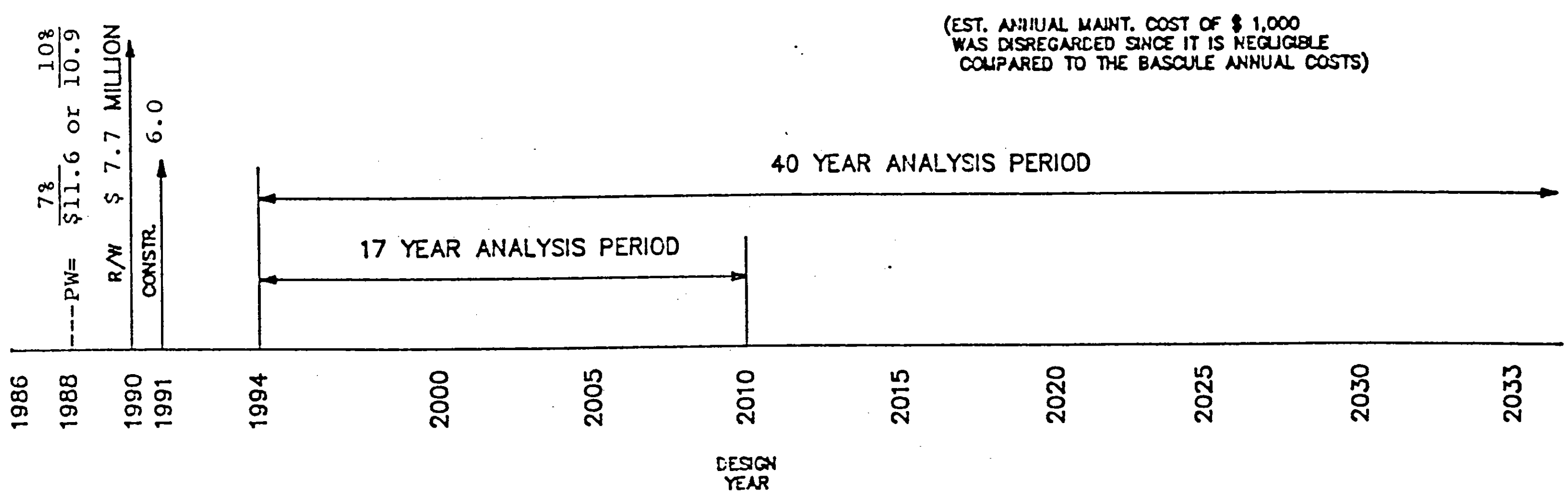
Table 9-3 is included to show the effects of using different discount (interest) rates and different lengths of analysis periods.

Following the economic analysis conducted in July of 1987, presentations were made to the MPO's Technical Advisory Committee (TAC), the Citizen's Advisory Committee (CAC), and to the MPO itself. These presentations are documented in correspondence included in Appendix B. On October 20, 1987, the MPO voted to support the Department's proposal to replace the existing vertical-lift bridge with a bascule (movable span) bridge.

FIGURE 9-9 BRIDGE CAPITAL AND OPERATING COSTS WITH 1988 PRESENT VALUES

NOTE: ROAD USER COSTS ARE COMPARED IN TABLE 9B

1. HIGH-LEVEL BRIDGE ALTERNATE



2. BASCULE BRIDGE ALTERNATE

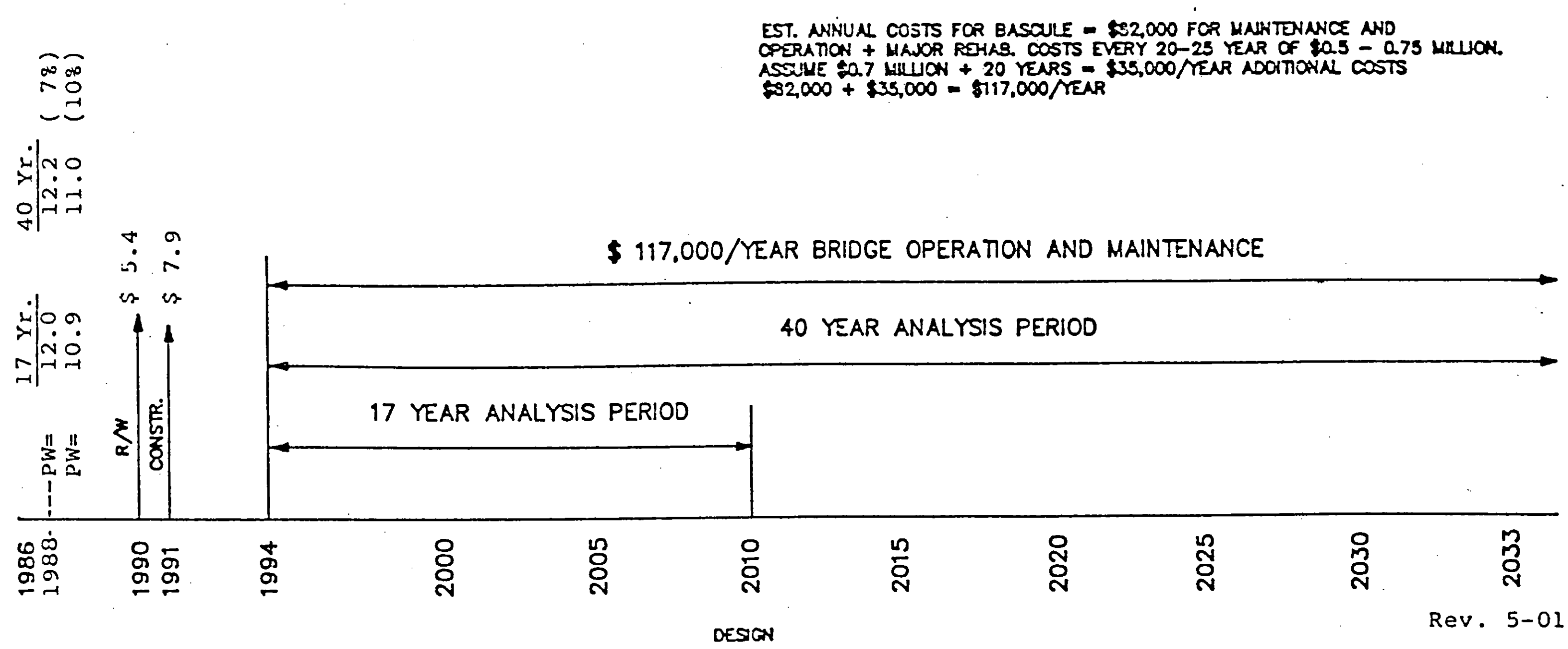


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TABLE 9-3 - COMPARISON OF PRESENT VALUES OF BRIDGE CAPITAL (R/W & CONSTRUCTION) AND OPERATING AND MAINTENANCE COSTS USING VARIOUS ANALYSIS PERIODS AND DISCOUNT RATES

($ Million)

Alternate	1988 R/W & Constr. Costs(1)	1988 Present Value Including Op. & Maint. Costs(2)			
		17-Year Analysis Period		40 Year Analysis	
		i = 7%	i = 10%	i = 7%	i = 10%
High Level	13.7	11.6	10.9	11.6	10.9
Bascule (Twin)	13.3	12.0	10.9	12.2	11.0
Difference	0.4	0.4	0.0	0.6	0.1

(1) If construction had occurred in 1988.

(2) Based on construction occurring in 1991 as shown in Figure 9-9. The two alternative analysis periods are also illustrated in Figure 9-9.

Based on the latest comparison of the different bridge alternatives, including costs updated in March, 1989, the twin bascule bridge is about 3% more expensive than the high-level fixed bridge. The $400,000 difference includes the added $760,000 maintenance cost associated with the bascule bridge.

However, the bascule bridge offers some important non-monetary advantages over a fixed bridge. These are as follows: fewer displaced businesses; less disruption to existing travel pattern; less noise associated with trucks on grade; fewer rear-end collisions due to stopping motorists at traffic signals at either end of a downgrade; less obstacles for bicyclists and pedestrians wishing to cross the bridge and last, a bascule bridge offers improved aesthetics as opposed to a high-level fixed bridge.

Based on the relatively insignificant cost difference, and considering the substantial additional impacts of a high-level fixed bridge, the Department feels that the twin bascule bridge alternate is the best alternate for this corridor, and it has recommended its approval for design.

Information relative to floodplain encroachments at the Hillsborough River is included in the Location Hydraulic Report (Appendix G).

For either bridge alternative, it is expected that the Coast Guard will require navigation on the River to be maintained during the bridge construction phase.

10. EVALUATION OF ALTERNATIVES AND RECOMMENDATIONS

Eight-Lane Alternates

As previously mentioned in Chapter 5, an eight-lane alternate was considered between Dale Mabry and Armenia to improve the capacities at several major intersections. After having analyzed the pros and cons of eight lanes, the eight-lane alternate is not recommended for the following reasons:

- An eight-lane arterial is inconsistent with the State's ultimate number of through lanes standard for arterial highways (Reference 5) as well as the MPO's Year 2010 Street and Highway Plan.
- The eight-lane alternate would cost an additional $5.0 million and result in approximately 23 additional relocations of businesses.
- The change in number of lanes would represent a discontinuity in design for the motorist.
- Technical staff from the City of Tampa, Hillsborough County, and the Florida Dept. of Transportation have all expressed concern regarding potential safety and operational problems with eight-lane arterials.
- Extensive research failed to discover any documentation on the safety and operational characteristics of eight-lane arterials.

The costs and impacts of various eight-lane alternates have been included in Table 10-1 anyway for comparison purposes.

TABLE 10-1 - PLAUSIBLE ALTERNATIVES WITH COSTS AND IMPACTS

Hillsborough Ave. Segment (From . . . To . . .)	Length (mi.)	Plausible Alternatives (Recom. Min. R/W)	Additional R/W Required (acres)	Displacements Bus.	Res.	NPO[1]	Tot	Total R/W Cost[2] ($ mill.)	Const. Cost ($ mill.)	Total Cost ($ mill.)
Eisenhower to West Shore	1.36	6-L Urban	--	--	--	--	--	--	3.2	3.2
		6-L Combin. Urb/Rur	--	--	--	--	--	--	2.7	2.7
		6-L "Modified Rural"	--	--	--	--	--	--	2.3	2.3
West Shore to Dale Mabry (W. Ramps)	1.06	6-L Urban	--	--	--	--	--	--	2.8	2.8
		6-L "Modified Rural"	--	--	--	--	--	--	1.9	1.9
Dale Mabry to Himes	0.33	6-L Urban (w/aux. lanes)	--	--	--	--	--	--	1.0	1.0
		8-L Urban	--	--	--	--	--	--	1.1	1.1
Himes to Lincoln	0.25	6-L Urban (122')	--	--	--	--	--	--	0.7	0.7
		8-L Urban (146')								
		Northern Alignment	0.4	--	--	--	--	0.4	0.9	1.3
		Central Alignment	0.1	--	--	--	--	0.1	0.9	1.0
		Southern/Combin. Alignment	0.2	--	--	--	--	0.1	0.9	1.0
Lincoln to Armenia	0.75	6-L Urban (110')								
		Northern Alignment	2.9	23	0	1	24	6.5	2.0	8.5
		Central Alignment	3.5	7	6	0	13	4.2	2.0	6.2
		Southern Alignment	3.7	11	6	0	17	4.7	2.0	6.7
		Comb. Alignment	3.5	10	6	0	16	4.6	2.0	6.6
		6-L Urban (122')								
		Northern Alignment	5.0	28	0	1	29	7.0	2.2	9.2
		Central Alignment	4.2	13	6	0	19	4.9	2.2	7.1
		Southern Alignment	4.5	11	11	0	22	5.5	2.2	7.7
		Comb. Alignment	4.2	19	6	0	25	5.3	2.2	7.5

TABLE 10-1 - PLAUSIBLE ALTERNATIVES WITH COSTS AND IMPACTS (Continued)

Hillsborough Ave. Segment (From . . . To . . .)	Length (mi.)	Plausible Alternatives (Recom. Min. R/W)	Additional R/W Required (acres)	Displacements Bus.	Res.	NPO[1]	Tot	Total R/W Cost[2] ($ mill.)	Const. Cost ($ mill.)	Total Cost ($ mill.)
Lincoln to Armenia (cont'd)		8-L Urban (146')[3]								
		Northern Alignment	8.0	34	0	1	35	8.8	3.4	12.6
		Central Alignment	6.5	51	6	1	58	12.8	3.4	16.2
		Southern Alignment	7.4	28	11	0	39	8.3	3.4	11.7
		Combin. Alignment	7.5	31	11	0	42	8.3	3.4	11.7
Armenia to Wishart	0.96	6-L Urban (122')								
		Northern Alignment	4.6	38	4	0	42	7.2	3.0	8.4
		Central Alignment	4.5	26	4	0	30	8.1	3.0	11.1
		Southern Alignment	4.3	10	4	0	14	3.4	3.0	6.4
Wishart to Highland	0.38	Fixed Span High Rise (Northern Align.[5])	7.0	19	3	0	22	5.7	4.7	10.4
		Movable (Bascule) Bridge (Northern Align.[5])	4.3	7	2	0	9	3.6	5.1	8.7
Highland to Nebraska	0.90	6-L Urban (122')[4]								
		Northern Alignment	5.6	18	10	0	28	8.6	3.1	11.7
		Southern Alignment[6]								
Total	5.99 mi.									

Legend/Notes

1 NPO = Non profit organization.

2 Includes costs for land, improvements, severance damage, R/W support, administrative and legal settlement, property owner appraisals, and relocation assistance costs. Costs for additional R/W for stormwater detention/retention not included in this table; see Table 11.

3 Includes transition from 8-L to 6-L east of Armenia Avenue.

4 Includes transition section east of Nebraska as well as widening of north and south approaches at both Florida Avenue and at Nebraska Avenue.

5 A southern alignment would involve taking a Section 4(f) property (a public park).

6 Not considered a plausible alternative due to the GTE Seminole telephone exchange on the southeast corner at Florida and Hillsborough.

Six-Lane Alternates

The plausible alternatives previously discussed in Chapter 7 are summarized in Table 10-1 along with right-of-way requirements and cost estimates. (All costs are expressed in terms of 1986 dollars; updated costs are included in Table 10-2 for the recommended "build" alternatives).

For the segments between Eisenhower and Dale Mabry, none of the plausible alternates require any additional right-of-way; therefore, the lowest cost option (six-lane "modified rural" typical section) is the recommended alternate. This alternative also has the advantage of providing ditches and swales for detention and treatment of stormwater runoff. The swale is proposed for the north side (with ditch-bottom inlets) and the ditch is proposed for the south side where more right-of-way is available.

For the segment between Dale Mabry and Himes, the recommended six-lane urban alternate could be constructed within existing right-of-way. In addition to the proposed six basic lanes, an auxiliary lane is proposed for eastbound motorists between the northbound-to-eastbound ramp at Dale Mabry and the exclusive right turn lane at Himes, resulting in four lanes in the eastbound direction.

For the segment between Himes and Lincoln, the six-lane urban with 22' median could be constructed within existing right-of-way.

For the segment between Lincoln and Armenia, two different six-lane alternates were evaluated in detail. As previously mentioned, a segment specific benefit-cost analysis showed the 14' TWLTL alternative to be more "cost-effective" than the 22' raised median, based on projected accident costs, etc. However, when all segments were considered collectively where new right-of-way was required, the raised median was the more cost-effective cross section. Also, due to the high functional importance of Hillsborough Avenue to the transportation system of the Tampa Bay region, and to provide design continuity for all segments of the proposed improvement project, the raised-median alternative is recommended for the entire project length. For the six-lane 22' raised median alternative, the central alignment minimizes both the costs and the number of relocations for this segment; therefore, it is the recommended alignment.

In late January, 1988, a decision was made to increase the median width from 22' to 28' between Himes and Habana Avenues, rather than having the median width transition from 28' to 22' back to 28'. The estimated incremental right-of-way cost for this revision is estimated to be about $100,000. No additional relocations are expected as a result of this revision. (As previously mentioned in Chapter 5, in October, 1987, the proposed median width was changed from 22' to 28' in the vicinities of Habana and Armenia Avenues in order to provide room for dual left turn lanes at these two intersections).

For the segment between Armenia and Wishart, a southern alignment is recommended to minimize both the costs and the number of displacements.

The segment between Wishart and Highland includes the bridge over the Hillsborough River. As previously discussed in the Bridge Alternatives section, a movable-span bridge is the preferred alternate; however, since the benefit/cost ratios for both build alternatives were very close, both alternatives were presented at the public information workshop held in December, 1986 to receive both citizen and agency comments. Subsequent to the workshop, the bascule bridge alternate was selected as the preferred alternate as explained in the previous chapter. The northern alignment for the bridge section is necessary due to the City park southeast of the existing bridge.

For the segment between Highland and Nebraska, as previously discussed, the only reasonable alternative for widening consists of a northern alignment, due to potential 4(f) impacts, impacts to a GTE switching facility, and the need to match the existing Hillsborough Avenue alignment east of Central Avenue.

In August, 1987, the proposed typical sections between Ola Avenue (east of the bridge) and Central Avenue were revised to make use of what would have been uneconomic remainders of parcels. As shown in Figure 10-1, for the segment between Ola Avenue and Florida Avenue (approximately 1300' in length) additional right-of-way is proposed to be acquired on the north side, to be used for a stormwater treatment/detention facility. In addition, a small landscaped berm is proposed to serve as a buffer between the highway and the residences along the north side of Hillsborough Avenue.

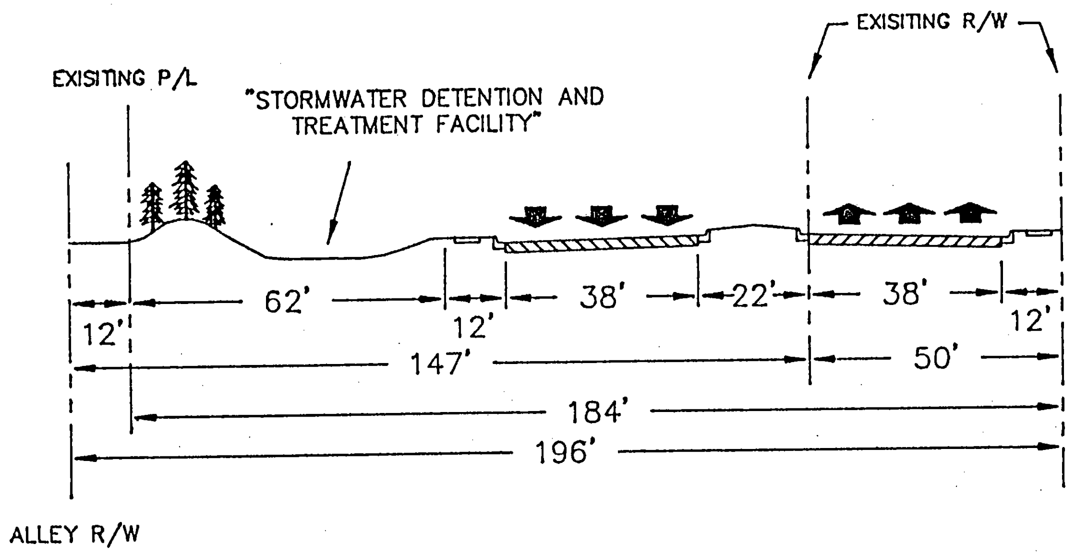
For the segment between Florida Avenue and Central Avenue (approximately 1300' in length), additional right-of-way is proposed to be taken primarily on the north side to provide space for landscaping and for noise/buffer walls (Figure 10-1). Additional revisions pertaining to this area (Seminole Heights) are documented at the end of this chapter.

As part of the Highland to Nebraska segment, the north and south approaches at both Florida and Nebraska Avenues would also be widened to provide single left turn lanes at Florida and dual left turn lanes at Nebraska.

Costs and Impacts of Recommended Alternates

For the recommended build alternatives, the total impacts and costs are summarized in Table 10-2. This table has been updated to include the latest right-of-way cost estimates prepared by the Department in December, 1987 and January, 1988. As shown at the bottom of the table, the total project cost is approximately $62

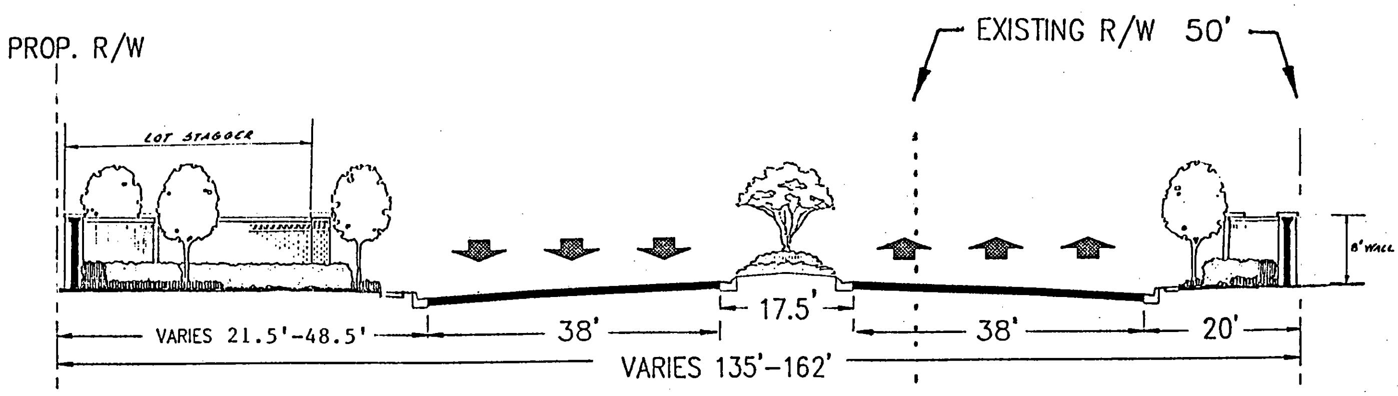
Ola Ave. to Florida Avenue



Approx. Scale: 1" = 40'

Florida Ave. to Central Avenue

SIX-LANE "CENTERED"



LOOKING EAST

Approx. Scale: 1" = 25'

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FIGURE 10-1 Recommended Typical Sections, Ola Ave. to Central Ave.

TABLE 10-2 - COSTS AND IMPACTS OF RECOMMENDED BUILD ALTERNATES

Segment	Length (mi.)	Recommended Build Alternate	Additional R/W (acres)	Estimated No. Displacements Bus.	Res.	NPO	Tot	Estimated 1989 Costs ($ Millions) Total R/W Cost[1]	Const. Cost[2]	Total Cost
Eisenhower to Dale Mabry	2.42	Mod. 6-L Rural	--	--	--	--	--	--	4.6	4.6
Dale Mabry to Armenia	1.33	6-L Urban (centered)	5.2	20	9	--	29	10.5	4.7	15.2
		Stormwater	2.6	--	--	--	--	1.8	--	1.8
Armenia to Beacon	0.79	6-L Urban (southern)	3.4	8	4	--	12	4.9	2.9	7.8
		Stormwater	1.5	--	6	--	6	1.2	--	1.2
Beacon to Tampa[4]	0.73	6-L Urban & Bascule Bridges (Northern)	7.0*	34	14	--	48	10.0	7.9[4]	17.9
Tampa to East of Nebraska[3]	0.83	6-L Urban (Northern)	6.5*	19	18	1	38	9.5	3.6	13.1
TOTALS	6.10		26.2	81	51	1	133	37.9	23.7	61.6 (say $62 million)

NOTES:

[1]R/W costs updated to 1989 and include costs of relocation, business & severance damages, appraisal fees, support costs, legal settlement factors, etc.

[2]Includes design and other engineering costs.

[3]Includes cost of widening north and south approaches at both Florida and Nebraska Avenues.

[4]Beacon to Tampa construction costs break down as follows: structure $6.0; existing bridge removal $0.23; roadway approaches $1.7.

*Includes small areas for stormwater detention.

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million for the six-lane alternate, including right-of-way and engineering costs. Right-of-way costs represent about 61% of the total costs, or about $38 million.

Table 10-2 does not include additional costs and impacts which would result if any of the "major intersection options" previously discussed were constructed. These additional costs and impacts are summarized in Table 10-3. None of these major intersection options are recommended at the present time due to the high costs ($28 million for the at-grade split diamonds and $51 million for the interchanges) associated with them relative to the cost of the straight six-laning project. In addition, the level of service could be improved to a more acceptable level by eight-laning a portion of the project at much lower cost.

TABLE 10-3 - ADDITIONAL COSTS AND IMPACTS OF MAJOR INTERSECTION OPTIONS

	Additional Costs & Impacts as Compared to Conventional At-Grade Intersections											
	"At-Grade Split Diamond" Option						Grade Separation Option					
	R/W	Additional Displacements		Additional Costs ($ million)			R/W	Additional Displacements		Additional Costs ($ million)		
Intersection	(acres)	Res.	Bus.	R/W	Const.	Total	(acres)	Res.	Bus.	R/W	Const.	Total
Himes & Hillsborough	8.3	0	4	5.6	2.0	7.6	15.0	1	2	7.4	8.1	15.5
Armenia & Hillsborough	10.3	22	16	8.7	2.0	10.7	7.4	0	22	7.7	10.8	18.5
Florida & Hillsborough	7.5	15	5	7.4	2.0	9.4	6.0	11	7	6.3	10.8	17.1
Totals	26	37	25	22	6.0	28	28	12	31	21	29.7	51

Notes

1. "Conventional at-grade intersections" refers to the proposed geometry for year 2010.
2. Grade separation options are partial cloverleaf at Himes & Hillsborough; urban interchanges at Armenia and at Florida.
3. Additional costs and impacts also include those associated with widening the north-south streets in the immediate interchange/intersection area.
4. All costs updated to 1989.

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Revisions to Seminole Heights Area Design Alternate

As a result of opposition to the proposed widening from residents in the Seminole Heights area (between Florida and Central Avenues), additional alternatives were analyzed in July and August, 1988. The alternate typical sections evaluated for this area are shown in Figure 10-2.

Alternate Number 1 consists of a six-lane "centered" urban typical section with "buffer" areas on each side consisting of small landscaped berms. Single left turn lanes are shown at Florida Avenue since dual left turn lanes would require a long transition east of Florida Avenue which would result in a wider typical section. Left turns from Hillsborough Avenue would be prohibited between Florida and Central Avenues. A 17.5' raised median is required due to the need to provide left turn lanes on Hillsborough Avenue at Florida and Central Avenues, respectively.

Alternate Number 2 (a and b) consists of a four-lane urban typical section with a 17.5' raised median. The additional right-of-way required to bring the lane widths up to current standards would result in the taking of the first row of houses located along the north side of Hillsborough Avenue, as shown in Figure 10-2.

Motorist delay associated with a four-lane "bottleneck" section was estimated using a deterministic queuing method documented in NCHRP Report No. 133: Procedures for Estimating Highway User Costs, Air Pollution, and Noise Effects. The results of that analysis are summarized below:

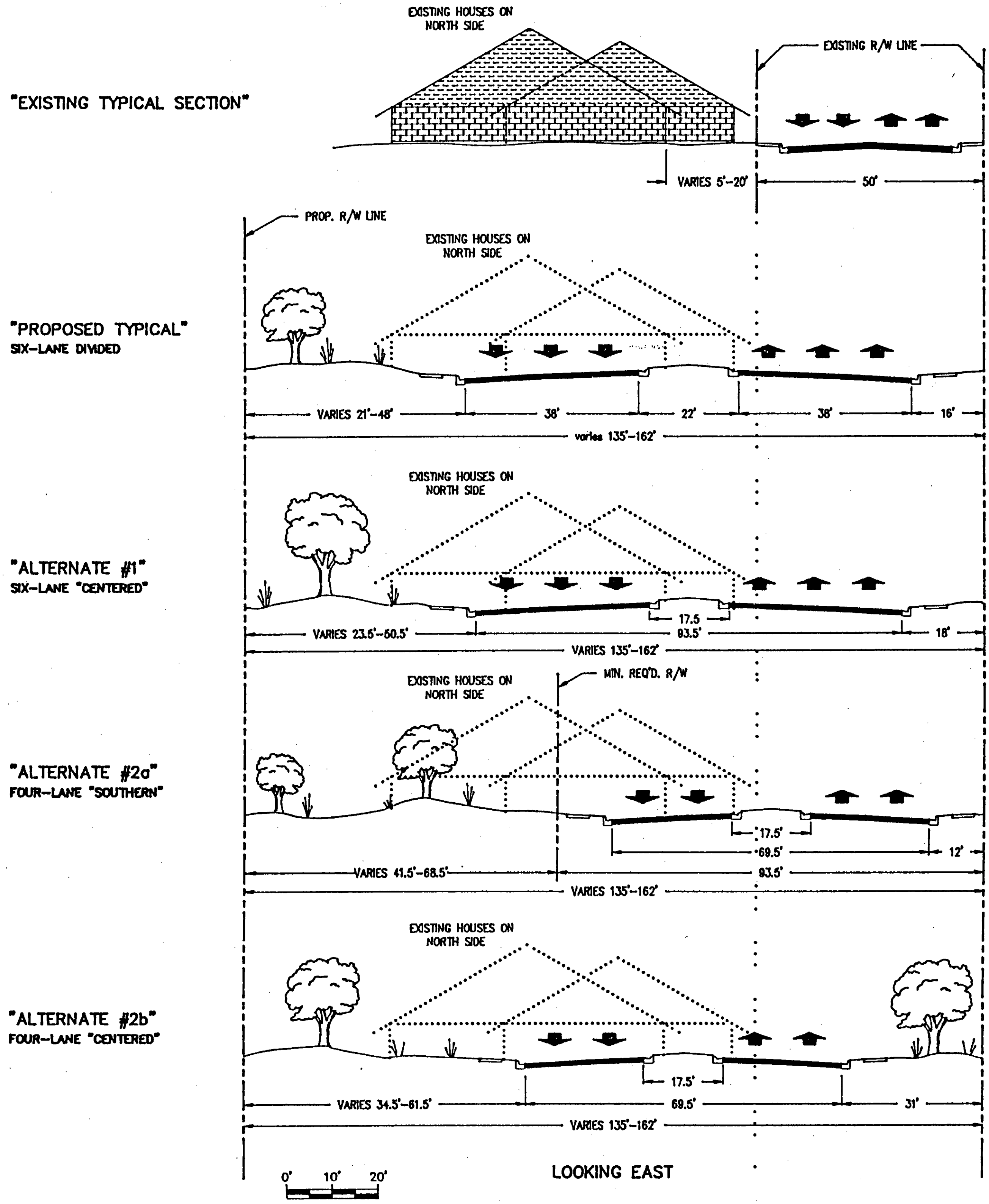

FIGURE 10-2 ALTERNATE TYPICAL SECTIONS FOR SEMINOLE HEIGHTS

(1) Year 2010 p.m. peak average delay for westbound motorists = 18.5 minutes

(2) Length of time to dissipate the queue is approximately 3.4 hours.

(3) Maximum length of the queue is 1.8± miles.

(4) Annual cost of the delay for both a.m. and p.m. peak periods is $8.7 million in 1988 dollars.

With respect to air pollution, the four-lane alternate would result in greater adverse air quality impacts to the neightborhood compared to the six-lane alternates since traffic congestion would be greater and more vehicles would be idling in the vicinity of the neightborhood.

With respect to noise impacts, the four-lane alternate would likely result in slightly lower noise levels than either six-lane alternate due to probable lower speeds during much of the day and lower volumes of traffic passing through the bottleneck section.

In addition to evaluating a four-lane alternate, the option of constructing a six-lane typical with single left turn lanes only on Hillsborough and Florida was considered (as opposed to dual left turn lanes). Table 10-4 shows the projected intersection levels of service at Florida and Hillsborough for various alternates for the years 1988 and 1993.

TABLE 10-4 - LEVEL OF SERVICE COMPARISON AT HILLSBOROUGH & FLORIDA FOR THE P.M. PEAK PERIODS

Year	"No Build"	Add Single Left-Turn Lanes Only	FDOT Proposed Design 6-Lanes + Dual Lefts on Hills. & Single Lefts on Florida
1988	D	D	B
1993	F	E	C

Based on the level of service analysis, the Department decided to retain six lanes through Semimole Heights and to keep the proposed dual left turn lanes at the intersection of Florida and Hillsborough. However, a number of changes were made in the proposed conceptual design in the Seminole Heights area.

As a result of coordination with representatives of the Seminole Heights Civic Association (following the public hearing held on June 28, 1988), the following changes were made in the proposed conceptual design for Hillsborough Avenue between the vicinities of Florida and Central Avenues:

(1) Openings in the median at intersections were eliminated, resulting in a continuous, raised median.

(2) The typical median width was reduced from 22 feet to 17.5 feet.

(3) The recommended length of storage for the westbound dual left turn lanes at Florida Avenue was shortened from 150 feet to 75 feet. This will still satisfy Year 2010 projected demand.

(4) The alignment was shifted approximately two feet farther north, resulting in a more "centered" alignment through Seminole Heights. The resulting border width on the south side is approximately 20 feet. The border width on the north side varies from approximately 22 feet to 49 feet; see Figure 10-1.

A revised conceptual design drawing (sheet no. 9 of 10, reduced to 11" x 17") showing the above changes is included in the Appendix of this report.

To help mitigate the noise impacts of the proposed project, as well as impacts to the proposed Seminole Heights Historic District, the Department has decided to fund the construction of noise/buffer walls on either side of Hillsborough Avenue through Seminole Heights (Florida Avenue to Central Avenue; see drawings in Appendix I). It has also agreed to provide enhanced landscaping in this area. In addition, research is currently underway regarding the potential provision of aesthetic/period street lighting in the Seminole Heights area.

Public involvement activities involving the Seminole Heights area are documented in the environmental determination/categorical exclusion "package" prepared for this project as well as in the Section 4 (f) Statement prepared for this project. Additional commitments made by the Department regarding the Seminole Heights area are included at the end of Chapter 11 of this Report.

11. PROPOSED DESIGN FEATURES AND CONSTRUCTION REQUIREMENTS

Design Speed and Horizontal and Vertical Alignment

The recommended design speed is 45 mph for all segments of Hillsborough Avenue.

The proposed horizontal alignment is illustrated on the conceptual design drawings and it generally follows existing alignment, which is tangent for the most part. In the vicinity of the proposed bridge over the Hillsborough River, a one degree± curve would be required on the eastbound approach to the bridge in order to construct a replacement bridge north of the existing one. The existing bridge would remain in service during construction of the new bridge.

Proposed vertical alignment would generally follow the existing vertical alignment, including the replacement bridge and its approaches.

Major Drainage Features

Drainage outfall locations are proposed at existing outfall locations. On the west end, between Eisenhower Blvd. and Dale Mabry, outfall locations consist of lateral ditches which run northerly to connect to the Henry Avenue canal (which ultimately drains into Tampa Bay). Detention ponds are proposed as shown on the concept drawings for stormwater flow attenuation and treatment. For the eastern half of the project, most of the drainage areas would outfall to the Hillsborough River through underground pipe systems. Potential detention areas are identified on the conceptual design drawings.

Major Intersection Improvements

As part of the proposed six-laning of Hillsborough Avenue, several intersections are proposed to be widened to include dual left-turn lanes and exclusive right-turn lanes, where warranted by projected Year 2010 design hour volumes. As shown on the conceptual design plans, these include Hillsborough at: Benjamin Road, Himes Avenue, Habana Avenue, Armenia Avenue, Wishart Blvd., Florida Avenue, and Nebraska Avenue. Table 11-1 summarizes proposed short-term and long-term intersection improvements.

Pedestrian and Bicycle Accommodations

For the "modified rural" typical sections, minimum 4' paved shoulders are proposed to facilitate bicycle travel; for the urban sections, 14' curb lanes are proposed which is consistent with FDOT's current design policies.

It is recommended that the mid-block pedestrian crossing signal located just west of Mendenhall Drive be retained following the widening of Hillsborough Avenue as there are no plans to change school boundaries, etc.

TABLE 11-1 - PLANNED AND RECOMMENDED INTERSECTION IMPROVEMENTS

Hillsborough Avenue at ...	"Short Term" Improvements to be done by FDOT	Recommended Long-Range Improvements By Others (for 2010)	Jurisdiction Responsible for Cross St.
Benjamin Road	Widen Hillsborough to include provisions for future dual left turns; widen Benjamin to provide dual left turn lanes on SB approach	---	Hills. County
Hoover Blvd.	Provide for dual left turns off of Hillsborough Ave. Provide right-turn lanes on east & west approaches	---	City and County
Anderson Rd./Westshore Blvd.	Widen median to allow dual left turns off of Hills. Ave. Tie into County's design to widen Anderson N. of Hills.	Six-lane north and south approaches in compliance with MPO's TUATS 2010 plan	Hills. County & City of Tampa
Hesperides Street	Provide exclusive right turn lanes on east & west approaches; provide dual left turn lanes on southbound approach.	---	City and County
Lois Avenue	Add exclusive right turn lane on south bound approach.	Widen N & S approaches to provide dual left turn lanes	City of Tampa
Himes Avenue	Provide dual left turn and exclusive right turn lanes on all approaches. Designer should coordinate with County's plans for 5-lane section of Himes north of Hillsborough.		City of Tampa & Hills. County
Habana Avenue	(Designer should coordinate with City's plans to widen Habana on either side of Hillsborough.)	---	City of Tampa
Armenia Avenue	Widen Hillsborough to provide dual left turn lanes; also widen Armenia to provide dual left turn lanes on N & S approaches.	---	Hills. County

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TABLE 11-1 - PLANNED AND RECOMMENDED INTERSECTION IMPROVEMENTS (CONTINUED)

Hillsborough Avenue at ...	"Short Term" Improvements to be done by FDOT	Recommended Long-Range Improvements By Others (for 2010)	Jurisdiction Responsible for Cross St.
Rome Avenue	Widen north and south approaches to provide adequate lane storage lengths and widths	---	City of Tampa
Wishart Blvd.	Re-channelize intersection as shown on conceptual design plans	---	City of Tampa
Highland Avenue	Restripe NB approach to provide 16' SB lane and two 12' NB approach lanes (instead of the existing 10' NB approach lanes)	---	City of Tampa
Florida Avenue	Widen approaches to provide dual left-turn lanes on Hills. Ave. and single left-turn lanes on Florida Ave.	---	FDOT
Central Avenue	No improvements proposed	---	City of Tampa
Nebraska Avenue	Widen all approaches to provide dual left turn lanes	---	FDOT

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Access Control

As previously mentioned in Chapter 6, medial access control measures are proposed consisting of special channelizing islands to be used in conjunction with standard raised islands. These channelizing islands are designed to prevent left-turn egress from driveways and minor (local) street approaches. Motorists will still be able to make left-turns off of Hillsborough Avenue at median openings, which will average 500'-600'± typical spacing. Median widths will typically range from 22' to 28', the latter width proposed for areas with greater frequency of dual left turn lanes on Hillsborough Avenue.

Utilities and Railroads

Routine utility adjustments are expected as part of the proposed reconstruction of Hillsborough Avenue. Existing utilities within the right-of-way include water mains, sanitary sewer, gas, telephone and electric.

With respect to utility crossings at the Hillsborough River, during the bridge design phase, it will be the responsibility of individual utility companies to determine the necessity of removal and relocation of their respective utility lines. During the planning of the construction and demolition, it will be determined whether the existing bridge can be removed without disrupting the continuity of utility service. The individual utilities will be required to review the methods they would use to relocate their service before dredge and fill quantities can be determined. In addition, the individual utilities must obtain their own dredge and fill permits and negotiate sovereign land use with the respective agencies since individual or unique permit conditions may be imposed by the permitting agencies.

With respect to the probable environmental impact, generally submarine cable crossings can be accomplished with minimal environmental impacts. This generality is of course dependant upon the site specific conditions and the methods used to install the cable. For example, FAC 17-4.04(9) (p) provides a FDER permit exemption for "the installation of subaqueous transmission and distribution lines laid on, or embedded in the bottoms of waters of the state, except in Class I-A and Class II waters and aquatic preserves provided that no dredging or filling is necessary".

As previously mentioned in Chapter 2, the rubberized railroad crossing on Hillsborough Avenue approximately 700 feet west of Westshore Blvd. has already been removed along with the warning devices.

Maintenance of Traffic Concepts

During the construction phase, the contractor will be required to maintain four lanes of traffic, at least during the peak travel hours. In the vicinity of the bridge, construction on the replacement bridge will take place while traffic is maintained on the existing structure. The maintenance of traffic plan will be dependent on contruction sequencing including the need to maintain drainage during the construction process.

Commitments for Seminole Heights Area

In addition to the commitment to provide noise/buffer walls and enhanced landscaping in the Seminole Heights area as mentioned in the previous chapter, additional commitments have been made as part of the development of the Section 4 (f) Statement and completion of the National Historic Preservation Act Section 106 process. The Seminole Heights Historic District has been determined to be eligible for inclusion in the National Register of Historic Places. A Memorandum of Agreement was signed in December, 1988, by FHWA, FDOT, and the State Historic Preservation Officer.

The following excerpts from the Section 4 (f) Statement explain the measures taken to minimize impacts and the mitigation measures to which the Department is commited:

The alignment and cross-sectional design of the proposed alternatives were extensively studied to arrive at a design which would minimize the number of displacements of contributing structures. Whether a southern, northern or central taking, even with a reduced facility properties would have to be taken because they have been built so close to the existing right-of-way. However, the cumulative impacts to 4 (f) and non-4 (f) impacts are the least with the "northern" alignment.

Mitigative measures proposed by the Department are:

1) At the request of the owners and provided that it is structurally feasible, the Department will move the buildings to new sites, within or close to the historic district. Before such a move, the house will be documented with photos, plans and specifications. The relocation and reconstruction will be done according to those plans and specifications, upon approval by the SHPO, FHWA and FDOT. All documentation will be permanently filed in the Florida Master Site File at the Florida Division of Archives, History and Records Management.

2) If the owner does not request relocation, the Department will purchase the structure and in consultation with the SHPO will prepare an individual marketing plan for each of the adversely affected buildings which will include the following elements:

   a. an information package about the building including but not limited to:

      i. photographs of the building
      ii. information on the building's historic significance
      iii. information on the building's cost
      iv. information on financial assistance for moving the building
      v. information on moving requirements
      i. notification that the purchaser will have to sign an agreement to maintain the building in accordance with the recommended approaches in the Secretary of the Interior's "Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings" (U.S. Department of the Interior, National Park Service, 1983)

   b. a distribution list of potential purchasers or transferees.

   c. an advertising plan and schedule

   d. a schedule for receiving and reviewing offers

Upon SHPO's agreement with the marketing plan, FDOT will implement this plan.

3) FDOT will review all offers in consultation with the SHPO prior to acceptance. The buildings shall be moved in accordance with approaches recommended in the Department of Interior's "Moving Historic Buildings" and consultation with the SHPO.

4) If there is no acceptable offer which will conform to the requirements of rehabilitation and maintenance, FDOT, with the approval of the SHPO may transfer the building or buildings without preservation restrictions. In this event proper photographic documentation will be provided and recorded. All negatives and prints will be processed archivally. Historic American Building Survey quality drawings of the property will accompany the photographic documentation.

5) Whether a northern or southern R/W taking, the roadway alignment will be centered in the R/W limits as much as possible, with landscaping on both sides of the Avenue. This will lessen visual impact of the new wider facility.

   The proposed 17.5 ft. landscaped median, continuous between Florida and Central Avenues, will be pedestrian friendly, providing safer crossing between signals.

   In order to mitigate noise impacts created by the improved facility, 8 ft. high brick walls will be constructed on both sides of Hillsborough Avenue, thus reducing future noise levels to below the present noise levels, as well as discouraging commercial development along the Historic District.

6) The Department will work together with the Historic Tampa/Hillsborough County Preservation Board to enhance the Seminole Heights segment with architectural features characteristic of 1910 and 1920 Tampa.

   If engineering feasibility determines that lamp posts characteristic of this period can be used, they will be added in this segment of Hillsborough Avenue.

   Other similar features recommended by the Preservation Board will also be considered, thus lessening the social/historic impacts that the widening is creating.

In addition to the above measure, at FHWA's request, the Department has agreed to provide a midblock pedestrian traffic signal to be installed on Hillsborough Avenue between Branch Avenue and Seminole Avenue.

12. REFERENCES

1. Technical Memorandum: Design Traffic, for Hillsborough Avenue Project Development and Environmental Study, DSA Group, Inc., March, 1986.

2. Interim Materials on Highway Capacity. Transportation Research Circular No. 212, Transportation Research Board, 1980.

3. Bureau of Multi-Modal Systems Planning, Florida Dept. of Transportation. Memos dated October 27, 1987 and November 19, 1987 with generalized daily and hourly levels of service, respectively.

4. Summary Report -- Year 2010 Long Range Transportation Plan for Hillsborough County. Tampa Urban Area Metropolitan Planning Organization, Hillsborough County City-County Planning Commission, March, 1986.

5. Florida Transportation Plan. Florida Department of Transportation, Division of Planning and Programming. Draft, February, 1986.

6. Marcuson, Joel K. "The At-Grade Split Diamond Intersection," I.T.E. Journal, February, 1986. Institute of Transportation Engineers.

7. A Policy on Geometric Design of Highways and Streets. 1984. American Association of State Highway and Transportation Officials (AASHTO).

8. Glennon, et al. Technical Guidelines for the Control of Direct Access to Arterial Highways--Vol. II - Detailed Description of Access Control Techniques. Midwest Research Institute for FHWA, 1975.

9. Manual on Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways. Florida Department of Transportation. August, 1986.

10. Phone conversations on January 22, 1988, between Larry Weatherby of DSA and Bill Glover, Director of Sales, CSX Transportation and Emory Tillis of the Engineering Department.

11. Phone conversation between Larry Weatherby of DSA and Ed Cooley, Director of General Aviation, on January 22, 1988.

12. Phone conversation on August 6, 1986, between Larry Weatherby of DSA and Dwight Danley of the Tampa FDOT maintenance office.

13. Phone conversation on July 30, 1986, between Larry Weatherby of DSA and Joel Jackson of the City of Tampa Parks and Recreation Department.

14. Phone conversation between Larry Weatherby of DSA and Tony Hamilton of GTE on July 28, 1986 and Cecil Polk of GTE on August 7, 1986.

15. A Manual on User Benefit Analysis of Highway and Bus Transit Improvements. 1977. AASHTO.

16. Benefit/Cost Analysis Computer Program, Version 3.1, October 1979, Florida Department of Transportation.

17. Phone conversation between Larry Weatherby of DSA and Emory Tillis of CSX Transportation (626-4214) on April 19, 1988. In addition, according to Mr. Tillis, Eddie Pollack (623-3358) of CSX is familiar with the agreement between CSX and the Aviation Authority concerning the spur railroad line.

18. Phone conversation between Larry Weatherby of DSA and Stewart Mast, Assistant Director of Planning and Development for the Hillsborough Aviation Authority (276-3406) on April 22, 1988.

Florida Department of Transportation

BOB GRAHAM
GOVERNOR

Thomas E. Drawdy
~~PAUL N. PAPPAS~~
SECRETARY

Post Office Box 1249
Bartow, Florida 33830

RECEIVED
APR 23 1986
DSA GROUP, INC.

M E M O R A N D U M

DATE: April 21, 1986

TO: J. G. Kennedy, District Director - Tampa Bay Urban Office

FROM: K. D. Gammon, District Multi-Modal Planning Manager (Acting)

COPIES: C. W. Lasseter, Dave Buser, Larry Weatherby

SUBJECT: K Factor
State Project No. 10150-1522
W.P.I. No. 1113334
Hillsborough Avenue from S.R. 589 to S.R. 45

On October 7, 1983, this office submitted a traffic estimate for the above project to Mr. M. E. Whitman. In this estimate a K factor of 10% was given. The 10% K has long been used by this office as a generalized estimate when no specific data was available regarding this value. This was the case in regard to this estimate.

On April 18, 1986, Mr. Larry Weatherby of DSA called our office and indicated that field data he gathered on the subject roadway indicated that the percentage of 24 hour traffic occurring in the peak hour on this facility varied from 7.2 to 8.0% We explained that the K factor used by the FDOT for design purposes is defined as the ratio of the 30th highest hour during the year divided by the Average Annual Daily Traffic and, therefore, is generally somewhat higher than the percentage of 24 hour traffic occurring during the peak hour on any given day. However, the FDOT now has, on its RCI file, estimated K factors for most state facilities. As permanent recorders are still relatively few and far between these estimated K values are extrapolated from permanent recorder data and applied to specific roadway section based on traffic and roadway characteristics. This method of estimating is far from ideal. However, it is somewhat more scientific than applying a generalized default value of 10%. Therefore, we have begun to use the estimated K's on the RCI file subject to their being reviewed for reasonableness. At the request of Mr. Weatherby we research the estimated K's on the RCI file and found that the average value for the section of Hillsborough Avenue in question is 8%. While this K value is unusually low, the hourly counts gathered by DSA do appear to support this figure. Based on this information, our department would not object to the use of an 8% K factor on this project for design purposes.

KDG:GJC:lgp

APPENDIX B

SUPPLEMENTARY INFORMATION FOR THE

HILLSBOROUGH AVENUE BRIDGE

ECONOMIC ANALYSIS

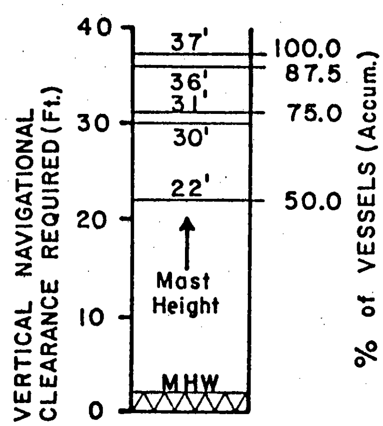
River and Roadway Traffic

River Traffic - Bridge No. 100920 opens on signal from 8:00 a.m. to 6:00 p.m. daily (10 hours per day). From 6:00 p.m. to 8:00 a.m., the draw is opened on signal if at least 2-hour notice is given.

For the period April, 1984, to December, 1985 (inclusive), Bridge No. 100920 opened 263 times for 165 vessels -- a monthly average of 12.5 openings for 7.9 vessels. (Note: The draw is also opened for maintenance. This accounts for more openings than vessels). Approximately 37% of the bridge openings are for routine maintenance.

The number of vessels passing through the open draw (165) is represented by 71± different vessels. Ten of these vessels (14%) were used for work and the remainder were used for recreational purposes as observed by the bridge tender. The bridge tender also observed and recorded, where apparent, vessel names or official vessel numbers. This listing was checked with the Hillsborough County Tax Office and with the U.S. Coast Guard; the names and addresses of 19 vessel owners were determined.

These vessel owners were contacted by mail regarding mast height (or highest point) of their vessel above water line. Eight of the 19 vessel owners responded as follows: 4-vessels with mast height of 20 feet and 1-vessel each with mast heights at 28 feet, 29 feet, 34 feet, and 35 feet, respectively. Seven of the 8-vessels were used for recreational purposes and the eighth was a City of Tampa fire boat (the fire boat has a mast height of 29 feet). The illustration below shows vertical navigational clearances needed, above mean high water (MHW), for the vessel heights of responding owners.



The above illustration shows a fixed high level bridge providing a 37+ foot vertical navigational clearance would allow all vessels to pass under MHW conditions.

Historically, the number of draw openings for the subject bridge has been erratic. There were 120 draw openings in 1982, 190 in 1983, 131 in 1984, and 168 in 1985 for a net increase of 48 (average increase of 16 per year). Adding the annual net increase to 1985 draw openings gives an estimated 568 draw openings in design year 2010, for an average of approximately 1 1/2 openings per day.

An analysis of seasonal and daily draw openings was made. Thirty percent of the draw openings occurred during the summer (June, July, August), 26.3% in the fall (September, October, November), 24.3% in the winter (December, January, February), and 19.4% in the spring (March, April, May). Daily openings analysis showed 52.8% of the openings occurred on weekends (Saturday, Sunday). Based on the above projections, an average of about one opening per weekday can be expected in Year 2010. Based on a limited sample for weekday and weekend openings combined, approximately 6% of all openings occur between 8:00 a.m. - 9:00 a.m., 11% occur between 4:00 p.m. - 5:00 p.m., and 2% occur from 5:00 p.m. - 6:00 p.m.

Hillsborough Avenue Traffic - 1985 average weekday traffic on the Hillsborough Avenue Bridge over the Hillsborough River was 34,760. Saturday and Sunday (weekend) traffic averaged 25± percent less. The average annual daily traffic (AADT) was 32,330±. On signal from vessels, roadway gates are lowered and the drawbridge is raised. The average duration of the bridge opening (from the time roadway gates are lowered until they are raised) is 3.4 minutes as recorded by bridge tenders. Over one half (52.8%) of the traffic that is delayed is weekend traffic.

Considering delay to the appropriate traffic components (weekday and weekend), it was estimated that 104 vehicles were delayed an average of 2.1 minutes for each of 168 draw openings in 1985. This cost (delay time to motorists) was included in a road user benefit cost analysis.[1]

For design year 2010, the number of vehicles delayed was calculated using the projected traffic (55,600 vpd) adjusted for weekend/ week-day travel and the previously projected (568) year 2010 draw openings.

The cost to road users for delay due to draw openings is included in the economic analysis described in Chapter 9.

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

BASCULE BRIDGE COST ESTIMATES
(1988 Dollars)

	Single Structure			Twin Structure		
Item	Quantity	Unit Price	($ mill.) Cost	Quantity	Price	($ mill.) Cost
Overall length = 370' ±	--	--	--	--	--	--
Bascule span	w 118' x l 118' =13,900 sf	$430	5.98	2x52.04' x94' =9780 sf	$430	4.21
Approach Spans	(370'-118') x118' =29,700 sf	$28	0.832	(370'-94') x2x52.04' =28,700 sf	$28	0.804
Roadway Approaches	0.40 mi.	$3.0 mill.	1.2	0.40 mi.	$3.0 mill.	1.2
Embankment	36,000 cy	$5.50	0.20	36,000 cy	$5.50	0.20
Removal of exist. strt.	18,630 sf	$10.00	0.19	18,630 sf	$10.00	0.19
Subtotals			$8.4			$6.6
E + C		+ 20%	$10.1		+ 20%	$7.9

Unit prices based on published FDOT data

Revisions: 1-11-87
7-16-87
11-4-88
1-30-89
3-23-89

BRIDGE CONSTRUCTION

1988 COST ESTIMATE

High-Level Fixed Span Bridge (Six Lane)

(To provide 36.4' vertical navigational clearance)

Out-to-Out width = 129'± (Rev. 3/89)

Est. Cost:

Fill for roadway approaches 120,000 CY at $5.50 =		$ 660,000
Roadwawy approaches 0.40 miles x $3.0 mill./mi. -		1,200,000
Structure: 370' x 129' x $60/SF[1] =		2,900,000
	Sub-Total	$4,800,000
Removal of existing bridge = (18,630 sf @ $10/sf)		186,000
	Sub-Total	$5,000,000
Engineering & contingencies at 20% =		1,000,000
	TOTAL	$6,000,000*

1Unit cost for 1988 construction of a high level bridge is $60/SF, provided by Jerry O'Steen of FDOT on 11-2-88; other unit prices based on published FDOT data.

* Add $1,000,000 for proprietary wall construction instead of an embankment.

Commander
Seventh Coast Guard District

Federal Bldg.
51 S.W. 1st Ave
Miami, FL 33130
Staff Symbol: (oan)
Phone: (305) 350-5[illegible]

16591/2733
Serial: 755

SEP 28 1984

Florida Department of Transportation
Attn: Mr. J.C. Kraft
605 Suwannee St. MS 37
Tallahassee, FL 32304

PROPOSED HILLSBOROUGH AVENUE BRIDGE, ACROSS HILLSBOROUGH RIVER (STATE PROJECT NO. 10150-1523)

Please be advised that a Coast Guard permit will be required for the subject bridge.

For planning purposes, any fixed bridge proposed at this location should provide navigational clearances equal to or greater than those provided by the governing bridge downstream (Buffalo Ave) located at mile 3.7. This bridge provides a vertical clearance of 36.4 feet above mean high water and a horizontal clearance of 50 feet.

These are only suggested clearances and approval of the plans submitted will be dependent upon comments received to our public notice when issued for the project.

Sincerely,

J. V. O'SHEA
Lieutenant Commander, U. S. Coast Guard
Assistant Chief, Aids to Navigation Branch
Seventh Coast Guard District
By direction of the District Commander

Copy: Florida Department of Transportation
Attn: Wendy J. Giesy

ZREYES___ JRKRETSCHMER___ ~~[illegible]~~___ JVO'SHEA___ ACATTALINI_
sj/0073b/8/30/84

TAMPA • RALEIGH • MIAMI • WINSTON-SALEM

DSA GROUP INC.

DSA BUILDING, 2005 PAN AM CIRCLE, TAMPA, FLORIDA 33607 (813) 870-8670

MEMORANDUM

TO: Lisa Hansen

DATE: July 20, 1987

FROM: Jim Brice JHB

SUBJECT: Hillsborough River/Hillsborough Avenue

The state and federally listed West Indian Manatee (Trichechus manatus latirostris) utilizes the lower Hillsborough River as part of its habitat. The presence of manatees in the Hillsborough River has been confirmed by the Florida Department of Natural Resources, Marine Patrol Division. Placing additional fill material in the Hillsborough River at Hillsborough Avenue will require both state and federal Dredge and Fill Permits. At the federal level this proposed action would trigger a Section 7 of the Endangered Species Act review by both the National Marine Fisheries Commission and the U.S. Fish and Wildlife Service. It is reasonable to believe that any reduction in the channel cross section (by fill) will force manatees into the main navigation channel. This "funneling" will increase the likelihood of manatee/boat collisions. Since boat induced injury and death of manatees are among the major causes of concern for this endangered species any proposed action; i.e., channel width reduction would probably receive strong negative review by the concerned agencies.

CC: 84077-F Master File

TAMPA • RALEIGH • MIAMI • WINSTON-SALEM
DSA GROUP INC.
DSA BUILDING, 2005 PAN AM CIRCLE, TAMPA, FLORIDA 33607 (813) 870-8670

MEMORANDUM

TO: Hillsborough Ave. PD&E Study File DATE: October 12, 1987

FROM: Larry Weatherby, P.E., Project Manager

SUBJECT: Presentation to MPO's Technical Advisory Committee (TAC) Concerning Bridge Recommendation at Hillsborough River

On Thursday, October 8th, I gave a presentation to the Tampa Urban Area MPO's TAC concerning DSA's recommendation for a bascule bridge to replace the existing vertical lift bridge. The Department's representative at the meeting was George Adriaansen.

After a brief introduction to the project and a description of the existing bridge and the need to replace it, I talked about the earlier B/C analysis that was done in May, 1986 and the previous recommendation for a high-level fixed bridge. I then described the more recent B/C analysis including changes in the input data. The presentation then followed the five-page summary writeup provided to Mr. Kubicki in our letter dated September 1, 1987. I also discussed the other bascule bridge advantages including aesthetics, noise impacts, fewer relocations, lower accident potential, and less disruption of neighborhood travel patterns.

Following the presentation, there was a question and answer period. Joe Zambito asked if business damages were included under the bascule bridge alternate for the businesses on the south side of Hillsborough, between River Blvd. and Highland Avenue, due to lack of access from the east (due to the median, etc.). I explained that I didn't think that they were (since the Department would not be taking any right-of-way from that side). However, there is the possibility of "inverse condemnation suits", which I will research with FDOT Right-of-Way staff. Other questions concerned the choice of the discount rate used, the need for the TAC to make a recommendation, accident statistics used, proposed bridge grade, etc. There remains some difference of opinion on the recommended bascule alternate among the TAC members. Following the question and answer period, the TAC narrowly voted to support the bascule bridge recommendation; no one from the City of Tampa was present for the vote.

Ron Jones requested that we also give a presentation to the MPO on October 20th concerning our bridge recommendation. I will contact Ron to find out the details.

CC: Alexander S. Byrne, P.E.
Larry J. Gaddy, P.E.
James G. Kennedy, P.E.

TAMPA • RALEIGH • MIAMI • WINSTON-SALEM

DSA GROUP INC.

DSA BUILDING, 2005 PAN AM CIRCLE, TAMPA, FLORIDA 33607 (813) 870 8670

MEMORANDUM

TO: Hillsborough Ave. PD&E Master File DATE: October 15, 1987

FROM: Larry Weatherby, P.E., Project Manager

SUBJECT: Presentation on October 14, 1987 to MPO's Citizens Advisory Committee

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On Wednesday, October 14, 1987, I gave a presentation to the MPO's Citizen Advisory Committee at the HCCCPC concerning our recommendation to replace the existing Hillsborough Avenue bridge at the Hillsborough River with a bascule bridge. The presentation was made in response to Ron Jones' request.

The presentation followed the attached outline. (The committee members had been previously furnished a copy of DSA's letter to Joseph Kubicki dated September 1, 1987, including the attachments which summarize the economic analysis). Following the presentation, the committee members asked a number of questions, such as:

- Would it be possible to coordinate bridge openings with the traffic signals?
- Was an 8-lane bridge considered to meet long-range demands?
- What is the average duration of delay during a bridge opening?
- Would right-of-way costs be less if the approaches to the high-level bridge were constructed on structure?

Some concerns expressed included:

- excess vehicle emissions during bridge openings
- the potential delays to motorists associated with bridge openings, especially during peak traffic hours
- possibility of a movable bridge being stuck in the open position
- possibility of movable bridge being out of service during major rehabilitation
- the uncertainty in predicting the future number of bridge openings

One member stated that he felt that the motoring public would be willing to pay the higher initial cost in order to avoid being caught in a traffic back-up caused by a bridge opening.

The committee members did not seem to feel that aesthetics or noise were significant issues. We also discussed the increased accident potential associated with traffic signals being located at the foot of a high-level bridge. My impression was that they have difficulty understanding how the present value of an annual stream of maintenance and operating costs (for a bascule bridge alternate) can be so small (as a result of applying a discount rate).

At the end of the discussion, the committee unanimously voted to recommend to the MPO that a high-level fixed bridge be constructed instead of a bascule bridge.

LW/lsl

Attachment

CC: James G. Kennedy, P.E.
Larry J. Gaddy, P.E.
Alexander S. Byrne, P.E.

HILLSBOROUGH AVENUE PD&E STUDY
(State Project No. 10150-1522)
BRIDGE ALTERNATIVES ANALYSIS

I. Purpose of Presentation

II. Existing Structure & Need for Replacement

III. Economic Analysis Results

- o Initial & Annual Costs (Table 9a)
- o B/C Ratios (Table 9b) & Incremental B/C Ratio

IV. Other Factors

- o Safety
- o Aesthetics
- o Noise
- o Relocations
- o Travel Patterns (# local streets cut off)

V. Current FDOT Plans

- o Design This Year
- o Right-of-Way Acquisition in FY '89-'90
- o Construction in FY '91-'92

October 14, 1987

DSA GROUP INC

TAMPA - RALEIGH - MIAMI - WINSTON-SALEM

DSA GROUP INC

DSA BUILDING, 2005 PAN AM CIRCLE, TAMPA, FLORIDA 33607 (813) 870-8670

MEMORANDUM

TO: Hillsborough Avenue PD&E Study File DATE: October 22, 1987

FROM: Larry Weatherby, P.E., Project Manager

SUBJECT: Presentation to MPO on October 20, 1987 concerning Bridge Alternatives at the Hillsborough River

---

On Tuesday, October 20, Jim Kennedy and I gave a brief presentation to the MPO concerning our recommendation to replace the existing bridge with a bascule type bridge. I gave the technical portion of the presentation (see attached outline) following an introduction by Jim Kennedy. Following our presentation, a few questions were asked by the committee members, and then they voted unanimously to support the bascule bridge concept. There was very little discussion, and there seemed to be a strong concensus among the members.

LRW/lsl

Attachment

CC: Larry J. Gaddy, P.E.

HILLSBOROUGH AVENUE PD&E STUDY
(State Project No. 10150-1522)
BRIDGE ALTERNATIVES ANALYSIS

I. Purpose of Presentation

II. Existing Structure & Need for Replacement

III. Economic Analysis Results

- o Initial & Annual Costs (Table 9a)
- o B/C Ratios (Table 9b) & Incremental B/C Ratio

IV. Other Factors

- o Safety
- o Aesthetics
- o Noise
- o Relocations
- o Travel Patterns (# local streets cut off)

V. Current FDOT Plans

- o Design This Year
- o Right-of-Way Acquisition in FY '89-'90
- o Construction in FY '91-'92

October 20, 1987

32.8 SUFFICIENCY RATING (STRUC DEF)

STRUCTURE INVENTORY AND APPRAISAL

03/06/85

IDENTIFICATION

(1)	STATE	FLORIDA
(2)	HIGHWAY DISTRICT	01
(3)	COUNTY 057 (4) CITY/TOWN	2075
(5)	INVENTORY ROUTE	121000920
(6)	FEATURE INTERSECTED	HILLSBOROUGH RIVER
(7)	FACILITY CARRIED	SR-600 US-92
(8)	STRUCTURE NUMBER	100920
(9)	LOCATION	1.0 MILES WEST OF SR-45
(10)	VERT CLEARANCE	14 FT 11 IN
(11)	MILEPOINT	11.92
(12)	ROAD SECTION NO	0635
(13)	DEFENSE BRIDGE LETTER	
(14)	DEFENSE MILEPOINT	2.40
(15)	DEFENSE SECTION LENGTH	3.1
(16)	LATITUDE 27D 59.7" (17) LONGITUDE 082D 27.8"	
(18)	PHYSICAL VULNERABILITY	3
(19)	BYPASS DETOUR LENGTH	05 MI
(20)	TOLL	ON FREE ROAD
(21)	CUSTODIAN	S H DEPT
(22)	OWNER	S H DEPT
(23)	FEDERAL-AID PROJECT NUMBER	095-H-1

CLASSIFICATION

(24)	HIGHWAY SYSTEM	FA PRIMARY, URBAN
(25)	ADMINISTRATIVE	STATE
(26)	FUNCTIONAL CLASS	OTHER PRINCIPAL ARTERIAL URBAN

STRUCTURE DATA

(27)	YEAR BUILT	3900
(28)	LANES ON STR 04 UNDER	00
(29)	ADT ON STR	033107
(30)	YEAR OF ADT	1984
(31)	DESIGN LOAD	H-15
(32)	APP RDWY WDTH W/SHLD	52 FT
(33)	BRIDGE MEDIAN	NONE
(34)	SKEW	00
(35)	STRUCTURE FLARED	NO
(36)	TRAFFIC SAFETY FTRS.	1000
(37)	HISTORICAL SIGNIFICANCE	5
(38)	NAV CONTROL	YES
(39)	NAV VERT CLEARANCE	056 FT
(40)	NAV HORIZ CLEARANCE	0074 FT
(41)	OPEN OR CLOSED	OPEN
(42)	TYPE SERVICE	HWY-PED / WATERWAY
(43)	STRUCTURE TYPE MAIN	STEEL / MUBL-LIFT
(44)	STRUCTURE TYPE APP	CONCRETE / STR/MB GR
(45)	NO OF SPANS MAIN	001
(46)	NO OF APPROACH SPANS	0008
(47)	TOTAL HORIZ CLEARANCE	40.0 FT
(48)	MAX SPAN LENGTH	0094 FT
(49)	STRUCTURE LENGTH	000358 FT
(50)	SIDEWALK	LEFT 5.0 FT RIGHT 5.0 FT
(51)	BRIDGE RDWY WIDTH CURB TO CURB	40.0 FT
(52)	DECK WIDTH OUT TO OUT	52.5 FT
(53)	VERT CLEARANCE OVER DECK	14 FT 11 IN
(54)	MIN VERT UNDERCLEARANCE	00 FT 00 IN
(55)	MIN LAT UNDERCLEARANCE RIGHT	99.9 FT
(56)	MIN LAT UNDERCLEARANCE LEFT	0.0 FT
(57)	WEARING SURFACE	CONCRETE

CONDITION

			RATING
(58)	DECK		6
(59)	SUPERSTRUCTURE		4
(60)	SUBSTRUCTURE		8
(61)	CHANNEL & CHANNEL PROTECTION		8
(62)	CULVERT & RETAINING WALLS		N
(63)	ESTIMATED REMAINING LIFE		05 YRS
(64)	OPERATING RATING	130	H 30T
(65)	APPROACH ROADWAY ALIGNMENT		7
(66)	INVENTORY RATING	118	H 18T

PROPOSED IMPROVEMENTS

(73)	YEAR NEEDED	1900
(74)	TYPE OF SERVICE	0
(75)	TYPE OF WORK	000
(76)	IMPROVEMENT LENGTH	000000 FT
(77)	DESIGN LOADING	UNKWN
(78)	ROADWAY WIDTH	0000 FT
(79)	NUMBER OF LANES	00
(80)	ADT 000000 (81) YEAR	1900
(82)	PROPOSED RDWY IMPROVEMENT YEAR	1900
(83)	APPROACH IMPROVEMENT	NOT APP

APPRAISAL

		RATING
(67)	STRUCTURE CONDITION	7
(68)	DECK GEOMETRY	2
(69)	UNDERCLEARANCE VERTICAL & LATERAL	N
(70)	SAFE LOAD CAPACITY	7
(71)	WATERWAY ADEQUACY	8
(72)	APPROACH ROADWAY ALIGNMENT	6

(84)	COST OF IMPROVEMENTS	$0
(85)	P E COST	$0
(86)	DEMOLITION COST	$0
(87)	SUBSTRUCTURE COST	$0
(88)	SUPERSTRUCTURE COST	$0
(89)		
(90)	DATE OF LAST INSPECTION	05/16/85

RECEIVED
JAN 29 1986
DSA GROUP, INC.

2-24-86
WHP

Talked to Ken Hancock: (FDOT)

Reference our meeting in Bartow on 2-27-86. I told him Teresa Estes had arranged mtgs. for us with Terry Dunn (R.O.W.) and Bryan Williams (Public Affairs)

Mentioned we were getting conflicting views re Bascule Bridge cost estimates. Estimates that sounded high to me. Ken said they were using $181 SF for Bascule Spans. He is going to send me some recent bid information.

TELEPHONE CONVERSATION RECORD

PROJECT: HILLSBOROUGH AVE. OVER HILLSBOROUGH RIVER

DSA CM. NO.: DATE: 11/2/88

CONVERSATION WITH: BUDDY PROVOST, P.E.

REPRESENTING: FLORIDA DEPARTMENT OF TRANSPORTATION - TALLAHASSEE

PHONE NO. (904) 487-4225

I HAD SPOKEN TO LYNN BIWER ON THE SUBJECT OF PRICING OF BASCULE SPANS ON OCTOBER 26, 1988. HE INFORMED ME THAT PRESENTLY THE FDOT WAS CONDUCTING A STUDY ON THE FOLLOWING BRIDGES:

1. SUNNY ISLES - TWO BRIDGES LOCATED 300 FT. APART. THESE BRIDGES HAVE A HYDRAULIC DRIVE, BUT ARE MACHINERY OPERATED.

2. SUNRISE - MECHANICAL BASCULE.

3. NEW PASS - SINGLE LEAF; MECHANICAL BASCULE.

4. MIAMI BRIDGE/MIAMI RIVER - TWIN STRUCTURES OPERATED BY HYDRAULIC CYLINDERS.

DURING THIS CONVERSATION MR. PROVOST GAVE ME A PRICING PER SQUARE FOOT OF AREA FOR THREE OUT OF THE ABOVE SITES.

1. SUNNY ISLES - THESE BRIDGES ARE 300 FEET APART, AND WERE LET UNDER SEPARATE CONTRACTS. ONLY ONE BRIDGE HAD A CONTROL HOUSE THAT OPERATED BOTH STRUCTURES.
   THE BRIDGE WITH THE CONTROL HOUSE = $446.00 /SF
   THE BRIDGE WITHOUT THE CONTROL HOUSE = $376/00

2. SUNRISE - $379/SQ.FT. THIS IS THE BRIDGE WITH THE LONGEST BASCULE SPAN. HIS FINDINGS HAVE INDICATED THAT THE COST OF A CONTROL HOUSE WHEN DISTRIBUTED BY A LONGER SPAN REDUCES THE COST OF THE BASCULE. THIS BASCULE SPAN IS 117 FEET.

3. NEW PASS - $489.00/SQ.FT.

Avg. of all 3 = $438/SF

TELEPHONE CONVERSATION RECORD

PROJECT: HILLSBOROUGH AVE. OVER HILLSBOROUGH RIVER

DSA CM. NO.: DATE: 11/2/88

CONVERSATION WITH: JERRY O'STEEN, P.E.

REPRESENTING: FLORIDA DEPARTMENT OF TRANSPORTATION - TALLAHASSEE

PHONE NO. (904) 488-4232

BASED ON JERRY'S EXPERIENCE THE RECENT PRICING FOR A HIGH LEVEL BRIDGE IS ABOUT $60.00/SQ. FOOT OF DECK AREA. A HIGH LEVEL BRIDGE BECOMES MORE EXPENSIVE THAN A MID LEVEL WHEN THE EQUIPMENT TO BUILD THE ADDITIONAL HEIGHT GETS INCORPORATED.

DSA GROUP INC.

TELEPHONE CONVERSATION RECORD

PROJECT: Hillsborough Ave. PD&E

DSA CM. NO: 84077-F7 DATE: 1-4 & 1-12 1989

CONVERSATION WITH: Ian McCartney

REPRESENTING: U.S. Coast Guard, Miami PHONE NO: (305) 536-5621

I called Coast Guard on Jan. 4 to relay FHWA's (Steve Walker's) comments re. use of a mid-level fixed bridge instead of a high level fixed bridge. I was referred to Mr. McCartney. McCartney's boss, Lt. Comm. Jerarld Fleming was out of the office that week. Mr. McCartney said he would have to research their files, talk to his boss, and call me back next week.

He also told me that, if FDOT propose's a mid-level fixed bridge, the Coast Guard would have to send out a public notice (goes to known waterway users, newspapers, waterway guide, etc.). He was not sure if an additional P/H would be required.

I called him back on Jan. 12 to follow-up since he hadn't called me back yet. He said that a P/H requirement would depend on the responses received from the public notice. He also said that their position is that downstream clearances generally control (i.e. Buffalo Ave. bridge) and that we would have to submit a written request if FDOT or FHWA proposes a replacement bridge with clearances less than either the existing bridge or the controlling bridge downstream (Buffalo Ave.)

I relayed this information verbally to Agnes on 1-12-89

BY: Larry Weatherby ROUTE TO

COPIES TO Agnes Spielmann, Kaiser Engineers

HAC/ASB

TELEPHONE CONVERSATION RECORD

DSA GROUP INC.

Hills Ave

PROJECT: Hillsborough Ave. PD&E

DSA CM. NO: 84077-F7 DATE: 1-30-89

CONVERSATION WITH: Larry Davis

REPRESENTING: FDOT, Tall., Bridge Maint. Section PHONE NO: (904) 488-4562

(Larry Davis had previously provided me with expected maintenance costs for bascule bridges.)

I called Mr. Davis to discuss maintenance costs for twin structures vs. a single structure.

He said that there wouldn't be much difference in maintenance costs for the two cases.

He also mentioned that the twin structures have major advantages in terms of MOT when major rehab. is required.

BY: Larry Weatherby

ROUTE TO

COPIES TO Agnes Spielmann, Kaiser Engr.

SCR @ DSA

APPENDIX C

ACCIDENT PATTERNS FOR FATAL ACCIDENTS AND PEDESTRIAN ACCIDENTS

Hillsborough Avenue -- Fatal Accidents

Year	M.P.	1 Type Acc.	2 Type Acc.	Light. Cond.	Site Loc.	# Veh.	# Killed	# Injured
'83	7.353	12	13	4	1	2	1	2
	8.407	26	21	1	2	1	1	1
	9.029	1 (ped)	36	3	2	1	1	0
	11.609	11	36	3	1	2	1	0
'84	7.852	5 (byc)	36	4	1	1	1	0
	11.327	10	15	3	1	2	2	3
'85	8.376	12	36	3	1	2	1	0
	9.029	1 (ped)	36	3	2	2	1	0

9 killed in 8 separate accidents

Accidents by Type of Collision

2 rear-end
1 single vehicle - hit fixed object
2 collision with pedestrian
1 collision with bicyclist

1 head-on collision
1 collision with fixed object above road

By # Vehicles Involved

3 single vehicle
5 two vehicles

By Lighting Condition

1 Daylight
5 Dark -- st. lighted
2 Dark -- not lighted

By Site Location

5 Not at Intersection
3 At Intersection

Accidents by Year

	'83	'84	'85	Sum
Fatal Acc.	4	2	2	8
Total Acc.	837	429	422	1688
% Fatal	0.48%	0.47%	0.47%	0.47%

(reporting criteria changed in '84)

Hillsborough Avenue -- Pedestrian Accidents

Year	M.P.	1 Type Acc.	2 Type Acc.	Light. Cond.	Site Loc.	# Veh.	# Killed	# Injured
'83	7.291	01	35	4	01	2	0	1
	7.685	01	36	4	01	1	0	1
	9.029	01	36	3	02	1	1	0
	10.791	01	36	1	01	1	0	1
	11.303	01	36	3	02	1	0	1
	11.699	01	36	2	01	1	0	1
'84	8.403	01	36	3	02	1	0	0
	9.155	01	36	3	01	1	0	2
	9.310	01	36	3	01	1	0	1
	10.259	01	36	1	01	1	0	1
	10.579	01	36	1	01	1	0	1
'85	9.029	01	36	3	02	2	1	0
	10.288	01	36	1	02	1	0	1
	10.288	01	36	1	02	1	0	1
	11.569	01	36	3	02	1	0	1
	12.002	01	36	1	02	1	0	1
	12.314	01	36	1	02	1	0	1
	12.824	01	36	3	01	1	0	1

18 acc. total

Accidents by Lighting Condition

7 Daylight
1 Dusk/Dawn
8 Dark - st. lighted
2 Dark - not lighted
18

Acc. by Site Location

9 Not at Intersection
9 At Intersection
18

By Severity

2 out of 18 involved fatalities (or 11%)

Accidents by Year

	'83	'84	'85	Sum
Ped. Acc.	6	5	7	18
Total Acc.	837	429	422	1688
% Ped.	0.72%	1.2%	1.6%	1.1%

(acc. reporting criteria changed in 1984)

APPENDIX D

PRELIMINARY STORMWATER DETENTION REQUIREMENTS BY DRAINAGE AREA

Existing Hills Ave. Subbasin area No.[1]	Approx. From & To Points	Lineal Distance (Ft)	Proposed[2] R/W (Ft)	Proposed[2] Type C.S.	R/W Area (lxw) S.F.	R/W Area (lxw) Acres	Prop.[3] Det. Area (Acres)	Comments
1	W. of Eisenhower to Benjamin Rd.	1500'	--	--	--	--	--	Interchange area could be used for detention, if necessary
2	Benjamin Rd. to Hoover	2700'	175	6 LD Mod. rural	472,500	10.8	2.2	
3	Hoover to SS Rail Road	2500'	180	6 LD Mod. rural	450,000	10.3	2.1	
4	SS Rail Road to Anderson Rd.	700'	180	6 LD Mod. rural	126,000	2.9	0.6 } 3.4	Combine area 4 with area 5
5	Anderson Rd. to Lois	3300'	190	6 LD Mod. rural	627,000	14	2.8 } 3.4	
6	Lois to 500' ± east of Lois	500'	190	6 LD Mod. rural	95,000	2.2	0.44	
7	500'± east of Lois to Church St.	1500'	190	6 LD Mod. rural	285,000	6.5	1.3	
8	Church St. to 400'± west of Himes	1600'	--	--	--	--	--	Interchange area could be used for detention if necessary

- continued -

APPENDIX D (Continued)

Rev. 3-9-87

PRELIMINARY STORMWATER DETENTION REQUIREMENTS BY DRAINAGE AREA

Existing Hills Ave. Subbasin area No.[1]	Approx. From & To Points	Lineal Distance (Ft)	Proposed[2] R/W (Ft)	Proposed[2] Type C.S.	R/W Area (1xw) S.F.	R/W Area (1xw) Acres	Prop.[3] Det. Area (Acres)	Comments
9	400'± west of Himes to Matanzas	2200'	varies; avg.=150'	6 LD Urban	330,000	7.6	1.5	
10	Matanzas to 300'± west of Armenia	3200'	110'	6 LD Urban	352,000	8.1	1.6	
11	300± west of Armenia to Berry Ave. (700' E. of Rome)	3800'	122'	6 LD Urban	464,000	11	2.1 } 3.4	
12	Berry Ave. to Hillsborough River	2300'	122'	6 LD Urban	281,000	6.4	1.3 }	
13	Hillsborough River to Branch Ave.	2800'	122'	6 LD Urban	342,000	7.8	1.6	
14	Branch Ave. to Nebraska Ave.	2200'	varies; min. 122'	6 LD Urban	268,000	6.2	1.2	Use part of interchange area for detention
	Totals	30,800 (5.8 mi.)					18.9	

[1]Drainage subbasin boundaries determined from City of Tampa drainage atlas and FDOT drainage maps.

[2]Does not include additional R/W for dual left turn lanes and/or exclusive right-turn lanes, in some cases.

[3]Based on 20% additional acreage for stormwater retention or detention and treatment; for the "modified rural" typical section areas, the ditches and swales will provide some detention and treatment within the existing R/W.

APPENDIX E - COST BENEFIT ANALYSES FOR VARIOUS SEGMENTS OF HILLSBOROUGH AVENUE

Lincoln to Armenia (0.75 mi.)

Median Width and Type Benefit Cost Analysis

Total no. of Accidents in 1983 = 107
Economic loss due to accidents in 1983 = $911,000
Economic loss per accident in 1983 = $8,514

To adjust to 1985 costs, increase 1983 economic loss per accident @ 4% per annum = $9,200

Analysis period = 25 years

Total no. of accidents over analysis period = 25 x 107 = 2,675

Alt. "A" = 6-lane urban typical section using 14' continuous 2-way left turn lane

Alt. "B" = 6-lane urban typical section using 22' raised median.

No. accidents saved using Alt. "A" median type[1] = (2675)(.286) = 765

No. accidents saved using Alt. "B" median type[1] = (2675)(.312) = 835

Accidents saved Alt. "B" - Alt. "A" = 70

Present worth of accident savings in 1985 dollars = (70)($9,200) = $644,000

Public agency capital costs using Alt. A = $6.7 million
Public agency capital costs using Alt. B = $7.7 million
Cost difference Alt. B - Alt. A = $0.9 million

Therefore, Benefits/Costs = $0.644 million/$1.0 million = <u>0.64</u>

The wider raised median is <u>not</u> cost effective for this particular segment.

[1] <u>Synthesis of Safety Research Related to Traffic Control and Roadway Elements</u>, Federal Highway Administration, December 1982, v. 1, pp. 4-14.

APPENDIX E - COST BENEFIT ANALYSES FOR VARIOUS SEGMENTS OF HILLSBOROUGH AVENUE (Continued)

Armenia to Wishart (0.97 mi.)

Median Width and Type Benefit Cost Analysis

Total no. accidents in 1983 = 174
Economic loss due to accidents, in 1983 = $989,000
Economic loss per accident in 1983 = $5,684

To adjust to 1985 costs, increase 1983 economic loss per accident @ 4% per annum = $6,150

Analysis Period = 25 years

Total no. of accidents over analysis period = 174 x 25 = 4,350

Alt. A' = 6-lane urban section with 14' continuous 2-way left turn lane

Alt. B' = 6-lane urban section with 22' raised median

No. accidents saved using Alt. 'A'[1]= (4,350)(.286) = 1244

No. accidents saved using Alt. 'B'[1]= (4,350)(.312) = 1357

Accidents saved Alt. 'B' - Alt. 'A' = 113

Present worth of accident savings in 1985 dollars = 113 x $6,150 = $695,000 (say $0.7 Million)

Public agency capital costs using Alt. 'A' = $6.1 Million
Public agency capital costs using Alt. 'B' = $6.4 Million
Difference in cost, Alt. 'B' - Alt. 'A' = $0.3 Million

Therefore Benefits/Costs = $0.7 Million/$0.3 Million = 2.3

The wider raised median is cost effective.

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[1] Synthesis of Safety Research Related to Traffic Control and Roadway Elements, Federal Highway Administration, December 1982, v. 1, pp. 4-14.

Highland to Central (0.44 mi.)

Median Width and Type Benefit Cost Analysis

Total no. of accidents in 1983 = 114
Economic loss due to accidents in 1983 = $497,000
Economic loss per accident in 1983 = $4,360

To adjust 1983 costs to 1985, increase $4,360 @ 4% per annum = $4700

Analysis period = 25 years

Total no. of accidents over analysis period = 25 x 114 = 2,850

Alt. "A" = 6-lane urban section using 14' continuous 2-way left turn lane

Alt. "B" = 6-lane urban section with 22' raised median.

No. accidents saved using Alt. "A"[1] = (2850)(.286) = 815

No. accidents saved using Alt. "B"[1] = (2850)(.312) = 889

No. accidents saved Alt. "B" - Alt. "A" = 74

Present worth of accident savings in 1985 dollars = (74)($4,700) = $348,000

Public agency capital costs using Alt. A = $5.4 million
Public agency capital costs using Alt. B = $5.5 million
Cost difference, Alt. B - Alt. A = $0.1 million

Therefore, Benefits/Costs = $0.348 million/$0.1 million = <u>3.48</u>

The wider raised median <u>is</u> cost effective.

[1] <u>Synthesis of Safety Research Related to Traffic Control and Roadway Elements</u>, Federal Highway Administration, December 1982, v. 1, pp. 4-14.

APPENDIX E - COST BENEFIT ANALYSES FOR VARIOUS SEGMENTS OF HILLSBOROUGH AVENUE (Continued)

Dale Mabry to Nebraska

Individual Segments Summary:

Segment	Cost (110' R/W, Painted Median) R/W	Constr.	Total ($ millions)
ALT. 'A'			
Lincoln - Armenia	4.2	2.0	6.2
Armenia - Wishart	2.5	3.6	6.1
Highland - Central	3.6	1.8	5.4
	$10.3	$7.4	$17.7

Segment	Cost (122' R/W, Raised Median) R/W	Constr.	Total ($ millions)
ALT. 'B'			
Lincoln - Armenia	3.4	3.0	6.4
Armenia - Wishart	3.4	3.0	6.4
Highland - Central	4.1	1.4	5.5
	$10.9	$7.4	$18.3

Total No. Accidents (1983):

	No. Accidents	
S.R. 580 - East of Himes	73	$ 396,000
E. of Himes - Tampania	104	515,000
Tampania - Howard	64	244,000
Howard - Rivershore	110	745,000
Rivershore - River Blvd.	16	122,000
River Blvd. - Tampa St.	34	97,000
Tampa St. - E. of Central	80	400,000
TOTAL	481	$2,519,000

Economic Loss ÷ No. Accidents =
$2,519,000/481 = $5,237

To adjust to 1985 cost, increase @ 4%/year
$5,237 x 1.0816 = $5,644

Total No. Accidents over analysis period =
481 x 25 = 12,025

APPENDIX E - COST BENEFIT ANALYSES FOR VARIOUS SEGMENTS OF HILLSBOROUGH AVENUE (Continued)

Dale Mabry to Nebraska

Using Alt. "A" - Total Accidents Saved	=		
12,025 x .286		=	3,439
Using Alt. "B" - Total Accidents Saved	=		
12,025 x .312		=	3,752
Total Acc. Saved = 3,752 - 3,125		=	313
Present worth of Accidents Saved	=		
$5,644 x 313		=	$1,766,572

Costs Using Alt. "A" = $17.7 Million
Costs Using Alt. "B" = $18.3 Million

Present worth of Difference in Public Agency Costs for Alt. "B" - "A" = $600,000

Therefore, B/C = $1,766,572/$600,000 = 2.94

APPENDIX F - COSTS AND IMPACTS OF POTENTIAL FAR-SIDE BUS BAYS (TURNOUTS)

Hillsborough at:	Corner	Displaced Homes/Businesses	Right-of-Way Costs: Land	4	5	6	Total	Constr. Cost	Total Cost
Anderson/West Shore	NW	0	$ 0	--			$ 0	$1,200	$1,200
	SE	0	0	--			0	1,200	1,200
Lois	NW	0	0	--			0	1,200	1,200
	SE	0	0	--			0	1,200	1,200
Himes	NW	0	0	--			0	1,200	1,200
	SE	0	0	--			0	1,200	1,200
Habana	NW	0	4,200	6,000	19,000	3,000	32,200	1,200	33,400
	SE	0	4,200	8,000	--	--	12,200	1,200	13,400
Armenia	NW	0	4,200	3,000	19,000	3,000	25,000	1,200	26,200
	SE	0	4,200	4,000	--	--	8,200	1,200	9,400
Rome	NW	0	4,200	4,000	19,000	3,000	30,200	1,200	31,400
	SE	0	4,200	7,000	--	--	11,200	1,200	12,400
Wishart	NW	0	4,200	3,000	--	--	7,200	1,200	8,400
	SE	0	4,200	--	--	--	4,200	1,200	5,400
Highland	NW	0	4,200	3,000	--	--	7,200	1,200	8,400
	SE	0	4,200	3,000	19,000	2,000	28,200	1,200	29,400
Florida	NW	0	4,200	--	--	--	4,200	1,200	5,400
	SE	0	4,200	(take from n. side to avoid GTE)			4,200	1,200	5,400
Central	NW	0	4,200	2,000	--	--	6,200	1,200	7,400
	SE	0	4,200	3,000	19,000	2,000	28,200	1,200	29,400
Nebraska	NW	0	4,200	--	--	--	4,200	1,200	5,400
	SE	1 (bus.)	4,200	40,000	19,000	22,100	85,300	1,200	86,500
							$298,100	$26,400	$324,500
									÷21 = $15,500/turnout

Notes:

1. Construction cost based on $17/sq. yd. for additional pavement and base x 72 sq. yds. = approx. $1200.
2. Bus turnouts for the north-south streets intersecting Hillsborough Avenue not included.
3. Additional R/W required for each turnout is approximately 700 sq. ft. Cost of land at $6/sq. ft. = $4200.
4. Business damages for loss of parking, gas pumps, etc.
5. R/W support ($15,000/parcel) and property owner appraisal fees ($4,000/parcel).
6. Administrative and legal settlement fees = 50% of land & improvement costs for parcel takings; not applicable where parcel is being taken anyway as part of the general 6 laning.

APPENDIX G

LOCATION HYDRAULIC REPORT

Introduction

The proposed action consists of widening Hillsborough Avenue between the vicinities of Eisenhower Boulevard and Nebraska Avenue, in Hillsborough County, from a 4-lane divided and undivided roadway to a six-lane divided facility. At the Hillsborough River, the existing bridge is proposed to be replaced with a new six-lane bascule (movable type) bridge.

Limits of the existing rural and urban typical sections are described earlier in the engineering report along with existing and proposed typical sections.

Informational sources for this report include National Flood Insurance Program flood insurance rate maps (FIRM) for the applicable sections of Hillsborough County and the City of Tampa; Flood Insurance Study by FEMA for City of Tampa; FDOT drainage maps for Hillsborough Avenue; and various City of Tampa drainage atlas sheets.

Assessment of Major Drainage Structures

In compliance with the requirements of FHPM 6-7-3-2, par. 7, a field review was made of the project corridor to evaluate the probable hydraulic impact of this project. Each of the major cross drains is discussed below, beginning at the west end. The drainage structures addressed have been in place 20-30 years at this time, and, unless otherwise noted in comments, appear to be sound based on field reviews. Neither is there evidence of hydraulic inadequacy of the structures within project limits. It is anticipated that they will be extended, to accommodate roadway widening, or replaced in kind. However, it is recommended that each pipe and CBC be examined closely during the design process in order to properly evaluate its structural adequacy. Extensions or replacement in kind will result in no measurable increase in headwater elevation as indicated in the sample calculation shown on sheet G-4.

<u>MP 7.157 30" x 68' CP to 3' x 2' x 54' CBC</u> (between Eisenhower and Benjamin Road)

This structure is located within the interchange area. Flow runs in a northerly direction from the south roadside ditch through the interchange and to the Henry Street drainage canal, located approximately 1300' north of and parallel to Hillsborough Avenue. The canal flows to a wetland and ultimately discharges into Sweetwater Creek, which is under the tidal influence of Tampa Bay.

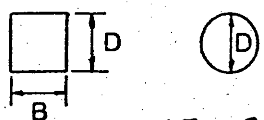
<u>MP 7.533 30" x 67' CP to 4' x 5' x 45' CBC</u> (west of Hoover Blvd.)

This cross drain conveys runoff from the southern roadside ditch to the north and into a concrete lined outfall ditch running perpendicular to Hillsborough Avenue. This outfall ditch discharges into the previously mentioned Henry Street Canal. Debris and sediment

PROJECT: *HILLSBOROUGH AVE.* DESIGNER: *DSA*

DATE: ________

HYDROLOGIC AND CHANNEL INFORMATION



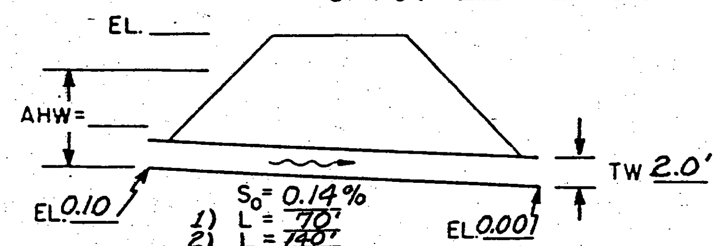
D = Diameter or Height
B = Span

Q_1 = *15 cfs* TW_1 = *2.0'*
Q_2 = ______ TW_2 = ______

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: ________



MEAN STREAM VELOCITY = ______
MAX. STREAM VELOCITY = ______

1) LS_o *0.10'*
2) LS_o *0.20'*

	CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE		HEADWATER COMPUTATION												CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
					INLET CONTROL			OUTLET CONTROL HW=H+DTW−LS_o												
			D	B	Q/B	HW/D	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	DTW	LS_o	HW					
1)	*GROOVE END WITH HEADWALL*	*15*	*24"*		-	*1.07*	*2.14*	*0.2*	*0.8*	*1.4*	*1.7*	*2.0*	*2.0*	*0.10*	*2.7*	*2.7*				*EXIST. LENGTH 70'*
2)	*GROOVE END WITH HEADWALL*	*15*	*24"*			*1.07*	*2.14*	*0.2*	*1.0*	*1.4*	*1.7*	*2.0*	*2.0*	*0.20*	*2.8*	*2.8*	*NOT CALCULATED*			*PROPOSED LENGTH 140'*

SUMMARY & RECOMMENDATIONS:

INCREASE IN HW ELEVATION OF 0.1' WHEN CROSSDRAIN LENGTH IS DOUBLED.

Design by ________ Checked by ________ Approved by ________

Worksheet for Culvert Capacity Calculations located in the ditch downstream of this crossdrain would tend to indicate lack of maintenance and/or standing water during some periods.

<u>MP 7.934 30" x 67' CP</u> (east of Hoover Blvd.)

This structure connects the roadside ditch along the south side of Hillsborough Avenue (partially choked with vegetation) to an outfall ditch running to the north which discharges into the Henry Street Canal. The outfall ditch is heavily overgrown with various types of wetland vegetation. Some spalling of the endwalls and pipe was observed at the inlet (south) end; replacement in kind would be analyzed during design.

<u>MP 8.786 DBL 6' x 3' x 69' CBC</u> (east of Hesperides)

This structure is part of a north-south ditch system which crosses Hillsborough Avenue and proceeds further north to the Henry Street Canal. The south side is heavily overgrown with various types of wetland vegetation. The north side also has heavy vegetation in the ditch. The structure appears to be in good condition.

MP 9.040 10' x 4' x 144' CBC (directly east of Lois)

The drainage systems in this area consist mostly of field drains connected to underground pipes and culverts. The 10' x 4' box crosses Hillsborough where it conveys flow in a northerly direction to a large ditch along the east side of Lois. The northern end of the box connects directly to a corrugated metal pipe culvert (<15 ft^2) in the ditch on the east side. This CMP functions as a downstream control on conveyance of the CBC. The box appears to be in good condition except for some spalling of the endwall at the upstream end.

MP 9.63 Double 12' x 6' x 187' CBC (at east end of ramps at Dale Mabry interchange)

This box culvert is part of a large drainage ditch system which runs along the east side of the Dale Mabry-Hillsborough Avenue interchange area. Flow is conveyed in a northerly direction to the Henry Street Canal, running parallel to and north of Hillsborough Avenue. The structure is generally in good condition although there is some minor spalling and chipping of the concrete. Vegetation in the ditch is heavy, particularly on the north side of the culvert.

MP 9.788 24" x 59' CP & 30" x 79' CP into 42" x 23' CP

The 24" & 30" CP convey ditch flow from Hillsborough Avenue northward into a manhole under the roadway. A 42" CP connects this MH to a storm sewer system running to the north, along the west side of Himes, discharging into the Henry Street Canal. Determination of pipe condition is difficult with an enclosed drainage system.

MP 11.919-987 Vertical Lift Bridge over the Hillsborough River

The structure crossing the Hillsborough River consists of a manned vertical-lift bridge, constructed in 1939. The main span length is 94 feet with eight concrete approach spans at 33 feet each, for a total bridge length of 358 feet. The out-to-out width is 52.5 feet. The Hillsborough River at this location is tidal with discharge into Hillsborough Bay.

Potential Floodplain Encroachment

FEMA Flood Insurance Rate Maps (FIRM) for Hillsborough County, FIRM and the accompanying Flood Insurance Study (FIS) for City of Tampa (Appendix H) were used to determine potential floodplain and floodway involvement associated with the proposed six laning of Hillsborough Avenue. Hillsborough Avenue within project limits traverses the base floodplain at one location - a 570'(±) transverse encroachment at the Hillsborough River Bridge (Figure G-1). Additionally, the FIS has designated the natural channel as a floodway in this area of the Hillsborough River (Page 13, Appendix H).

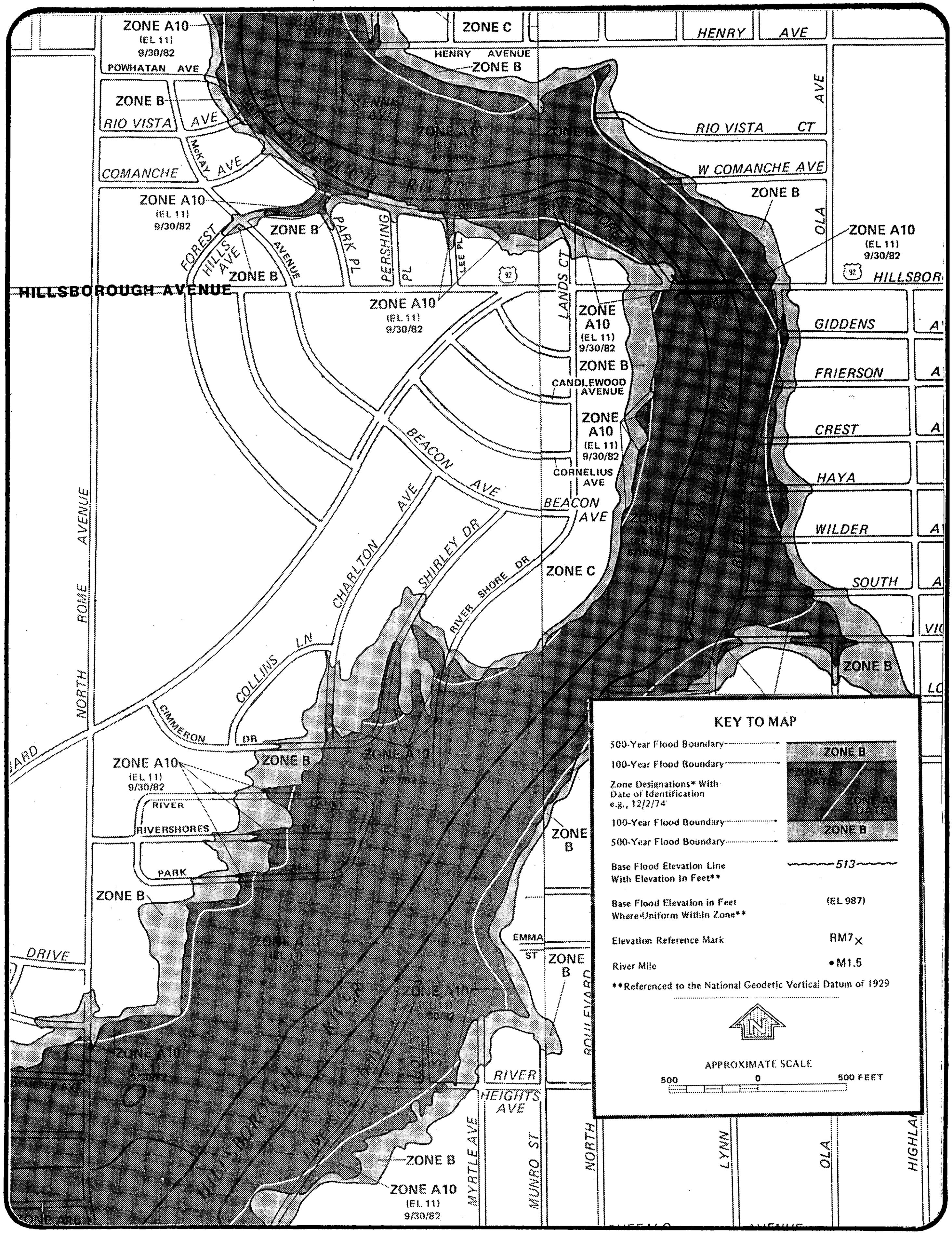


FIGURE G-1 - 100 YEAR AND 500 YEAR FLOOD ZONES

HILLSBOROUGH AVENUE

A Flood Insurance Study has been prepared for the City of Temple Terrace (Reference 25). The Temple Terrace study does not include the effects of the flood-control project on the Hillsborough River and, therefore, does not agree with this study.

The U.S. Geological Survey has published a report of the Lower Hillsborough River (Reference 16). The U.S. Geological Survey report does not include the effects of the flood-control project. This Flood Insurance Study supersedes the U.S. Geological Survey Report because of the inclusion of the flood-control project.

The Federal Insurance Administration has prepared a study including 100-year surge elevations for Tampa Bay, Hillsborough Bay, and Old Tampa Bay (Reference 26). Surge elevations in the Federal Insurance Administration study are from 3.0 to 5.5 feet higher than those presented in this study. The difference in elevations can be attributed to the hydrodynamic model and statistical analysis used in the two studies.

The Federal Insurance Administration is preparing a Flood Insurance Study for Hillsborough County (Reference 27). The county study is in complete agreement with this study.

This study is authoritative for the purposes of the National Flood Insurance Program; data presented herein either supersede or are compatable with all previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Federal Insurance Administration, Regional Director, 1371 Peachtree Street, NE., Atlanta, Georgia 30309.

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APPENDIX I

CONCEPTUAL DESIGN DRAWINGS

(Reduced Size)

and

CONCEPTUAL WALL AND LANDSCAPE

DESIGN FOR SEMINOLE

HEIGHTS AREA

Construction of the Tampa Bypass Canal and Lower Hillsborough Flood Detention Area, upstream of Hillsborough Avenue allows for diversion of and detention of all floods up to and including the 500 year event (Page 7, Appendix H). As a result, downstream of the Tampa Waterworks Dam the water surface elevation in the river is influenced by tidal cycles from Hillsborough Bay (Page 9, Appendix H), as evidenced by a base flood elevation equal to that of the Bay (El. 11.0).

The existing roadway profile at the Hillsborough River (utilizing a vertical lift bridge) and the proposed profile (utilizing a bascule bridge) are included in Figure G-2. As indicated in this figure, the existing roadway is slightly above the 11' elevation associated with the base floodplain (Zone A10). Widening of the transverse base floodplain encroachment is anticipated due to construction of a wider replacement bridge. However, since flood elevations at this site are under tidal influence, widening of the bridge to accommodate additional lanes will have no impact on base flood elevations. Theoretically, tidal control of water surface elevation on the Hillsborough River in this area would tend to encourage consideration of shortening the proposed bridge length for economic reasons, which would entail placement of additional fill within the main channel. Channel reduction is not felt to be a feasible design consideration due to the presence of Manatees along this portion of the Hillsborough River. Increasing the likelihood of injury to this endangered species by forcing them into the main navigational channel would pose serious permitting difficulties on both a state and federal level (see memorandum, Appendix B).*

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*No economic or risk analysis was performed at this site; proposed bridge length has no effect on base flood plain elevation and cannot be reduced due to constraints inherent in the Endangered Species Act.

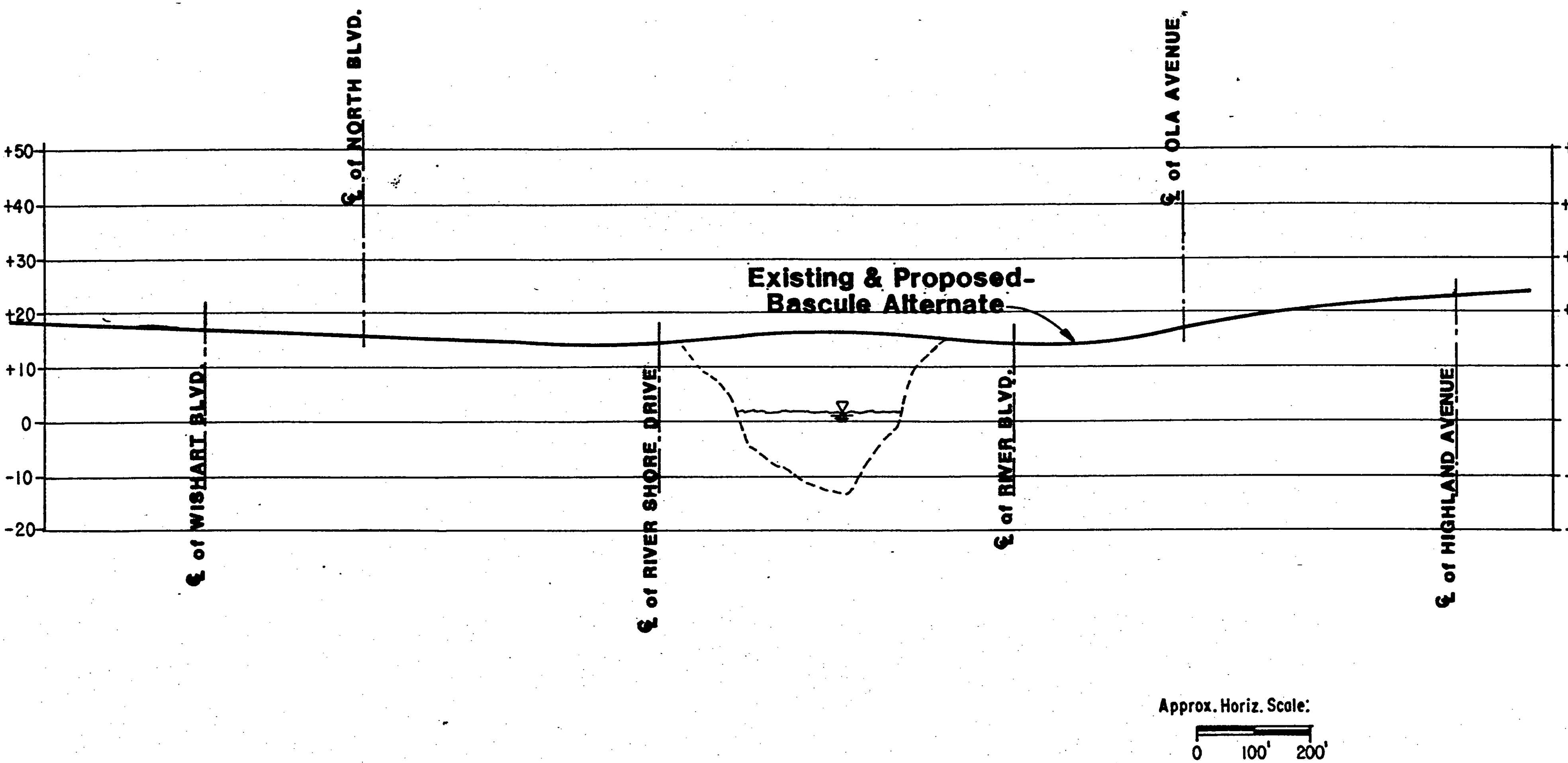


FIGURE G-2 EXISTING AND PROPOSED ROADWAY PROFILES AT HILLSBOROUGH RIVER

HILLSBOROUGH AVENUE

Alternative alignments to reduce potential floodplain encroachment would entail realignment of Hillsborough Avenue in the vicinity of the bridge, significantly increasing right-of-way costs and impacts to adjacent property owners. From a cost/benefit standpoint, alternative bridge alignments are not feasible.

The grade of the proposed bascule bridge would exceed both the 100-year (Zone A) and the 500-year (Zone B) flood elevations; thus, overtopping of the proposed facility is not an area of concern.

Probable Impacts on Flood Zones

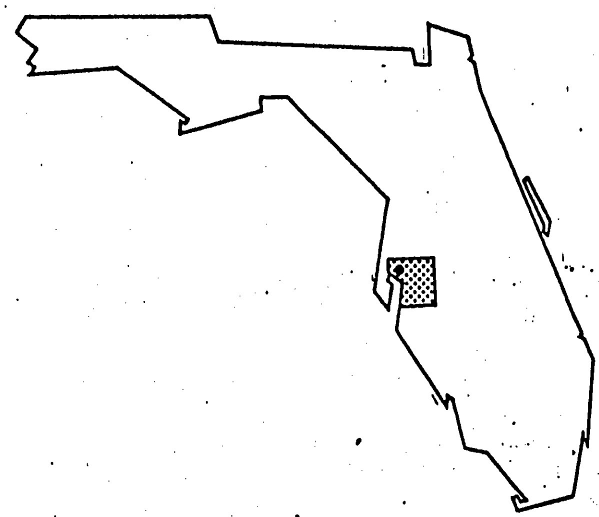
The proposed improvements include replacement of the existing underground storm sewer system for much of the project area; the exception is the segment between Eisenhower and Dale Mabry, which would retain a ditch/swale system for collection and treatment of stormwater runoff. A detailed evaluation and re-design of the existing drainage system will occur during the design phase of this project. The to-be-designed system will include detention ponds for flow attenuation and treatment of stormwater runoff.

The proposed replacement bridge structure would be designed in such a way as to minimize any adverse impacts to the floodplain, including effects on property owners both upstream and downstream of the proposed bridge.

The proposed project would not increase the base flood elevation (or increase the flood zone area), nor would the project contribute to development in the flood zone, since the corridor is already an urbanized area. There will be no increased risk of flooding associated with this project.

FLOOD INSURANCE STUDY

CITY OF TAMPA, FLORIDA
HILLSBOROUGH COUNTY



MARCH 1980

FEDERAL EMERGENCY MANAGEMENT AGENCY
FEDERAL INSURANCE ADMINISTRATION

COMMUNITY NUMBER - 120114

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FLOOD INSURANCE STUDY

1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this Flood Insurance Study is to investigate the existence and severity of flood hazards in the City of Tampa, Hillsborough County, Florida, and to aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of this information will be to convert Tampa to the regular program of flood insurance by the Federal Insurance Administration. Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain development.

1.2 Coordination

Information describing hydrological conditions, drainage patterns, and other flood-related data, as well as information on the topography, roads, bench marks, and demography of Tampa was sought from the following agencies:

City of Tampa
County of Hillsborough
Florida State Department of Community Affairs
Florida State Department of Transportation
Heidt and Associates, Tampa
National Oceanic and Atmospheric Administration
U.S. Soil Conservation Service
Southwest Florida Water Management District
Tampa Bay Regional Planning Council
U.S. Army Corps of Engineers, Jacksonville District
U.S. Geological Survey

A final community coordination meeting was held in Tampa on August 21, 1979. The meeting was attended by representatives of the Federal Insurance Administration, the study contractor, and the City of Tampa. All changes resulting from that meeting have been included in this study.

1.3 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

The hydrologic and hydraulic analyses for this study were performed by Tetra Tech, Inc., for the Federal Insurance Administration, under Contract No. H-4510. This work, which was completed in June 1979, covered all significant flooding sources affecting the City of Tampa.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Tampa, Hillsborough County, Florida. The area of study is shown on the Vicinity Map (Figure 1).

Flooding caused by tidal surges originating in the Gulf of Mexico and by overflow from Hillsborough River was studied in detail.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by the Federal Insurance Administration and the City of Tampa.

Those areas studied by detailed methods were chosen with consideration given to all proposed construction and forecasted development through 1984.

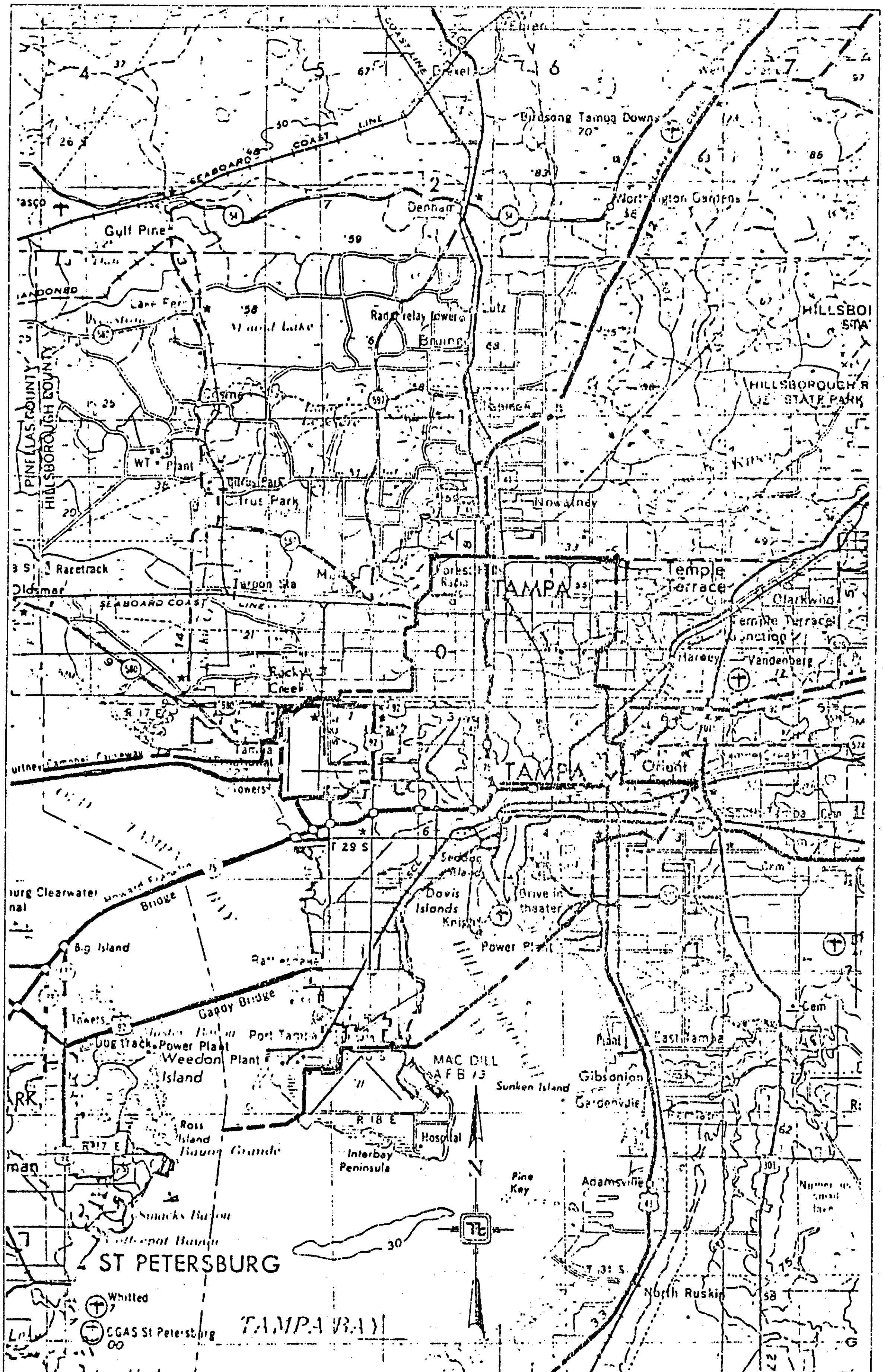
2.2 Community Description

Tampa, one of the three largest cities in Florida, and the county seat of Hillsborough County, occupies an area of approximately 84 square miles and is in northwest Hillsborough County, in west-central Florida. The city is located approximately 225 miles northwest of Miami, approximately 200 miles southwest of Jacksonville, and approximately 230 miles southeast of Tallahassee. The study area is bounded on the north and east by unincorporated areas of Hillsborough County, on the northeast by the City of Temple Terrace, on the south and southeast by Hillsborough Bay, on the west by Old Tampa Bay, and on the northwest by unincorporated areas of Hillsborough County.

The U.S. Bureau of the Census recorded the 1970 population of Tampa at 277,714, a 1-percent increase over the 1960 census of 274,970. The 1975 permanent population was estimated to be more than 280,000, which represents an increase of less than 1 percent over the 1970 figures (Reference 1).

Tampa, a major seaport, was incorporated as a city in 1855 and is now primarily urban and almost totally developed. Its main export commodity is phosphate, which is mined in Hillsborough and nearby counties. The city is an important industrial center whose chief manufactured products include processed foods, chemicals, cigars, and machinery. Fishing and tourism also make important contributions to the economy of the city. Tampa is a prominent recreational area, with facilities for boating, fishing, and swimming.

The study area is in the subtropical climatic zone which is characterized by mild, dry winters and warm, wet summers. The wet season extends



APPROXIMATE SCALE

5 0 5 10 15 MILES

VICINITY MAP

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration

CITY OF TAMPA, FL
(HILLSBOROUGH CO.)

FIGURE 1

from June through September and coincides with the hurricane season. During this period, the study area receives nearly two-thirds of its annual precipitation. The average annual precipitation in Tampa is 49.38 inches and the average annual temperature is 72.2°F (Reference 2).

Physiographically, Tampa is in the Coastal Lowlands and is characterized by rolling terrain except for the flat flood plains along the Hillsborough River and low-lying areas along the bay. Much of the city is built on islands and peninsulas, and its coastal areas are highly developed. Elevations in most of the Tampa area range from sea level to approximately 40 feet; the eastern part of the city reaches an elevation of approximately 60 feet.

The major stream within the study area is the Hillsborough River, which flows north of and through the city and drains approximately 690 square miles from its source in Green Swamp to its outlet in Hillsborough Bay at Tampa. A control structure (S-155) for the Lower Hillsborough River Flood Detention Area is located on the Hillsborough River at River Mile 25.2. Downstream of S-155, the local drainage area is 211 square miles, including a 164-square-mile major tributary area of Cypress Creek. A control structure for flood diversion (S-161) is located at River Mile 16.3 near Harney. Tampa Water Works Dam, constructed in 1945, is located at River Mile 10. The reservoir stage is controlled during both low and flood periods, in accordance with existing and anticipated hydrologic conditions.

2.3 Principal Flood Problems

Flooding in the Tampa area results primarily from severe storms and tropical hurricanes which produce tidal surges along the bay and overflow of Hillsborough River. Not all storms which pass close to the study area produce extremely high tides. Storms which produce extreme flooding conditions in one area may not necessarily produce the same conditions in other parts of the study area.

The Hillsborough River is a broad estuary; under certain conditions tides generated at its mouth can intrude far upstream. Rainfall, which usually accompanies hurricanes, can aggravate the tidal flood situation, particularly in areas where the secondary drainage system is poorly developed.

Storms passing in the vicinity of Tampa have periodically produced damaging floods in the area. A brief description of several significant tropical storms provides historic information to which coastal and riverine flood hazards and the projected flood depths can be compared.

The September 25, 1848, hurricane entered the west coast of Florida in the vicinity of Tampa Bay. The tide at Fort Brooke, the military post at Tampa, was estimated at 14 feet. High winds and tides destroyed all the wharves and most public buildings at the post. A second hurricane in October affected the same area, causing tides estimated at 9 feet.

The hurricane of September, 1919, originated in the Virgin Islands east of Puerto Rico and passed near Key West and over Dry Tortugas. Tides at Tampa were noted as being the highest in more than 50 years. Water flooded the Bayshore Boulevard area for a distance of one-half block from the bayfront. The tide was also reported to have flooded the Palmetto Beach section of east Tampa. Extensive damage was reported at Ballast Point.

The hurricane of October, 1921, was considered one of the most severe to strike the Gulf coast. It originated in the western Caribbean Sea and entered Florida north of Tarpon Springs. Flooding conditions were prolonged because of the slow forward movement of the storm. In Tampa, peak winds of 75 miles per hour were recorded. A tide height of 9.6 feet was observed on the tide gage at Eagle Street Terminal in Hillsborough Bay. The tide was above the gage and was calculated by the U.S. Army Corps of Engineers. Most of downtown Tampa was flooded, and damage in the area was estimated at $1 million.

Intense rainfall associated with the tropical hurricane of September 4, 1933, which passed across central Florida northwesterly from the Atlantic Ocean, caused extensive damage in Hillsborough County, particularly to citrus crops and transportation facilities. Urban damage was severe in the Tampa suburb of Sulphur Springs following failure of the Tampa Electric Company Dam on the Hillsborough River. Sudden release of the stored waters washed out bridges and overflowed banks in the lower river reaches, and the river was out of its banks for approximately 5 weeks. Much of the area experienced maximum stages and discharges of record, with estimated frequencies of occurrence greater than once in 50 years. At the 40th Street bridge in Tampa, a discharge of 16,500 cubic feet per second (cfs) was measured near the flood crest (26.3 feet) in Hillsborough River.

Hurricane Easy occurred from September 3 through September 7, 1950. This small but severe hurricane, which struck the west coast of Florida, was accompanied by intense rainfall which caused streams and lakes in the vicinity of Tampa to overflow their banks, inundating and causing washouts in highways and damage to buildings and pasturelands. Brooksville recorded 15.4 inches of rain in 2 days, and 12.7 inches were reported at Clearwater. Tampa also experienced the highest tides reported in the area since the 1921 hurricane. Water was over Bayshore Boulevard, inundating stalled automobiles, and was reported as being waist-deep in some of the residences in the Palmetto Beach subdivision. The Courtney Campbell Causeway between Tampa and Clearwater was damaged by wave action.

From March 15 through March 18, 1960, thunderstorms and heavy rainfall averaging more than 10 inches over a 10,000-square-mile area occurred in central Florida. The most intense rains occurred in the area between Tampa and Brooksville, where unofficial reports indicate over 27 inches of rainfall. There was severe damage to agricultural and urban lands in the Hillsborough River basin and the upper Tampa Bay watershed.

Hurricane Donna flooded the west coast of Florida on September 10 and 11, 1960. Although precipitation averaged 5-7 inches, antecedent rainfall of approximately 10 inches in the previous 3 weeks had saturated the ground, and consequently, flooding resulted. Although the main effects of the rain and storm tides hit south of Tampa, the city received 13.96 inches of rain in 2 days and suffered flooding of homes and streets. Damage to the Hillsborough River basin was estimated at $1 million.

Hurricane Agnes, occurring from June 17 through June 19, 1972, originated on the northeastern tip of the Yucatan Peninsula and traveled westward. The storm was of large diameter, and, although the center of this storm passed approximately 150 miles west of the Florida peninsula, it produced a high, damaging tidal surge and flooding conditions of extreme magnitude in Tampa Bay. The passage of the storm in the Tampa Bay region was not accompanied by large amounts of rainfall. Tides at Tampa were estimated at 5.6 feet, and there was damage to trees and buildings from a tornado that accompanied the hurricane.

2.4 Flood Protection Measures

The U.S. Army Corps of Engineers has initiated construction on several phases of a flood-control project in the Hillsborough River basin (Reference 3). This project includes the Tampa By Pass Canal and the Lower Hillsborough Flood Detention Area. The project is estimated to be completed in fiscal year 1979. This study reflects the flood situation after completion of the flood-control project. Flooding in Tampa from the overflow of the Hillsborough River is significantly reduced beyond the 500-year event by proper operation of the flood-control project.

3.0 ENGINEERING METHODS

For flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual occurrence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported here reflect flooding potential based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail in the community.

The determination of coastal inundation from storm surge caused by passage of a hurricane was approached by the joint probability method (Reference 4). The storm populations were described by probability distributions of five parameters which influence surge heights. These were central pressure depression (which measures the intensity of the storm), radius to maximum winds, forward speed of the storm, shoreline crossing point, and crossing angle. These characteristics were described statistically based upon an analysis of observed storms in the vicinity of Hillsborough County. Primary sources of data for this analysis were the National Climatic Center (Reference 5), Cry (Reference 6), Ho, Schwerdt, and Goodyear (Reference 7), the National Hurricane Research Project (Reference 8), and the Monthly Weather Review (Reference 9). Digitized storm information for all storms from 1886 through 1977 was used to correlate statistics (Reference 10). A summary of the parameters used for the Hillsborough County area is presented in Table 1.

For stream flooding along Hillsborough River, the study was conducted on the basis that the Lower Hillsborough Flood Detention Area and the Tampa By Pass Canal would be able to detain and divert the floods up to and including the 500-year flood. Consequently, the magnitude and frequency of floods up to the 500-year return period downstream from the detention area may be determined based on the local runoffs only. The study began with the consideration of natural conditions with the flood-control gates on Hillsborough River closed at the detention area (S-155) and at Harney (S-161). Then, the effects of the gate operations during the floods were incorporated (Reference 3). To investigate the natural flood discharges, an incremental procedure based on the regression estimates developed by the U.S. Geological Survey was used (Reference 11). Adjustment due to the urbanization near the Tampa area was performed using the procedure outlined by Leopold (Reference 12) in conjunction with the rainfall data from the National Weather Service (Reference 13). The flood diversion gate along Hillsborough River at Harney (S-161) was assumed to be open whenever flow through the Tampa Waterworks Dam exceeds 6200 cfs, the estimated nondamaging bankfull capacity downstream of the dam.

Central Pressure Depression (mb)		85	75	65	55	45	35	25	15	5
Probabilities	Entering Exiting Parallel	0.02 0.04 0.06	0.02 0.04 0.06	0.03 0.05 0.08	0.04 0.07 0.11	0.15 0.09 0.13	0.09 0.11 0.13	0.25 0.2 0.14	0.25 0.2 0.15	0.25 0.2 0.14
Storm Radius (nm)				15			30			
Probability				0.55			0.45			
Forward Speed (knots)				8	14					
Probabilities	Entering Exiting Parallel			0.26 0.55 0.62	0.46 0.41 0.34	0.28 0.04 0.04				
		Exiting							Entering	
Angles (degrees)		-90		045		0	45		90	
Probability (Angular Rates		0.05 0.000204		0.17 0.00098		0.22 0.000898	0.26 0.015		0.30 0.00122)	
Frequency	4.08×10^{-3} storms/nm – year									

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CITY OF TAMPA, FL
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PARAMETER VALUES FOR SURGE EVALUATION

TABLE 1

Peak discharge-drainage area relationships for the Hillsborough River are shown in Table 2.

During the dry season, the pool elevation above Tampa Water Works Dam is kept at the maximum possible stage of 22.5 feet. This elevation is in excess of the 500-year flood elevation when the flood-control project is in operation for the entire reach within Tampa. Because this stage is produced every winter, it has been taken to be the elevation corresponding to all frequency events considered in this study above Tampa Water Works Dam.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of streams in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each stream studied in the community.

Water-surface elevations due to runoff were calculated for the Hillsborough River using the U.S. Army Corps of Engineers HEC-2 step-backwater model (Reference 14).

Cross section data used in the step-backwater computation were field surveyed.

Roughness coefficients (Manning's "n") used in this study were determined from aerial photographs (Reference 15) and calibrated using high-water marks. Roughness coefficients ranged from 0.014 to 0.025 in the channel and from 0.080 to 0.100 along the overbank areas.

The starting elevation for the Hillsborough River was taken to be mean high tide. Above Tampa Water Works Dam, the starting elevations for the Hillsborough River were taken from the U.S. Geological Survey rating curve for the dam (Reference 16).

Computations for flood levels along the lower reach of the Hillsborough River were performed independently for both coastal surges and runoff. The independent results were combined statistically in order to obtain flood levels for each selected return period.

The results of the hydraulic analyses on the Hillsborough River showed that elevations downstream of the dam are influenced by tidal surges and elevations above the dam are less than the dry season pool elevation for all events considered. Due to these results, no flood profiles are presented in this study.

For areas subject to flooding directly from Hillsborough Bay and Old Tampa Bay, the Federal Insurance Administration standard coastal surge model was used to simulate the coastal surge generated by any chosen storm (that is, any combination of the five storm parameters defined earlier). Performing such simulations for a large number of storms each of known total probability, permits one to establish the frequency distribution of surge height as a function of coastal location.

Table 2. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (CFS) 10-Year	50-Year	100-Year	500-Year
Hillsborough River At Mouth	211	3360	6210	7780	8790

These distributions incorporate the large-scale surge behavior but do not include an analysis of the added effects associated with much finer-scale wave phenomena such as wave height, setup, or runup. As the final step in the calculations, the astronomic tide for the region is statistically combined with the computed storm surge to yield recurrence intervals of total water level. The entire procedure is detailed in the Coastal Flooding Handbook (Reference 17). This procedure uses a grid pattern approximating the geographical features of the study area and the adjoining areas. Surges were computed using grids of 5 nautical miles and 1 nautical mile, depending on the resolution required.

Surge levels in the Hillsborough River were computed with the aid of a one-dimensional unsteady-flow model. The values for the mouth were taken from the results of the coastal model.

Elevations for floods of the selected recurrence intervals on the flooding sources studied in detail are shown in Table 3.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage State and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Insurance Administration as the base flood for purposes of flood plain management measures.

The 500-year flood is employed to indicate additional areas of flood risk in the community. The boundaries of the 100-year flood have been delineated using the computed flood elevations; topographic maps at a scale of 1:24,000, with a contour interval of 5 feet (Reference 18); and city maps at a scale of 1:36,000 (Reference 19).

Additional charts and maps were consulted in order to cross-check boundaries (References 15, 20, 21, 22, and 23).

In cases where the 100- and 500-year flood boundaries are close together, only the 100-year flood boundary has been shown.

Table 3. Summary of Elevations

Flooding Source And Location	Elevation (Feet) 10-Year	50-Year	100-Year	500-Year
Gulf of Mexico				
Old Tampa Bay Near Prescott Street	5.2	8.4	9.9	13.1
Old Tampa Bay At Interstate Highway 275	5.3	8.6	10.2	13.4
Hillsborough Bay Near Mouth of Seddon Channel	5.7	9.3	11.0	14.2
Hillsborough River At Interstate Highway 75	7.0	9.9	10.8	13.4
Hillsborough River Reservoir Above Tampa Water Works Dam	22.5	22.5	22.5	22.5

Approximate flood boundaries in some portions of the study area were taken from the Federal Insurance Administration Flood Hazard Boundary Map (Reference 24).

The study contractor has determined that some areas shown on the Federal Insurance Administration Flood Hazard Boundary Map (Reference 24) are areas of minimal flooding; therefore, they were not delineated on the maps.

Flood boundaries are indicated on the Flood Insurance Rate Map (Exhibit 1). On this map, the 100-year flood boundary corresponds to the boundary of the areas of special flood hazards (Zones A, A1, A8, A9, A10, V9, and V10); and the 500-year flood boundary corresponds to the boundary of the areas of moderate flood hazards (Zone B).

Small areas within the flood boundaries may lie above flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity and increases flood heights, thus increasing flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment in order that the 100-year flood be carried without substantial increases in flood heights. Due to the effects of the flood-control project on the Hillsborough River, encroachment up to the natural channel banks will not increase the flood elevations. Therefore, the natural channel serves as the floodway in Tampa. Because the floodway is defined in this way, no floodway data or delineations are presented in this study.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the Federal Insurance Administration has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting the City of Tampa.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

In tidal areas, reaches are limited to the distance for which the 100-year flood elevation does not vary more than 1.0 foot.

The locations of the reaches determined for the flooding sources of Tampa are summarized in Table 4.

5.2 Flood Hazard Factors

The Flood Hazard (FHF) is the Federal Insurance Administration device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective Flood Hazard Factors, the entire incorporated area of the City of Tampa was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or Flood Hazard Factors determined.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (FEET NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Gulf of Mexico							
Reach 1	10,20,29, 30,36,37, 42,43,46	-4.7	-1.5	3.1	045	V9	10
Reach 2	10,37,42, 43,46	-4.7	-1.5	3.1	045	A9	10
Reach 3	10,11,20, 21,29,30, 31,36,37	-4.9	-1.5	3.2	050	V10	10
Reach 4	10,11,12, 20,21,22, 30,31,36, 37	-4.9	-1.5	3.2	050	A10	10
Reach 5	32,33,34, 38,44	-5.2	-1.6	3.2	050	V10	11
Reach 6	5,6,14,15, 23,24,25, 26,27,32, 33,34,38, 43,44	-5.2	-1.6	3.2	050	A10	11
Reach 7	6,7	-4.0	-1.0	2.3	040	A8	11
Hillsborough River							
Reach 1	7,8	0.0	0.0	0.0	005	A1	23

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

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Federal Insurance Administration

CITY OF TAMPA, FL
(HILLSBOROUGH CO.)

FLOOD INSURANCE ZONE DATA

GULF OF MEXICO-HILLSBOROUGH RIVER

TABLE 4

Zones A1, A8, A9, and A10:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to Flood Hazard Factors.
Zones V9 and V10:	Special Flood Hazard Areas along coasts inundated by the 100-year flood as determined by detailed methods, and that have additional hazards due to velocity (wave action); base flood elevations shown, and zones subdivided according to Flood Hazard Factors.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 feet; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

The flood elevation differences, Flood Hazard Factors, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community are summarized in Table 4.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Tampa is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevations show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the Federal Insurance Administration.

6.0 OTHER STUDIES

The Federal Insurance Administration has published a Flood Hazard Boundary Map for Tampa (Reference 24). Due to the more detailed methods used in this Flood Insurance Study, it supersedes the Flood Hazard Boundary Map.

A Flood Insurance Study has been prepared for the City of Temple Terrace (Reference 25). The Temple Terrace study does not include the effects of the flood-control project on the Hillsborough River and, therefore, does not agree with this study.

The U.S. Geological Survey has published a report of the Lower Hillsborough River (Reference 16). The U.S. Geological Survey report does not include the effects of the flood-control project. This Flood Insurance Study supersedes the U.S. Geological Survey Report because of the inclusion of the flood-control project.

The Federal Insurance Administration has prepared a study including 100-year surge elevations for Tampa Bay, Hillsborough Bay, and Old Tampa Bay (Reference 26). Surge elevations in the Federal Insurance Administration study are from 3.0 to 5.5 feet higher than those presented in this study. The difference in elevations can be attributed to the hydrodynamic model and statistical analysis used in the two studies.

The Federal Insurance Administration is preparing a Flood Insurance Study for Hillsborough County (Reference 27). The county study is in complete agreement with this study.

This study is authoritative for the purposes of the National Flood Insurance Program; data presented herein either supersede or are compatable with all previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Federal Insurance Administration, Regional Director, 1371 Peachtree Street, NE., Atlanta, Georgia 30309.

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APPENDIX I

CONCEPTUAL DESIGN DRAWINGS

(Reduced Size)

and

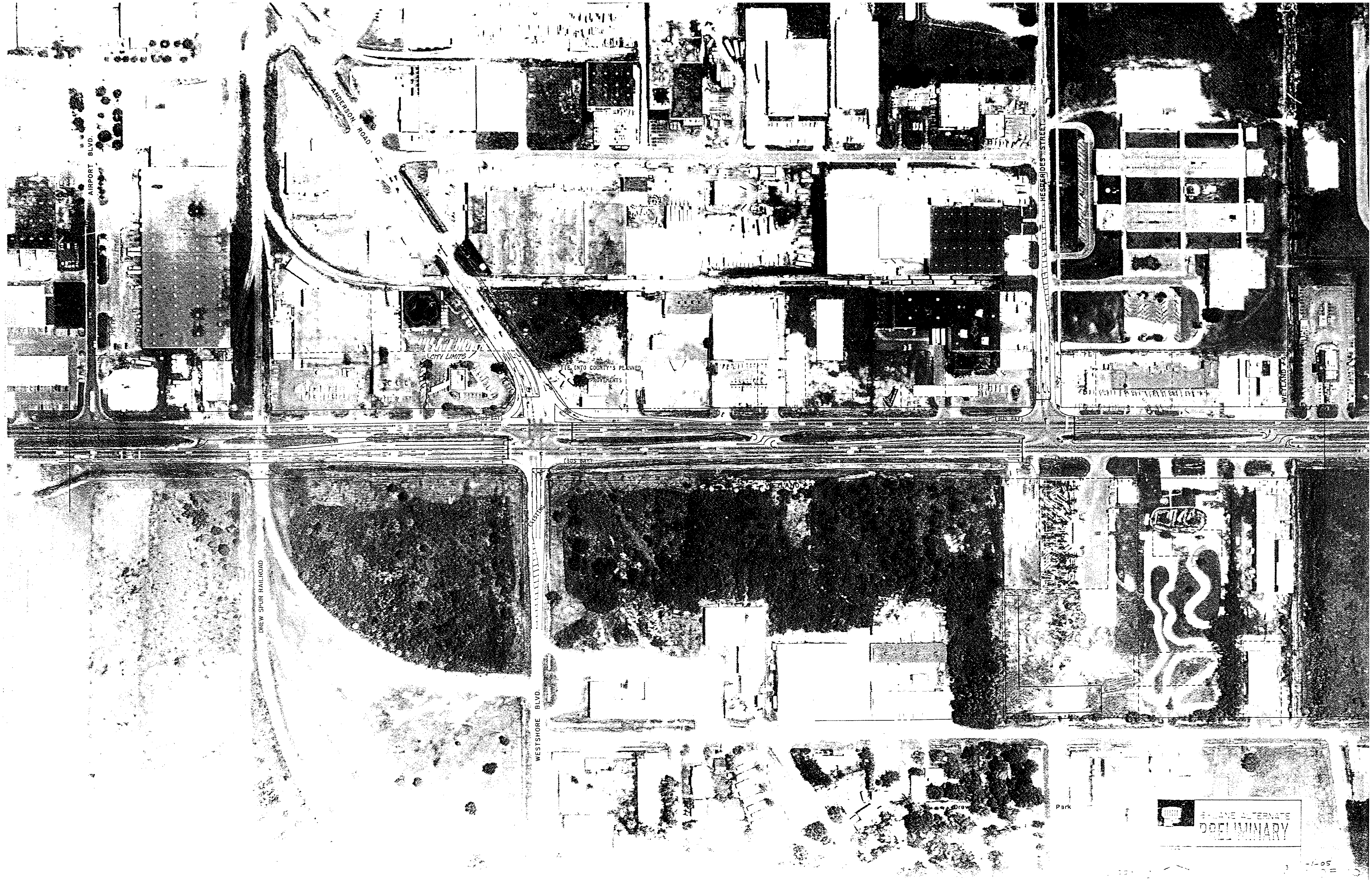
CONCEPTUAL WALL AND LANDSCAPE

DESIGN FOR SEMINOLE

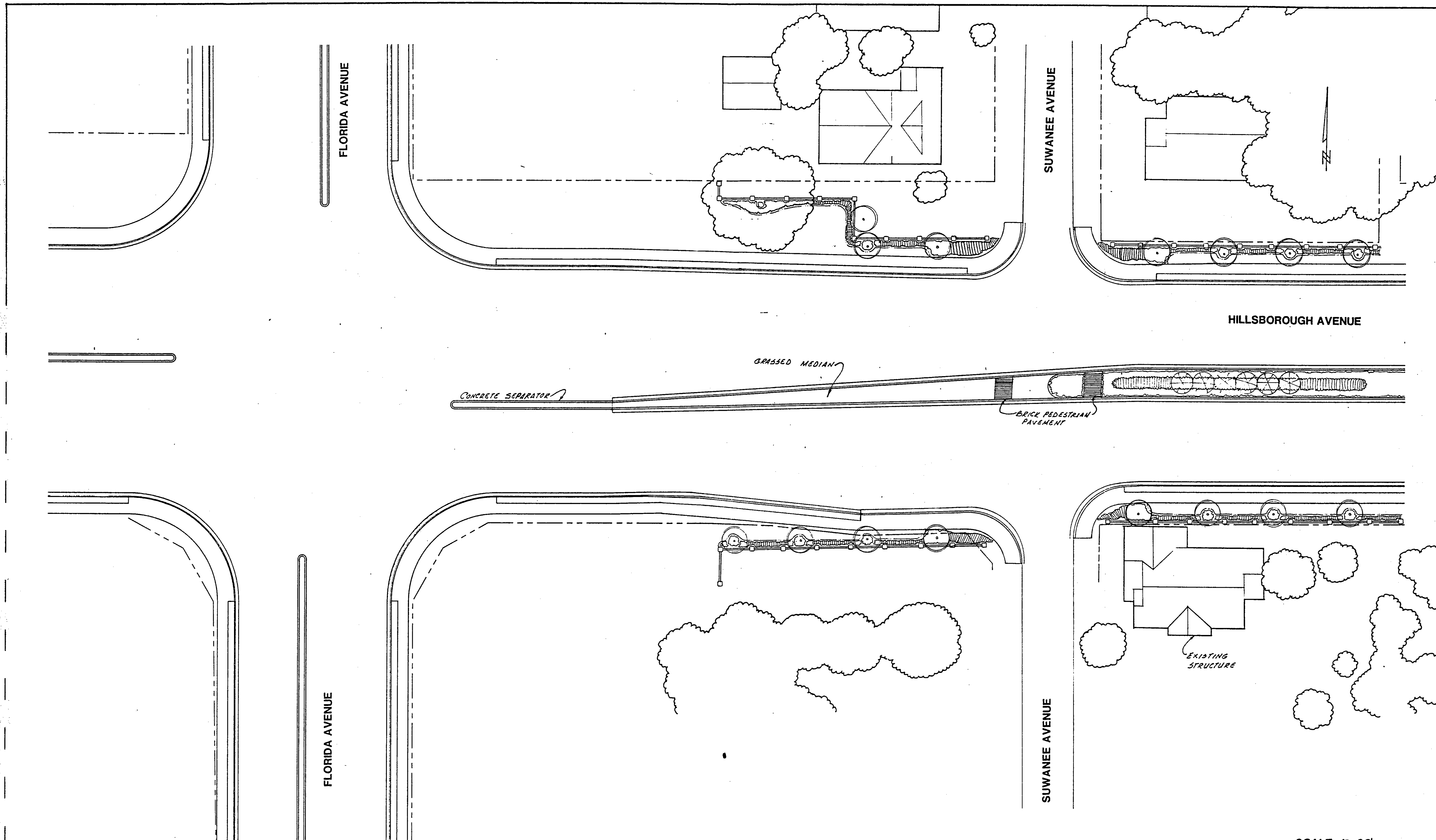
HEIGHTS AREA


FOREST HILLS DR
1 ACRE DETENTION POND TO BE REQUIRED IN THIS AREA
McKAY AVENUE
PERSHING PLACE
LEE PLACE
RIVER SHORE DRIVE
WETLAND 7
EXISTING BRIDGE TO BE REMOVED
DETENTION POND 0.49 AC.
NORTH BLVD
CLANTON AVENUE
BEACON AVENUE
WISHART BLVD
BLANN DR
HILLSBOROUGH RIVER
SCALE 1"=100' HORIZ. 1"=10' VERT.
360
365
370
375
380
385
+50
+40
+30
+20
+10
0
EXISTING
PROPOSED GRADE
WISHART BLVD
NORTH BLVD
RIVER SHORE DRIVE
MHW
6-LANE ALTERNATE
BASCULE BRIDGE ALTERNATE
PRELIMINARY


NEW PARKING
HOOVER BLVD
WETLAND #2
(BUS BAY)
(BUS BAY)



AIRPORT BLVD.
ANDERSON ROAD
HESPERIDES STREET
WEYLAND
CITY LIMITS
TIE INTO COUNTY'S PLANNED IMPROVEMENTS
(BUS BAY)
DREW SPUR RAILROAD
WESTSHORE BLVD.
Drew
Park
6-LANE ALTERNATE
PRELIMINARY



SCALE: 1": 20'

NO.	DATE	REVISIONS DESCRIPTION	BY	CHK'D

DESIGNED BY: J. W. S.
DRAWN BY: J. W. S.
CHECKED BY: J. W. S.
APPROVED BY:
DSA COMM. NO: 84077 - F7
DATE: DECEMBER 5, 1988

TAMPA • RALEIGH • MIAMI • WINSTON-SALEM "COMMITMENT TO QUALITY"

DSA GROUP INC.

DSA BLDG. 2005 PAN AM CIRCLE TAMPA, FLORIDA 33607

HILLSBOROUGH AVE. PD&E SUPPLEMENT - SEMINOLE HEIGHTS AREA

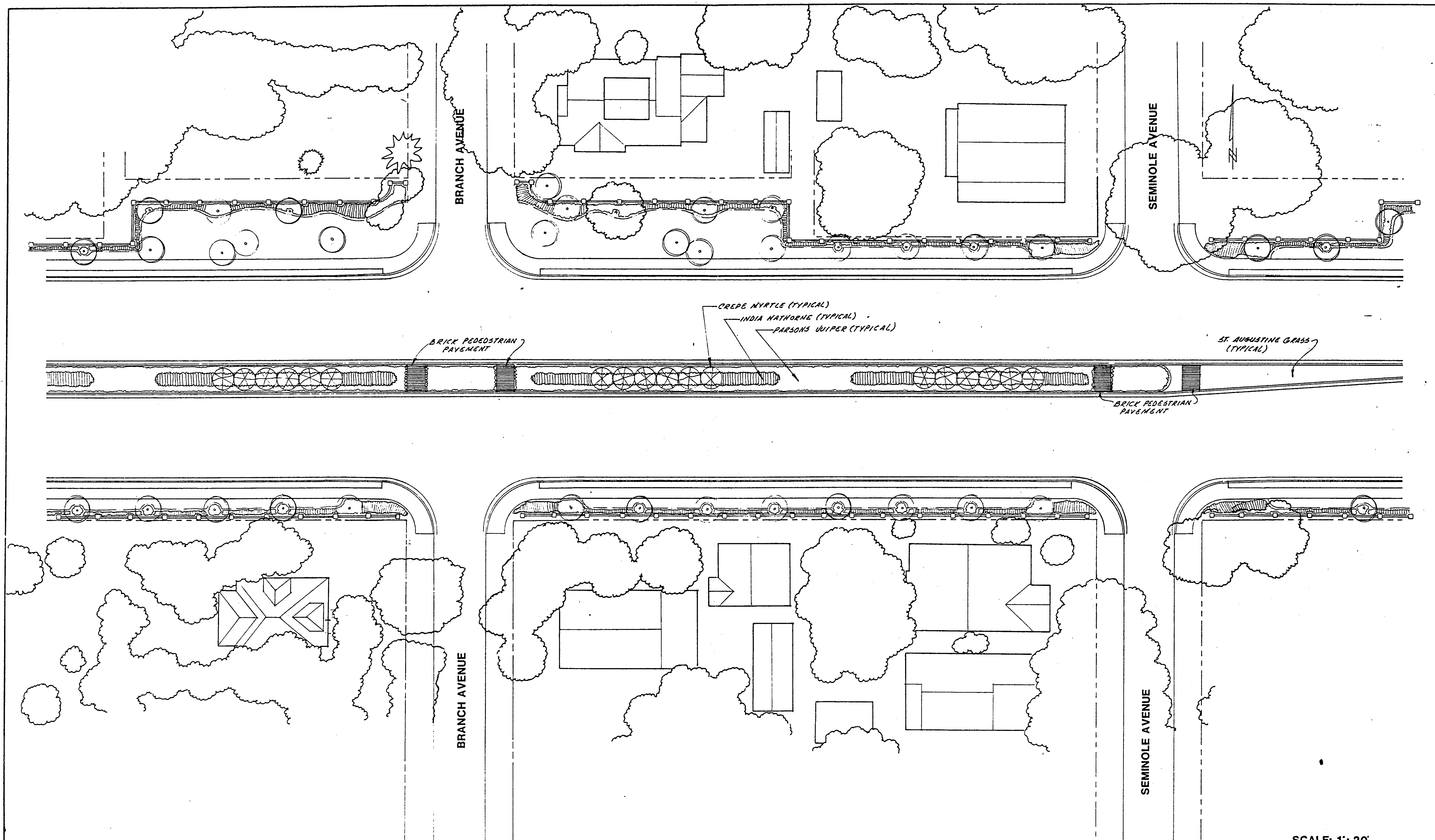
WALL AND LANDSCAPE PLAN

SIGNED

FLA. P.E. REG. NO.

DRAWING NO. 1

OF SHEETS



SCALE: 1": 20'

REVISIONS				
NO.	DATE	DESCRIPTION	BY	CHK'D

DESIGNED BY: J. W. S.
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DSA GROUP INC.

DSA BLDG. 2005 PAN AM CIRCLE TAMPA, FLORIDA 33607

HILLSBOROUGH AVE. PD&E SUPPLEMENT - SEMINOLE HEIGHTS AREA

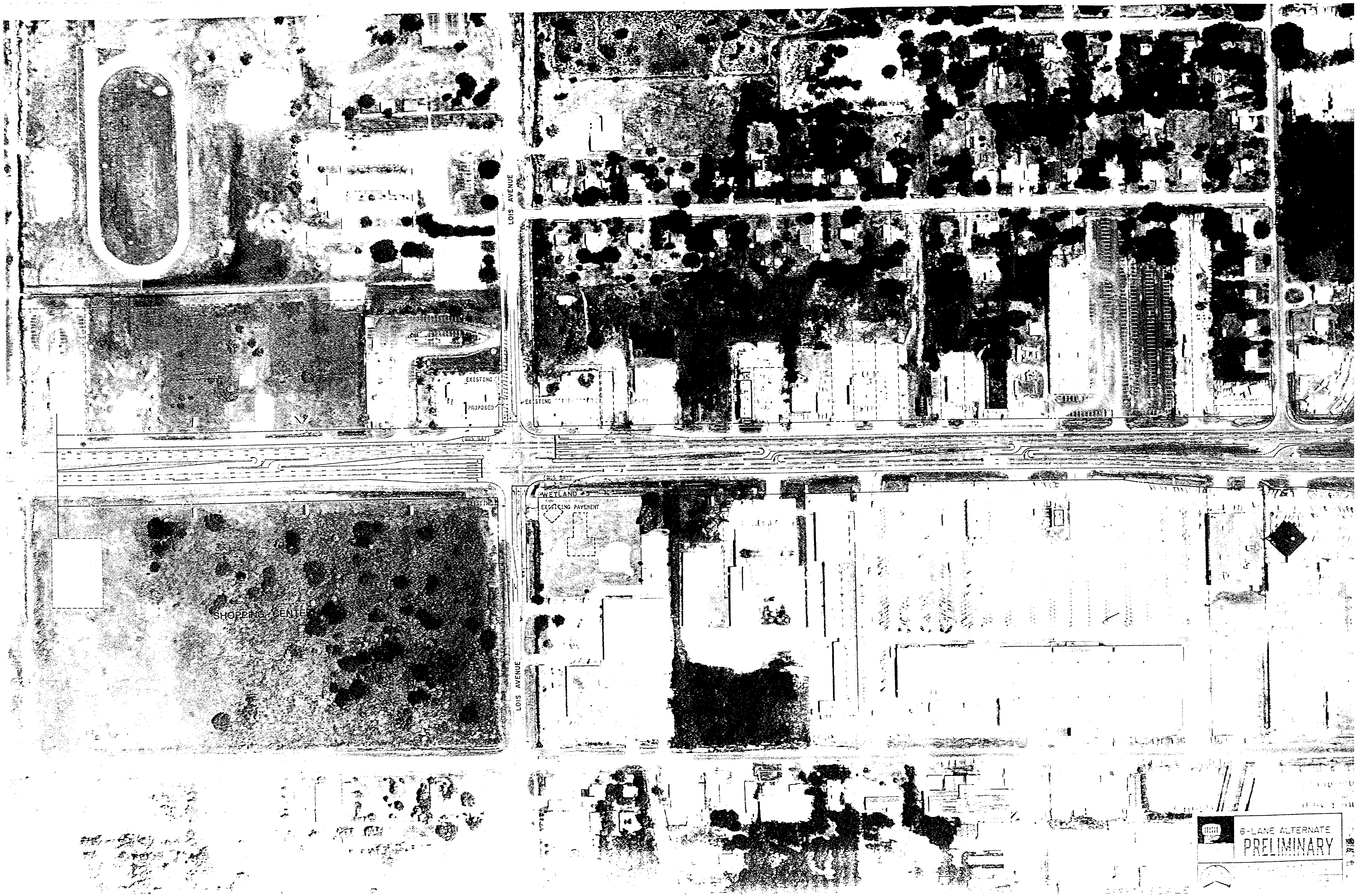
WALL AND LANDSCAPE PLAN

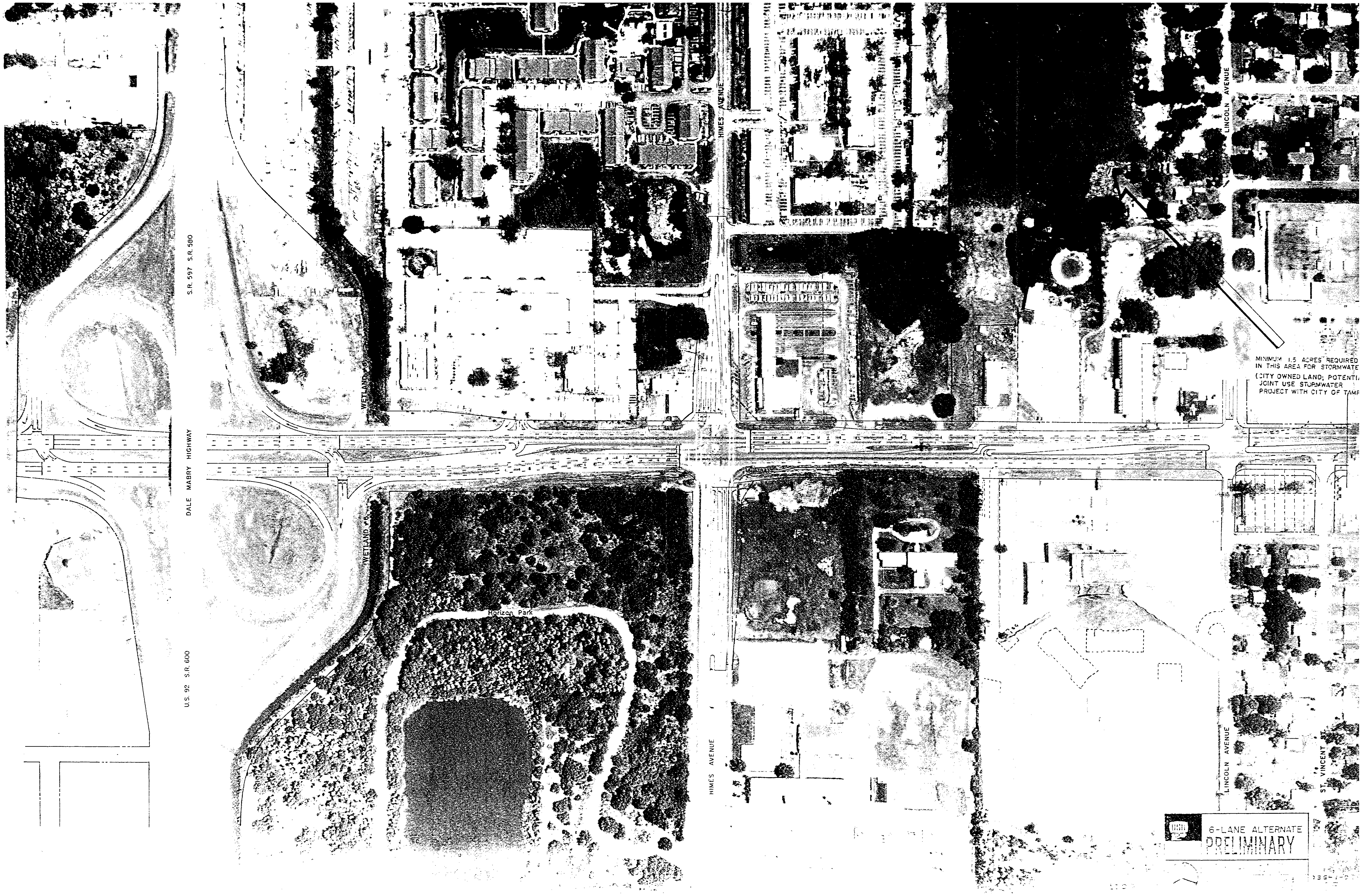
SIGNED

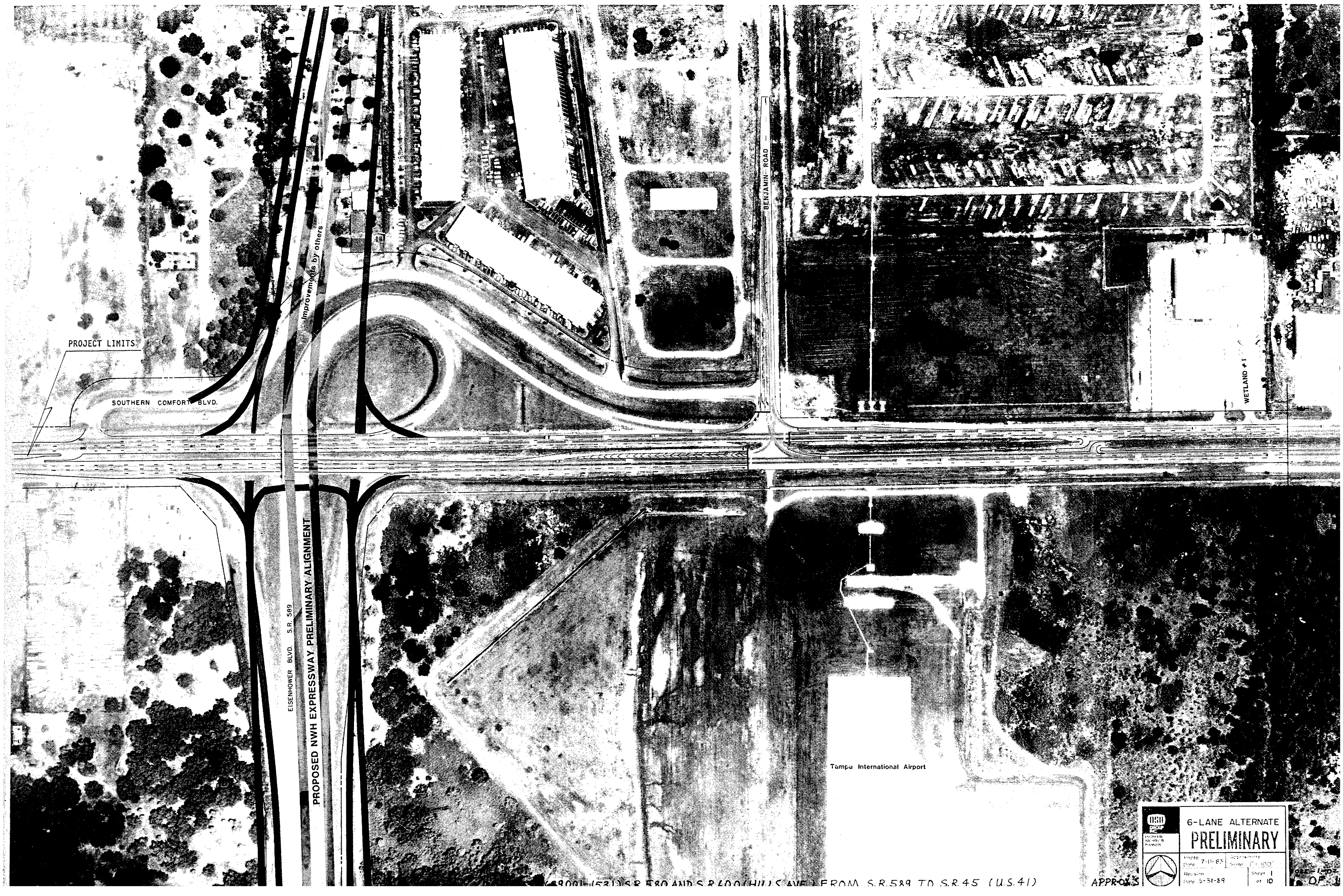
FLA. PE. REG. NO.

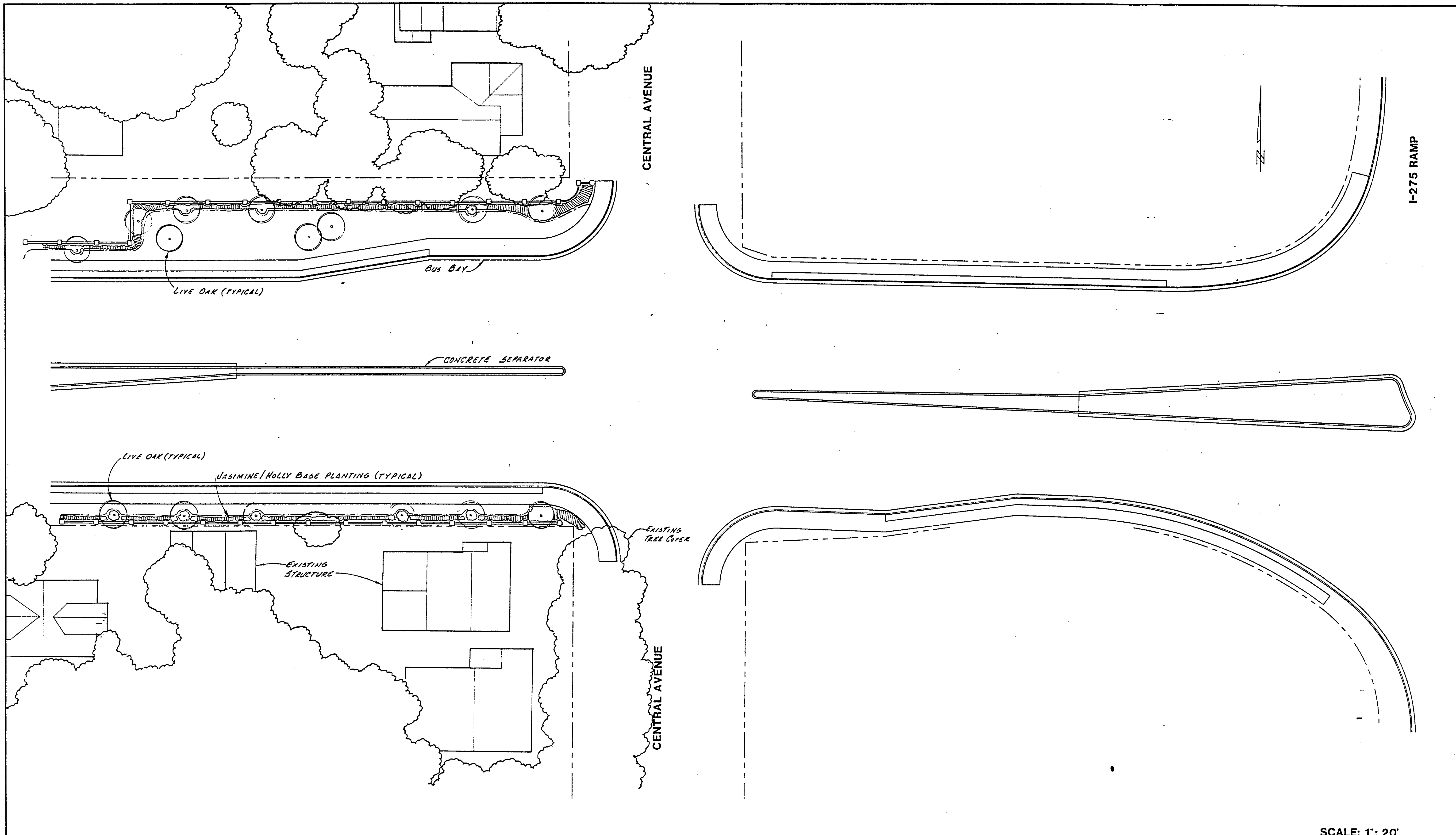
DRAWING NO. 2

OF SHEETS


LOIS AVENUE
EXISTING
PROPOSED
EXISTING
BUS BAY
BUS BAY
WETLAND #5
EXISTING PAVEMENT
SHOPPING CENTER
LOIS AVENUE
6-LANE ALTERNATE
PRELIMINARY


S.R. 597 S.R. 580
DALE MABRY HIGHWAY
U.S. 92 S.R. 600
WETLAND
WETLAND
Horizon Park
HIMES AVENUE
HIMES AVENUE
LINCOLN AVENUE
LINCOLN AVENUE
ST. VINCENT ST.
MINIMUM 1.5 ACRES REQUIRED
IN THIS AREA FOR STORMWATE
(CITY OWNED LAND; POTENTI
JOINT USE STORMWATER
PROJECT WITH CITY OF TAMP
6-LANE ALTERNATE
PRELIMINARY


PROJECT LIMITS
SOUTHERN COMFORT BLVD.
Improvements by others
BENJAMIN ROAD
WETLAND #1
EISENHOWER BLVD. S.R. 589
PROPOSED NWH EXPRESSWAY PRELIMINARY ALIGNMENT
Tampa International Airport
6-LANE ALTERNATE
PRELIMINARY
Photo Date 7-11-83
Approximate Scale 1" = 100'
Revision Date 5-31-89
Sheet 1 of 10
(9001-1531) S.R. 580 AND S.R. 600 (HILLS AVE.) FROM S.R. 589 TO S.R. 45 (U.S. 41)



REVISIONS				
NO.	DATE	DESCRIPTION	BY	CHK'D

DESIGNED BY: J. W. S.
DRAWN BY: J. W. S.
CHECKED BY: J. W. S.
APPROVED BY:
DSA COMM. NO: 84077-57
DATE: DECEMBER 5, 1988

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DSA GROUP INC.

DSA BLDG. 2005 PAN AM CIRCLE TAMPA, FLORIDA 33607

HILLSBOROUGH AVE. PD&E SUPPLEMENT - SEMINOLE HEIGHTS AREA

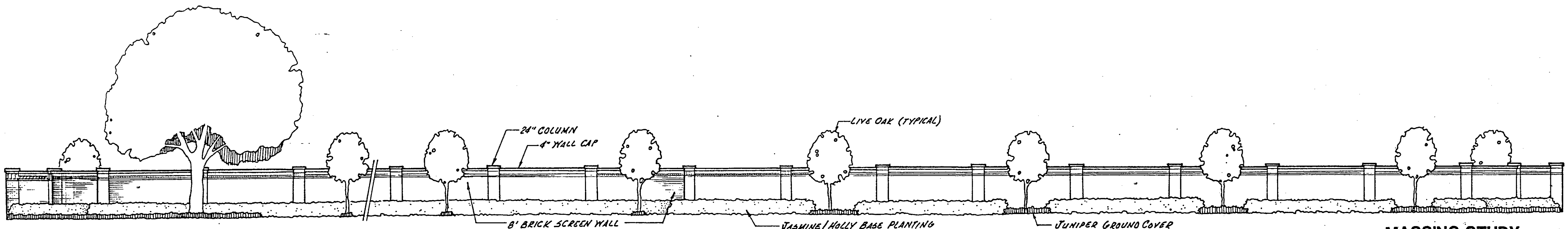
WALL AND LANDSCAPE PLAN

SIGNED

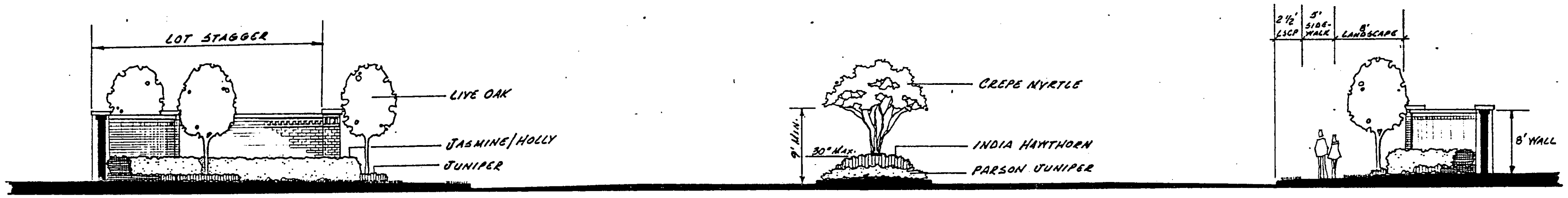
FLA. P.E. REG. NO.

DRAWING NO. 3

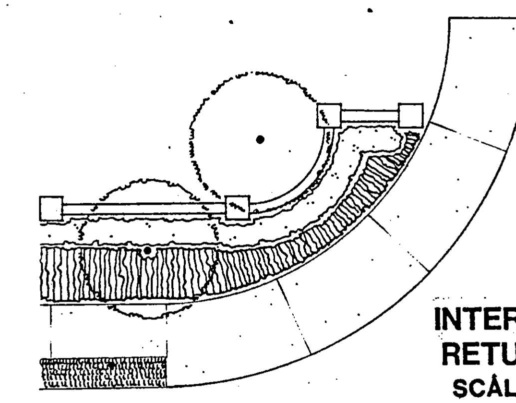
OF SHEETS



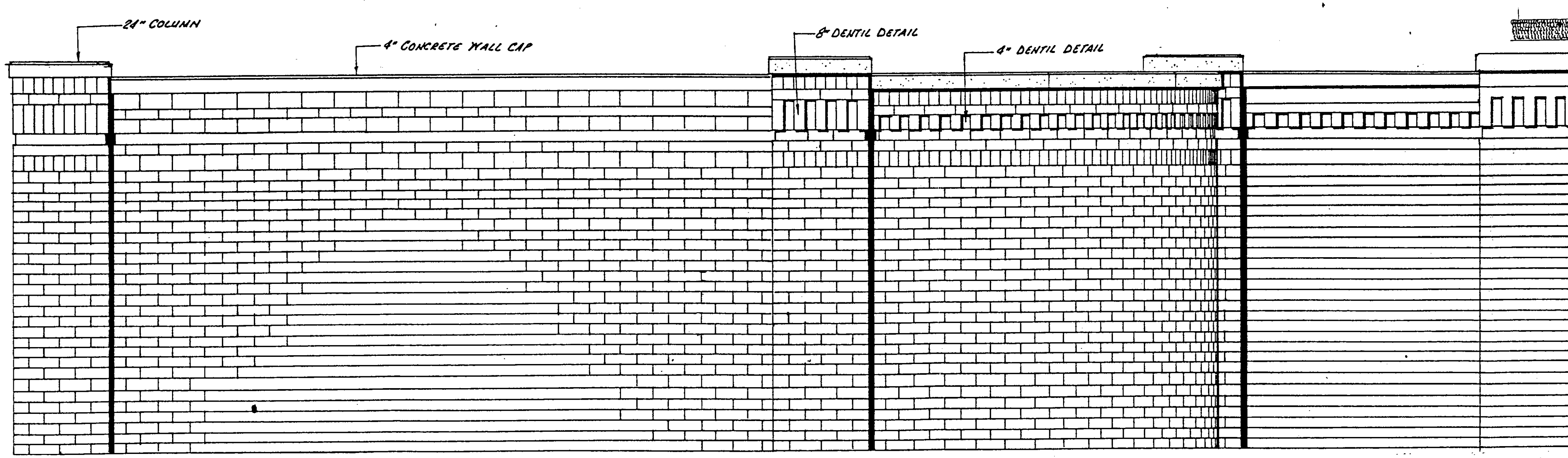
MASSING STUDY
SCALE: 1/8": 1'



CROSS SECTION
SCALE: 1/8": 1'



INTERSECTION RETURN PLAN
SCALE: 1/8": 1'



BRICK WORK DETAIL
SCALE: 3/4": 1'

REVISIONS				
NO.	DATE	DESCRIPTION	BY	CHK'D

DESIGNED BY: J. W. S.
DRAWN BY: J. W. S.
CHECKED BY: J. W. S.
APPROVED BY:
DSA COMM. NO: 84077-F7
DATE: DECEMBER 5, 1988

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DSA GROUP INC.

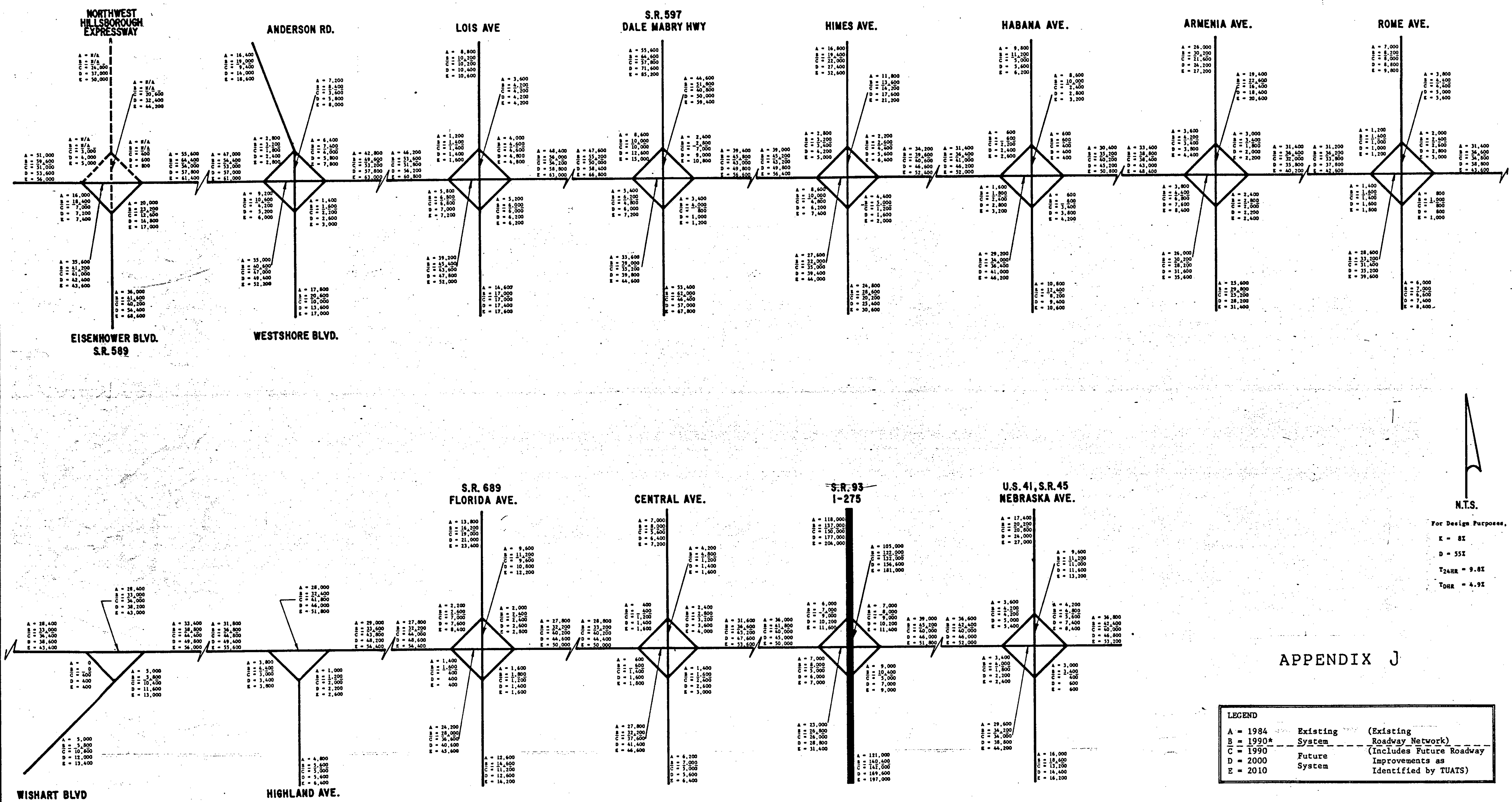
HILLSBOROUGH AVE. PD&E SUPPLEMENT – SEMINOLE HEIGHTS AREA

CHARACTER SKETCHES

SIGNED

DRAWING NO.

EXISTING AND DESIGN TRAFFIC VOLUMES
(AVERAGE DAILY TRAFFIC)



For Design Purposes,

K = 8%

D = 55%

T_{24HR} = 9.8%

T_{DHR} = 4.9%

APPENDIX J

LEGEND

A = 1984	Existing	(Existing
B = 1990*	System	Roadway Network)
C = 1990	Future	(Includes Future Roadway
D = 2000	System	Improvements as
E = 2010		Identified by TUATS)

* ASSUMES A UNIFORM SYSTEM-WIDE GROWTH IN TRAFFIC OF 16% BETWEEN 1984 AND 1990, BASED UPON AN AVERAGE ANNUAL GROWTH OF 2.7% ON HILLSBOROUGH AVENUE, BETWEEN 1975 AND 1984.

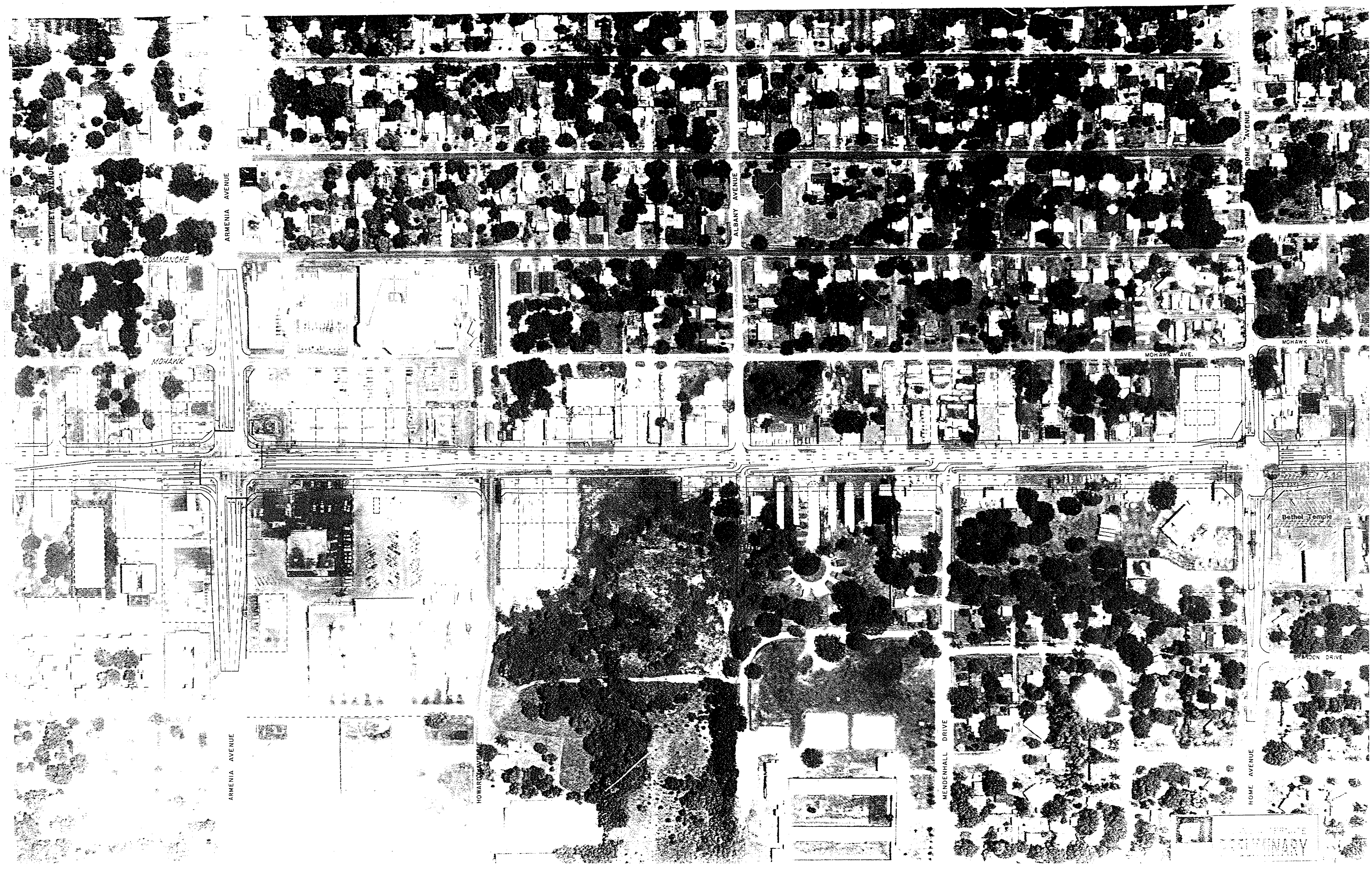
SOURCE: DESIGN TRAFFIC TECHNICAL MEMORANDUM FOR HILLSBOROUGH AVENUE, PREPARED BY DSA GROUP, INC., NOVEMBER, 1985.

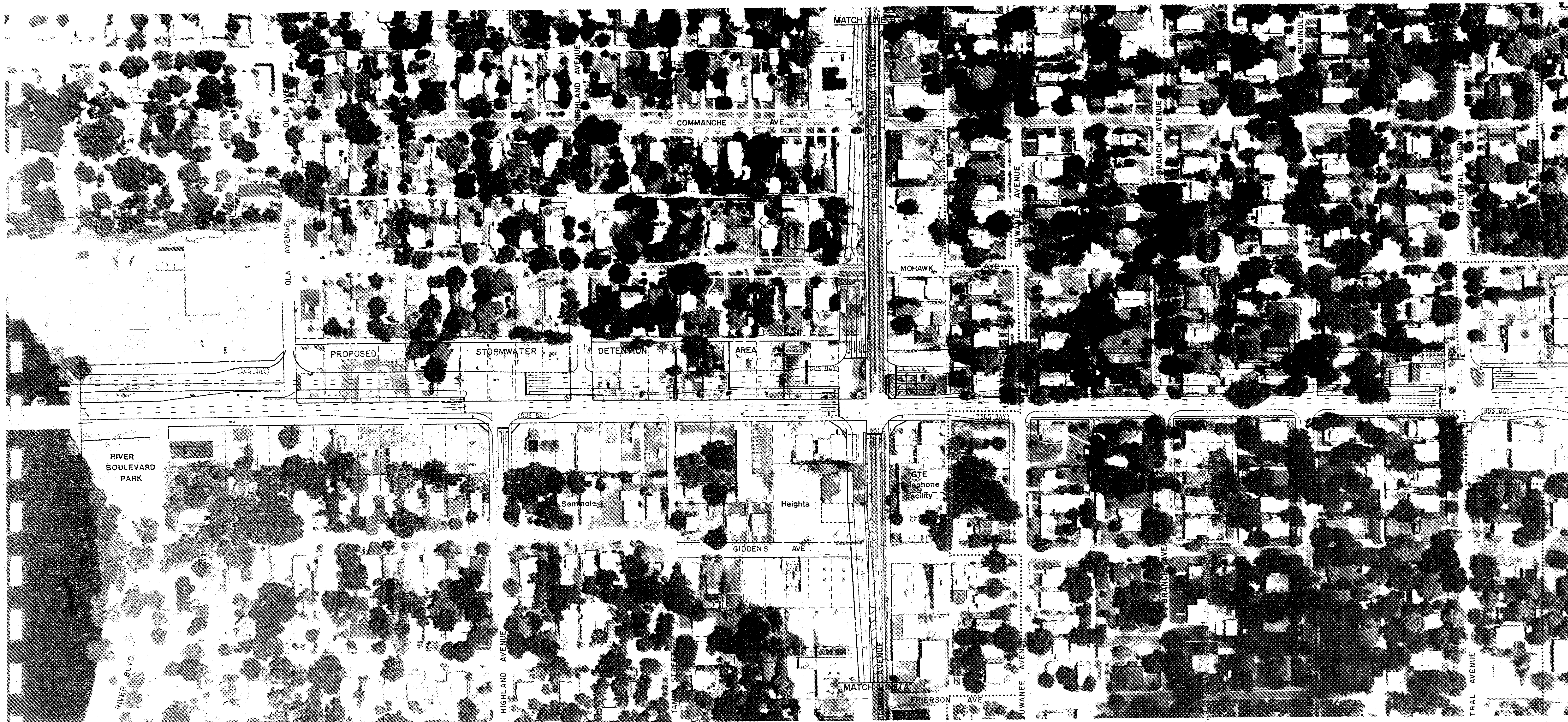
DSA GROUP INC — ENGINEERS • SURVEYORS • PLANNERS — TAMPA, FLORIDA

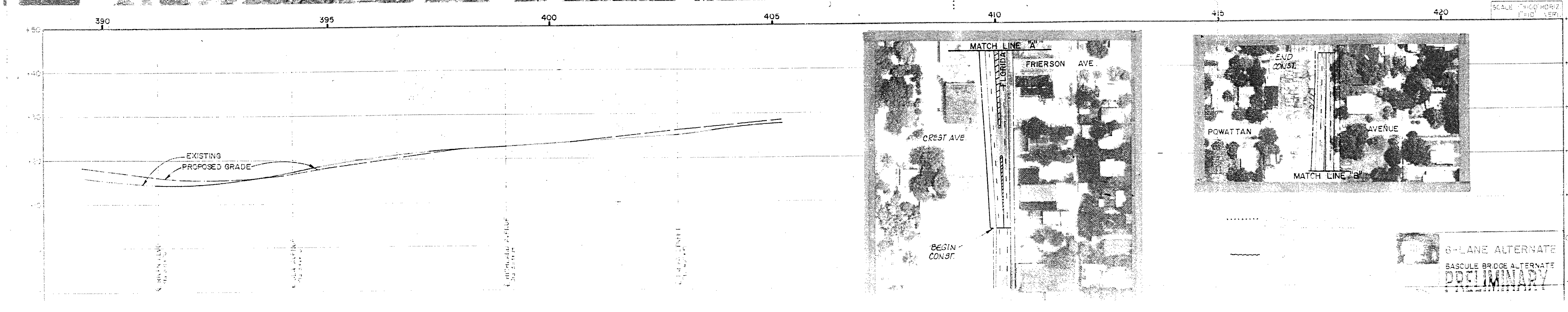
HILLSBOROUGH AVENUE S.R. 580/600

PROJECT DEVELOPMENT STUDY

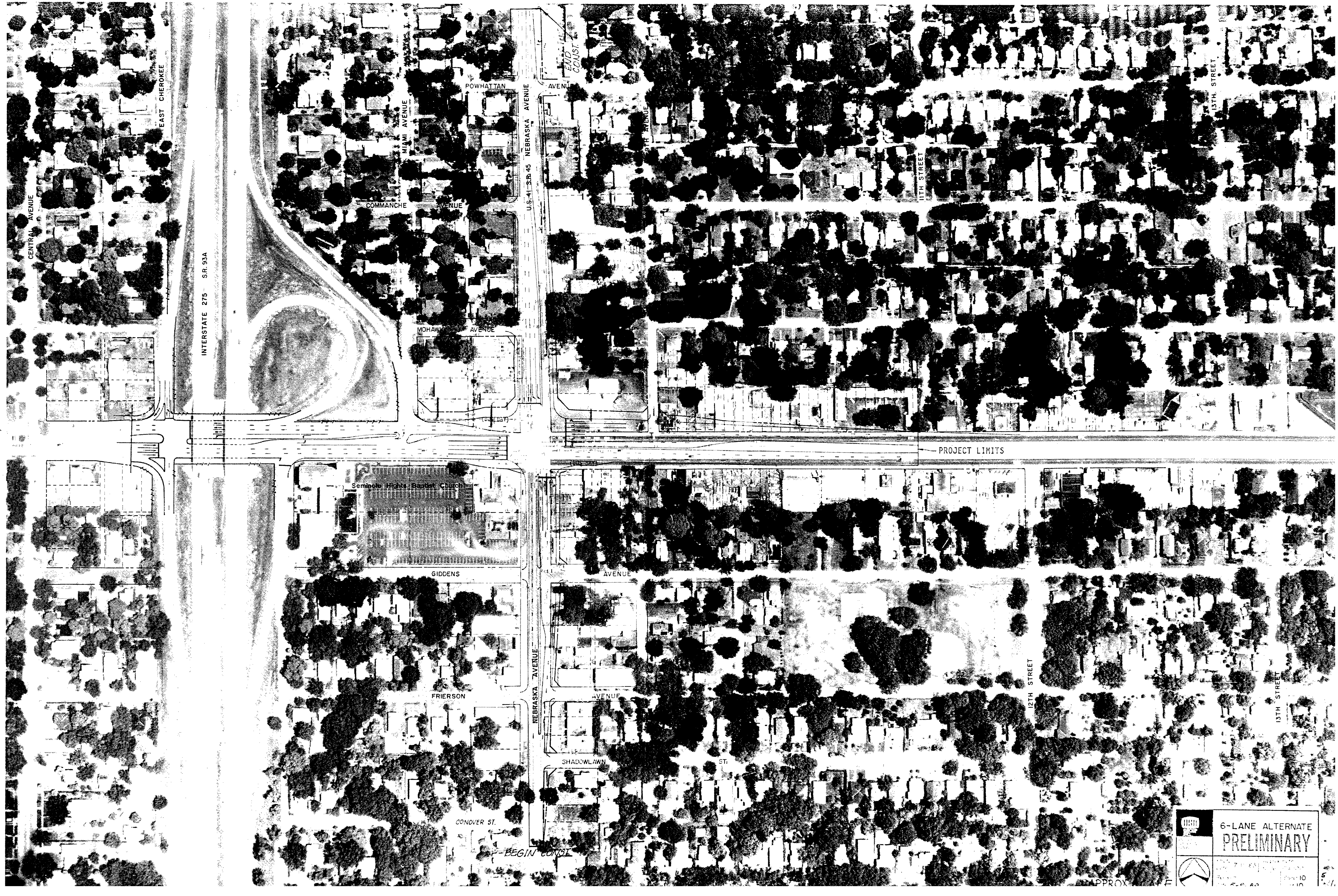
MACDILL AVENUE
ROBERTS AVENUE
HABANA AVENUE
NORTH TAMPANIA
DRIVE
MOHAWK AVE.
TIE INTO CITY'S
PROPOSED CONSTRUCTION
West Hillsboro
6.73 ACRES
DETENTION POND TO BE
REQUIRED IN THIS AREA
TIE INTO CITY'S
PROPOSED CONSTRUCTION
MATANZAS AVENUE
JAMAICA STREET
MACDILL AVENUE
HABANA AVENUE
TO INSET
A


ST. PETE AVENUE
ARMENIA AVENUE
ALBANY AVENUE
ROME AVENUE
COMMANCHE
MOHAWK
MOHAWK AVE.
MOHAWK AVE.
Bethel Temple
BRANDON DRIVE
ARMENIA AVENUE
HOWARD AVENUE
MENDENHALL DRIVE
HOME AVENUE





6-LANE ALTERNATE
BASCULE BRIDGE ALTERNATE
PRELIMINARY



EAST CHEROKEE
CENTRAL AVENUE
INTERSTATE 275 S.R. 93A
POWHATTAN
AVENUE
MIAMI AVENUE
END CONST.
U.S. 41 - S.R. 45 NEBRASKA AVENUE
COMMANCHE AVENUE
MOHAWK AVENUE
11TH STREET
13TH STREET
PROJECT LIMITS
Seminole Heights Baptist Church
GIDDENS AVENUE
FRIERSON AVENUE
NEBRASKA AVENUE
12TH STREET
13TH STREET
SHADOWLAWN ST.
CONOVER ST.
BEGIN CONST.
6-LANE ALTERNATE
PRELIMINARY