U.S. 19 PROJECT DEVELOPMENT AND ENVIRONMENTAL STUDIES

PINELLAS AND PASCO COUNTIES, FLORIDA

STATE PROJECT NO. 15150-1565

FINAL REPORT ELEVATED FREEWAY ALTERNATIVE

Prepared For

THE FLORIDA DEPARTMENT OF TRANSPORTATION

Prepared By
GREINER ENGINEERING SCIENCES, INC.
Tampa, Florida

DECEMBER 1987

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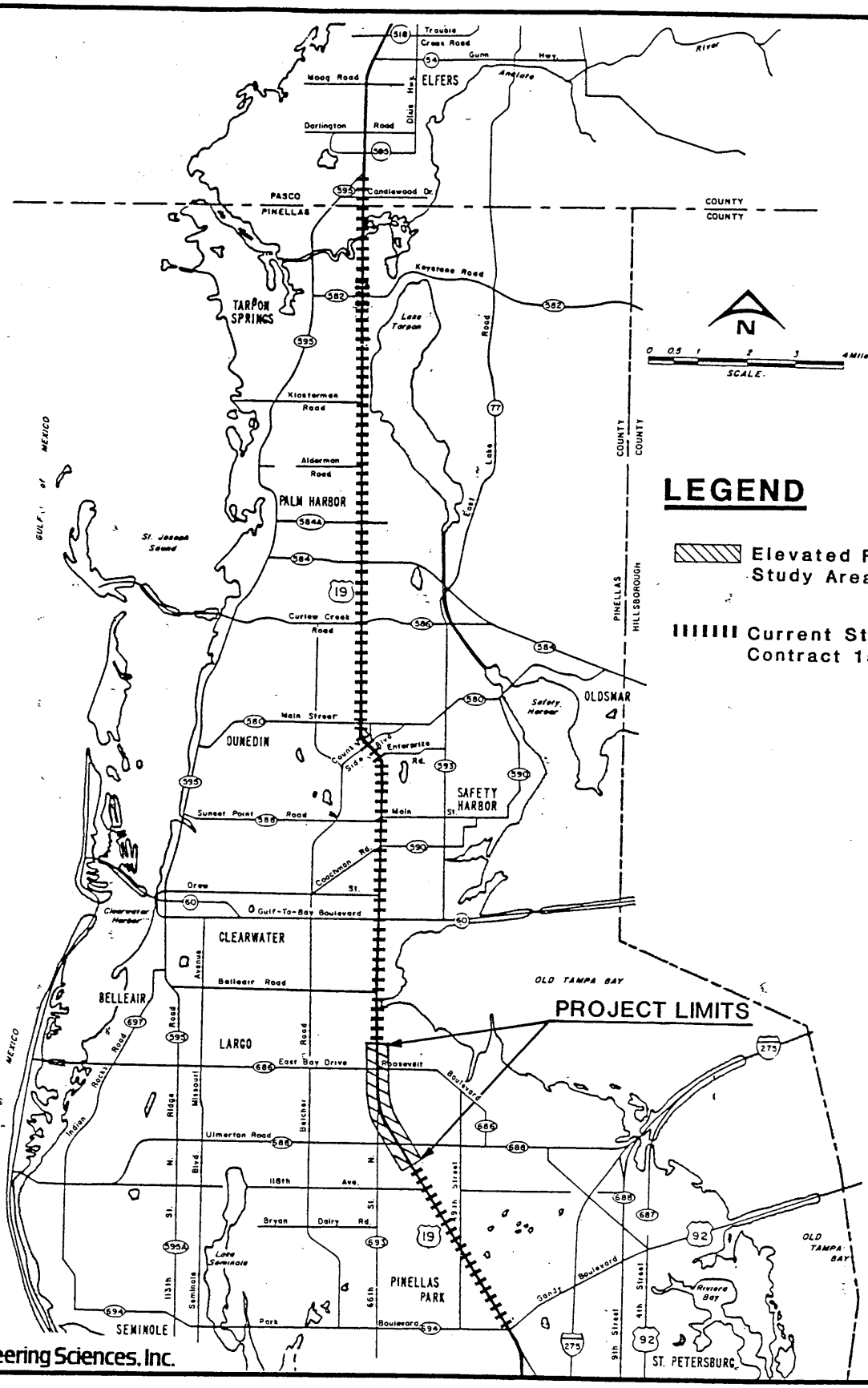
INTRODUCTION

The Florida Department of Transportation (FDOT) is in the final stages of planned improvements to the U.S. 19 corridor from Cross Bayou Canal (south of S.R. 688/Ulmerton Road) to Haines Bayshore Road (north of S.R. 686/East Bay Drive). These improvements were approved by a Federal Environmental Impact Statement (EIS) in 1980. Design plans were subsequently prepared and bids taken for construction in 1987. See Exhibit 1 (Study Area) and 2 (Location Map) for the geographic location of the study area.

The currently approved plans, which are under construction, provide for a limited access freeway with parallel one-way frontage roads. Interchanges are provided at major arterial crossroads (i.e., Ulmerton Road, 66th Street, East Bay Drive). Overpasses or minor interchanges are provided at 126th Avenue North, 142nd Avenue North, and Whitney Road. Numerous ramping connections for local traffic access to and from the U.S. 19 freeway are provided throughout the study area.

This study, conducted by Greiner, Inc., examines the application of an elevated freeway, a.k.a. "Double Deck," as a design alternative to the current construction program. The study area chosen corresponds with state construction project numbers 15150-3551 (station 674+00 through station 711+25), 15150-3447 (station 711+25 through station 798+00), and 15150-3542 (station 798+00 through station 870+08.21), as shown on Exhibit 3. This 3.71-mile-long study area incorporates several key factors for its use as a case study of an elevated freeway alternative. First, the study area is



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U.S. 19 PROJECT DEVELOPMENT AND ENVIRONMENTAL STUDIES

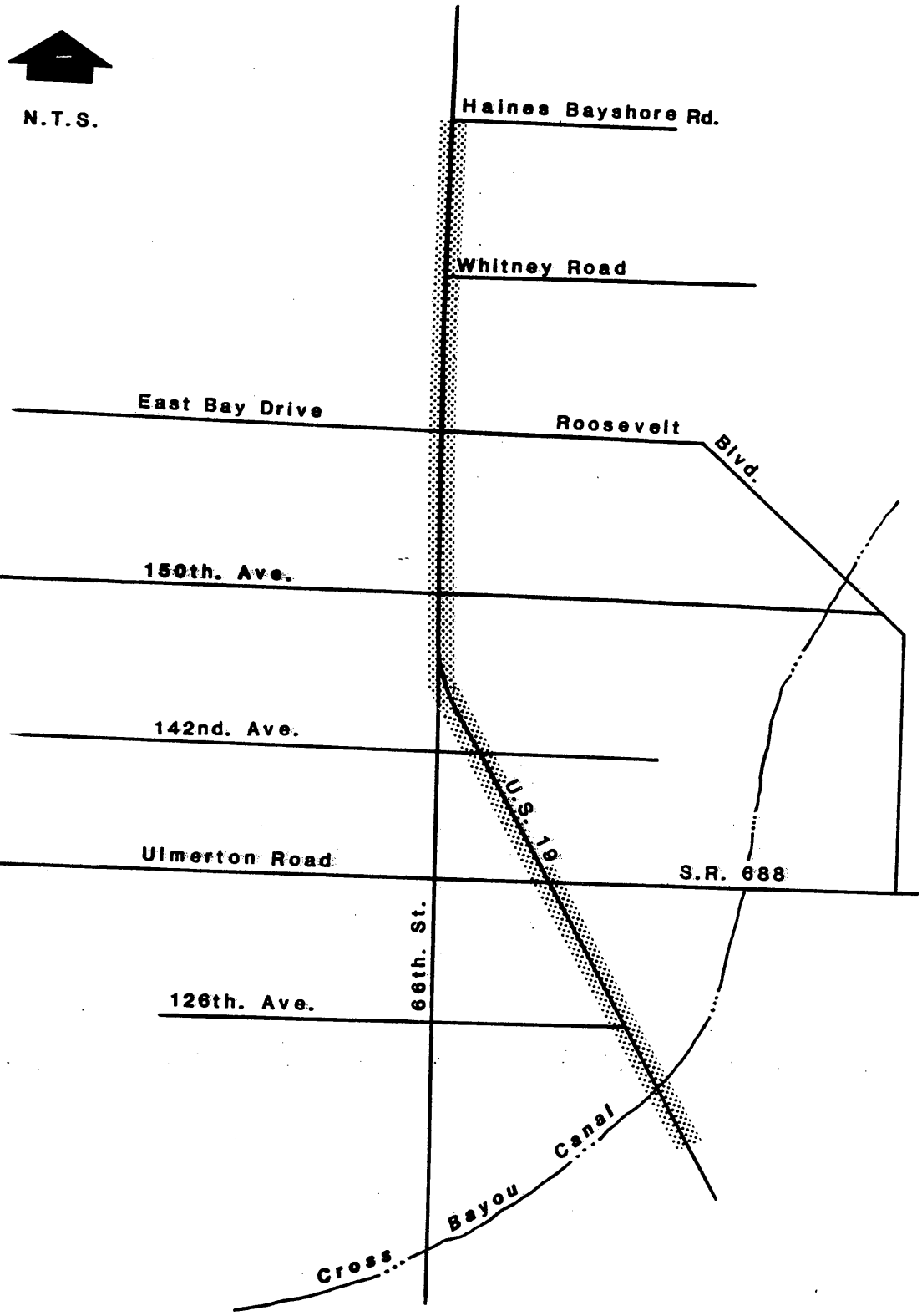
Pinellas and Pasco Counties, Florida

STATE PROJECT NO. 15150-1565

ELEVATED FREEWAY STUDY AREA

Florida Department of Transportation

EXHIBIT 1



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LEGEND

Study Location

U.S. 19 PROJECT DEVELOPMENT AND ENVIRONMENTAL STUDIES

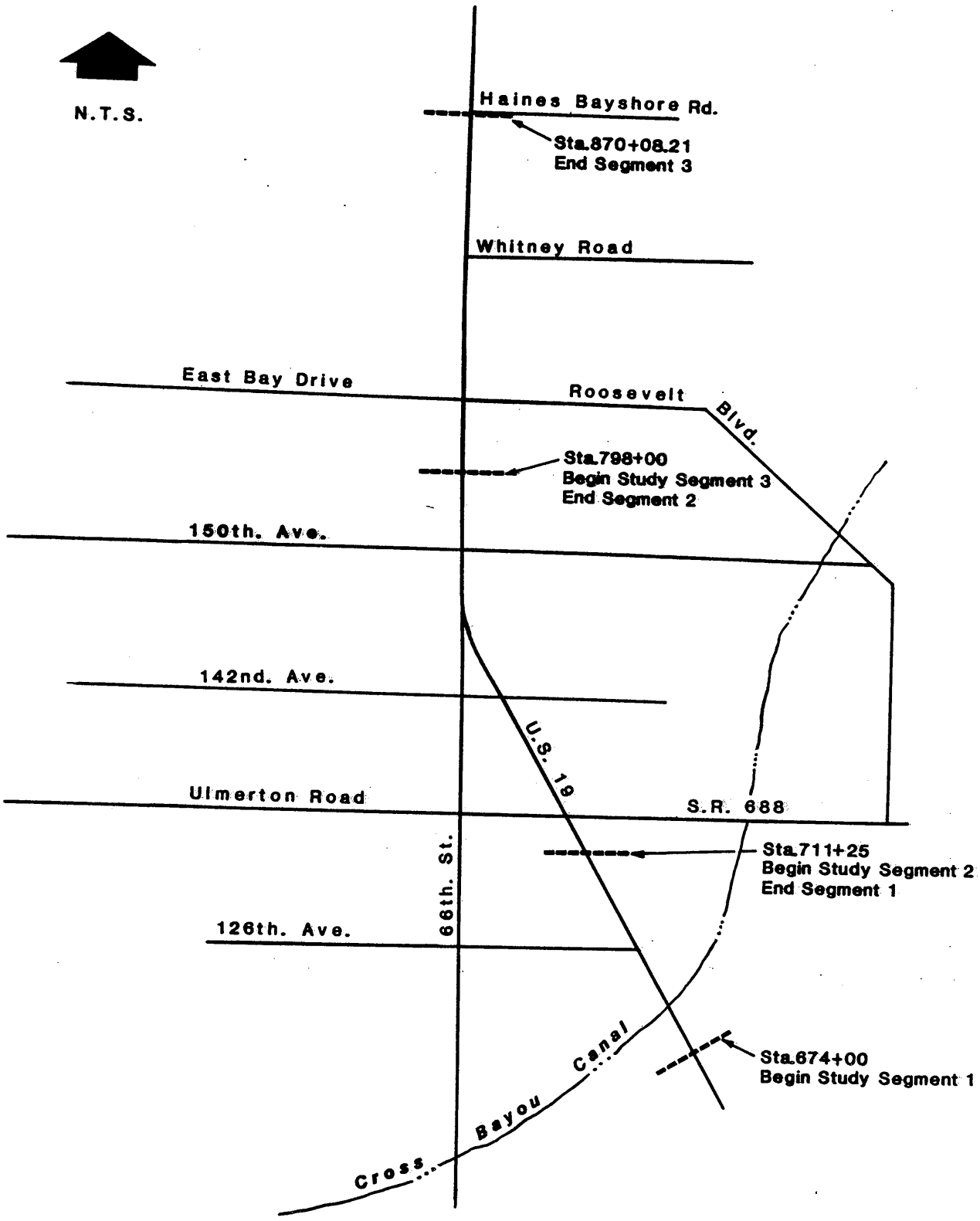
Pinellas and Pasco Counties, Florida

STATE PROJECT NO. 15150-1565

STUDY LOCATION MAP

Florida Department of Transportation

EXHIBIT 2



Greiner Engineering Sciences, Inc.

LEGEND

Study Segment 1
-State Project No.15150-3551

Study Segment 2
-State Project No.15150-3547

Study Segment 3
-State Project No.15150-3542

U.S. 19 PROJECT DEVELOPMENT AND ENVIRONMENTAL STUDIES

Pinellas and Pasco Counties, Florida
STATE PROJECT NO. 15150-1565

CURRENT CONSTRUCTION PROGRAM LIMITS

Florida Department of Transportation

EXHIBIT 3

clearly definable both geographically and operationally. Second, the previous studies defined the traffic demands in the corridor and the required laneage.

Third, the FDOT has already assembled detailed cost estimates for right-of-way utilities, construction, and related project costs for each of the three construction contracts. These factors allow a clear comparison between the concepts.

DATA COLLECTION

Data collection for the study involved information from a wide range of agencies and sources. Previous FDOT reports of the study area and current program of improvements were evaluated, and appropriate information used from these sources. Research, design and construction projects from other areas were also used to develop comparative evaluations. Traffic projections from previously approved traffic studies were used to develop scenarios for freeway arterial assignments.

Since the principal feature of an elevated freeway alternative is structural, significant attention was given to structural components and costs.

STRUCTURAL DATA

There are a wide range of structural types suited for an elevated freeway. In an effort to select the most viable alternatives, information on structural concepts and costs used in similar applications along with information on costs for various generic structural elements were obtained and reviewed. Structural concepts reviewed for other projects included the FDOT's Dale Mabry Highway Study, the Texas State Department of Highways and Public Transportation elevated I-10, the I-35 project in San Antonio, Texas, ("Downtown Y") and the Tennessee D.O.T. I-40/I-75/I-640 integral steel girder post-tensioned concrete cap concept. Cost data assembled for structural elements included AASHTO prestressed girders, Florida bulb-tee girders, double-tee girders and steel plate girders. The information obtained from the various review sources is summarized below.

Dale Mabry Highway Study

The Dale Mabry study was done by the DSA Group for the FDOT. This study investigated building a double deck freeway for 7.9 miles along Dale Mabry Highway in Tampa, Florida. The freeway would run from Tampa Bay Boulevard to Erhlich Road. For purposes of the study, a "spine wing" type structure similar to the one used in the San Antonio, Texas Downtown "Y" project was considered. The structure consisted of a central spine superstructure with 36 foot cantilever arms. The "spine wing" is supported by 18-foot-wide columns spaced at 100 feet apart. Costs for this structure were estimated to be $38.00 per square foot without contingencies.

The San Antonio "Downtown Y"

The San Antonio "Downtown Y" is a 10-mile project to add six lanes to I-10 and I-35 where they merge in a Y-shaped pattern near the central business district. The July 30, 1987 Engineering News Record highlighted this project as its cover story. Data from this article, the study by Harland Bartholomew & Associates, Inc., and discussion with Texas State Department of Highway and Public Transportation representatives provided information used in our study.

The "Downtown Y" structure will consist of separate inbound and outbound three-lane structures. Special existing conditions require structures to be supported on single column piers located in the shoulders of the existing Interstate roadways.

The results of the Harland Bartholomew & Associates, Inc., study using 100- foot spans estimated precast "I" girder construction to be the most economical at $39.69/ft^2$. The "spine wing" was next at $40.73, followed by steel plate girders at $42.52. The most expensive was the precast segmental box girder at $49.50/ft^2$. In addition, the segmental box was rated low in the categories of ease of construction, erection over traffic, accommodation of ramps and curves, and future widening.

Discussions with Texas officials indicated three contracts bid to date have resulted in costs per square foot of $19.25 for the first contract, $27.28 for the second and $33.00 for the third. These are only structural costs and do not include contingency and mobilization. These costs are equivalent to $30.80, $43.65, and $52.80, respectively, with these other costs included. The opinion of the Texas officials was that the 71 percent increase in unit cost between the first contract and the third one was due to the fact that the contractors found that the "spine wing" and segmental box construction is more difficult and time consuming than first thought. Furthermore, Texas officials have found AASHTO Type IV girders very competitive for construction. In fact, an 1800-foot-long portion of the "Downtown Y" was bid at $21.42/ft^2$ (again not including mobilization, and contingency) and right-of-way costs which equates to $34.27 with these costs included. In general, Texas statewide averages for AASHTO Type IV and Type 54 construction are about $25.00/ft^2$ without the mobilization and contingency, or $40.00/ft^2$ with the costs.

The Tennessee DOT I-40/I-75/I-640 Project

The Tennessee D.O.T. I-40/I-75/I-640 project consisted of 21 bridges in the Knoxville area. While this project is not a true "double decking", it provides costs for steel plate girder bridges for a large project. The project utilized an integral steel girder concrete pier cap which provided information for this study. In the integral cap, the steel girders pass directly through the pier's concrete cap instead of over the top of it as with conventional methods. The cap is then either conventionally reinforced or pre-stressed to carry the loads. This results in less structure depth and is aesthetically pleasing. Structure costs on this project were $\$58/ft^2$ which includes removal of existing bridges and modifications to others.

The above review of various national projects of a similar nature is provided for comparison purposes.

TRAFFIC DATA

Future year traffic volumes for the study area were obtained from the Department's currently approved EIS. These volumes are comparable to the volumes used in the current Pre-Draft EIS. Previous study volumes used in this evaluation are within 5 to 6 percent $\pm$ of the current EIS volumes.

Use of previous study traffic volumes is preferred in this case study. Since the evaluation of traffic must be conducted on an equal basis to determine lane requirements and corresponding levels of service, it was determined that keeping the original traffic assignments was proper for this report.

Exhibit 4 provides generalized year 2010 traffic assignments for the study area.

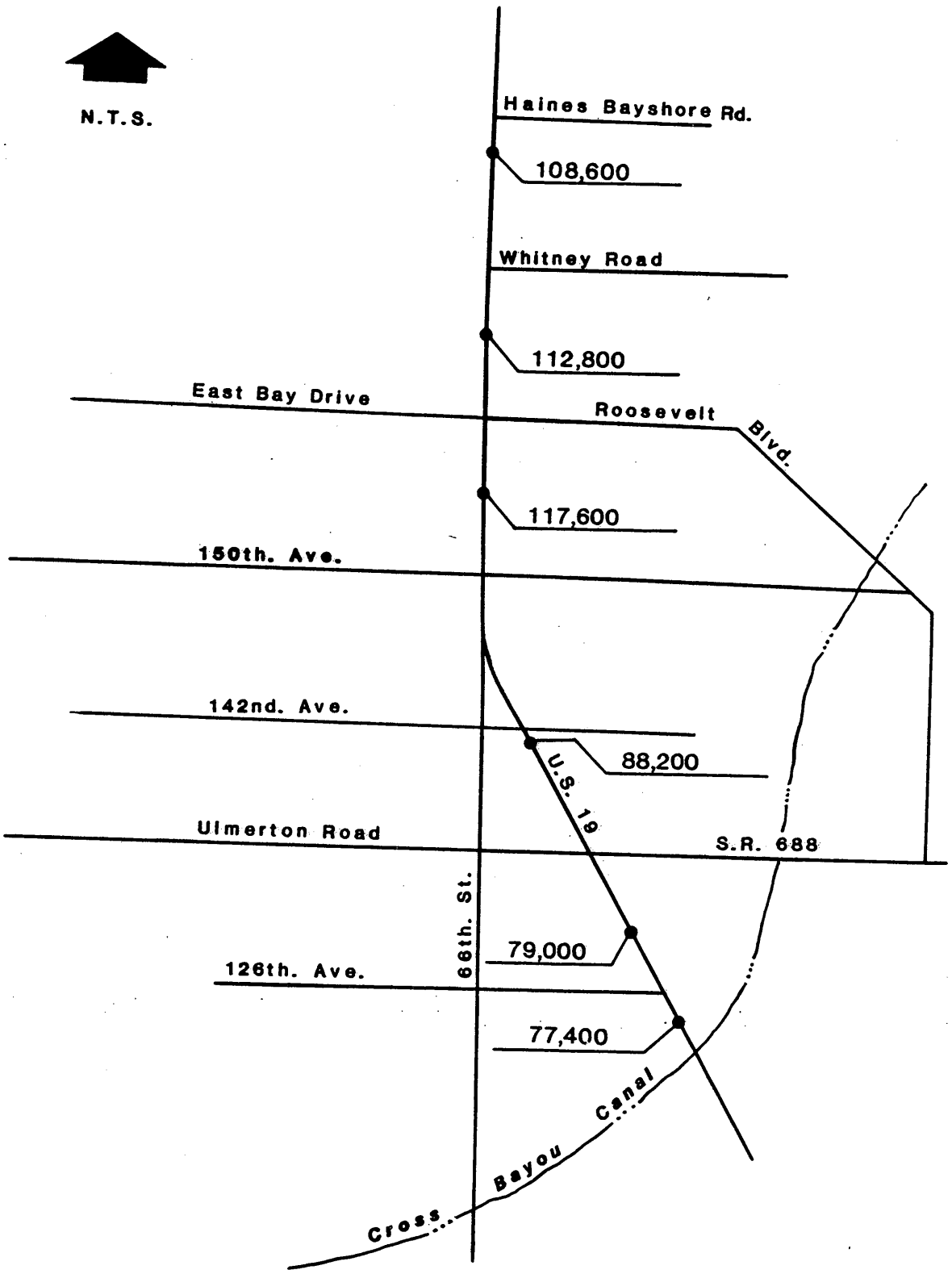
UTILITY DATA

Utility and utility relocation costs were developed from current utility estimates provided by the FDOT for construction projects 15150-3542, 15150-3547 and 15150-3551. These contracts cover the elevated freeway study area. Utility relocation costs were provided for the following utilities:

* General Telephone Company
* Pinellas County Water Department
* City of Clearwater Gas Department
* Florida Power Corporation
* Peoples Gas Systems, Inc.
* Florida Gas Transmission Company
* City of St. Petersburg
* Vision Cable of Pinellas, Inc.
* City of Largo

RIGHT-OF-WAY DATA

Right-of-way was estimated by the FDOT based on estimates of taking provided by Greiner, Inc. The right-of-way costs were based upon recent FDOT settlements and costs associated with current construction.



Greiner Engineering Sciences, Inc.

LEGEND

Data Location

77,400 Year 2010 Daily Volume

U.S. 19 PROJECT DEVELOPMENT AND ENVIRONMENTAL STUDIES

Pinellas and Pasco Counties, Florida

STATE PROJECT NO. 15150-1565

FUTURE TRAFFIC VOLUMES

Florida Department of Transportation

EXHIBIT 4

COSTS DATA

Current FDOT bid tabulations for comparable construction items were inventoried for unit costs of construction for roadways. Structural unit costs were developed from both FDOT bids and research of other data sources throughout the United States. Acceptable industry-wide percentages of costs for design engineering, contingency and construction management were also included in costs. All costs are in 1987 dollars without inflation.

CONCEPT DEVELOPMENT

The goals of the elevated freeway concept are to minimize, to the greatest extent possible, the costs of required right-of-way takings and interruptions to travel within the corridor. Additionally, the concept should minimize reconstruction of the existing U.S. 19 travel lanes and provide an acceptable level of traffic service for the future traveling public. Finally, the concept should maximize property accessibility.

PRELIMINARY STUDIES

Preliminary concepts for the study area were developed initially for the East Bay Drive/ Roosevelt Boulevard interchange only. This initial stage of the evaluation provided background information on ramping connections, profile, intersection geometry, system continuity, and cross corridor access. Further development of the East Bay Drive prototype elevated freeway urban interchange concept was carried forth and used to evaluate potential additional interchange locations suitable for this application. It was assumed for this study that any elevated freeway concept applied to the entire 25-mile-long corridor would have interchange locations similar to those provided in the current freeway study.

The initial elevated freeway concepts, developed at 1"=100' scale photography, were reviewed with FDOT staff for comment. These reviews centered on configuration and traffic operations and did not concentrate on structural alternatives, maintenance of traffic and costs. Structural alternatives are discussed further in the Data Collection and Concept Evaluation sections of this report.

Several preliminary operational schemes were reviewed and preliminary concepts sketched out for the prototype elevated freeway and interchange. These concepts are:

Alternative 1. Elevated freeway within median of U.S. 19 without ramp connections to U.S. 19 at-grade roadway.

Alternative 2. Elevated freeway with ramp connections on "outside" of structures placed within the median of existing U.S. 19.

Alternative 3. Elevated freeway with ramp connections on "inside" of structure placed within the median of existing U.S. 19.

Alternative 4. Elevated freeway with ramp connections from elevated U.S. 19 structure straddle-bent over existing at-grade roadway travel lanes.

The four basic alternatives listed here were examined for compatibility with the study goals and objectives. The conclusions of that evaluation are summarized as follows.

Alternative 1

This is the "purest" form of elevated freeway and would result in the least right-of-way takings. This alternative could be built with no, or minor, right-of-way takings. Interruptions to the existing U.S. 19 travel lanes would be less than other alternatives;

however, U.S. 19 reconstruction and Maintenance of Traffic (MOT) would still be required. Diversion of "long trip" travel (i.e., 5 miles or longer) to the elevated freeway are believed to be significant enough to relieve congestion on the remaining U.S. 19 travel lanes. Without total reconstruction and addition of a significant number of lanes (and more right-of-way takings), the level of service would be unacceptable. Property accessibility to at-grade U.S. 19 would be essentially the same as current conditions; however, since few ramp opportunities to the elevated freeway would be provided, the lack of freeway accessibility off-sets this advantage.

The evaluation of Alternative 1 concluded the concept should not be developed further.

Alternative 2

This concept takes the Alternative 1 plan and adds ramp connections for major interchanges. This concept provides on and off ramps on the outer edge of the freeway and is compatible with the County's adopted plan for U.S. 19. Right-of-way takings are required where each of the ramp connections are located. Since the pier support system (similar to Alternative 1) would require reconstruction of some of the existing U.S. 19 travel lanes, interruptions to travel would occur most significantly at ramp locations. The diversion of traffic to the elevated structure would have to be as high as 57 percent of all travel in the future U.S. 19 corridor to allow the 6-lane U.S. 19 highway to operate at Level of Service (LOS) D on a daily basis. Daily LOS C is the adopted policy of the region and Pinellas County; however, this would probably

not be realistically attainable with the elevated freeway concept. With up to 57 percent of corridor travel diverted to the freeway (and Daily LOS D on the at-grade section), the freeway level of service falls to LOS E (an unacceptable level of service for a four-lane freeway) in the heaviest traveled portions of the corridor. Therefore, a six-lane elevated alternative would be required, along with a substantially wider bridge.

Property accessibility to at-grade U.S. 19 is not dramatically reduced with Alternative 2, however, cross corridor access would be eliminated whenever ramping connections are made to or from the U.S. 19 freeway.

The evaluation of Alternative 2 concluded the concept should be developed further.

Alternative 3

Alternative 3 is functionally similar to Alternative 2 except the ramping connections are placed within the median of the elevated structure. This concept is currently used on Interstate 4 through the CBD of Orlando. The characteristics of Alternative 3 are very similar to Alternative 2 except that the left entry/exit ramps can cause operational problems, especially in proximity to other ramps. Corridor accessibility is the same as Alternative 2. Reconstruction of the existing U.S. 19 roadway would be more extensive than Alternative 2.

Based upon the observed reluctance of federal and state agencies to construct inside entry/exit ramps elsewhere due to operational problems, it was concluded to not develop Alternative 3 further.

Alternative 4

This alternative is commonly referred to as a "straddle-bent" plan, in reference to the structural type used to carry the elevated freeway over the existing roadway. The straddle-bent concept works well in limited application for short distances. This is particularly true when all ramping connections are conducted outside the actual elevated freeway area. The elevated freeway is carried over the top of the existing roadway and is supported by piers placed on the outside of the edges of pavement. Very little right-of-way would be needed for the Alternative 4 concept except where ramps are needed. Complications relating to ramps are extensive. If ramps are placed on the outside of the structure, then a new roadway for local adjacent property access must be constructed parallel to the freeway, or the freeway ramps must be placed on the inside area between the two elevated roadways. Whatever methods are used, significant traffic circulation, local access, and cross-corridor access problems are apparent.

The diversion of trips to the straddle-bent concept, as with each of the other alternatives, would have negative level of service impacts.

Based upon the evaluation, it was concluded that Alternative 4 should not be developed further.

Summary

Alternative 2 was the design concept selected for further evaluation. Each of the other three alternatives were considered to be "fatally flawed" or subject to rejection by specific policy of transportation agencies. Alternative 2 was also felt to represent the least costly alternative overall, while still achieving the study's goals.

CONCEPT EVALUATION

Alternative 2, the selected roadway plan from the Concept Development phase, was used to guide further development of the elevated freeway plan. Conceptual plan evaluations were conducted for key elements, such as structural components, and for general plan elements such as traffic operations. Cost comparisons of significant design components were also evaluated.

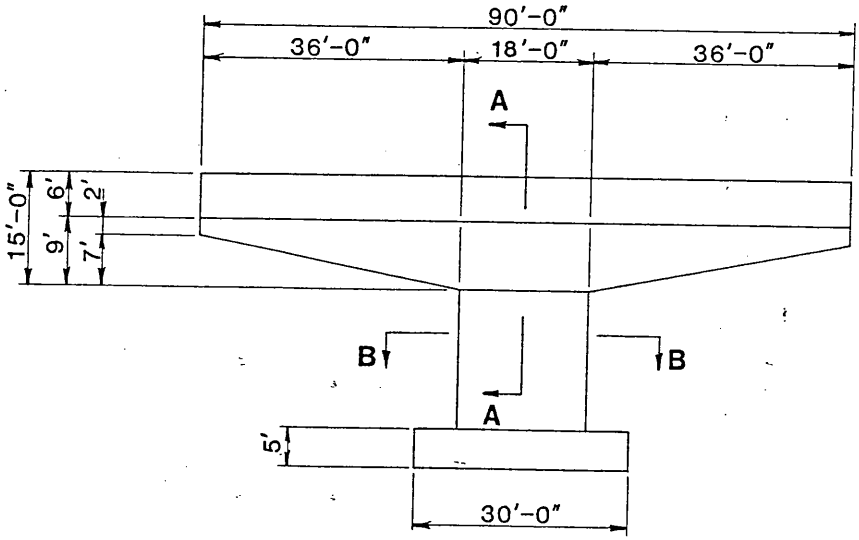
The following factors were evaluated at this stage of the elevated freeway study:

1. Structural and Roadway Design
2. Local Access
3. Traffic Operations
4. Right-of-Way
5. Maintenance of Traffic
6. Construction Costs

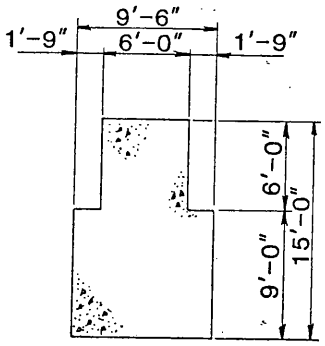
Each of these factors are discussed in this section of the report.

STRUCTURAL AND ROADWAY DESIGN

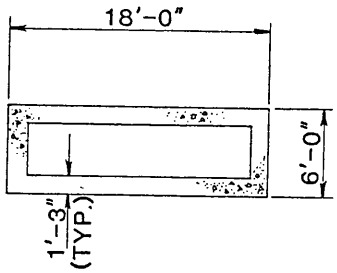
Since the central design elements of the elevated freeway alternative study are the various structures, it was decided to evaluate available structural designs applicable to the U.S. 19 elevated freeway study. This was accomplished with the data collected early in the study, augmented by Greiner's in-house structural design data base.



ELEVATION



SECTION A-A



SECTION B-B

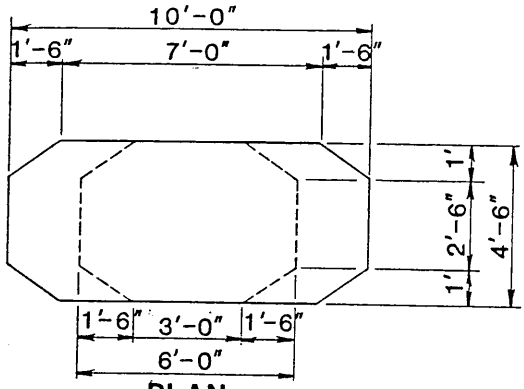
Greiner Engineering Sciences, Inc.

U.S. 19 PROJECT DEVELOPMENT AND ENVIRONMENTAL STUDIES
Pinellas and Pasco Counties, Florida
STATE PROJECT NO. 15150-1565

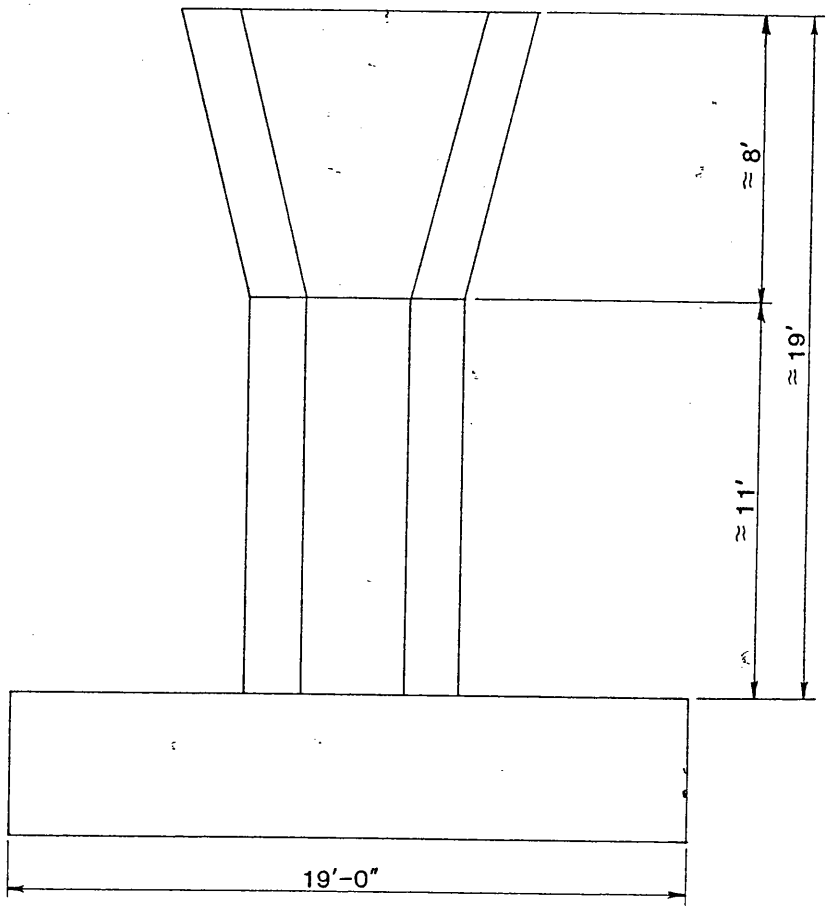
SINGLE COLUMN HAMMER HEAD PIER

Florida Department of Transportation

EXHIBIT 5



PLAN



ELEVATION

Greiner Engineering Sciences, Inc.

U.S. 19 PROJECT DEVELOPMENT AND ENVIRONMENTAL STUDIES
Pinellas and Pasco Counties, Florida
STATE PROJECT NO. 15150-1565

TULIP PIER

Florida Department of Transportation

EXHIBIT 6

In evaluating the elevated structure types, two (2) major factors considered were constructability and maintenance of traffic. With these factors in mind, the following two basic approaches to structural pier placement were evaluated for the previously selected Alternative 2 plan concept (see Concept Development section):

1- Maintain the existing U.S. 19 roadway locations and construct an elevated freeway supported by a structural system within the existing median along U.S. 19. The existing median within these study limits generally varies between 16 and 28 feet. This approach is referenced as the "single median pier" concept.

2- Construct an elevated freeway using a more conventional type substructure and relocate the U.S. 19 roadway toward the outside of the existing pavement. This approach is referenced as the "multiple median pier" concept.

Single Median Piers

The first approach would require detouring U.S. 19 traffic away from the median in order to construct the large single column (Examples of single pier structural systems are provided on Exhibits 5 and 6). Use of these single column pier support systems could be applied in the existing 16- and 28-foot U.S. 19 median.

The single median pier scheme requires a temporary detour of traffic during construction of the footings for the hammerhead piers. The size of the footings are such that they protrude under the roadway. Utilities located in the median must be relocated using this scheme.

Problems also occur at cross road overpasses where ramps are necessary. The extra structure width required for the ramps makes it necessary to use straddle type bents. These bents, in addition to being aesthestically displeasing substantially limit access to businesses fronting on U.S. 19. This condition would also occur with use of retained fill ramp sections. The excavation for the footing (approximately 30'x 24'), plus a safe distance in which to work, requires much more room than is available within the existing median. The ultimate typical section would require a safe horizontal clear distance for the protection of this structural column. Therefore, the proposed minimum median width would appear to be approximately 49 feet (14'0" shoulder - 1'6" barrier - 18'0" column - 1'6" barrier - 14'0" shoulder). This would require quite a large cantilevered section (approximately 36' on each side) to support the 4-lane elevated freeway. Whenever a ramp would be needed, additional structure width would be required and the use of a straddle type bent would be introduced to carry ramp traffic down to grade over U.S. 19 traffic.

The area along U.S. 19 bounded by the limits of the on and off ramps would virtually be denied access to U.S. 19. One solution to this would involve constructing a service road the length of the ramping area which would require additional right-of-way. The existing utilities existing within the U.S. 19 median and other affected areas

would have to be removed and relocated. This approach would also require construction of the elevated freeway with vehicular traffic passing under the cantilevered section throughout. Construction would be difficult, access to site would be impaired, and staging areas would be between pier footings.

Multiple Median Piers

The second approach would be to construct a portion of an ultimate northbound and southbound at-grade U.S. 19 roadway toward the outside of the existing roadway. This portion of new roadway would be utilized for maintenance of traffic while the elevated freeway and remaining portions of U.S. 19 at-grade arterial construction were completed. The existing right-of-way would be adequate for the majority of construction, with all desirable clearances. Limited right-of-way would be required at the nose areas of on and off ramps. The elevated freeway and ramps could be constructed with conventional methods, with the ramps toward the inside travel lanes of the at-grade U.S. 19 roadways.

Adjacent properties would have access at all points. The utilities within the existing median would have to be removed, or could remain between the proposed structure footings, if desired. The elevated freeway could be constructed entirely free of vehicular traffic underneath except for the crossroads. Construction would occur behind temporary concrete barriers approximately 100'± apart allowing access to site and a simpler construction method than the single median pier approach. Maintenance of traffic and construction staging concepts are discussed further in this report.

Pier Evaluation

In evaluating the elevated structure types, consideration was given to maintaining, to the greatest extent possible, the existing roadway and locating piers in the existing median. Relocating the existing roadway within the current right-of-way limits, however, seems to be the most advantageous solution, as discussed in this report. This concept, shown on Exhibits 7, 8 and 9 (and the appended 1"=100' scale preliminary concept drawing) was carried forth.

By relocating the existing roadway and using the multiple column pier concept, the problems of the single median pier scheme are eliminated. Utility relocation effort could be reduced. The new roadway can be constructed and traffic maintained on it during construction of the elevated structure. Ramps can easily be handled using retained earth. In addition, this concept provides a larger staging area because of the increased median.

Structural Costs

Structural costs further support the concept which utilizes the multiple pier concept and relocates the existing roadway within existing right-of-way.

Many AASHTO girder type bridges have been constructed throughout Florida. Based on Greiner's experience and cost data records, it was determined that the optimum span length for Type IV girders is 95 feet. Costs were developed for both the single

column pier (Approach 1) and the multiple column pier (Approach 2). Exhibit 10 shows a typical girder arrangement for the AASHTO Type IV design.

Recently, Florida has utilized the Florida bulb tee girder for construction of highway bridges. Spans longer than those possible with Type IV girders can be obtained, and the bulb tee girders are more cost effective than AASHTO Type V or VI girders. The recently bid I-275 Howard Frankland Bridge in Tampa, Florida resulted in a low bid using Florida bulb tee girders with spans of 143 feet. Exhibit 11 shows a typical arrangement of Florida bulb tee girders in a 140 to 150 foot span. The cost per square foot was $42.41, which was cheaper than the segmental box alternative. Considering that this was construction in and over water, and adjusting the costs for the U.S. 19 location, the unit cost would be about $32.62 per square foot. This compares well with calculations which resulted in $33.00/ft^2 utilizing 140-foot spans.

Segmental box construction lends itself to spans longer than 100 feet. Greiner's study resulted in an optimum span length of 150 feet. In addition, segmental boxes can be modified to span the 210 feet required at urban interchange locations. This results in a bridge that is all segmental box construction and has a pleasing appearance. Because of the width, however, a single column type substructure with a single cell box becomes very expensive and therefore impractical. Two boxes would better apply to the roadway width required for U.S. 19 and thus Approach 2 would be necessary with the two box approach. Exhibit 12 shows a typical two segmental box with 150-foot spans.

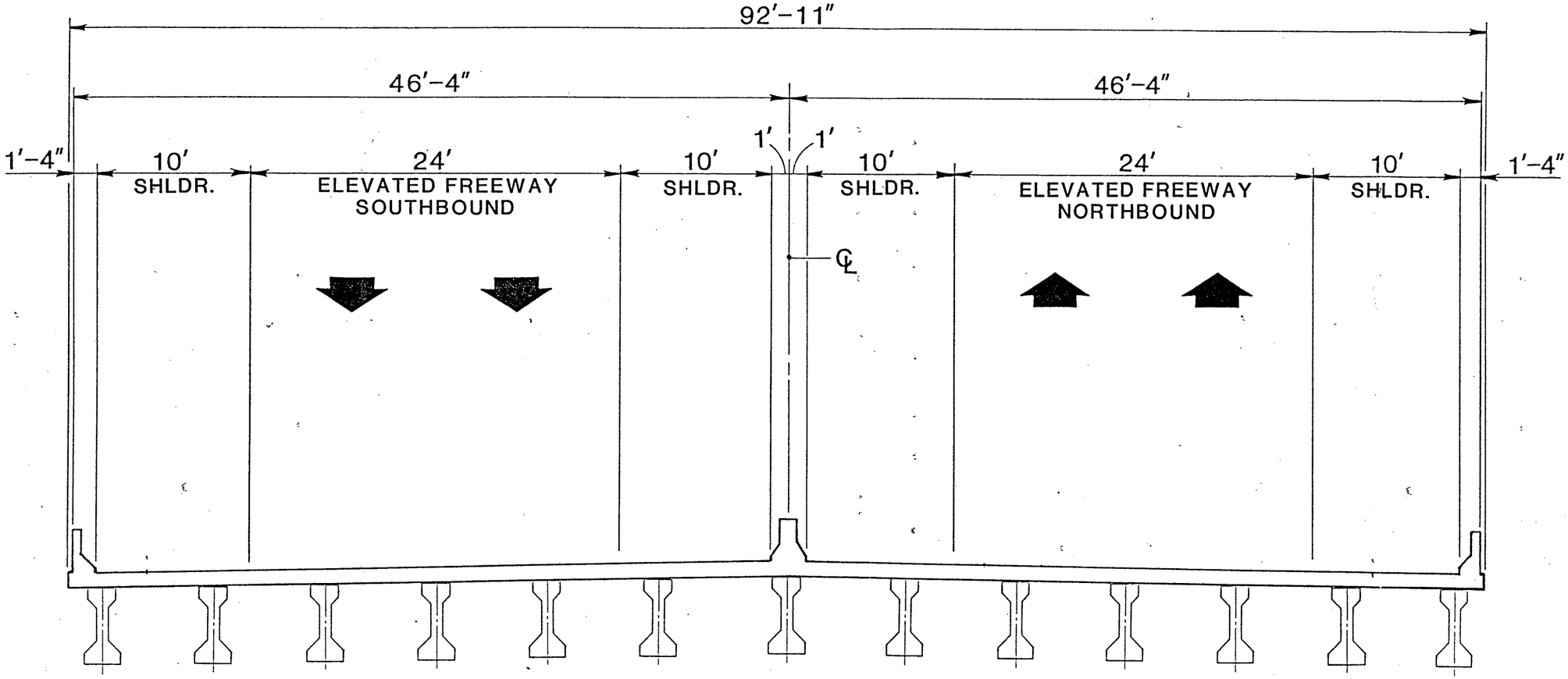
TABLE 1

Structural Approach 1 Costs

Type	Substructure	Superstructure	Total	Cost Rank
AASHTO Type IV @95 ft. Spans	$28.26	$23.74	$52.00	4
Florida Bulb Tee @150 ft. Spans	$21.20	$24.80	$46.00	3
Florida Bulb Tee @140 ft. Spans	$29.20	$24.80	$44.00	1
Segmental Box @150 ft. Spans	(not considered)			
Cellular Structure	(not applicable)			
Spine Wing @100 ft. Spans	$20.02	$33.98	$44.00	2*
Steel Plate Girders @210 ft. Spans	$13.26	$59.74	$73.00	6
Steel Plate Girders @150 ft. Spans	$18.25	$46.05	$64.30	5

Structure Costs ($/ft^2)
Single Column Pier within the Existing Median

* Ranked second due to Construction difficulties.



U.S. 19 PROJECT DEVELOPMENT AND ENVIRONMENTAL STUDIES
Pinellas and Pasco Counties, Florida
STATE PROJECT NO. 15150-1565

TYPE IV AASHTO GIRDER 95 FOOT SPANS

Florida Department of Transportation

EXHIBIT 10

Greiner Engineering Sciences, Inc.

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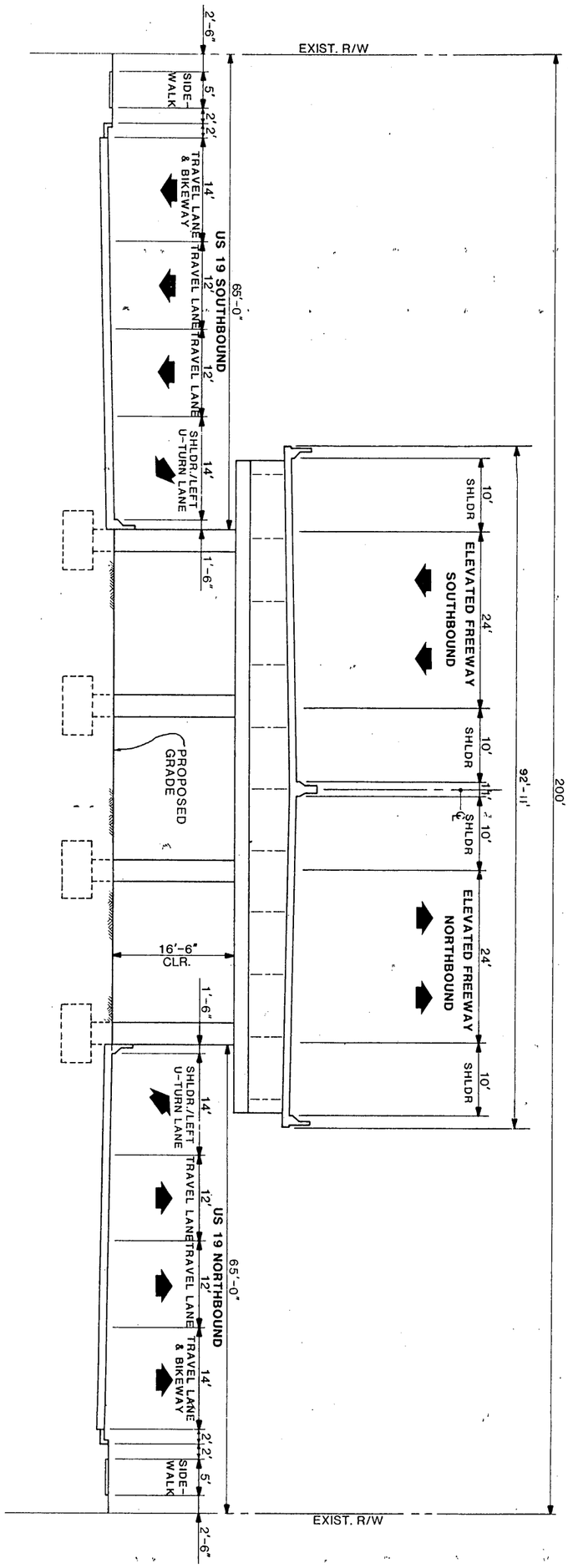

U.S. 19 PROJECT DEVELOPMENT AND ENVIRONMENTAL STUDIES
Pinellas and Pasco Counties, Florida
STATE PROJECT NO. 15150-1565

RECOMMENDED ELEVATED FREEWAY MAINLINE TYPICAL SECTION

Florida Department of Transportation

EXHIBIT 7

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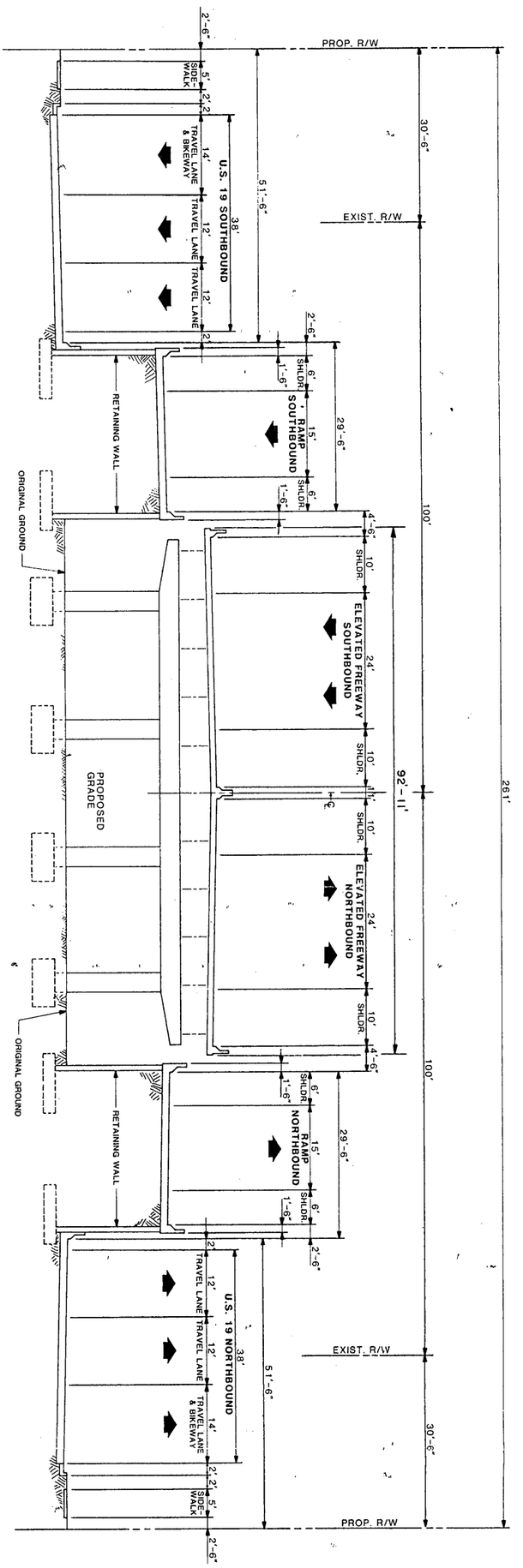
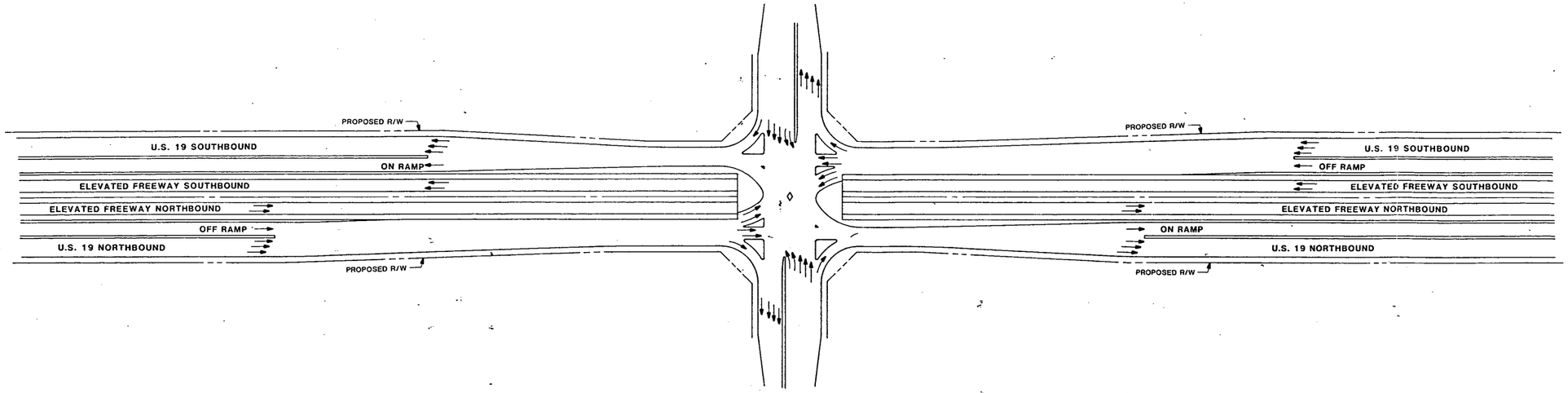


U.S. 19 PROJECT DEVELOPMENT AND ENVIRONMENTAL STUDIES
Pinellas and Pasco Counties, Florida
STATE PROJECT NO. 15150-1565

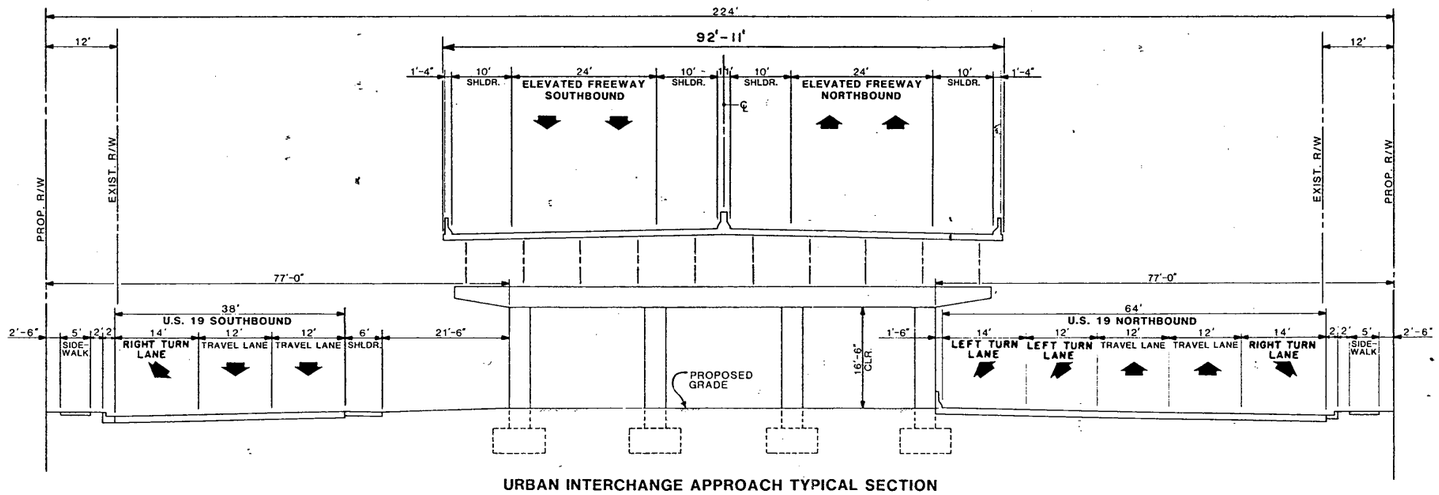
RECOMMENDED ELEVATED FREEWAY RAMPING TYPICAL SECTION

Florida Department of Transportation

EXHIBIT 8



TYPICAL ELEVATED FREEWAY INTERCHANGE PLAN VIEW WITH RAMPS



URBAN INTERCHANGE APPROACH TYPICAL SECTION

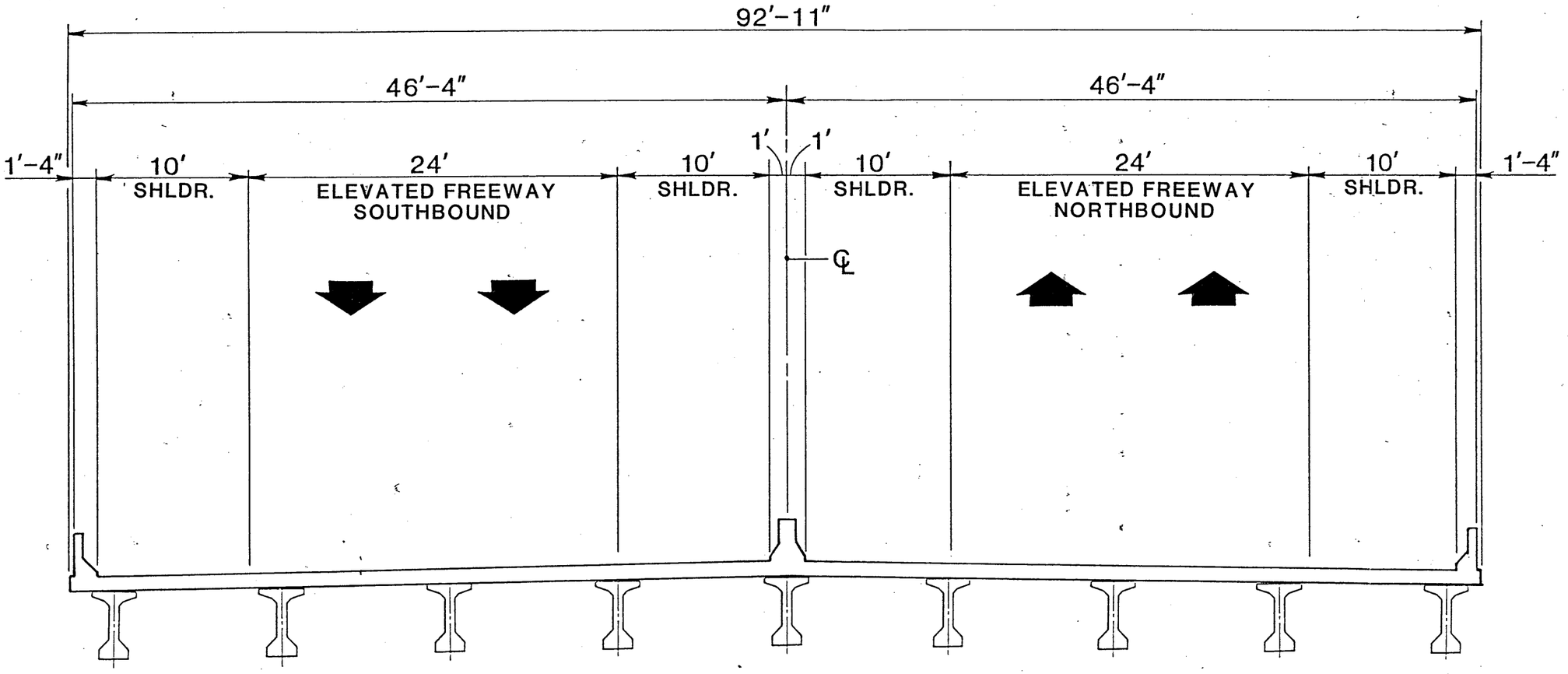
Greiner Engineering Sciences, Inc.

U.S. 19 PROJECT DEVELOPMENT AND ENVIRONMENTAL STUDIES
Pinellas and Pasco Counties, Florida
STATE PROJECT NO. 15150-1565

RECOMMENDED TYPICAL INTERCHANGE PLAN AND ELEVATION VIEWS

Florida Department of Transportation

EXHIBIT 9



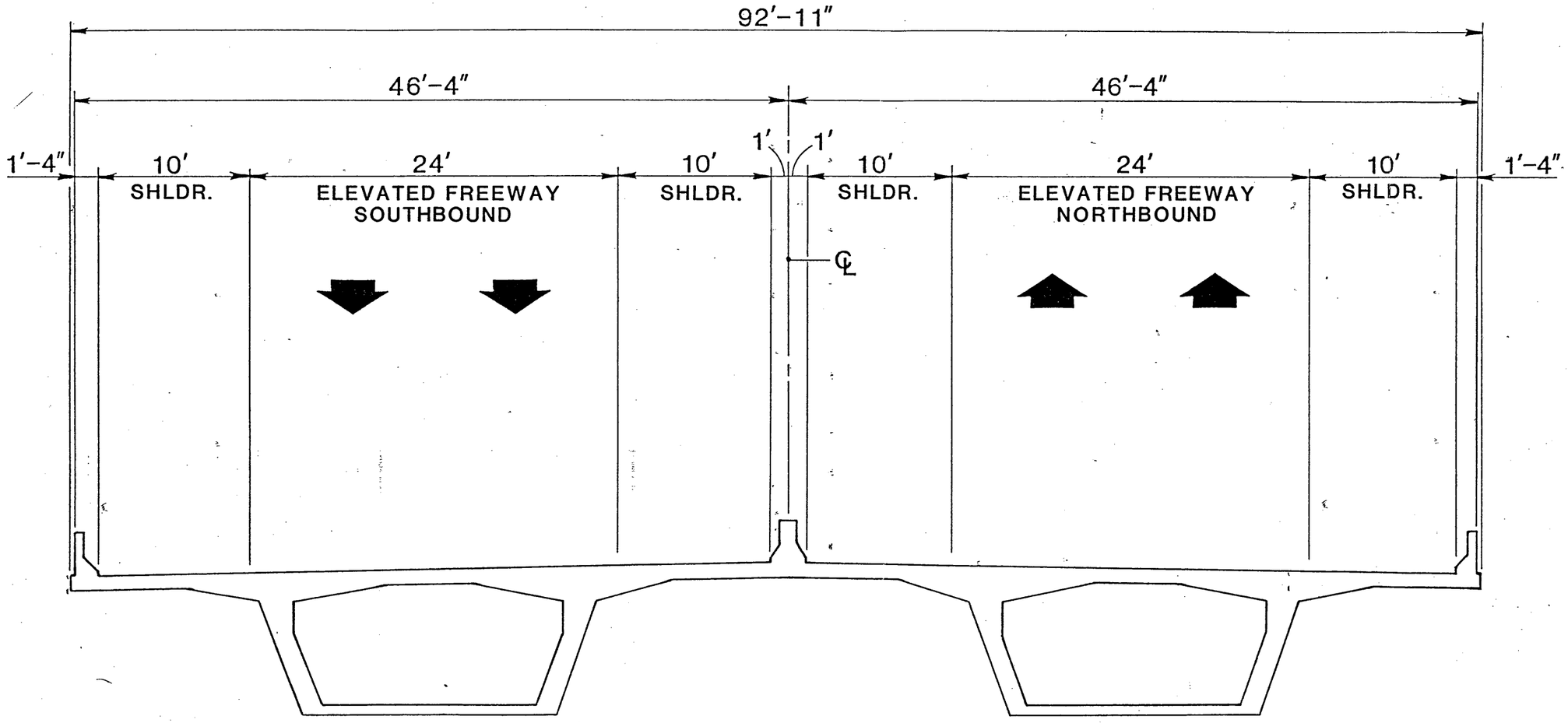
U.S. 19 PROJECT DEVELOPMENT AND ENVIRONMENTAL STUDIES
Pinellas and Pasco Counties, Florida
STATE PROJECT NO. 15150-1565

FLORIDA BULB TEE 140 - 150 FOOT SPANS

Florida Department of Transportation

EXHIBIT 11

Greiner Engineering Sciences, Inc.



U.S. 19 PROJECT DEVELOPMENT AND ENVIRONMENTAL STUDIES
Pinellas and Pasco Counties, Florida
STATE PROJECT NO. 15150–1585

SEGMENTAL BOX 150 FOOT SPANS

Florida Department of Transportation

EXHIBIT 12

Greiner Engineering Sciences, Inc.

TABLE 2

Structural Approach 2 Costs

Type	Substructure	Superstructure	Total	Cost Rank
AASHTO Type IV @95 ft. Spans	$11.26	$23.74	$35.00	3
Florida Bulb Tee @150 ft. Spans	$10.20	$24.80	$35.00	2
Florida Bulb Tee @140 ft. Spans	$ 8.20	$24.80	$33.00	1
Segmental Box @150 ft. Spans	$ 5.75	$40.25	$46.00	4
Cellular Structure	N/A	N/A	$41.00*	
Spine Wing @100 ft. Spans	(not considered)			
Steel Plate Girders @210 ft. Spans	$ 5.26	$59.74	$65.00	6
Steel Plate Girders @150 ft. Spans	$ 7.95	$46.05	$54.00	5

Structure Costs ($/ft^2)
Multiple Column Piers with Relocated U.S.19 Roadway

* Judged unsuitable due to limited cross corridor accessibility.

TABLE 3

Structural Unit Price Summary

SUPERSTRUCTURE CONCRETE	$300.00	CY
PARAPETS	$ 38.00	LF
STRUCTURAL STEEL	$ 0.90	LB
AASHTO TYPE IV GIRDERS	$ 70.00	LF
FLORIDA BULB-TEE GIRDERS	$ 85.00	LF
SUBSTRUCTURE CONCRETE	$275.00	CY
FOOTING CONCRETE	$175.00	CY
REINFORCING STEEL	$ 0.47	LB
18" PFC PILES	$ 28.00	LF

Unit costs taken from current bids

LOCAL ACCESS

The concept developed from the plans shown on Exhibits 7, 8 and 9 provides maximum accessibility for both freeway and U.S. 19 traffic. The issue of local access is two-fold. First, the corridor traveler has a high degree of accessibility whether traveling on the elevated freeway or the local U.S. 19 at-grade roadway. This is due to the use of numerous slip ramps to allow the elevated freeway traveler to reach the at-grade roadway and major cross roads. This concept is similar to the current construction program.

Second, the traveler who desires to cross the elevated freeway roadway and use either direction of the U.S. 19 at-grade roadway is well served by the recommended concept. Trips crossing from east to west, turning left from cross streets, or trips making U-turns and left-turns along U.S. 19 can use the frequent openings in the elevated freeway. The concept recommended in this report provides such openings every 140 to 150 feet, except at ramp locations where profile grade changes reduce vertical clearances below 16.5 feet.

TRAFFIC OPERATIONS

Traffic data was evaluated for the year 2010. These evaluations did not include weaving, merge, diverge or signal analyses. Traffic demand projections of elevated freeway assignments at this stage are intended as an indicator of basic level of service in the corridor and not detailed traffic operations. Therefore, the basic assignments in the entire U.S. 19 corridor were assigned to each of the two roadway components by

a simple process of percentage allocation. Since no detailed model projections of "elevated freeway" versus "at-grade" roadway exist, it can be safely assumed for this level of study that the potential assignment to the elevated freeway component would lie between 20 and 40 percent of the entire corridor assignment.

The three categorical ranges of 20, 30 and 40 percent of travel demand were assigned to the elevated freeway. These values were then tested for the potential link level of service. Conversely, the remaining 80, 70 and 60 percent of total corridor travel demand was placed on the at-grade arterial. For the purpose of this study, the elevated freeway was assumed to be a four-lane freeway with shoulders and a raised median barrier (see Exhibit 7 for this typical section). The at-grade U.S. 19 arterial was assumed to be a minimum six-lane arterial with dedicated left-turn lane for traffic crossing the corridor. Appropriate signalized intersection geometry was assumed at all locations.

Table 4 provides the results of the link level of service analysis under the three assignment scenarios. The results show that the four-lane elevated freeway would operate at no lower than LOS C in the most congested segment. The local arterial, however, would operate at LOS E and F (unsatisfactory) in the 20, 30 and 40 percent scenarios, except for a few links in the 40 percent freeway case.

The analysis indicates that significant traffic must be diverted from the local roadway corridor to achieve a LOS D (minimum acceptable). This further diversion may have to reach as high as 20,000 more vehicles, or the equivalent

TABLE 4
YEAR 2010 U.S. 19 AND ELEVATED FREEWAY
ROADWAY LINK DAILY LEVELS OF SERVICE

Link #	Location	20% Freeway Case[1]				30% Freeway Case[1]				40% Freeway Case[1]			
		Freeway		U.S.19		Freeway		U.S.19		Freeway		U.S.19	
		Volume	LOS[2]	Volume	LOS[2]	Volume	LOS[2]	Volume	LOS[2]	Volume	LOS[2]	Volume	LOS[2]
1	North of Cross Bayou Canal	15,480	A	61,920	F	23,220	A	54,180	E	30,960	B	46,440	D
2	South of SR 688	15,800	A	63,200	F	23,700	A	55,300	E	31,600	B	47,400	D
3	North of SR 688	17,640	A	70,560	F	26,460	A	61,740	F	35,280	B	52,920	E
4	South of SR 686	23,520	A	94,080	F	35,280	B	82,320	F	47,040	C	70,560	F
5	North of SR 686	22,560	A	90,240	F	33,840	B	78,960	F	45,120	C	67,680	F
6	North of Whitney Rd.	21,720	A	86,880	F	32,580	B	76,020	F	43,440	C	65,160	F

[1]Assumes 6 lane U.S. 19 at-grade arterial roadway section with auxiliary turn lanes, and 4-lane freeway elevated above U.S. 19.

[2]Level of Service based on FDOT Generalized Capacities by Facility Type.

4 Lane Freeway - 76,000 ADT
6 Lane Arterial - 55,700 ADT

See Exhibit 4 for link locations

of 57 percent of all travel in the segment south of East Bay Drive to achieve LOS D. This degree of elevated freeway use would potentially require the expansion of the elevated freeway from four to six lanes and dramatically increase the cost of such a facility.

The brief analysis conducted for this study shows that there are serious potential operational problems with the use of an elevated alternative, particularly if the intent is to primarily service trips with high trip lengths. This results in a fairly small diversion and "overloading" of the at-grade facility. Although no specific origin-destination study for U.S. 19 travel in this portion of the corridor has been conducted, a similar portion of U.S. 19 in north Pinellas and Pasco County was surveyed in 1985 and resulted in a 3 to 4 percent of total trips assigned to such a "long trip" category.

RIGHT-OF-WAY

A primary concern of all highway improvement studies is right-of-way takings, relocations, and costs of such actions. Similar concerns were evaluated in this study.

Based upon detailed estimates of specific right-of-way takings by parcel (see appended plan sheets), the FDOT estimated the cost of land for the elevated freeway concept. These right-of-way estimates are based upon actual land takings already conducted by the Department in the study area.

Results of the right-of-way evaluations showed that the elevated freeway alternative takings resulted in a total of $21,200,000. This distributed into the three study segments as follows:

* Study Segment 1 - $ 1,250,000
* Study Segment 2 - $ 8,550,000
* Study Segment 3 - $11,400,000

These costs were significantly lower than the current construction program, which resulted in takings of $28,200,000. Specific square footages and location of takings are provided on the appended plan sheets to this report.

MAINTENANCE OF TRAFFIC AND SEQUENCE OF CONSTRUCTION

Construction of the improvements to U.S. 19, which will include three lanes northbound and three lanes southbound at-grade, two lanes northbound and two lanes southbound elevated, along with ramps and associated retaining walls, will require construction by stages. The following is a brief description of how the elevated freeway improvement could be conducted with minor disruption to traffic. Construction on cross streets can occur within any of the three stages. Exhibits 13, 14 and 15 show schematic sequence of construction and maintenance of traffic for the elevated freeway alternative

Stage 1

First, construction of the outermost 30 feet of pavement northbound and southbound for mainline sections, should occur. Next there should be construction of 42 feet of

pavement to provide two through lanes and a left-turn lane. This construction can be accomplished while traffic remains on the existing roadway with only minor disruption at cross roads and access to properties on U.S. 19. Curb and gutter will be completed on the outside of the roadway while the inside, closest to the existing median, will have a temporary concrete barrier for protection from construction occurring in the median during Stage 2.

Stage 2

Traffic is now traveling on the newpavement constructed during Stage 1. Next, the existing pavement will be removed and the elevated freeway foundations constructed. The elevated freeway will be constructed between the temporary concrete barriers without disruption to the traffic except at cross streets. The elevated freeway ramps and retaining walls will be constructed during this stage.

Stage 3

Traffic is now traveling on the elevated mainline section and Stage 1 at-grade pavement. In the third stage the remainder of U.S. 19 at-grade pavement closest to the median, both northbound and southbound, can be constructed. A portion of the pavement to be constructed in this stage will be situated under the cantilevered elevated freeway. Some disruption of the traffic on the at-grade roadway will occur during this stage.

General

All maintenance of traffic, temporary signing and striping, will be in accordance with the FDOT Manual For Uniform Traffic Control. All utilities which are to be abandoned, adjusted and/or relocated shall be accomplished in that stage which best allows the greatest maintenance of traffic. Permanent signing and sign supports construction can occur within the stage which allows the best opportunity. Necessary temporary drainage measure and the final drainage system will be coordinated and constructed within stages in order to ensure a proper and adequate drainage system throughout the duration of construction.

CONSTRUCTION COSTS

Construction costs were developed for each of the three study segments shown on Exhibit 3. These construction cost estimates are based upon current construction bids developed by the FDOT.

Table 5, 6 and 7 provide details of the cost estimates, including the estimated cost of maintenance of traffic. These costs are not inflated beyond 1987 dollars. Construction costs, shown in Table 5, 6 and 7, do not include utility relocations, design administration, contingency, or construction engineering inspection (CEI) costs.

Table 8 provides a complete cost estimate for all cost elements of the elevated freeway alternative. The total cost for the entire 3.71 mile study

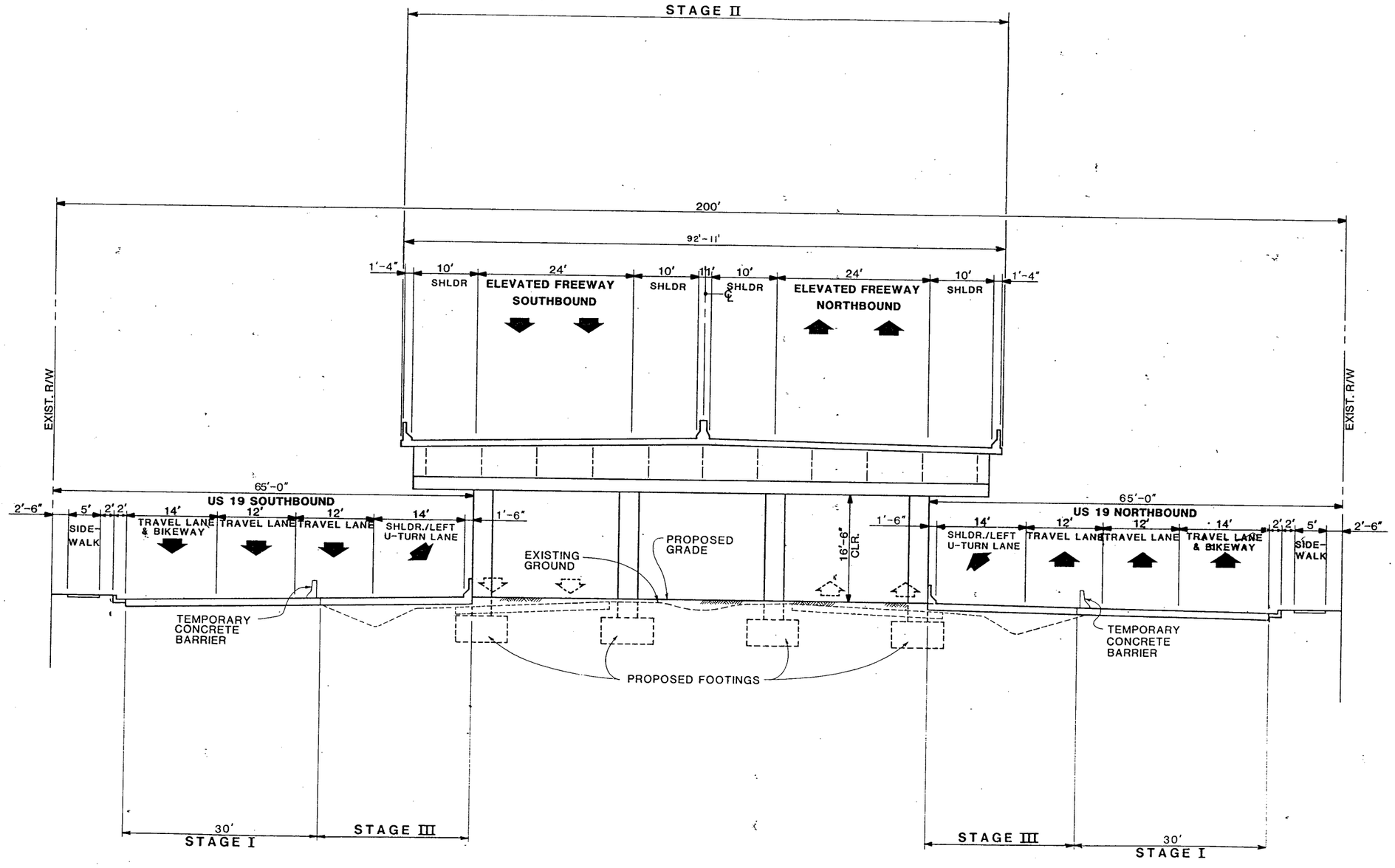
U.S. 19 PROJECT DEVELOPMENT AND ENVIRONMENTAL STUDIES

Pinellas and Pasco Counties, Florida
STATE PROJECT NO. 15150-1565

TYPICAL MAINLINE SECTION SEQUENCE OF CONSTRUCTION MAINTENANCE OF TRAFFIC

Florida Department of Transportation

EXHIBIT 13



Greiner Engineering Sciences, Inc.

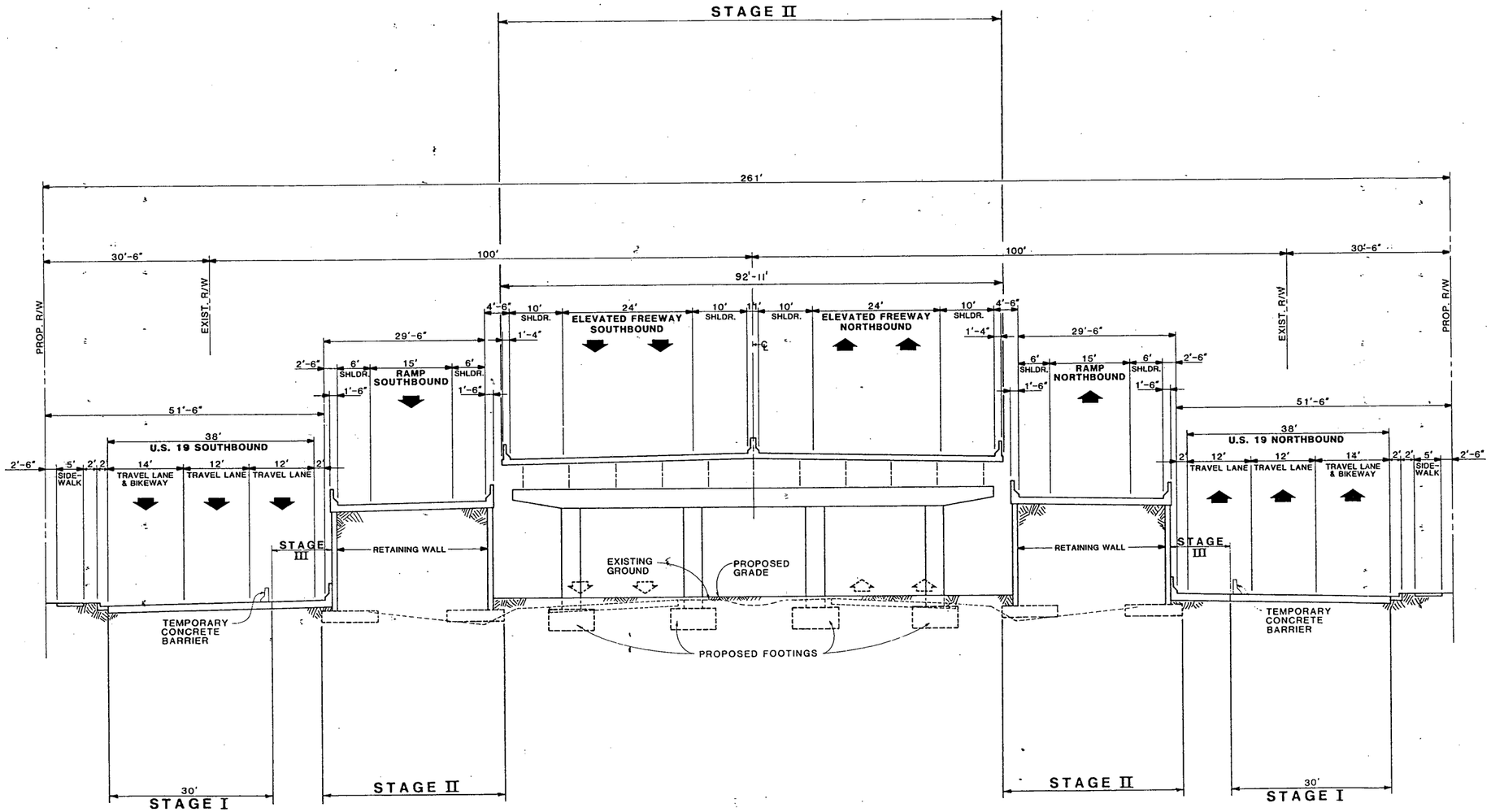
U.S. 19 PROJECT DEVELOPMENT AND ENVIRONMENTAL STUDIES

Pinellas and Pasco Counties, Florida
STATE PROJECT NO. 15150-1565

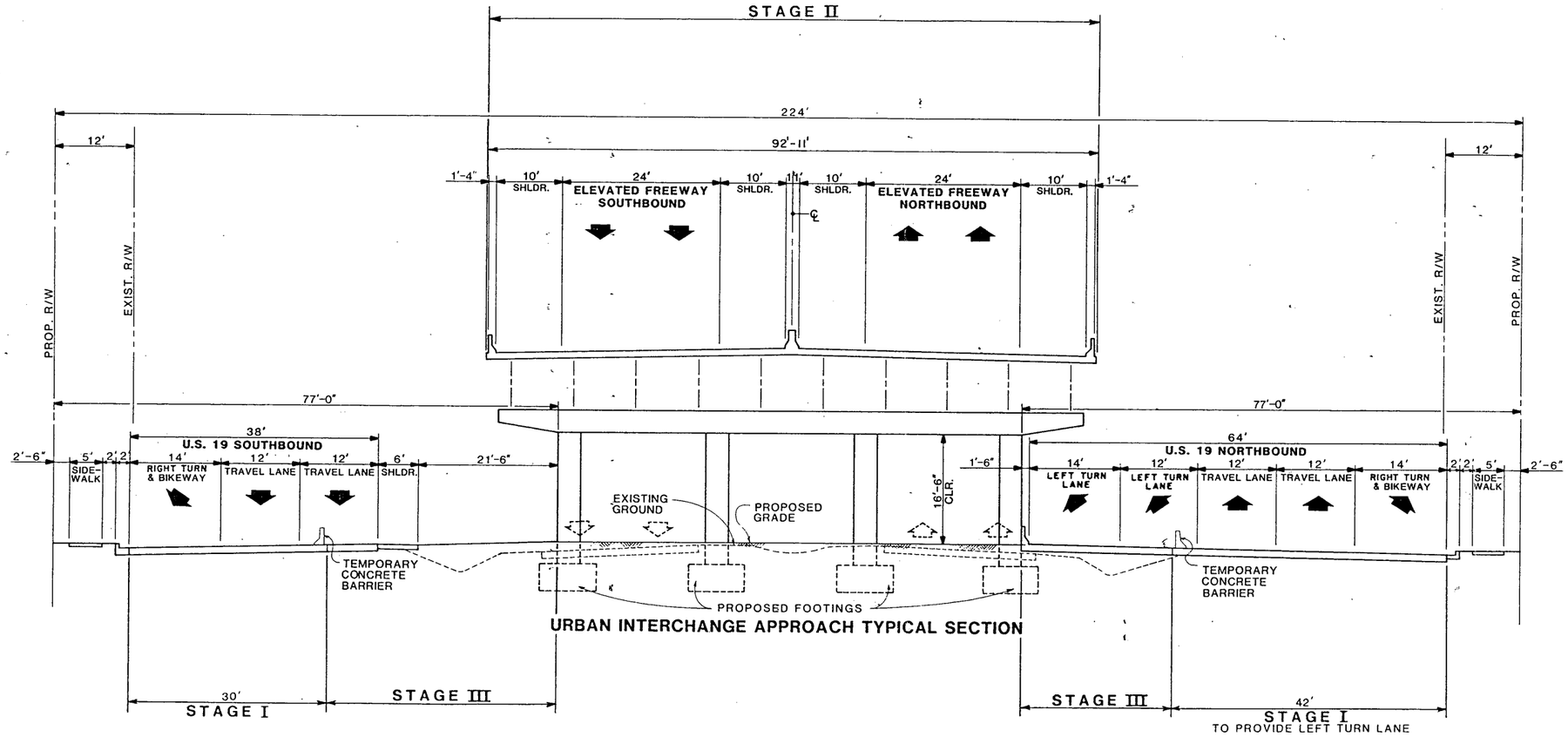
TYPICAL RAMPING SEQUENCE OF CONSTRUCTION MAINTENANCE OF TRAFFIC

Florida Department of Transportation

EXHIBIT 14



Greiner Engineering Sciences, Inc.



URBAN INTERCHANGE APPROACH TYPICAL SECTION

Greiner Engineering Sciences, Inc.

U.S. 19 PROJECT DEVELOPMENT AND ENVIRONMENTAL STUDIES

Pinellas and Pasco Counties, Florida
STATE PROJECT NO. 15150-1565

TYPICAL INTERCHANGE SEQUENCE OF CONSTRUCTION MAINTENANCE OF TRAFFIC

Florida Department of Transportation

EXHIBIT 15

TABLE 5
U.S. 19 Elevated Freeway Study Segment 1
Construction Costs

TOTAL LENGTH 3,725 L.F. or 0.71 MILE[1]	
Typical Section 1 - 2700 x 402.91 =	$ 1,087,857
Typical Section 3 - 1025 x 554.95 =	568,824
Ret.Walls/On-Off Ramps - 2 @ 999,662 =	1,999,324
Lighting @ 400,000/mile x 0.71 =	284,000
Drainage @ 750,000/mile x 0.71 =	532,500
Striping @ 35,000/mile x 0.71 =	24,850
Signing @ 100,000/mile x 0.71 =	71,000
Bridge Structure 3,275 x 92.75 @ 33.00 = Typical (140' spans)	10,023,956
Bridge Structure (3 x 150) x 92.75 @ 35.00 = Underpass or U-Turn	1,460,812
Bridge Structure (1200+575) x $\frac{29+0}{2}$ @ 33.00 = Typical Widening	849,338
Study Segment 1 TOTAL CONSTRUCTION COST	**$16,902,461**
$\frac{\$16,902,461}{0.71 \text{ miles}}$ = **$23,806,283/MILE**	
Maintenance of Traffic	847,539
TOTAL INCL. M.O.T.	**$17,750,000**

[1] See Exhibit 3 for current construction program limits.
Study Segment 1 same length as State Project No. 15150-3551.

TABLE 6
U.S. 19 Elevated Freeway Study Segment 2
Construction Costs

TOTAL LENGTH 8,675 L.F. or 1.64 MILE[1]

Typical Section No. 3 1300 L.F. @ 554.95 = $	721,435
Typical Section No. 2 1000 L.F. @ 402.88 =	402,880
Typical Section No. 3 2300 L.F. @ 554.95 =	1,276,385
Typical Section No. 1 800 L.F. @ 402.91 =	322,328
Typical Section No. 3 2200 L.F. @ 554.95 =	1,220,890
Typical Section No. 2 1075 L.F. @ 402.88 =	433,096
Typical Section No. 1 1000 L.F. @ 402.91 =	402,910
Ret.Walls/On-Off Ramps - 6 @ 999,6662 =	5,997,972
Lighting @ 400,000/mile x 1.64 =	656,000
Drainage @ 750,000/mile x 1.64 =	1,230,000
Striping @ 35,000/mile x 1.64 =	57,400
Signing @ 100,000/mile x 1.64 =	164,000
Bridge Structure (Typical 140'spans) 92.75 x 8175 x 33.00/sf =	25,021,631
Bridge Structure (Underpass U-Turn 150'Spans) 92.75 x 150 x 2 x 35.00/sf =	973,875
Bridge Structure (200' Span Interchange) 92.75 x 210 x 1 x 65.00/sf =	1,266,038
Bridge Structure Widening (1200 + 575) x $\frac{29+0}{2}$ x 3 x 33.00/sf =	2,548,012
Study Segment 2 TOTAL CONSTUCTION COST	**$42,694,852**
$\frac{42,694,852}{1.64 \text{ miles}}$ = $26,033,446/mile	
Maintenance of Traffic	2,135,148
TOTAL INCL. M.O.T.	**$44,830,000**

[1] See Exhibit 3 for current construction program limits.
Study Segment 2 same length as State Project No. 15150-3547.

TABLE 7
U.S. 19 Elevated Freeway Study Segment 3
Construction Costs

TOTAL LENGTH 7,208 L.F. or 1.37 MILE[1]

Typical Section No. 3	400 L.F. @ 554.95 = $	221,980
Typical Section No. 2	2,600 L.F. @ 402.88 =	1,047,488
Typical Section No. 3	1,200 L.F. @ 554.95 =	665,940
Typical Section No. 1	3,008 L.F. @ 402.91 =	1,211,953
Typical Section No. 1	800 L.F. @ 402.91 =	322,328
Ret.Walls/On-Off Ramps 4 @ 999,6662	=	3,998,648
Lighting @ 400,000/mile x 1.37	=	548,000
Drainage @ 750,000/mile x 1.37	=	1,027,500
Striping @ 35,000/mile x 1.37	=	47,950
Signing @ 100,000/mile x 1.37	=	137,000
Bridge Structure (Typical 140'spans) 92.75 x 6,558 @ 33.00/sf	=	20,072,398
Bridge Structure (150'Spans) 92.75 x 150 x 3 @ 35.00/sf	=	1,460,817
Bridge Structure (200' Span) 92.75 x 210 x 1 @ 65.00/sf	=	1,266,038
Bridge Structure (widening) (1200 + 575) x $\frac{29+0}{2}$ x 33.00/sf	=	849,338
Study Segment 3 TOTAL CONSTUCTION COST		**$32,877,373**

$\frac{32,877,373}{1.37 \text{ miles}}$ = $23,998,082/MILE

Maintenance of Traffic	1,642,627
TOTAL INCL. M.O.T.	**$34,520,000**

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[1] See Exhibit 3 for current construction program limits.
Study Segment 2 same length as State Project No. 15150-3547.

area is estimated at $153,873,000. This results in a per mile cost of $41,475,000. The costs include approximately $12,000,000 in ramping costs in addition to the basic structural and roadway construction.

For comparison, a table of estimated current construction program costs was prepared. These costs are presented in Table 9. The total estimated costs of the FDOT's current construction program is $90,907,000. The average cost per mile for these improvements is $24,503,000.

The net difference in proposed construction costs between the elevated freeway and the State's current program is approximately $63 million.

RECOMMENDATIONS

Based upon the information provided in this report, the following recommendations are made:

1. Elevated freeway alternative concepts which provide for limited interchange opportunities should not be considered for implementation in the U.S. 19 corridor. Use of such a concept would not serve the commercial and office land uses of the corridor. In addition, there is no documented demand for long distance through-trips. The elevated freeway concept would require a substantial increase in costs and cause a deterioration in level of traffic service.

2. Implementation of an elevated freeway concept with suitable ramping connections is extremely costly in comparison to a more conventional design, such as the current FDOT construction program, and should not be pursued for the corridor in total.

3. Limited examination of the use of a cantilevered urban interchange bridge to reduce both right-of-way takings and signalized intersection clearance times should be conducted for specific interchange locations with the following characteristics:

   A. Isolation from adjacent major interchanges (up to approximately 3000 to 6000 feet);

B. Costs of adjacent right-of-way are extremely high and off-set higher construction costs;

C. Implementation does not affect overall system accessibility or functioning.

There are three candidate locations for such studies during preliminary (30 percent) design. These locations are the interchanges at Sunset Point Road through NE Coachman Road, S.R. 60, and Belleair Road. Evaluation of the Alternatives should be conducted as competitive designs up to 30 percent plan submittals. Selection of the preferred concept would result from a value engineering study by the Department and the design consultant.

TABLE 8
SUMMARY OF ELEVATED FREEWAY ALTERNATIVE COSTS

STUDY SEGMENT[1]	LOCATION DESCRIPTION	STATION LOCATION	DISTANCE FEET/MILES	CONSTRUCTION COSTS	MOT COSTS	UTILITY COSTS	DESIGN ADMIN. CONT.	CEI	R-O-W COSTS	TOTAL COST	AVG. COST PER MILE
1	South of Cross Bayou Canal to South of Ulmerton Road	Begin 674+00 End 711+25	3,725/0.71	$16,902,461	$ 847,539	$1,282,051	$ 3,368,673	$ 1,903,205	$ 1,250,000	$ 25,553,929	$35,991,449
2	South of Ulmerton Road to North of 150th Avenue	Begin 711+25 End 798+00	8,675/1.64	$42,694,852	$2,135,148	$3,003,432	$ 8,466,517	$ 4,783,343	$ 8,550,000	$ 69,633,292	$42,459,324
3	North of 150th Avenue to Haines Bayshore Road	Begin 798+00 End 870+08.21	7,208/1.37	$32,877,373	$1,642,627	$2,508,998	$ 6,554,132	$ 3,702,900	$11,400,000	$ 58,686,030	$42,836,518
Totals	South of Cross Bayou to Haines Bayshore Road	Begin 674+00 End 870+08.21	19,608/3.71	$92,474,686	$4,625,314	$6,794,481	$18,389,322	$10,389,448	$21,200,000	$153,873,251	$41,475,270

[1]See Exhibit 3 for graphic location of study segments
1987 Dollars

TABLE 9
SUMMARY OF CURRENT FREEWAY CONSTRUCTION PROGRAM COSTS

STUDY SEGMENT[1]	LOCATION DESCRIPTION	STATION LOCATION	DISTANCE FEET/MILES	CONSTRUCTION COSTS	MOT COSTS	UTILITY COSTS	DESIGN ADMIN. CONT.	CEI	R-O-W COSTS	TOTAL COST	AVG. COST PER MILE
1	South of Cross Bayou Canal to South of Ulmerton Road	Begin 674+00 End 711+25	3,725/0.71	$ 6,366,000	$ 335,000	$1,282,000	$1,413,000	$ 658,000	$ 2,300,000	$12,354,000	$17,400,000
2	South of Ulmerton Road to NOrth of 150th Avenue	Begin 711+25 End 798+00	8,675/1.64	$18,229,000	$ 959,000	$3,003,000	$3,928,000	$1,290,000	$10,800,000	$38,209,000	$23,298,000
3	North of 150th Avenue to Haines Bayshore Road	Begin 798+00 End 870+08.21	7,208/1.37	$16,727,000	$ 880,000	$2,509,000	$3,560,000	$1,568,000	$15,100,000	$40,344,000	$29,448,000
Totals	South of Cross Bayou to Haines Bayshore Road	Begin 674+00 End 870+08.21	19,608/3.71	$41,322,000	$2,174,000	$6,794,000	$8,901,000	$3,516,000	$28,200,000	$90,907,000	$24,503,000

[1]See Exhibit 3 for graphic location of study segments
Rounded 1987 Dollars