Bridge Concept Report

Replacement of US 701 Bridges

Over Great Pee Dee River,
Pee Dee Overflow & Yauhannah Lake

Horry/Georgetown Counties, SC

Submitted To:

SCDOT

The South Carolina Department of Transportation

Submitted By:

τβα **Tuhin Basu & Associates, Inc.**

May 3, 2006

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May 3, 2006

Mr. Mike Barbee, PE
Program Manager
SC Department of Transportation
955 Park Street, Room 421
Columbia, SC 29202-0191

**RE: Replacement of US 701 Bridges over Great Pee Dee River,
Pee Dee Overflow and Yauhannah Lake
SC File No. 22.124B, Project No. BR-BR88(044), PIN No. 30688
Bridge Concept Report**

Dear Mr. Barbee:

Enclosed for your review and comments are six (6) copies of the **Bridge Concept Report** prepared for the subject project. The report summarizes the findings of the bridge type, size and layout study and provides recommendations for the preferred bridge type and span arrangement to be used at each structure location.

Should you have any questions, please do not hesitate to call me at 703-447-0082.

Sincerely,

TUHIN BASU & ASSOCIATES, INC.

Tuhin K. Basu, PE
Project Manager

Enclosures

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I. Introduction

A. Project Description

The US 701 Bridge Replacement project consists of the replacement and realignment of an approximately two-mile long section of US 701 located in Georgetown and Horry Counties. The project includes the replacement of the three existing bridges over the Great Pee Dee River, Pee Dee River Overflow and Yauhannah Lake. These existing bridges were built in the early 1950’s and replaced the older bridges constructed circa 1920. Existing US 701 within the project study limits is a two-lane rural undivided highway. The purpose of this project is to replace the existing structurally deteriorated and functionally obsolete US 701 bridges and maintain the principal direct rural connection between the larger towns of Conway and Georgetown, as well as smaller communities such as Bucksport and Yauhannah. During the construction of the replacement bridges and approaches, traffic will be maintained on the existing facilities. These existing bridges will be demolished upon completion of construction. A site location map can be found in Figure 1 of this report.

South Carolina Department of Transportation (SCDOT) has contracted with Tuhin Basu & Associates, Inc. (TBA) to provide engineering design services for this project. As a part of the project conceptual design phase, Tuhin Basu & Associates, Inc. performed a study of conceptual alternative alignments for the US 701 Bridge Replacement project as detailed in the Conceptual Alignment Report submitted to SCDOT on July 19, 2005. The study included the development and evaluation of various alternative new alignments for this project as well as recommendations for the preferred alignment. Based on the design issues, costs, impacts on properties, impacts on wetlands, utility relocations, ease of construction, relocation of the boat landing and other factors associated with each alignment alternative, it was recommended that the project proceed with a new alignment positioned 55 feet downstream from the centerline of existing US 701.

The conceptual design phase of this project culminates with a study of various alternative bridge types for each of the bridge structures. Tuhin Basu & Assoc., Inc. (TBA) has performed a study of conceptual bridge alternatives, bridge types, and bridge layouts for the US 701 Bridge Replacement Project. This **Bridge Concept Report** summarizes the findings of the concept bridge type and layout study and provides recommendations for the preferred bridge type to be used at each structure location.

B. Site Description

The two-mile long project section of US 701 consists of a very rural corridor that is dominated by water bodies, wooded floodplain and forested wetlands. Several residences and a retail gas station are located at the northwestern end of the corridor. Several residences and two small restaurants are located at the southwestern end of the corridor. A public boat landing is located on the Horry County bank of the Great Pee Dee River, directly upstream of the existing bridge. Four abandoned concrete piers from a previous bridge are adjacent to the existing bridge over the Great Pee Dee River on the downstream side. Two of these piers are in the river and one is on each river bank. The Waccamaw National Wildlife Refuge occupies much of the project corridor.

On the Horry County side, most of the project corridor is zoned Commercial Forest/Agricultural (CFA). Small sections of land at the northeastern end are zoned Residential District (MR-4) and Highway Commercial District (HC). The residential portions of the corridor are zoned for single family homes. The project corridor area is not zoned on the Georgetown County side.

A cultural resources survey was performed for this project. The survey confirmed the presence of one previously identified intact site (38GE18) on the Yauhannah Bluff site and located more than 130 feet from the centerline of existing US 701. No significant historic structures were recorded and no significant underwater resources were identified.

Most of the corridor traverses the Waccamaw National Wildlife Refuge. In this corridor, the Wildlife Refuge is predominantly forested wetland. The 22-acres Yauhannah Bluff property near the Georgetown County end of the project has been recently acquired by the Waccamaw National Wildlife Refuge as the new site for a visitor center. There will be a direct access to the visitor center from US 701.

C. Description of Existing Bridges

The existing US 701 corridor in the proposed project area has three bridges connected by roadways on embankment fills. The bridge over Yauhannah Lake is located in Georgetown County and is 1,440 feet long. The bridge consists of 48 spans, with each span approximately 30 feet long, comprised of concrete T-Beams supported on concrete bents. The bridge has a 26 feet wide clear roadway with a 2’-6” wide sidewalk on each side. The entire bridge is on a 0% longitudinal grade.

The bridge over the Great Pee Dee River has a total length of 1,603 feet, and consists of both steel and concrete spans supported on concrete substructure units. The approach span unit at each end of the bridge is comprised of a 12 span, simply supported, concrete T-Beam unit with equal span lengths of 30'-0". A four span continuous steel girder superstructure approach span unit flanks both sides of the bridge main span with a span arrangement of 71'-0", 90'-0", 90'-0" and 72'-0". The original main span for this bridge was comprised of a 176'-6" long steel thru-truss supported by concrete piers. This main span was replaced in 1996 with a three span unit having span lengths of 30'-9", 115'-0" and 30'-9". The center span of this new unit consists of a steel girder superstructure supported by drilled shafts and both exterior spans of this unit are comprised of a concrete flat slab superstructure. The entire bridge has a clear roadway width of 26 feet with a 2’-6” wide sidewalk on each side. The bridge is in a crest vertical curve with a maximum longitudinal grade of 3.5%.

The bridge over the Pee Dee River Overflow in Horry County is a 44 span concrete T-Beam bridge supported by concrete bents with equal span lengths of 30'-0". The bridge has an overall length of 1,320 feet and has a clear roadway width of 26 feet with a 2’-6” wide sidewalk on each side. The entire bridge is on a 0% longitudinal grade.

The roadway carrying US 701 between these bridges is supported on embankment fills with a maximum fill height of about 20 feet. The roadways in the embankment areas are on 0% longitudinal grades with normal cross slopes of 2.08% from the roadway crown.

In general, the existing facilities are narrow, structurally deficient and functionally inadequate for carrying the US 701 traffic under the current highway standards. The proposed replacement facilities will feature a cost-effective design with appropriate considerations to the environment, safety and ease of construction.

D. Subsurface Conditions

A conceptual geotechnical exploration of the project site was performed by S&ME, Inc. (S&ME) under subcontract to Tuhin Basu & Associates, Inc. The purpose of the conceptual phase exploration was to characterize and provide information about the on-site subsurface soils based upon the borings and soundings conducted. The information obtained was used to provide preliminary recommendations for the proposed construction including their potential suitability for foundation support and their relative suitability for use as structural fill. A total of 5 soil test borings, and 3 electronic cone penetrometer (CPT) soundings were obtained throughout the project site. The three CPT soundings were subsequently re-drilled as soil test borings after CPT tools refused at depths of 30 to 64 feet. The results of the conceptual geotechnical investigations and recommendations are included in the "Report of Conceptual Phase Geotechnical Exploration for the US 701 Bridge Replacements over Great Pee Dee River, Pee Dee Overflow and Yauhannah Lake" prepared by S&ME and dated May 17, 2005. This report includes: a description of observed site conditions; methods and results of field tests and sampling; laboratory tests of recovered samples; and, an assessment of the soil properties as they relate to design issues.

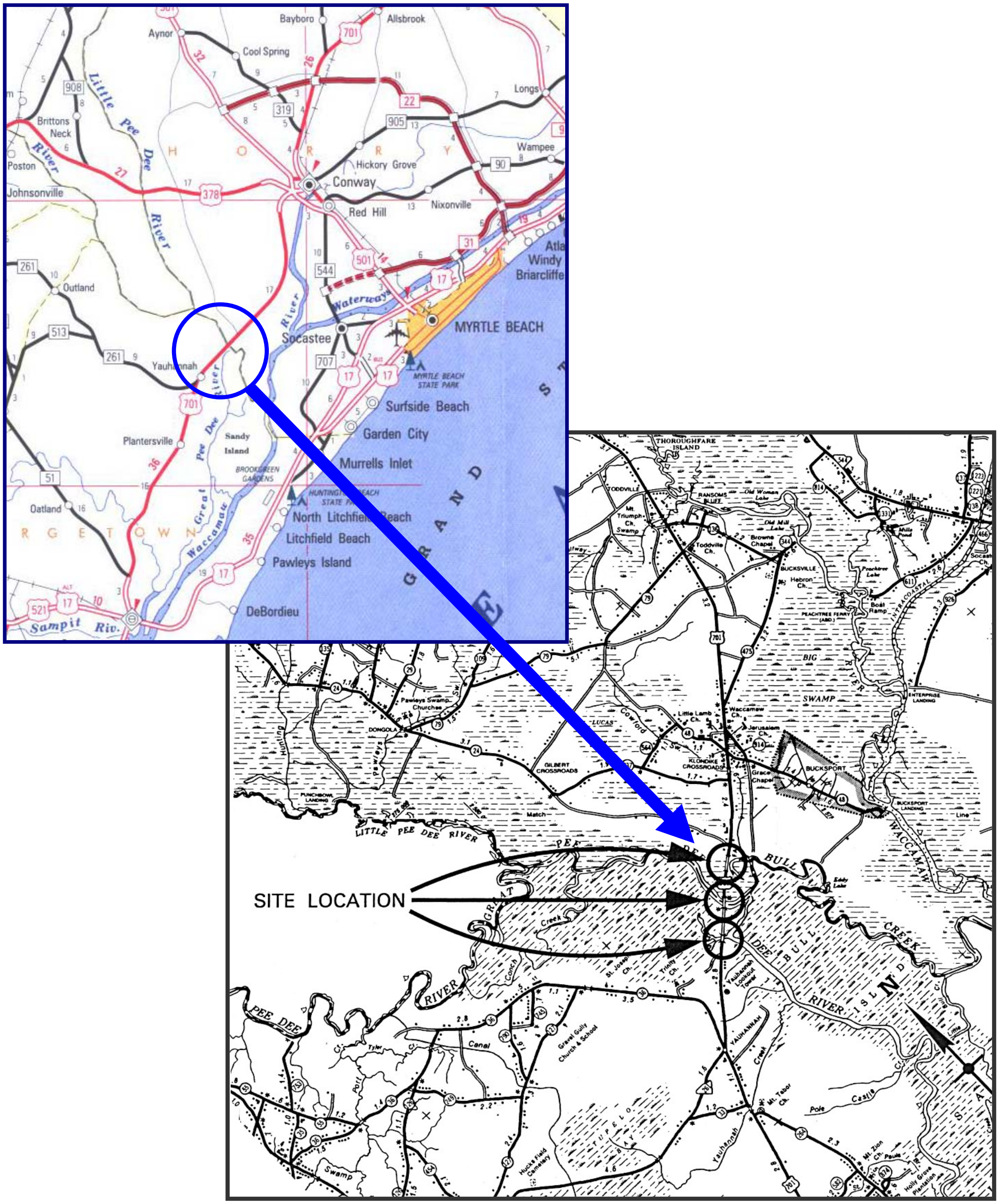


Figure 1. Site Location Map

II. Design Parameters

The conceptual bridge design study was performed in accordance with the "Project Criteria Document" (PCD) dated November 18, 2004 and prepared by Tuhin Basu & Associates, Inc. (TBA), and based on discussions with South Carolina Department of Transportation (SCDOT). The following is a summary of the design criteria used during the conceptual design phase of this project.

A. Design Specifications

The conceptual design of the US 701 Bridge Replacement Project was performed in accordance with the following primary design and construction specifications:

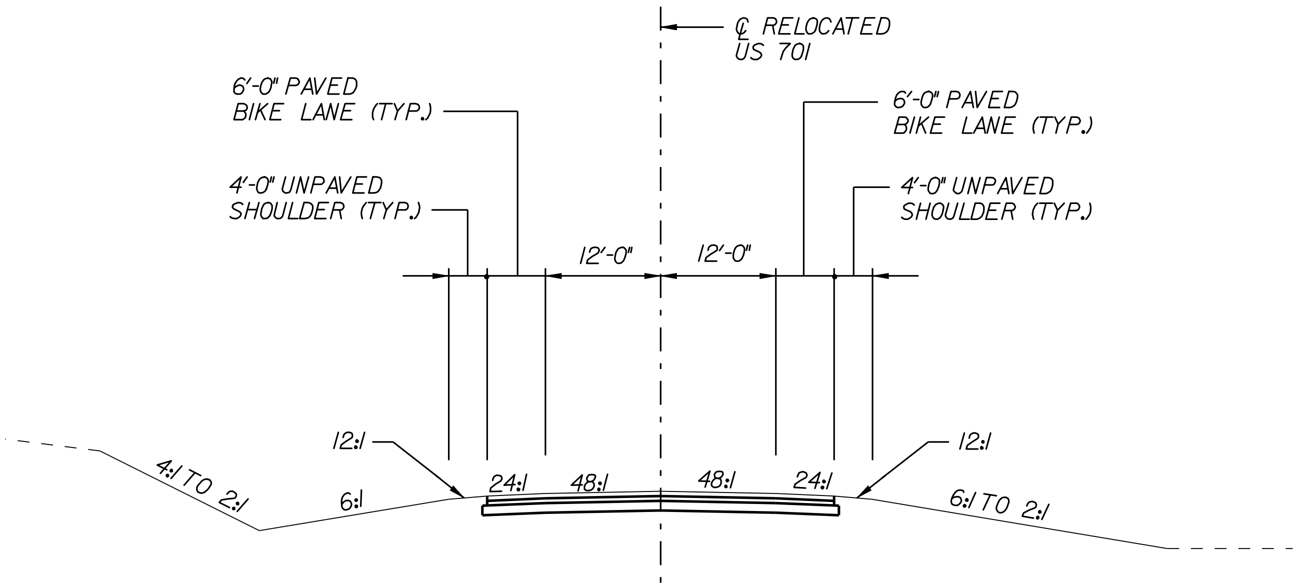
1. AASHTO LRFD Bridge Design Specifications, Third Edition, 2004 with interims thru 2006, by the American Association of State Highway and Transportation Officials (AASHTO).
2. Guide Specifications for Distribution of Loads for Highway Bridges, 1994, by AASHTO.
3. Guide Specifications for Thermal Effects in Concrete Bridge Superstructures, 1989, by AASHTO.
4. Bridge Welding Code: AASHTO-AWS-D1.5M-D1.5, An American National Standard, ANSI/AASHTO/AWS, 2002, with 2003 interim revisions.
5. A Policy on Geometric Design of Highways and Streets, Fifth Edition, 2004, by AASHTO.
6. SCDOT Standard Specifications for Highway Construction, 2000, SCDOT as modified by supplemental specifications.
7. Highway Design Manual, 2003, SCDOT including revisions thru 2004.
8. Roadway and Bridge Design Standard, SCDOT.
9. Bridge Design Memorandums, SCDOT
10. Standard Design Drawings and Details for Highway Bridges, SCDOT.
11. Seismic Design Specifications for Highway Bridges, 2001, SCDOT, including Interim Revisions thru 2003.
12. Requirements for Hydraulic Design Studies, May 14, 2000, SCDOT.

B. Highway Design Criteria

The highway design criteria for the proposed US 701 Bridge Replacement Project are presented in Table 1. Typical roadway and bridge cross sections are shown in Figures 2 and 3, respectively.

Table 1. Highway Design Parameters

Design Element				Design Criteria
Design Controls	Classification			Rural Arterial
	Design Speed			60 mph
	Grades	Maximum		3.0%
		Minimum		0.5%
	Vertical Curves	"K" – Crest		151
		"K" – Sag		136
	Horizontal Curve	Minimum Radius		1205'
	Maximum Superelevation Rate			8.0%
Cross Section Elements	Travel Lane Width			12'
	Shoulder Width	Total Width		10'
		Paved Bike Lane Width		6'
		Unpaved Shoulder Width		4'
Roadway Slopes	Cross Slope	Travel Lane		2.08%
		Paved Bike Lane		4.17%
		Unpaved Shoulder		8.33%
	Side Slopes	Cut Section	Foreslope	6H:1V
			Ditch Type	V-Ditch
			Back Slope	4H:1V to 2H:1V
		Fill Section	0' – 5'	6H:1V
			5' – 10'	4H:1V
			> 10'	2H:1V
Bridges	New Bridges	Clear Roadway Width		44'
		Out-to Out Bridge Width		47'
		Structure Capacity		HL-93



TYPICAL SECTION

SCALE: 1" = 20'-0"

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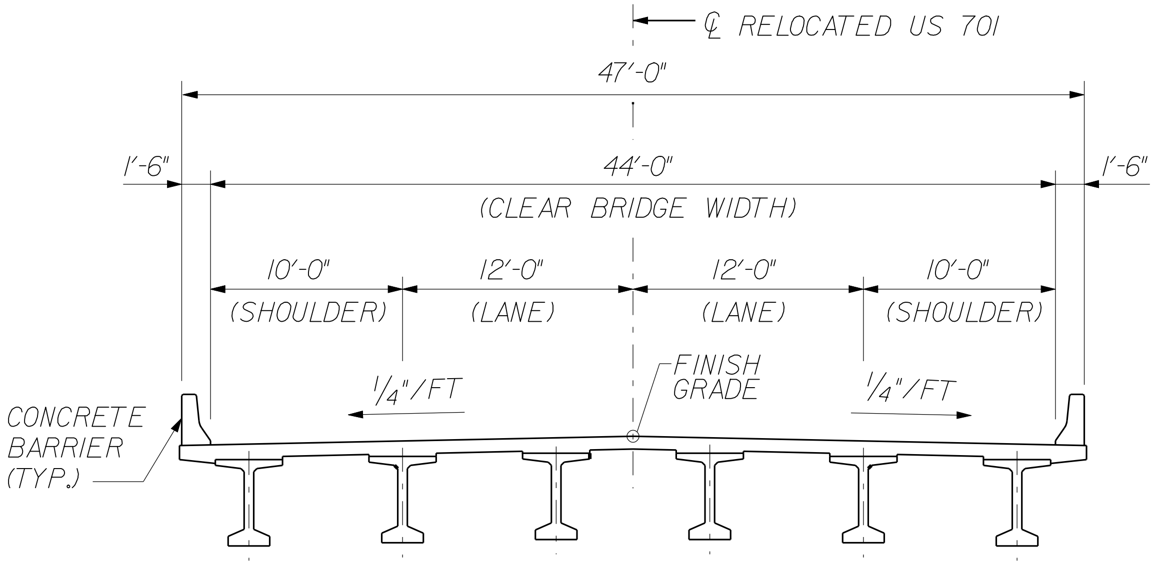
REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& YAUHANNAH LAKE

HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

TYPICAL ROADWAY SECTION

FIGURE 2



TYPICAL SECTION

SCALE: 1" = 10'-0"

SCDOT
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& YAUHANNAH LAKE

HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

TYPICAL BRIDGE SECTION

FIGURE 3

C. Survey/Topographic Controls

Survey of the existing site for the conceptual study was prepared by B.P. Barber & Associates, Inc., under contract to Tuhin Basu & Associates, Inc. for the project. Aerial mapping and field survey was performed for a 300-foot width along the centerline of existing US 701 from Trinity Road at the south end of the project to Lucas Bay Road at the north end of the project. The survey and aerial mapping was based on the following controls:

- Horizontal Control: SC State Plane Coordinates NAD 83 (86 adjustment) Datum
- Vertical Control: National Geodetic Vertical Datum (NGVD) 1988

D. Hydrology Data

The conceptual bridge design is based on the following estimated hydrologic data:

Discharge Area (D.A.) =	14,700	sq. mi. =	9,408,000 ac.
Discharge (Q_{50}) =	112,000	cfs	
50 Year W.S. Elev. =	14.8	feet	
Discharge (Q_{100}) =	125,000	cfs	
100 Year W.S. Elev. =	15.9	feet	
Discharge (Q_{500}) =	159,000	cfs	
500 Year W.S. Elev. =	18.7	feet	

In accordance with the SCDOT Requirements of Hydraulic Design Study, the design discharge for this project site is based on the 50-year flood event. Final computed hydrologic data including the results of the scour investigation and overtopping flood data will be determined during the preliminary design phase of the project.

E. Navigational Clearances

The Great Pee Dee River has been classified as navigable, although in the vicinity of US 701 the river is predominately used by small pleasure crafts. The only section of the river that is considered commercially navigable is significantly to the south of US 701 near the City of Georgetown.

There are no established guidelines for the navigational clearances on this part of the river and therefore, it is recommended that the new replacement bridge provide clearances generally equal to the clearances provided by the existing US 701 bridges. The following navigational clearances have been considered for the Great Pee Dee River Bridge on the US 701 bridge replacement project:

Minimum Vertical Clearance = 35 feet
Minimum Horizontal Clearance = 100 feet

Additionally, in accordance with the SCDOT Requirements of Hydraulic Design Study, the bridges will provide the following minimum freeboard above the design high water level (i.e., 50 year flood event):

Bridge	Freeboard
Yauhannah Lake	4.0 feet
Great Pee Dee River	7.0 feet
Pee Dee Overflow	4.0 feet

F. Bridge Design Criteria

The following is a summary of the design criteria used to perform the conceptual bridge design for the US 701 Bridge Replacement Project.

1. Design Loads

- The AASHTO HL-93 standard live loading.
- The design loading includes 15 lb/sf allowance for future wearing surface.

2. Seismic Design Loads

- The bridges were designed in accordance with SCDOT – Seismic Design Specifications and Bridge Design Memorandums.
- The bridges are considered "normal" bridges and Importance Classification III structures as defined by SCDOT – Seismic Design Specifications for Highway Bridges.
- Due to the presence of deep deposits of liquefiable soils in the soil profile, the Great Pee Dee River Bridge and the Pee Dee Overflow Bridge sites are considered to be Site Class F. S&ME performed a site specific evaluation of the seismic response at these locations using time history provided by the SCDOT geotechnical group for geologically realistic site conditions. The SEE S_{DS} and S_{D1} values were calculated to be 0.79g and 0.29g, respectively.
- It is questionable whether the liquefiable soils present throughout most of the project site also extend into the Yauhannah Lake bridge. At this time, based on boring data and shear wave velocity profiles, the Yauhannah Lake Bridge site has been classified as Site Class D. SEE spectral response accelerations for Ss and S_1 were provided by SCDOT for Geologically Realistic Site Conditions. For the provided spectral response values, the SEE S_{DS} and S_{D1} values were calculated to be 0.64g and 0.42g, respectively. The site class for the Yauhannah Lake bridge will be confirmed during the final geotechnical exploration for the project site.

3. Materials

a.	Structural Steel	AASHTO M270 Grade 50
b.	Cast-in-Place Concrete	Class 4000, $f'_c = 4000$ psi Class 4000 DS, $f'_c = 4000$ psi
c.	Precast Concrete	$f'_c = 5000$ psi through 8000 psi
d.	Reinforcing Steel	AASHTO M31 Grade 60

4. Superstructure Design

All superstructure elements were designed using the Load and Resistance Factor Design Method (LRFD) with live load deflections limited to L/1000. Continuous span girders were designed to act compositely with the deck slab in the positive moment regions and with the reinforcing steel in the negative moment regions.

Precast prestressed concrete superstructures were designed using the CONSPAN computer software by Leap, Inc., a computer program used for the design of precast girders made continuous for live load with mild reinforcing. The girders were designed for a HL-93 live load and $0.0948(f'_c)^{1/2}$ tension in the concrete (i.e., bottom of the beams at mid-span) under final stress conditions. Concrete strengths of 5000, 6000, 7000 and 8000 psi at 28 days were considered in the superstructure design. Composite action was assumed in both the positive and negative moment regions.

Steel plate girder superstructures were designed by use of Merlin Dash and MDX computer programs developed by the BEST Center and MDX software, Inc., respectively.

Concrete deck design has been performed using hand calculations and spreadsheets. A 28-day concrete strength of 4000 psi has been assumed for the bridge decks. The use of stay-in-place forms has been considered in this project.

5. Substructure Design

All substructure elements were designed using the Load and Resistance Factor Design Method (LRFD). Pier columns were designed to resist biaxial bending. A 28-day concrete strength of 4,000 psi was used in the design of the substructure units.

G. Foundation Design

Based on the geotechnical recommendations contained in the Conceptual Phase Geotechnical Report prepared by S&ME, Inc., drilled shafts are considered to be the preferred foundation option for the substructure units on this project due to presence of liquefiable sands or soft clays up to 40 feet deep over much of the flood plain. The use of pile bent type substructures for the intermediate piers was not considered feasible since the piles would be essentially unsupported over lengths approaching 50 feet. The drilled shafts have the advantage of providing substantial lateral load capacity under seismic loads. The viability of using driven piles for the foundation in the end bents of each bridge will be investigated during the preliminary design phase of the project.

Generally, the drilled shaft size, required capacity and shaft lengths were dictated by the estimated loads based on the structure span length, superstructure type, and the substructure unit height above the existing ground line or stream bed. Six foot diameter drilled shafts have typically been considered for the structures, with the exception being the main span unit for the Great Pee Dee River Bridge, where seven foot diameter shafts have been considered.

III. Conceptual Bridge Alternatives

A. Introduction

The major factors that influenced the development of concepts for the US 701 Replacement Bridges over Yauhannah Lake, the Great Pee Dee River and the Pee Dee Overflow were the freeboard and clearance requirements, minimizing the embankment fill heights, constructability, long term durability, future maintenance requirements and initial construction costs. Towards this end, a series of investigations were performed to determine the most economical span arrangement for each of the bridges. Generally, two alternatives utilizing concrete and steel materials with alternative span arrangements have been considered for each structure. Due to the size and cost of the Great Pee Dee River Bridge, a third alternative was added that included a combination of both steel and concrete materials.

B. Design Considerations

The following is a brief discussion of the design issues considered in the development of the bridge concepts and alternatives investigated for each structure during the bridge concept design phase of the US 701 Bridge Replacement Project. A layout of the bridge alternatives investigated, typical bridge cross sections, and substructure details can be found in Section VI of this report.

- All bridge concepts developed are based on Alignment Alternative 3 (preferred alignment) and associated geometrics as presented in the Conceptual Alignment Report submitted to SCDOT on July 19, 2005. This alignment is positioned 55 feet downstream of existing US 701, measured from the centerline of the existing roadway to the centerline of the new roadway. Minor modifications have been made to the vertical profile of Relocated US 701 during the preliminary roadway design phase of the project. These modifications are reflected in each of the alternatives presented in this bridge concept report. A general plan and profile of Relocated US 701 and the associated geometrics can be found in Figures 5 through 10 contained in Section VI of this report.
- Alignment Alternative 3 (preferred alignment) provides a constant clear distance of 4'-9" between the existing bridges and the new bridges. This distance is considered sufficient to construct the new bridges and permit the safe operation of US 701 during construction. The clear distance also ensures that the battered piles from the existing structure will not conflict with the foundation for the proposed structures. A typical section of the existing and new bridges is shown in Figure 4 located in Section VI of this report.
- The maximum height of the roadway embankment fill adjacent to the proposed bridges has been limited to 22 to 25 feet, measured from the existing ground line to the profile grade line, although typically, the embankment height through most the roadway fill

sections is limited to 22 feet. This limitation was established to minimize impacts on the wetland areas, assist in addressing liquefaction concerns of subsurface soils and to facilitate roadway construction. In establishing the embankment height, the existing ground elevation was evaluated not only at the centerline of the new alignment, but also at the toe of the proposed embankment slope. The embankment height measured at the centerline of Relocated US 701 generally yielded a slightly lower value then the height measured at the toe of the slope because the proposed centerline intersects a portion of the existing roadway embankment slope. The embankment height limitation influences the end of bridge location as well as the available structural depth for each of the structures.

The above design considerations were utilized to develop the bridge concepts for the replacement of the US 701 bridges over the Great Pee Dee River, Pee Dee Overflow and Yauhannah Lake.

C. Bridge Type Studies

A series of investigations were performed to determine the most cost efficient bridge type and span arrangement for each of the replacement structures on the US 701 project. The bridge type studies were limited to multi-beam systems utilizing concrete and/or steel materials. The first step in the study was to identify the viable superstructure types for a variety of span arrangements. This information was then utilized to develop the substructure types and sizes. Finally, a comparative cost analysis was performed to determine the most effective combination of superstructure and substructure for each structure based on the relative height of the structure. The following summarizes the general study performed during the conceptual design phase of the US 701 project.

1. Concrete Superstructure Alternatives

The study for the concrete superstructure alternative considers the use of precast, prestressed concrete girders made continuous for live load supporting a cast-in-place slab. A variety of prestressed girder types, girder spacings and span lengths were investigated as part of this study. All superstructures investigated at this stage of the study were based on four span continuous units. The span lengths that were investigated as part of this study are as follows:

- 70 foot spans
- 80 foot spans
- 90 foot spans
- 100 foot spans
- 110 foot spans
- 120 foot spans
- 130 foot spans
- 140 foot spans

The following three girders spacings were investigated for each span length: 6 girders spaced at 8'-0" on centers; 5 girders spaced at 10'-0" on centers; and, 4 girders spaced at 12'-6" on centers. The following prestressed concrete girder types were examined:

- AASHTO Type III
- AASHTO Type IV
- AASHTO Type V
- AASHTO Type VI
- BT-54
- BT-63
- BT-65
- BT-72
- BT-78

A cost evaluation was performed on a per linear foot basis for a variety of girder types and girder spacing combinations. This evaluation considered additional cost factors such as concrete strength requirements, prestressing strand requirements, number of girders, deck thickness, and deck reinforcing requirements. Based on this cost evaluation, the following superstructure configuration was considered most cost effective for each of the span lengths investigated:

Span Length	Girder Type	Number of Girders	Concrete Strength (psi)	Deck Thickness (in.)
70'	BT-54	5	6000	8
80'	BT-54	5	8000	8
90'	BT-63	5	7000	8
100'	BT-65	5	7000	8
110'	AASHTO Type V	5	7000	8
120'	BT-78	4	8000	9
130'	BT-78	4	8000	9
140'	BT-78	5	8000	8

Following the completion of the superstructure evaluation, an investigation was performed to determine the appropriate substructure configuration, drilled shaft size and drilled shaft length for the anticipated loading and seismic conditions. As indicated in Section II-G of this report, drilled shafts are the preferred foundation option for the substructure on this bridge replacement project. Based on the conceptual substructure design, substructure units comprised of two column bents founded on 6-foot diameter drilled shafts were generally the most suitable for each of the bridges. The exception to this is the main span unit over the Great Pee Dee River, where the use of two column bents founded on 7-foot diameter drilled shafts has been assumed. The size of the bent cap beam and bent column varied depending on the span length and anticipated loads. Load calculations were prepared to estimate the drilled shaft lengths and tip elevations for each of the span lengths and superstructure types investigated. Drilled shaft capacities as a function of the shaft embedment were obtained from the Conceptual Geotechnical Report and were used to determine the required shaft embedment lengths.

The final step of the concrete alternative study included a cost analysis to determine the appropriate superstructure configuration, span arrangement and substructure for each bridge based on the structure height (measured from the profile grade line to the ground line). This cost evaluation, performed on a cost per linear foot basis, combines the cost of the superstructure and substructure for each of the span arrangements and superstructure types investigated. Generally, as the span length increases, the superstructure cost increases and the substructure cost decreases. The results of this cost analysis were used to determine the most cost effective structure type utilizing prestressed concrete girders and span arrangement for each bridge.

2. Steel Superstructure Alternatives

The steel alternative considered for each structure consists of a continuous steel plate girder superstructure supporting a cast-in-place concrete deck. Generally, the goal of this alternative was to reduce the number of substructure units required by use of longer span lengths. For comparison purposes, the same structural length developed for the concrete alternative at each bridge site was also used for the steel alternative study. The superstructure cross section for each bridge utilizes five lines of steel plate girders spaced at 10 foot on centers and were designed considering a steel strength of 50 ksi. The span arrangement for the steel alternative was proportioned to achieve efficiency in the continuous steel girder section.

Similar to the concrete superstructure alternative, the substructure for the steel alternative generally consists of two column bents founded on 6-foot diameter drilled shafts. The main span unit over the Great Pee Dee River is the exception, where two column bents founded on 7-foot diameter drilled shafts has been assumed. The embedment lengths and resulting tip elevations for the drilled shafts were determined based on load calculations and use of the shaft capacities contained in the Conceptual Geotechnical Report.

D. Yauhannah Lake Bridge

1. Layout Considerations

The main factors influencing the layout of the Yauhannah Lake Bridge was the location of the southern bank of Yauhannah Lake, the location of the channel, superstructure depth limitation, freeboard requirements and the embankment fill height limitation at the north end of the structure. The top of the southern channel bank is located at approximately Sta. 120+50 and the embankment height at Sta. 135+00 is approximately 22 feet above the existing ground line. Based on the profile in the area of the Yauhannah Lake Bridge and the freeboard requirements, the maximum structural depth available is approximately 6.4 feet.

As previously mentioned, span length versus structure height (top of slab to top of ground) studies were performed to achieve the most economically efficient span arrangement. To facilitate a direct comparison between the steel and concrete alternatives, the same structure length was considered for both alternatives. The span arrangements and typical sections for both alternatives investigated for this structure are shown in Figures 11 – 13 contained in Section VI of this report.

2. Yauhannah Lake Bridge Alternative A

Alternative A for the Yauhannah Lake Bridge considers the use of precast, prestressed concrete girders made continuous for live load supporting a cast-in-place slab. Continuous span lengths ranging from 70 feet to 100 feet were considered for the Yauhannah Lake Bridge. Based on the comparative cost evaluation, the most cost efficient span length for this structure is between 80 feet to 90 feet.

The final span arrangement for Alternative A was dictated by the location of the Yauhannah Lake channel, the location of the southern bank and the preferred transition to embankment locations. It also was desirable to have one of the spans centered about the deepest part of the channel. Based on these constraints, a span length of 85 feet was considered appropriate. Beginning from the south and proceeding towards the north, Alternative A for the bridge consists of a 9 span continuous prestressed concrete unit followed by an 8 span continuous prestressed concrete unit with each span having a length of 85 feet. The bridge has a total length of 1450 feet and all substructure units are oriented normal to the centerline of Relocated US 701. All substructure units for the Yauhannah Lake Bridge consist of two column bents founded on 6-foot diameter drilled shafts.

It was also determined based on the proposed profile grade line that a superstructure containing a BT-63 or BT-65 girder in this bridge would not pass the 500 year storm. Therefore, a superstructure comprised of 6 lines of BT-54 beams spaced at 8-feet on centers is recommended for this alternative.

3. Yauhannah Lake Bridge Alternative B

Alternative B consists of a continuous steel plate girder superstructure supporting a cast-in-place concrete deck. As previously mentioned, the same structural length developed for Alternative A (concrete alternative) was also used for Alternative B. The superstructure consists of five steel girders spaced at 10 foot on centers. The resulting span arrangement for this alternative consists of two–5 span continuous units, each having span lengths of 121'-3"-160'-160'-160'-121-3".

Similar to Alternative A, the substructure for this alternative consists of two column bents founded on 6-foot diameter drilled shafts with the bents oriented normal to the US 701 centerline.

E. Great Pee Dee River Bridge

1. Layout Considerations

The main factors influencing the layout of the Great Pee Dee River Bridge were the location of the channel, the location of the existing piers from the 1920's bridge, navigational clearance requirements, the proposed bridge profile, superstructure depth limitation, freeboard requirements and the embankment fill height limitation at the ends of the structure. Two of the existing piers from the 1920's bridge remain in the channel and two of the existing piers are located on the river banks. The existing piers, comprised of reinforced concrete shafts supported by a timber pile footing, are spaced at 176'-6"on centers and are centered about Sta. 157+42. Based on the construction plans for the existing bridge, the timber piles are not battered. It is assumed that only the portion of the existing 1920's piers above the mud line will be removed during the construction of the new Great Pee Dee River Bridge. Hence, the location of all piers and span arrangements investigated for the new bridge will be positioned to avoid conflict with the existing piers.

The beginning and ending location of the Great Pee Dee River Bridge is largely dictated by the maximum preferred embankment height. A preferred embankment height of 25 feet (slightly larger than the Yauhannah Lake Bridge embankment) was considered acceptable for this bridge since the profile grade (3.0%) descends rapidly away from the bridge. The embankment height of 25 feet occurs near Sta. 146+25 at the south end of the structure and near 170+50 at the north end of the structure. Based on the profile grade in the area of the Great Pee Dee River Bridge and the freeboard requirements, the maximum structural depth available is approximately 7.5 feet.

In general, span length versus structure height studies were performed for several alternatives to arrive at the most economically efficient span arrangement. The three superstructure alternatives considered during the study included a concrete superstructure, steel superstructure and a combined concrete and steel superstructure. The same structure length was considered for all alternatives investigated to facilitate the direct comparison between the alternatives. This was achieved by establishing the bridge limits based the concrete alternative, and using the same structural length for the other two alternatives. Figures 14 through 19 in Section VI of the report illustrate the span arrangements and typical sections for each of the alternatives investigated for this structure.

2. Great Pee Dee River Bridge – Alternative A

a. Main Span Unit (Alternative A)

Alternative A for the Great Pee Dee River Bridge considers the use of precast, prestressed concrete girders made continuous for live load supporting a cast-in-place slab. The location of the proposed main span unit piers were influenced by the location of the existing 1920's piers which are spaced at 176'-6" on centers. Span lengths greater than the existing pier spacing is beyond the structural limits of conventional prestressed concrete girders. Additionally, there should be sufficient clearance between the existing pier and the new foundation to facilitate the construction of the new foundations. The foundation of the existing pier is approximately 13'-0" wide according to the original construction plans. Hence, it was determined that the maximum span length for the new bridge utilizing prestressed girders would be 130'-0". This span length would result in a clearance of 13'-9" between the existing pier foundation and the proposed bridge foundation assuming 7 foot diameter drilled shafts.

Continuous span lengths ranging from 100 feet to 130 feet were considered for the main span unit of the Great Pee Dee River Bridge. Based on the comparative cost evaluation, the most efficient span length utilizing prestressed concrete girders on the main span unit of this structure is between 125 feet to 135 feet. The final span arrangement selected for the main span unit of Alternative A consists of a 7 span continuous unit with each span having a length of 130 feet, resulting in a total unit length of 910 feet. All bents of the main span unit are oriented normal to the centerline of US 701. The superstructure for this alternative is comprised of 4 lines of BT-78 prestressed concrete beams spaced at 12'-6" on centers.

Due to the span length, all substructure units for Alternative A of the Great Pee Dee River Bridge main span unit are comprised of two column bents founded on 7-foot diameter drilled shafts. All substructure units for the main span are oriented normal to the centerline of US 701.

b. Approach Span Units (Alternative A)

Similar to the main span unit, Alternative A for the approach span units consists of precast, prestressed concrete girders made continuous for live load supporting a cast-in-place slab. Continuous span lengths ranging from 80 feet to 120 feet were considered for this portion of the Great Pee Dee River Bridge. Based on the cost evaluation, the most cost efficient span length for this structure is between 90 feet to 105 feet.

The final span arrangement for Alternative A of the Great Pee Dee Approach Spans was largely determined by the end of the main span unit and the transition to the preferred embankment height location. Based on these constraints, a span length of approximately 95 feet has been selected at both approach sections of the Great Pee Dee River Bridge. The superstructures of both approaches are comprised of 5 lines of BT-65 girders spaced at 10'-0" on centers. The span arrangements for the approach units are as follows:

- South Unit: 7 spans at 95'-0" = 665'-0"
- North Unit: 9 spans at 95'-0" = 855'-0"

All substructure units for the approach spans of the Great Pee Dee River Bridge consist of two column bents supported by 6-foot diameter drilled shafts with the centerline of bent normal to the bridge centerline.

3. Great Pee Dee River Bridge – Alternative B

a. Main Span Unit (Alternative B)

Alternative B for the main span unit of the Great Pee Dee River Bridge consists of a continuous steel plate girder superstructure supporting a cast-in-place concrete deck. Similar to the evaluation of Alternative A for the main span, the location of the proposed main span unit piers was influenced by the location of the existing 1920's piers. To achieve the goal of minimizing substructure units via the use of longer span lengths, a main span length of 220 feet was recommended. This would position the new piers to the outside of the existing piers and provide a larger opening. The proposed span length results in a clearance of 11'-9" between the existing pier foundation and the proposed bridge foundation assuming the use of 7-foot diameter drilled shafts.

The superstructure consists of five steel girders spaced at 10'-0" on centers. To balance the main span length of 220 feet, a five span continuous unit having span lengths of 175'-220'-220'-220'-175' was selected. The unit has a total length of 1010 feet.

Similar to Alternative A for the main span unit, all substructure units for this alternative consist of two column bents founded on 7-foot diameter drilled shafts. All substructure units are oriented normal to the US 701 centerline.

b. Approach Span Units (Alternative B)

Similar to the main span unit for Alternative B, the approach span units also are comprised of a continuous steel plate girder superstructure supporting a cast-in-place deck. As previously mentioned for comparison purposes, the length of Alternative B is the same as Alternative A. Therefore, the lengths of the north and south approach span units for this alternative are dictated by the length and location of the main span unit for Alternative B and the beginning and end of bridge locations based on Alternative A for the Great Pee Dee River Bridge. The resulting length of the south and north approach span units are 615 feet and 805 feet, respectively. The span arrangement and span lengths selected for the two units are as follows:

- South Unit: 5 Span Unit – 105'-135'-135'-135'-105'
- North Unit: 6 Span Unit – 112.5'-145'-145'-145'-145'-112.5'

The superstructure for this alternative is comprised of five steel girders spaced at 10'-0" on centers and all substructure units consist of two column bents supporting 6-foot diameter drilled shafts.

4. Great Pee Dee River Bridge – Alternative C

Alternative C for the Great Pee Dee River Bridge is comprised of a combination of both Alternative A and Alternative B. The main span unit for this alternative is identical to the main span unit presented in Alternative B. Specifically, the unit has five continuous spans with span lengths of 175'-220'-220'-220'-175' resulting in a total length of 1010 feet. The superstructure for the main span unit is comprised of five steel girders spaced at 10'-0" on centers. The substructure for the main span unit of this alternative is founded on 7-foot diameter drilled shafts.

Alternative C for the approach span units consists of precast, prestressed concrete girders made continuous for live load supporting a cast-in-place slab. The lengths of the north and south approach span units for this alternative are identical to the lengths of the approach span units for Alternative B. The span arrangement and span lengths selected for the two units are as follows:

- South Unit: 7 Span Unit – one span at 87' and 6 spans at 88' = 615'-0"
- North Unit: 6 Span Unit – 8 spans at 90' and one span at 85' = 805'-0"

The superstructure for the approach spans of this alternative is comprised of 6 BT-54 prestressed concrete girders spaced at 8 feet on centers. The two column bent substructure is supported by 6-foot diameter drilled shafts.

F. Pee Dee Overflow Bridge

1. Layout Considerations

The main factors influencing the layout of this bridge were the superstructure depth limitation, freeboard requirements and the embankment fill height limitation. The embankment height of 22 feet generally occurs at approximately Stations 190+00 and 204+00 in the Overflow structure. Based on the profile in the area of the Pee Dee Overflow Bridge and the freeboard requirements, the maximum structural depth available is approximately 6.4 feet.

Span length to structure height studies, similar to the studies prepared for the Yauhannah Lake and Great Pee Dee River Bridges, were performed for the Overflow structure. This study, to determine the most economically efficient span arrangement, included both concrete and steel superstructure alternatives. The same structure length has been assumed for both alternatives for direct comparison purposes. The span arrangements and typical sections for both alternatives investigated for the Pee Dee Overflow structure are shown in Figures 20 – 22 contained in Section VI of this report.

2. Pee Dee Overflow Bridge - Alternative A

Similar to the Yauhannah Lake Bridge, Alternative A for the Pee Dee Overflow Bridge considers the use of precast, prestressed concrete girders made continuous for live load supporting a cast-in-place slab. The continuous span lengths that were investigated for this structure include: 70 foot spans; 80 foot spans; 90 foot spans; and, 100 foot spans. Based on the comparative cost evaluation, the most cost efficient span length for this structure is between 80 feet to 90 feet.

The final span arrangement for Alternative A was dictated by the location of the existing bridge abutments and the preferred transition to embankment locations. Alternative A consists of two 8-span continuous prestressed concrete units with each span having a length of 85 feet resulting in a total bridge length of 1365 feet. Identical to the Yauhannah Lake Bridge, it was determined based on the proposed profile that a superstructure containing a BT-63 or BT-65 girder in this bridge would not be able to pass the 500 year. Therefore, a superstructure comprised of 6 lines of BT-54 beams spaced at 8-feet on centers has been recommended for this alternative. All substructure units are comprised of two column bents supported by 6-foot diameter drilled shafts.

3. Pee Dee Overflow Bridge - Alternative B

Alternative B consists of a continuous steel plate girder superstructure supporting a cast-in-place concrete deck. Similar to the steel alternatives for the other structures in this project, the goal of this alternative was to reduce the number of substructure units. The same structural length developed for Alternative A (concrete alternative) was also used for Alternative B. The five lines of steel girders were spaced at 10 foot on centers and designed considering a steel strength of 50 ksi. The resulting span arrangement for this alternative consists of two – 5 span continuous units, each having span lengths of 115'-150'-150'-150'-115'.

The substructure for this alternative consists of two column bents founded on 6-foot diameter drilled shafts oriented normal to the centerline of US 701.

G. General Construction Considerations

The US 701 Bridge Replacement Project will require construction in an ecologically and environmentally sensitive environment. The construction must be performed in a manner to minimize the impacts on all wetlands, streams and rivers within the project site. Several critical issues must be considered as part of the constructability process including construction staging area, construction access, and the general method of construction. However, final resolution of these issues will be dictated by environmental restrictions that may arise as a result of the environmental and NEPA process for this project. The following is a brief discussion of the construction staging and construction access requirements for this project.

1. Construction Staging Area

Construction staging areas will be required for construction of the project and must be coordinated with the site access. The staging areas will serve as a hub for construction operations and would contain construction trailers, equipment, storage of construction materials and room for parking. Given the length of the project and access limitations there may be a need for several construction staging areas. Ideally, the construction trailers should be located where there is available power supply and easy access to existing US 701, which generally limits the feasible locations to the beginning or end of the project limits. Existing power distribution lines terminate before the Yauhannah Lake Bridge on the Georgetown County side of the project and to the north of the Pee Dee Overflow Bridge on the Horry County side of the project. There is no available existing right-of-way space south of Yauhannah Lake on the Georgetown County side of the project to accommodate the construction staging area. Although there is ample available right-of-way space on the Horry County end of the project, there is a right-of-way issue in this area that has not been resolved. The Department is currently working with various government officials in Horry County to resolve this issue. The final recommendation for the location of the construction trailer can not be provided until this existing right-of-way issue has been resolved. There is also a possibility that the Contractor may be required to obtain his own construction operations area by entering into an agreement with one of the existing property owners.

It is anticipated that two other staging areas will be required to efficiently accommodate the construction of this project. These staging areas could be located on both banks of the Great Pee Dee River in an area below the proposed bridge alignment and extending slightly towards the downstream direction. The additional wetland impact to accommodate the staging area will have to be considered in future discussions pertaining to temporary wetland impacts. It will be important for the contractor to keep the storage of major bridge components to a minimum to help minimize the environmental impacts.

2. Construction Access

Existing access along the length of the proposed project is very limited and in some locations virtually non-existent. The project site ranges from non-navigable waterway at the Yauhannah Lake, minimally navigable waterway at the Great Pee Dee River, forested wetland areas with shallow water depths, to dry forested wetland areas. In general, the extent of water in the wetland areas is dependent on seasonal precipitation and storm events.

Although the Great Pee Dee River has been classified as navigable, the river is predominately only used by small pleasure crafts in the vicinity of US 701. The only section of the river that is considered commercially navigable is significantly to the south of US 701 near the City of Georgetown. It is unlikely that the delivery of the various bridge components will be accomplished via barge. Therefore, it is assumed that all equipment and materials required for construction of the US 701 project will be transported by trucking over land.

There are several options to access the proposed bridge areas during construction. A few options include the use of barge mats, temporary trestles and temporary causeway. Of the three options, the temporary causeway would have the greatest impact to the wetland areas. Additional discussions will be required during subsequent phases of the project to identify the appropriate access option that balances cost considerations with environmental concerns. In all cases, it is assumed that the new embankments between the bridges and to the north of the Pee Dee Overflow could be used as construction access for the bridge construction when possible. The roadway embankment fills will generally be constructed during the early stages of construction to achieve the anticipated settlements during the construction period.

IV. Summary of Bridge Alternatives Construction Costs

Material construction quantities have been computed based on the conceptual design performed for each bridge alternative and initial construction cost estimates in 2006 dollars have been prepared. A summary of the initial construction cost estimates for each bridge alternative is presented in Table 2 for comparison purposes. Costs for the various bid items were based on unit bid prices for SCDOT contracts awarded within the past few years, and also discussions with precast concrete contractors. The costs for each alternative also include the costs for demolishing the existing bridges. Construction costs for Alternative C are based on a combined steel and concrete superstructure for the Great Pee Dee River Bridge. Alternative C construction costs for the Yauhannah Lake and Pee Dee Overflow Bridges are based on a concrete superstructure for comparison purposes only and hence, this cost is identical to the Alternative A costs.

A life cycle cost analysis has not been performed since it is anticipated the alternatives containing steel would have greater future maintenance costs than the concrete alternatives and hence, the results of a life cycle cost analysis would not change the relative cost rankings for the alternatives based on initial construction costs.

Table 2. Bridge Alternatives Cost Comparison

Bridge	Length (ft.)	Estimated Construction Costs		
		Alternative A	Alternative B	Alternative C
Yauhannah Lake	1450	$7,864,000	$9,259,000	$7,864,000
Great Pee Dee River	2435	$13,247,000	$17,408,000	$15,751,000
Pee Dee Overflow	1365	$7,251,000	$8,805,000	$7,251,000
Total Bridge Costs		**$28,362,000**	**$35,472,000**	**$30,866,000**

Note:
Alternative A – Concrete Superstructure
Alternative B – Steel Superstructure
Alternative C – Combined Concrete and Steel Superstructure

Table 3 provides a total cost summary for the entire project including roadway and right-of-way acquisition costs. The roadway cost given in Table 3 was obtained from the Concept Alignment Report for the US 701 Bridge Replacement Project dated July 19, 2005 for the preferred alignment. No costs have been included for right-of-way acquisition due to the pending right-of-way issue on the Horry County side of the project. The total cost estimate does not include costs for engineering or construction engineering services.

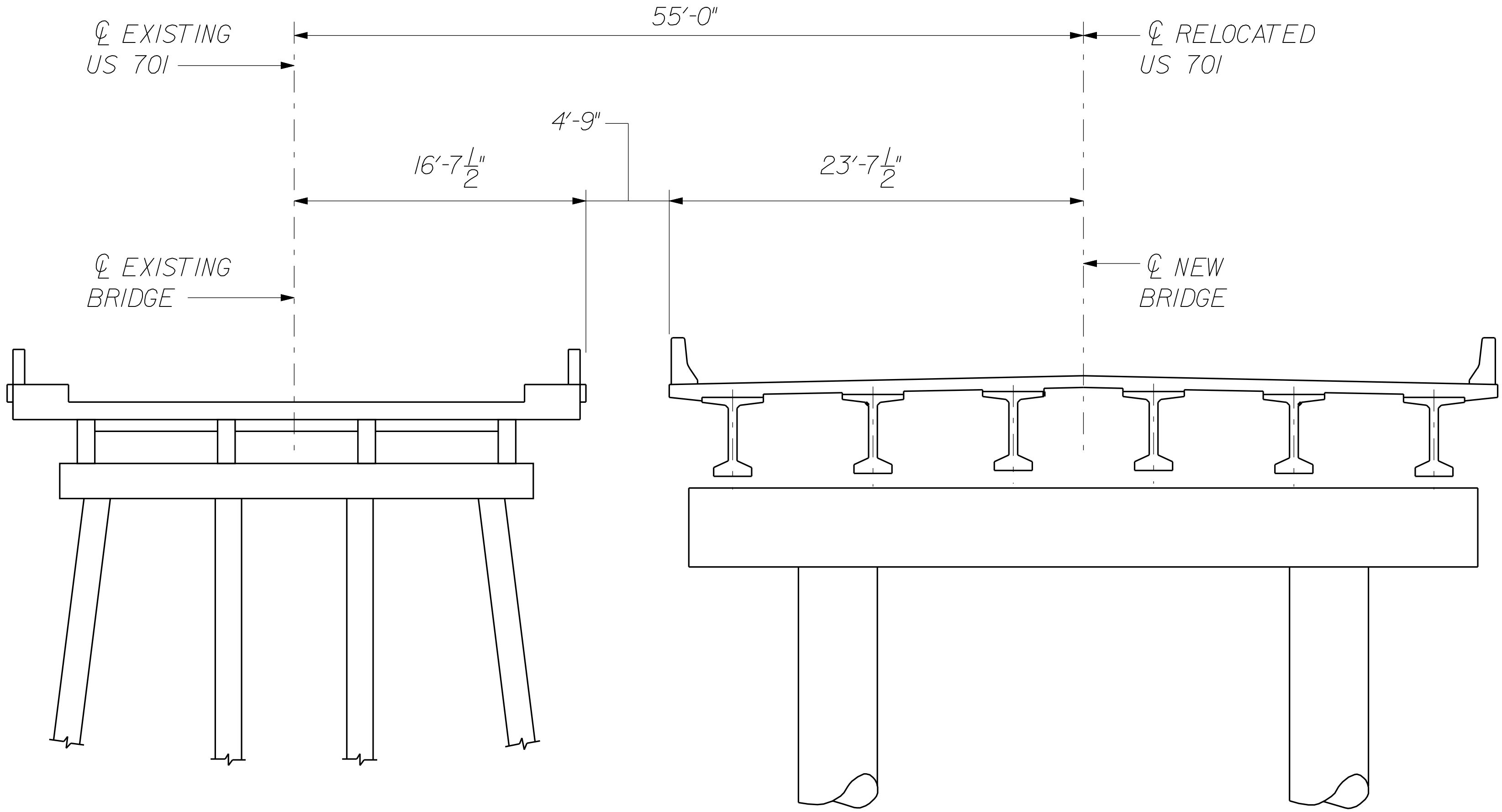
Table 3. Total Project Cost Summary

Description	Estimated Costs		
	Alternative A	**Alternative B**	**Alternative C**
Bridge Costs	$28,362,000	$35,472,000	$30,866,000
Roadway Costs*	$2,702,000	$2,702,000	$2,702,000
Right of Way Costs	---	---	---
Comparative Estimate (Sub-total)	$31,064,000	$38,174,000	$33,568,000
Contingency @ 15%	$4,660,000	$5,726,000	$5,035,000
Comparative Estimate	**$35,724,000**	**$43,900,000**	**$38,603,000**

* Obtained from Concept Alignment Report, dated July 19, 2005.

V. Recommendations

The results of the cost analysis given in Tables 2 and 3 indicates that Alternative A (concrete alternative) has the lowest initial construction cost and it is expected this alternative would also have the least total present worth costs if one were to consider life cycle costs. This alternative will provide a structure that has long term durability, low future maintenance requirements and ease of construction. Therefore, it is recommended that the project proceed with Alternative A – Concrete Alternative – in preliminary and final design phases of the US 701 Bridge Replacement Project.



TYPICAL SECTION
EXISTING BRIDGE AND NEW BRIDGE

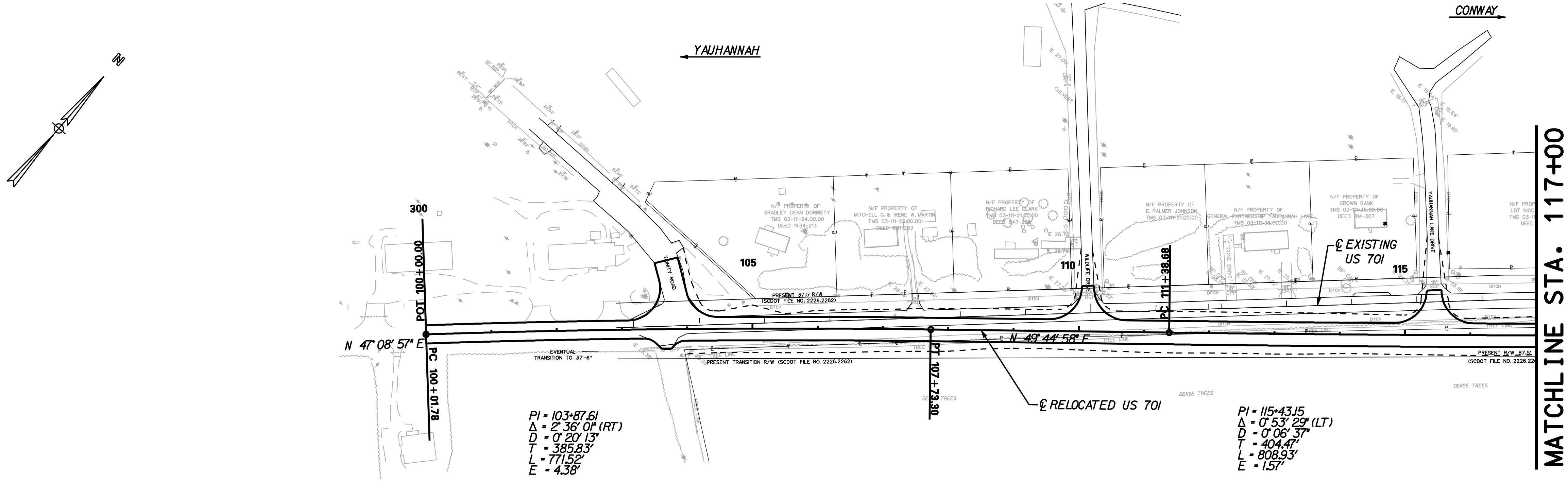
SCALE: 1" = 10'-0"

SCDOT
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& YAUHANNAH LAKE

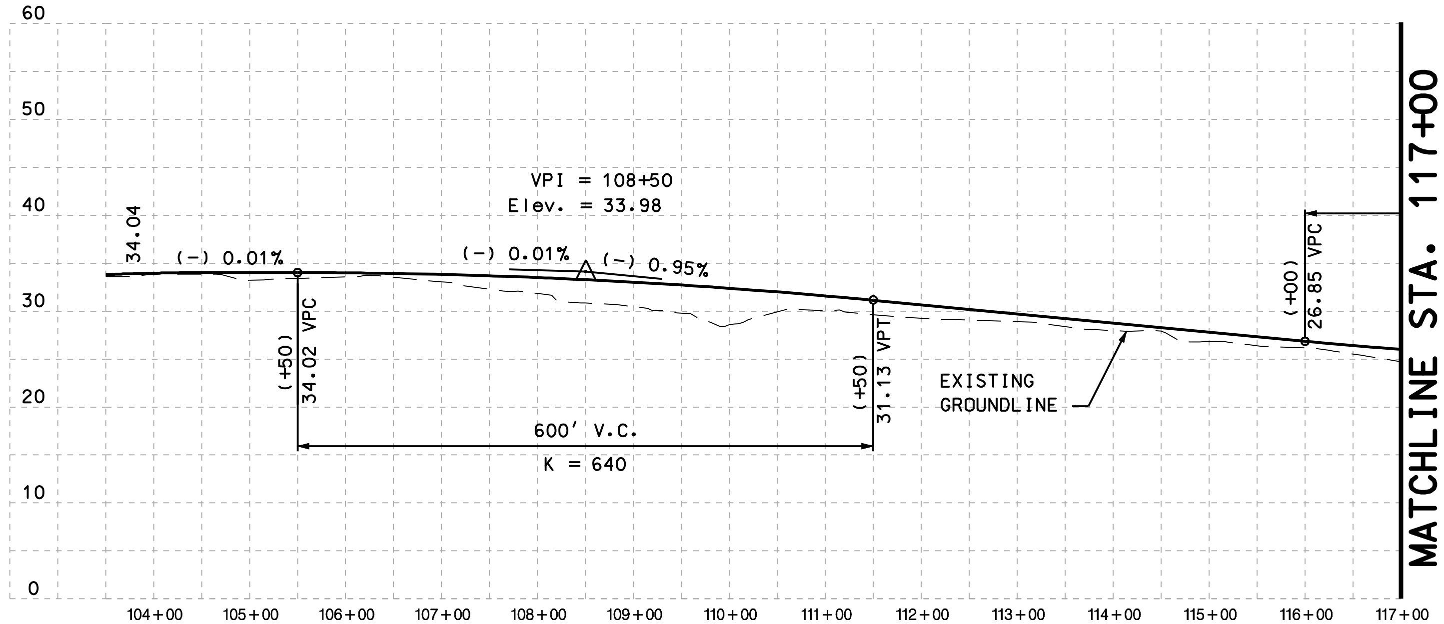
HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

TYPICAL SECTION
EXISTING BRIDGE AND NEW BRIDGE
FIGURE 4



PLAN

SCALE: 1" = 200'



PROFILE

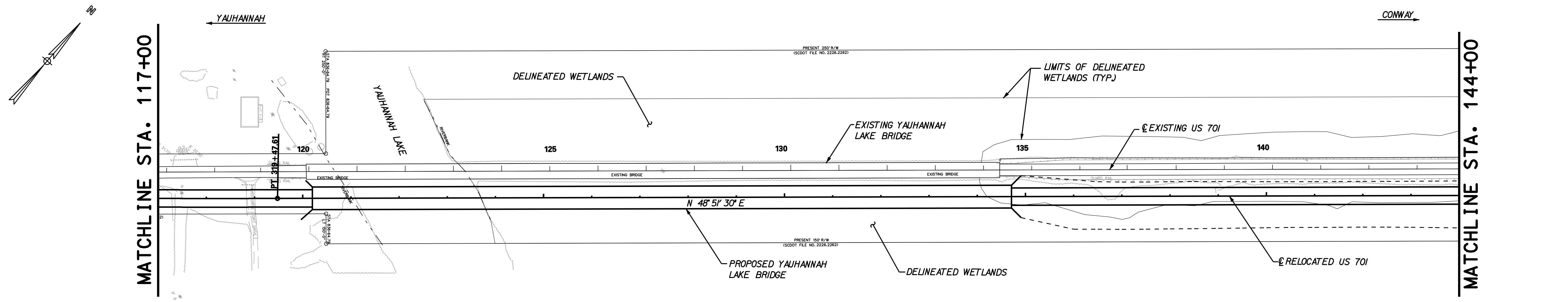
H SCALE: 1" = 200'
V SCALE: 1" = 20'

SCDOT
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& YAUHANNAH LAKE

HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

GENERAL PLAN & PROFILE (1 OF 6)
STA. 100 + 00 to STA. 117 + 00
FIGURE 5



PLAN

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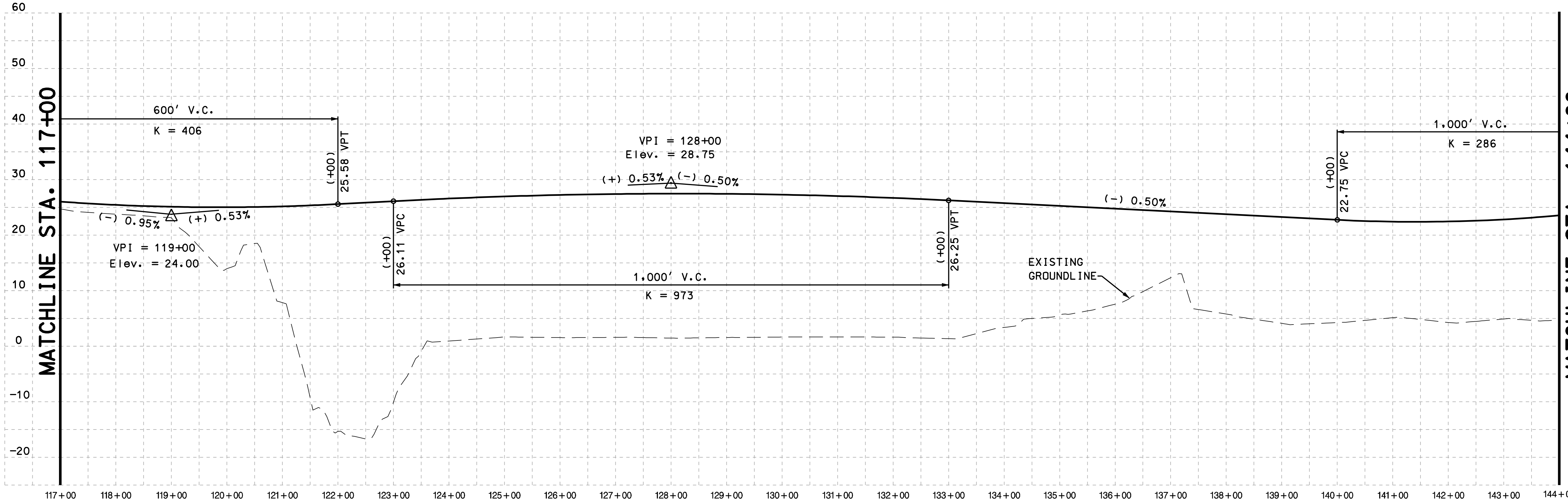

PROFILE

H SCALE: 1" = 200'
V SCALE: 1" = 20'

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SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

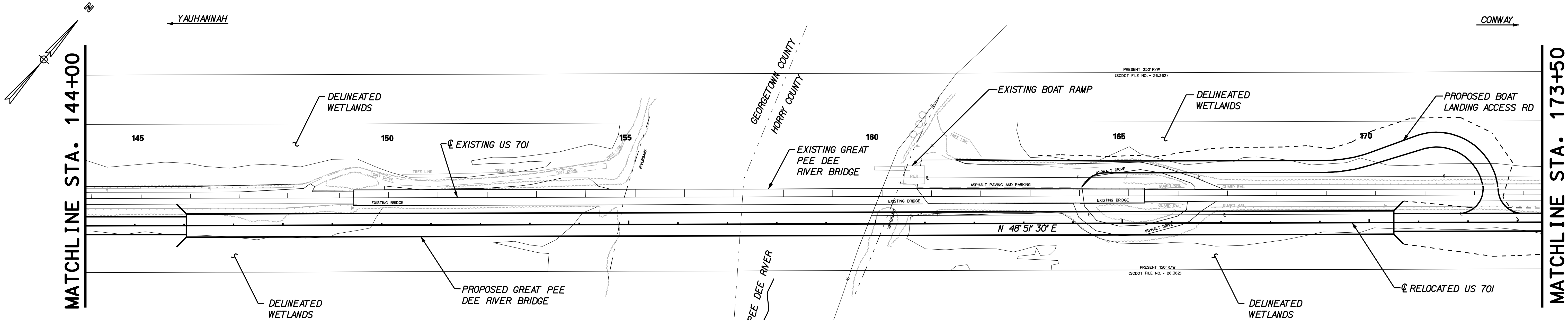
REPLACEMENT OF US 701 BRIDGES OVER GREAT PEE DEE RIVER, PEE DEE OVERFLOW & YAUHANNAH LAKE

HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

GENERAL PLAN & PROFILE (2 OF 6)

STA. 117 + 00 to STA. 144 + 00

FIGURE 6



PLAN

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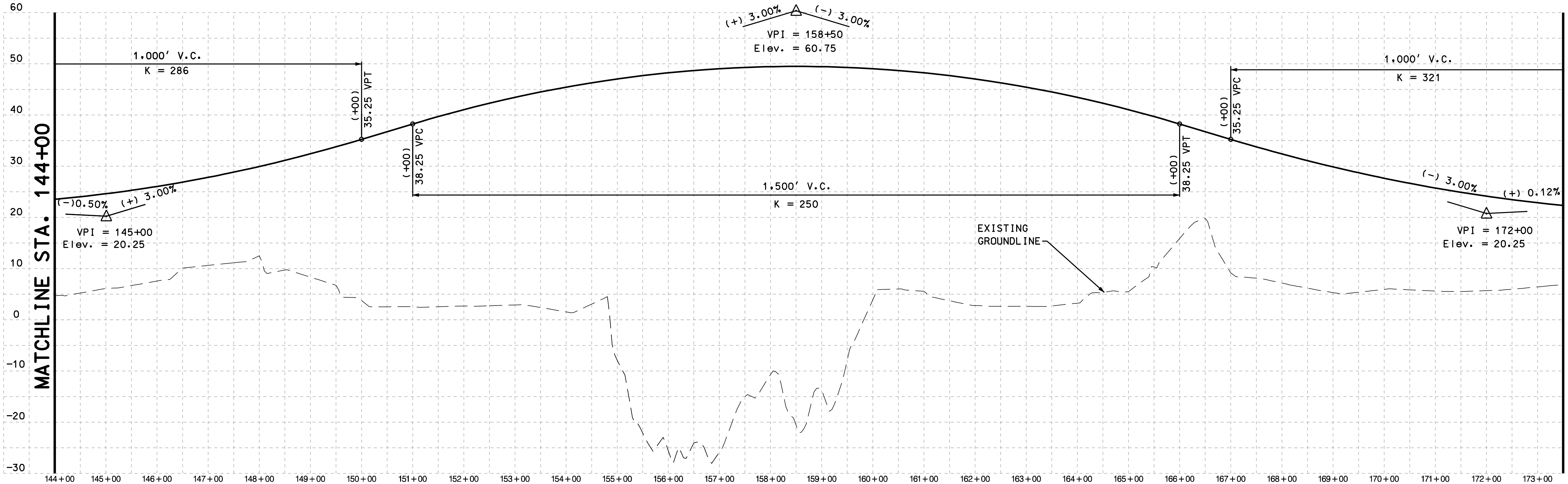

PROFILE

H SCALE: 1" = 200'
V SCALE: 1" = 20'

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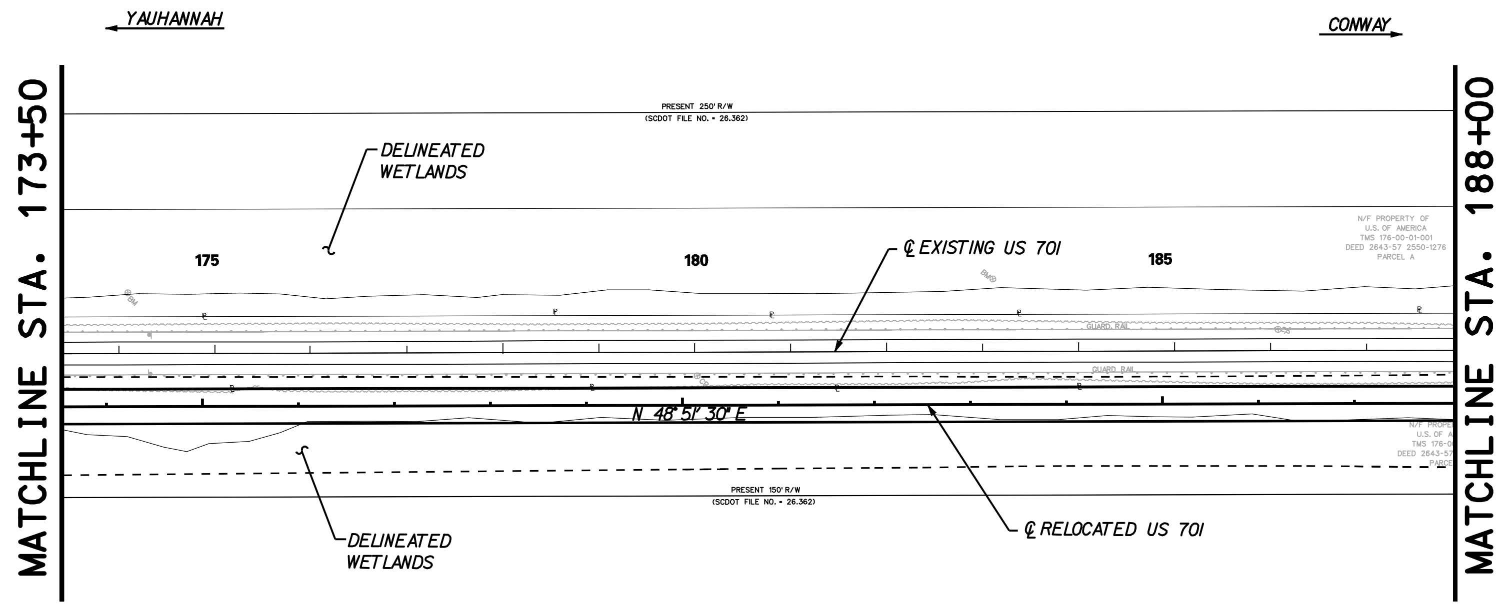
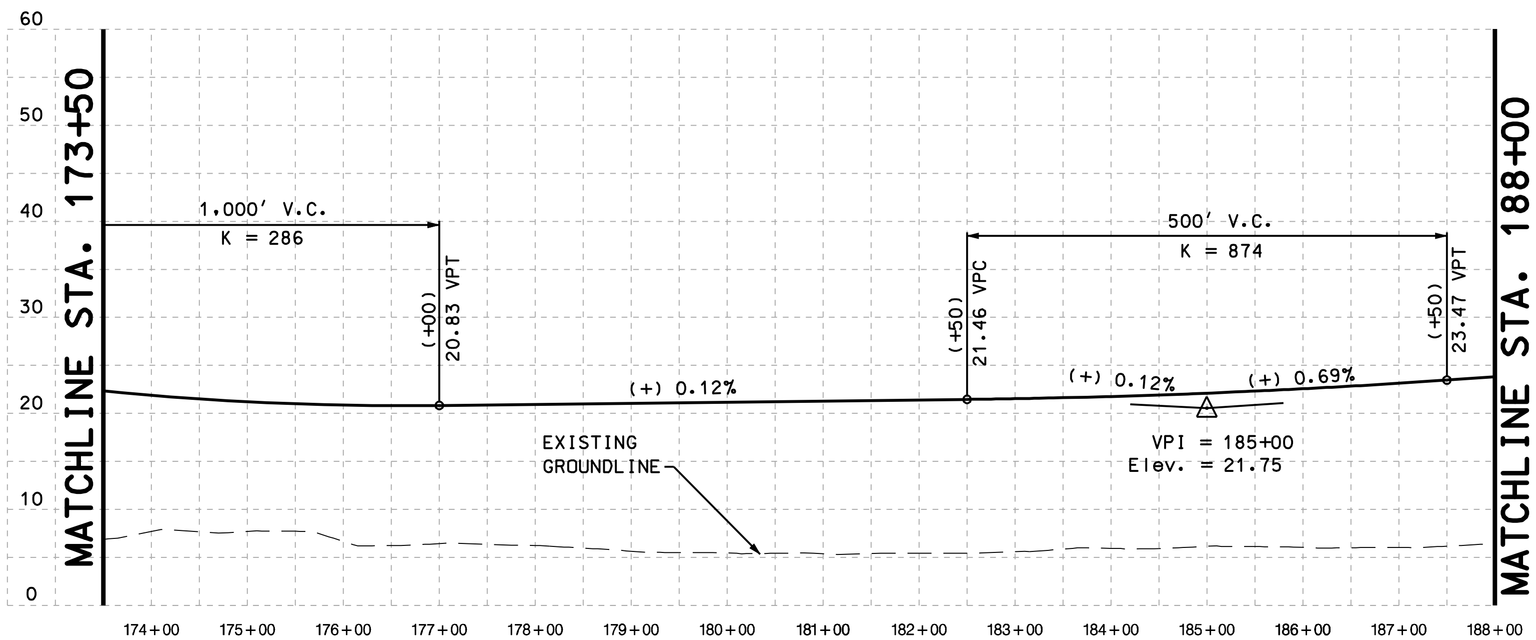
REPLACEMENT OF US 701 BRIDGES OVER GREAT PEE DEE RIVER, PEE DEE OVERFLOW & YAUHANNAH LAKE

HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

GENERAL PLAN & PROFILE (3 OF 6)
STA. 144 + 00 to STA. 173 + 50
FIGURE 7



PLAN
SCALE: 1" = 200'



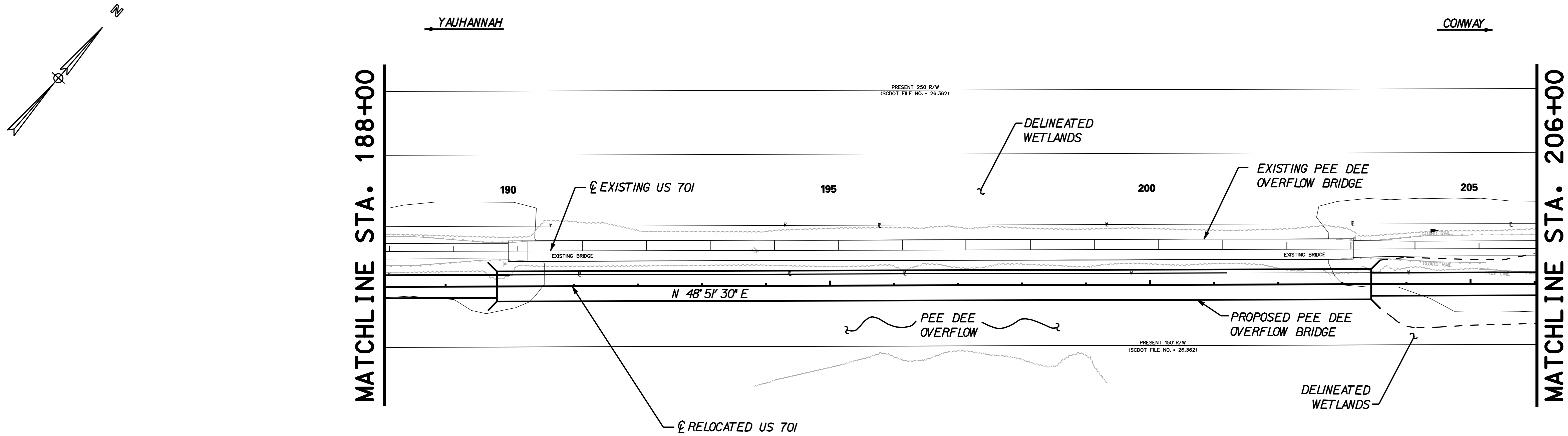
PROFILE
H SCALE: 1" = 200'
V SCALE: 1" = 20'

SCDOT
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

REPLACEMENT OF US 701 BRIDGES OVER GREAT PEE DEE RIVER, PEE DEE OVERFLOW & YAUHANNAH LAKE

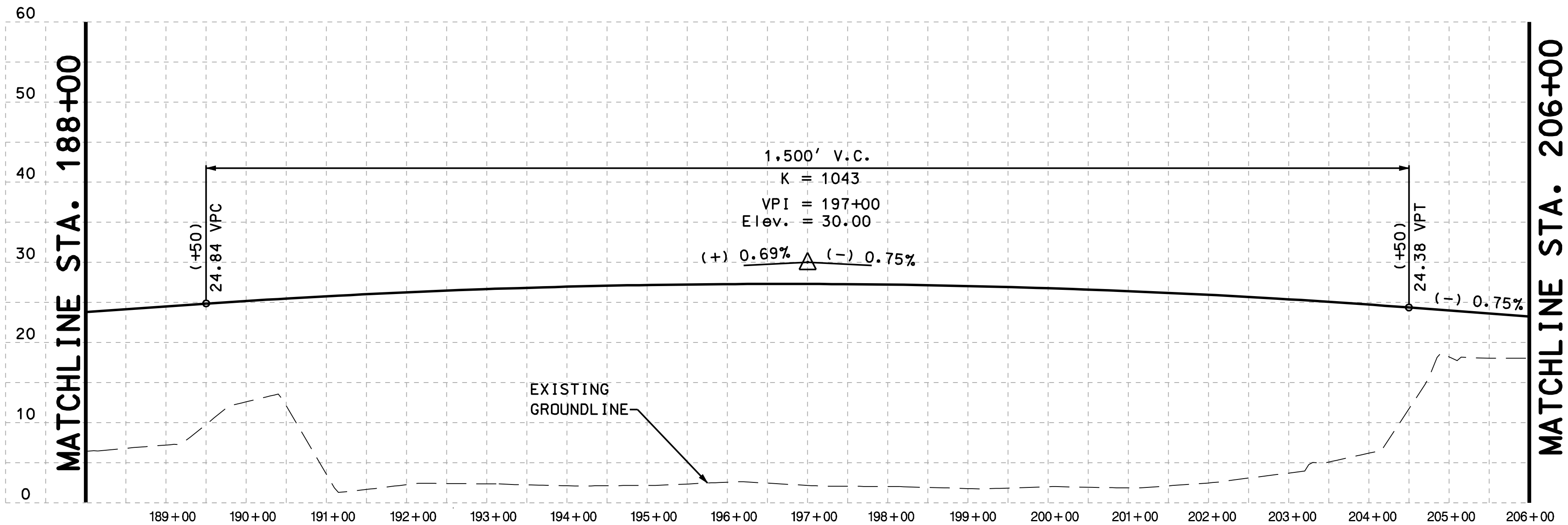
HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

GENERAL PLAN & PROFILE (4 OF 6)
STA. 173 + 50 to STA. 188 + 00
FIGURE 8



PLAN

SCALE: 1" = 200'



PROFILE

H SCALE: 1" = 200'
V SCALE: 1" = 20'

SCDOT
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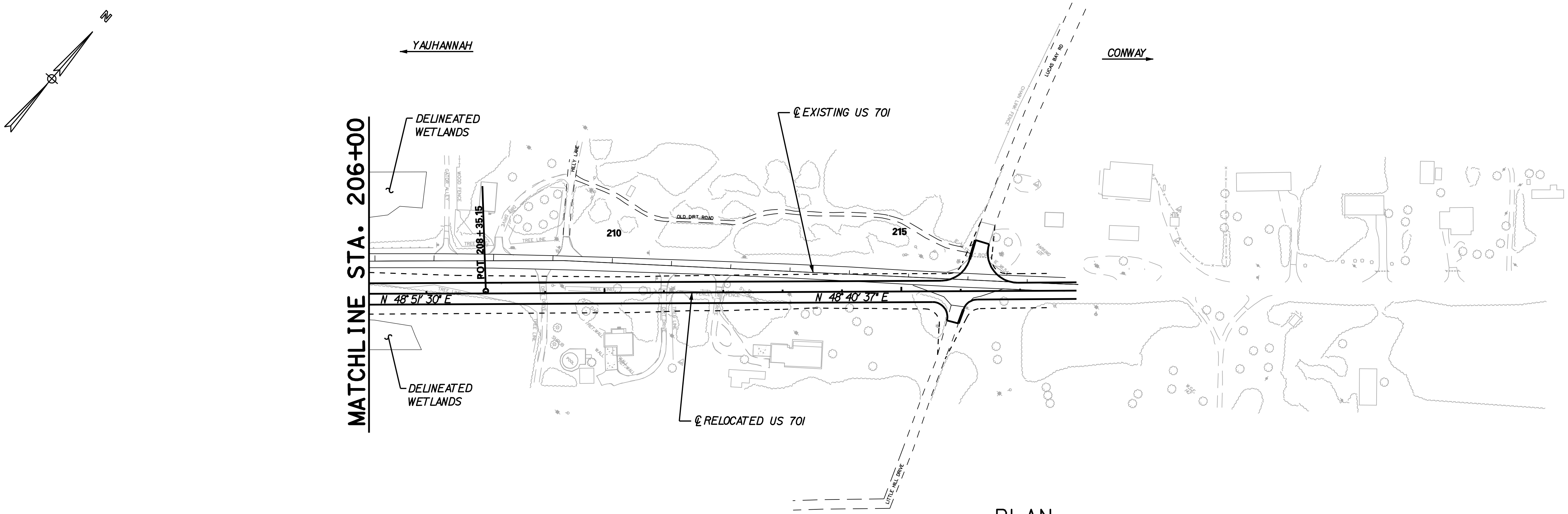
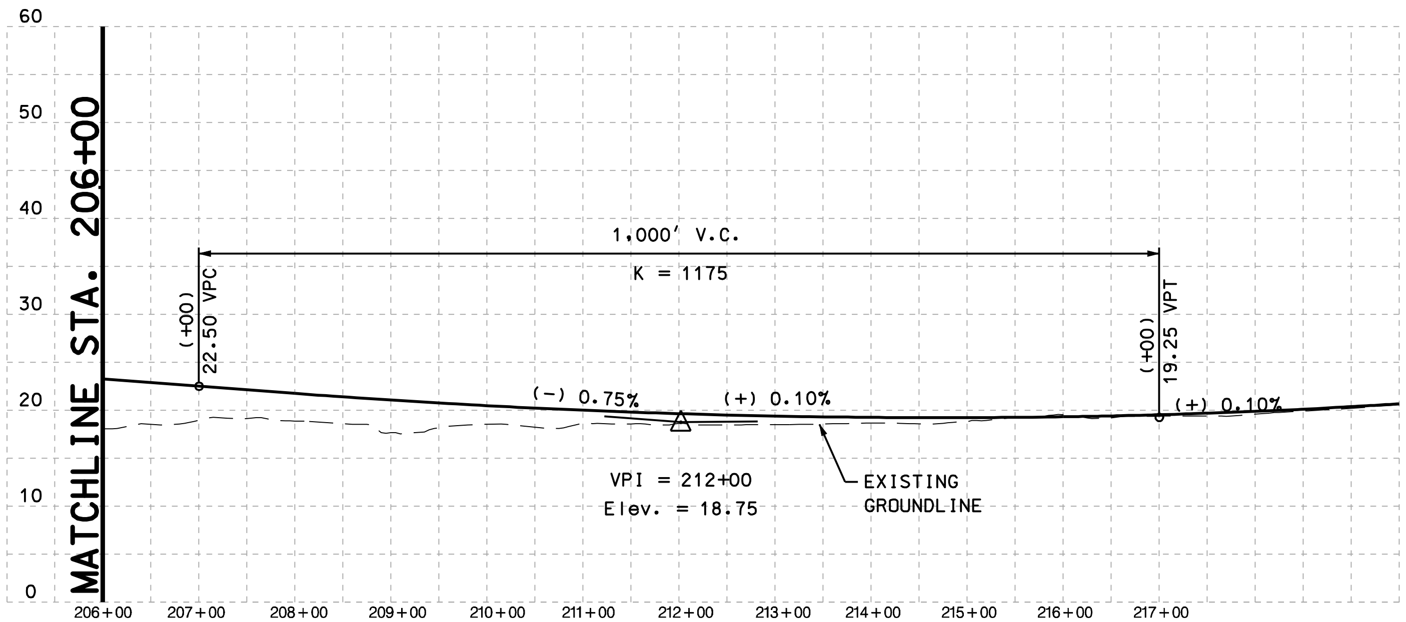
REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& YAUHANNAH LAKE

HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

GENERAL PLAN & PROFILE (5 OF 6)
STA. 188 + 00 to STA. 206 + 00
FIGURE 9



PLAN
SCALE: 1" = 200'



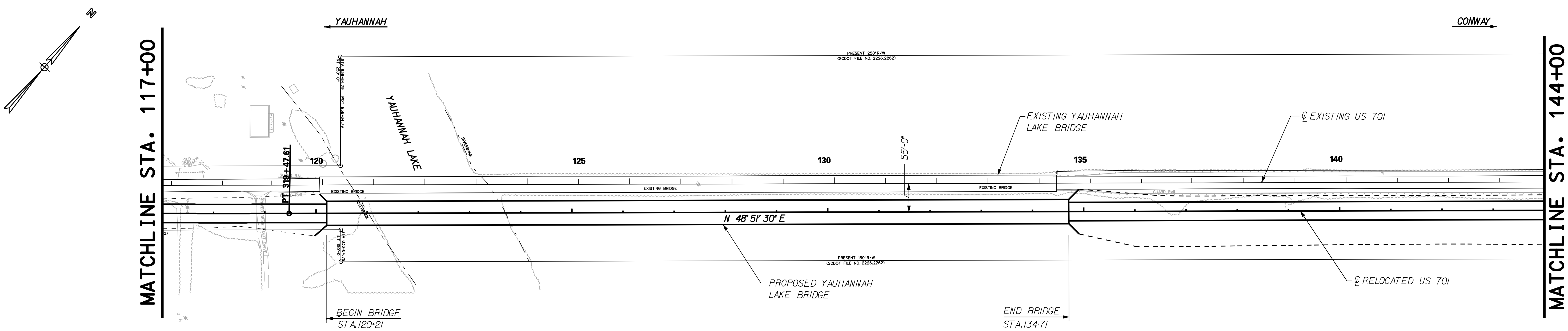
PROFILE
H SCALE: 1" = 200'
V SCALE: 1" = 20'

SCDOT
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& YAUHANNAH LAKE

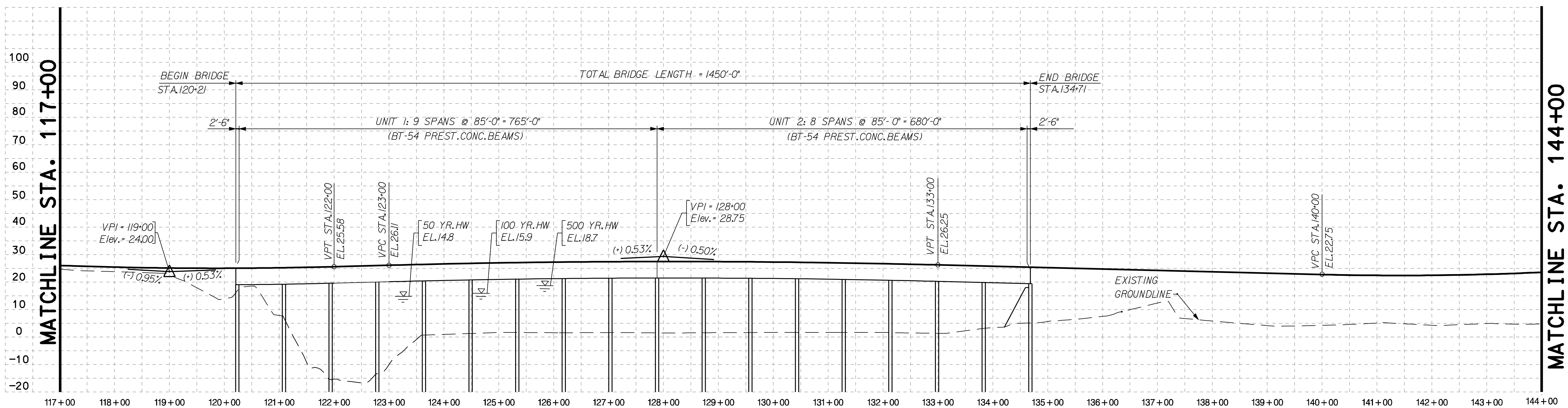
HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

GENERAL PLAN & PROFILE (6 OF 6)
STA. 206 + 00 to STA. 217 + 00
FIGURE 10



PLAN

SCALE: 1" = 200'



ELEVATION

H SCALE: 1" = 200'
V SCALE: 1" = 40'

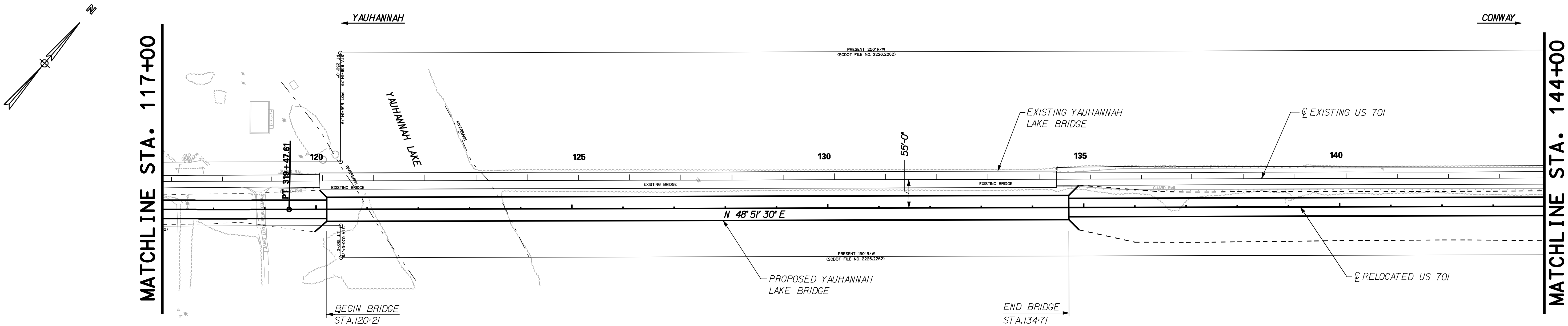
NOTE: DELINEATED WETLANDS NOT SHOWN.

SCDOT
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

REPLACEMENT OF US 701 BRIDGES OVER GREAT PEE DEE RIVER, PEE DEE OVERFLOW & YAUHANNAH LAKE

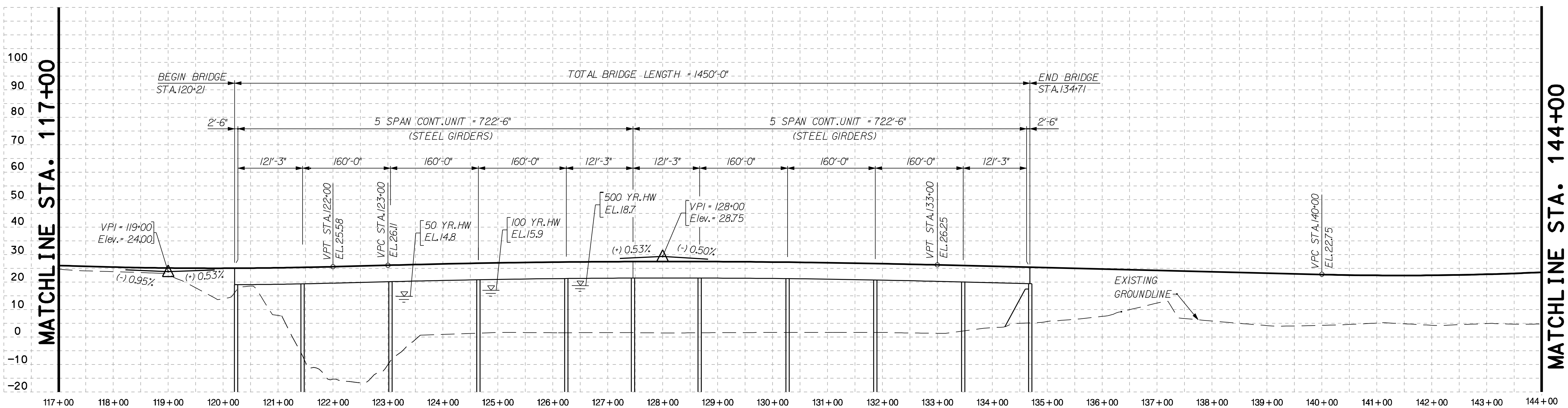
HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

YAUHANNAH LAKE BRIDGE
PLAN & ELEVATION - ALTERNATIVE A
FIGURE 11



PLAN

SCALE: 1" = 200'



ELEVATION

H SCALE: 1" = 200'
V SCALE: 1" = 40'

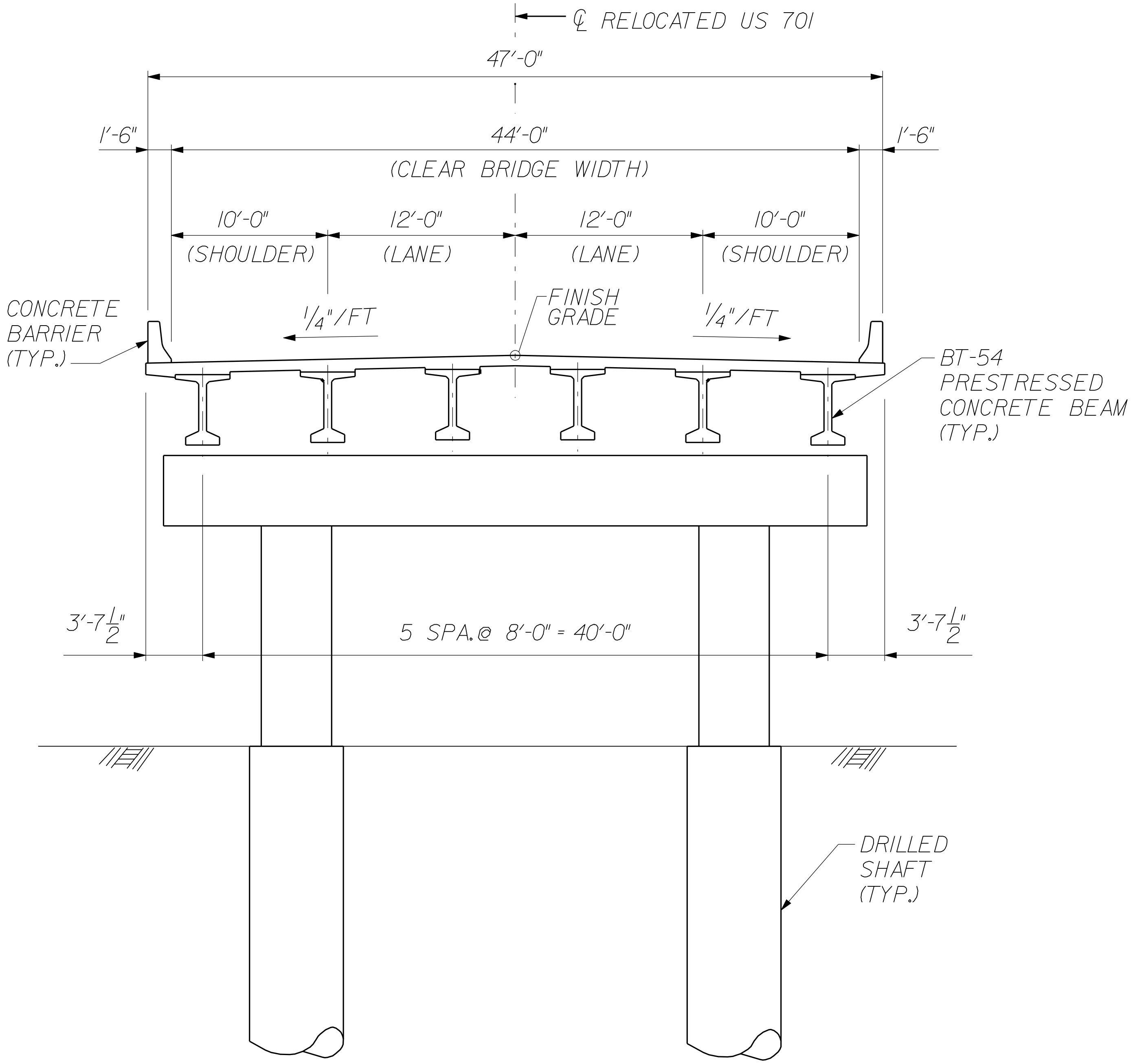
NOTE: DELINEATED WETLANDS NOT SHOWN.

SCDOT
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& YAUHANNAH LAKE

HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

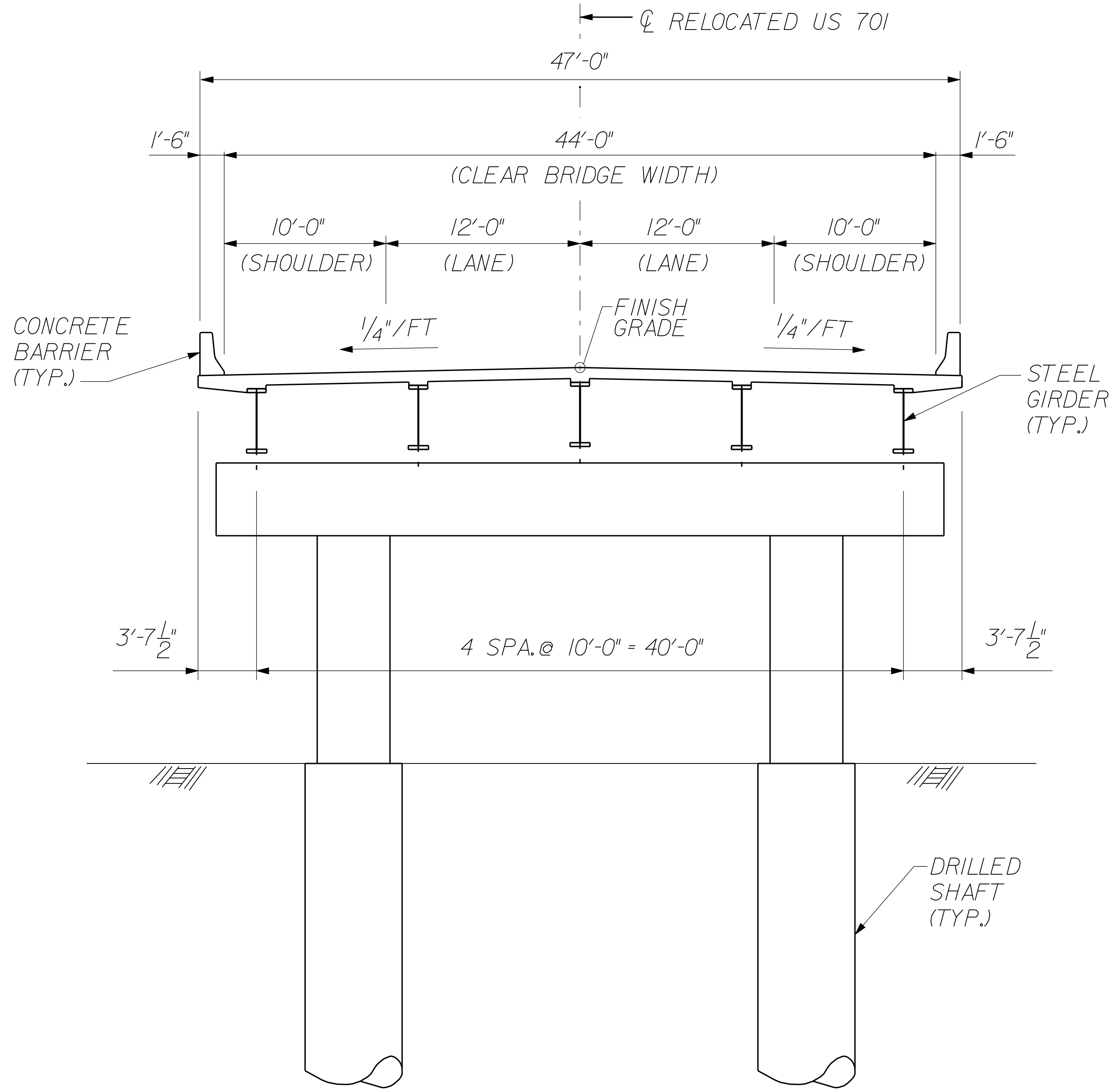
YAUHANNAH LAKE BRIDGE
PLAN & ELEVATION - ALTERNATIVE B
FIGURE 12



TYPICAL SECTION

ALTERNATIVE A

SCALE: 1" = 10'-0"



TYPICAL SECTION

ALTERNATIVE B

SCALE: 1" = 10'-0"

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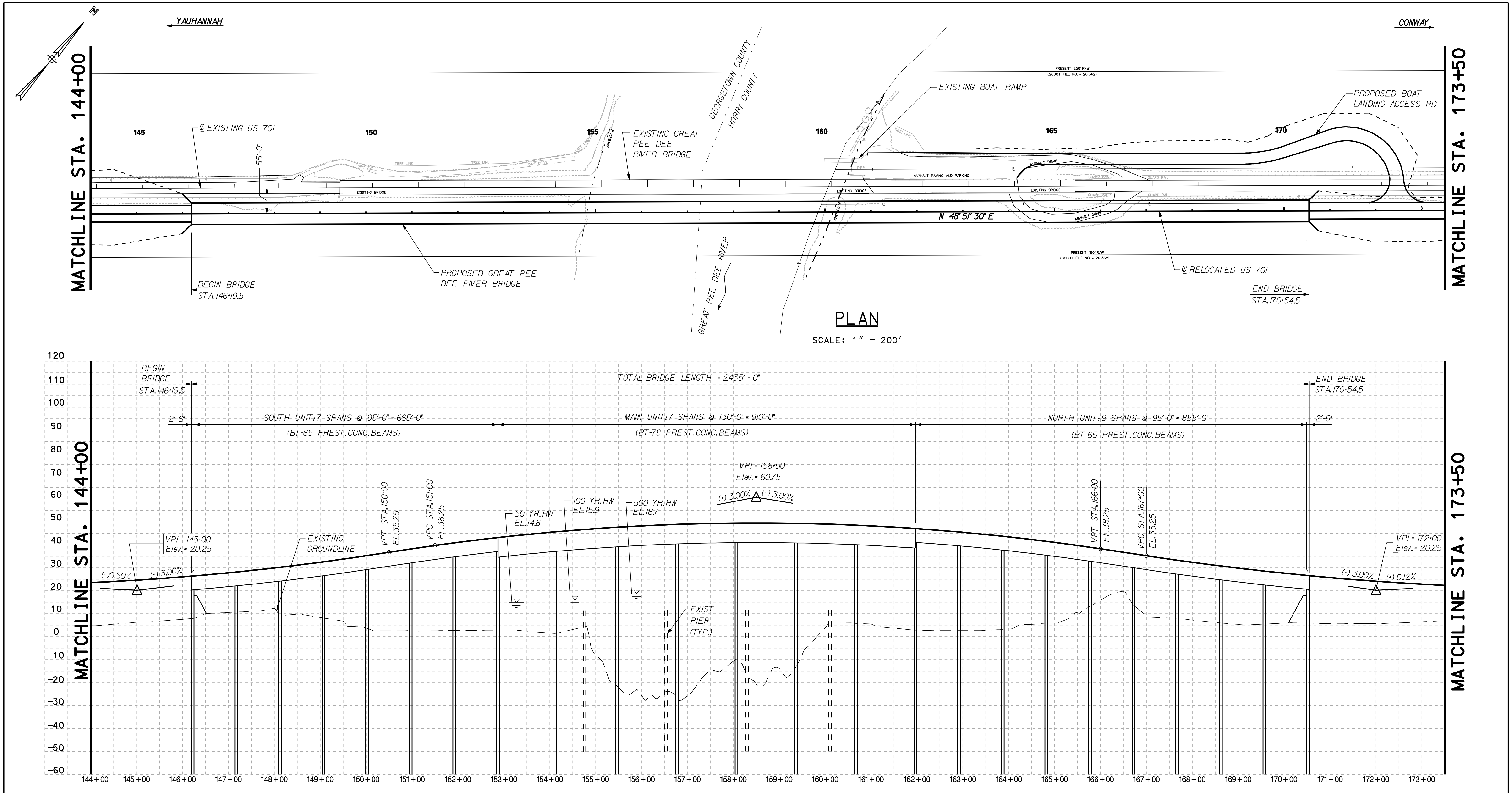
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& YAUHANNAH LAKE

HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

YAUHANNAH LAKE BRIDGE
TYPICAL SECTIONS
FIGURE 13



NOTE: DELINEATED WETLANDS NOT SHOWN.

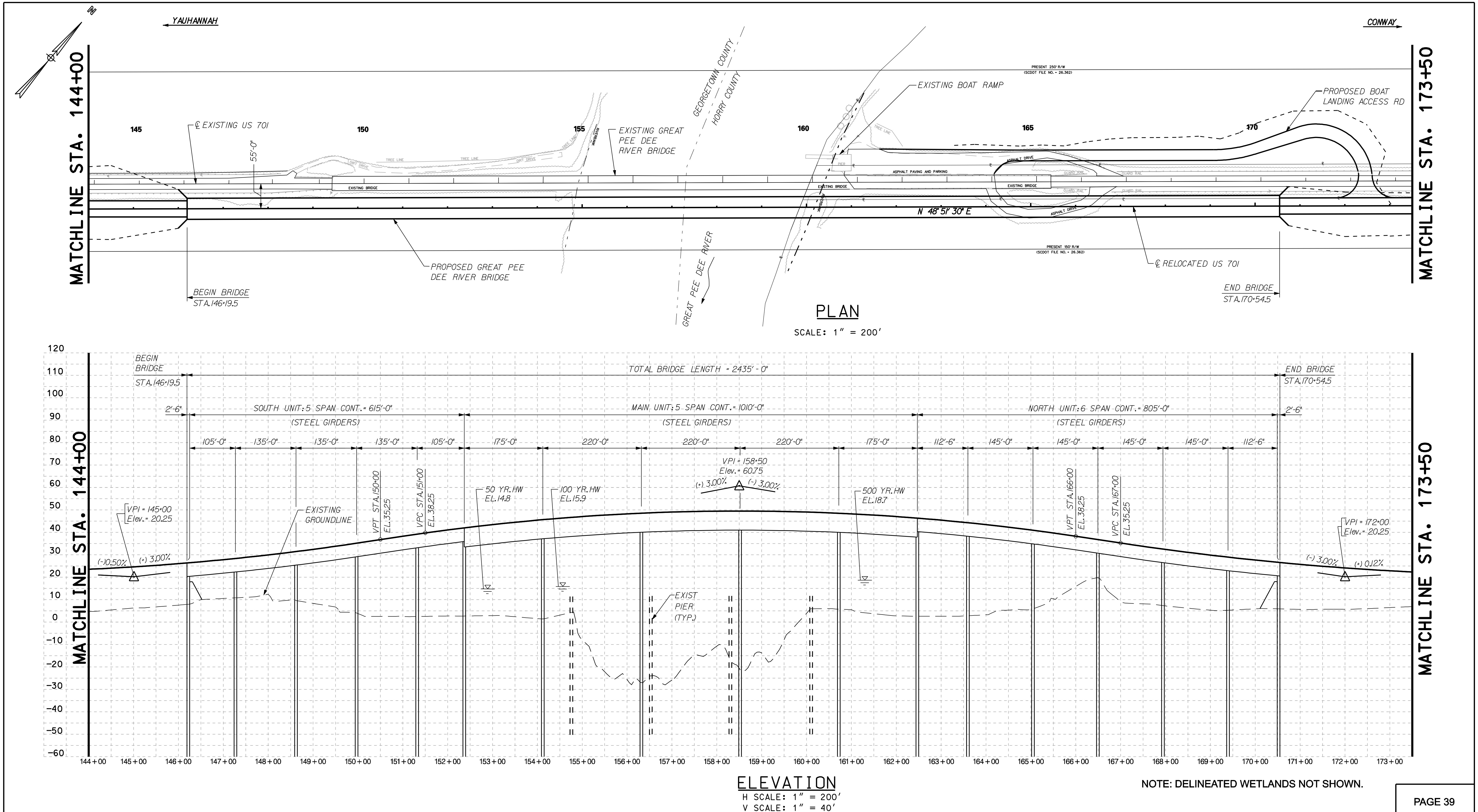
SCDOT
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

REPLACEMENT OF US 701 BRIDGES OVER GREAT PEE DEE RIVER, PEE DEE OVERFLOW & YAUHANNAH LAKE

HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

GREAT PEE DEE RIVER BRIDGE PLAN & ELEVATION - ALTERNATIVE A

FIGURE 14



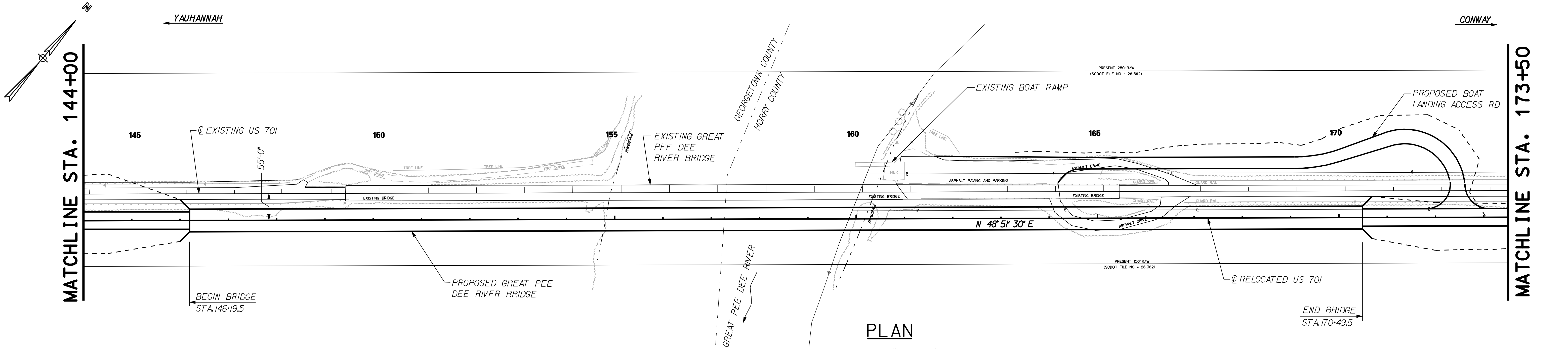
NOTE: DELINEATED WETLANDS NOT SHOWN.

SCDOT
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

REPLACEMENT OF US 701 BRIDGES OVER GREAT PEE DEE RIVER, PEE DEE OVERFLOW & YAUHANNAH LAKE

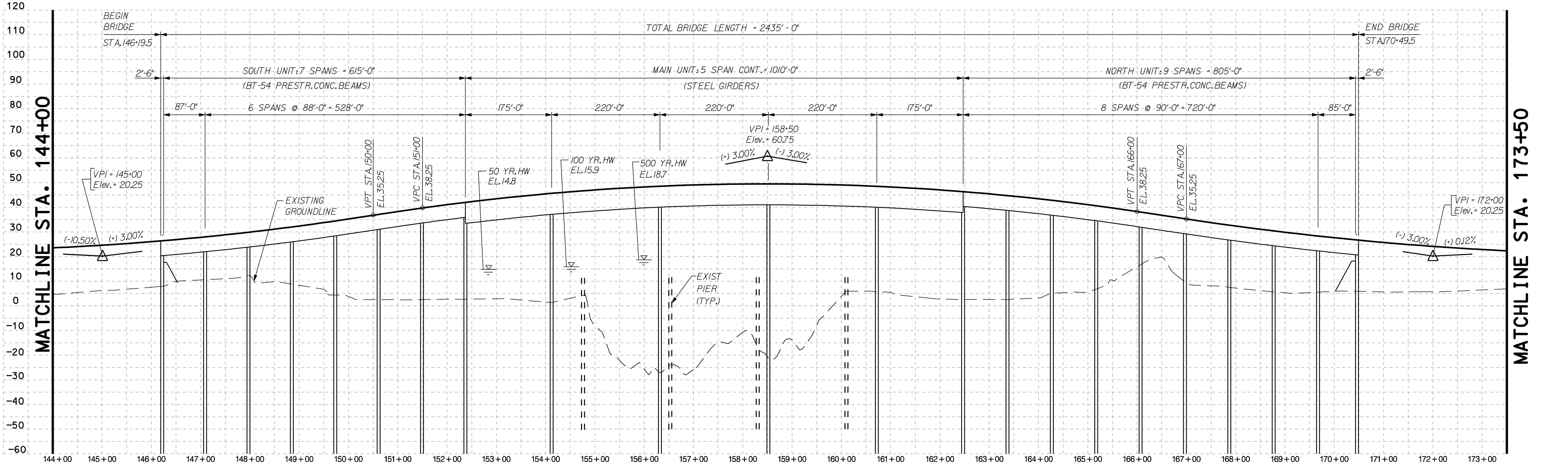
HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

GREAT PEE DEE RIVER BRIDGE
PLAN & ELEVATION - ALTERNATIVE B
FIGURE 15



PLAN

SCALE: 1" = 200'



ELEVATION

H SCALE: 1" = 200'
V SCALE: 1" = 40'

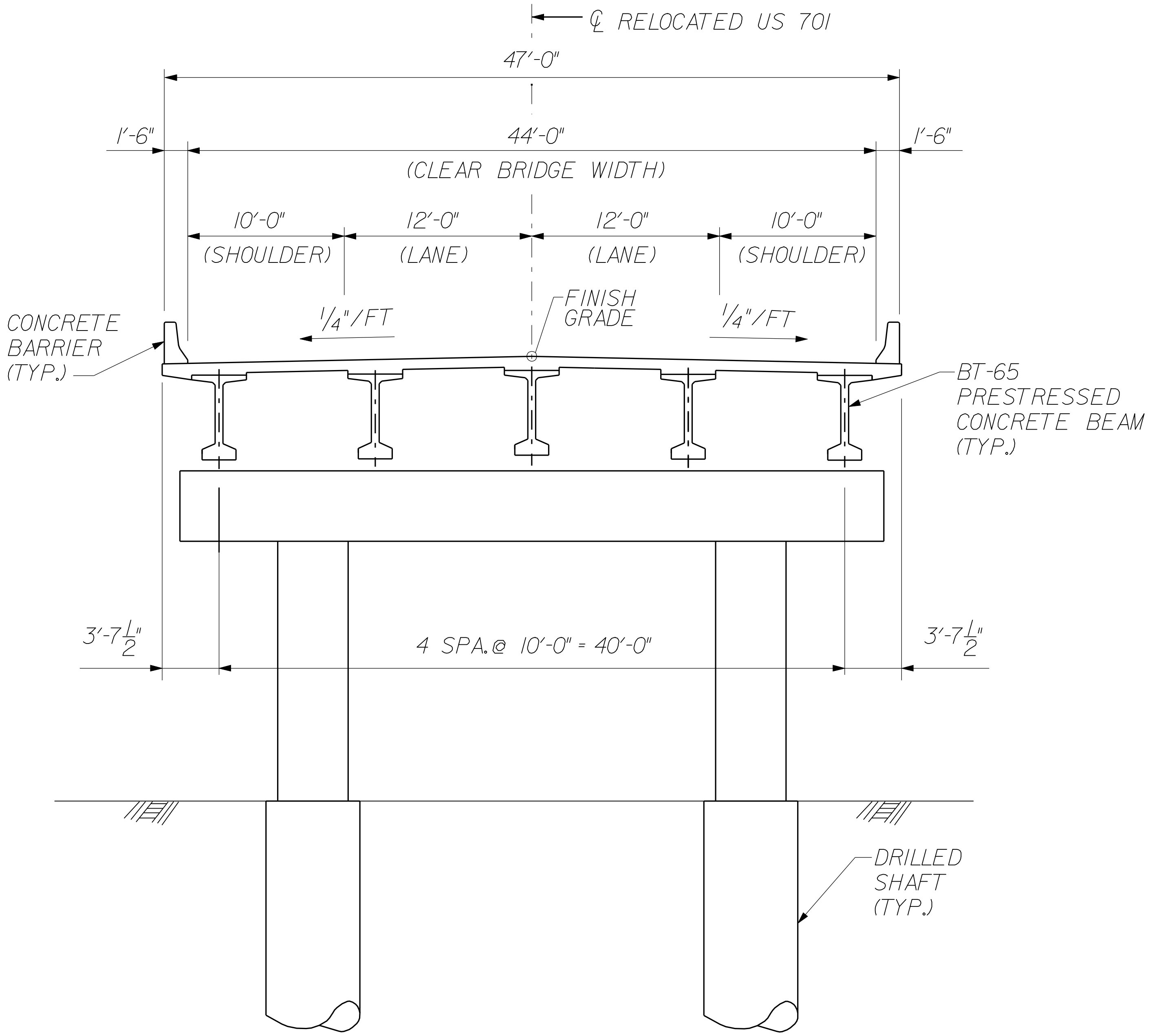
NOTE: DELINEATED WETLANDS NOT SHOWN.

SCDOT
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& YAUHANNAH LAKE

HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

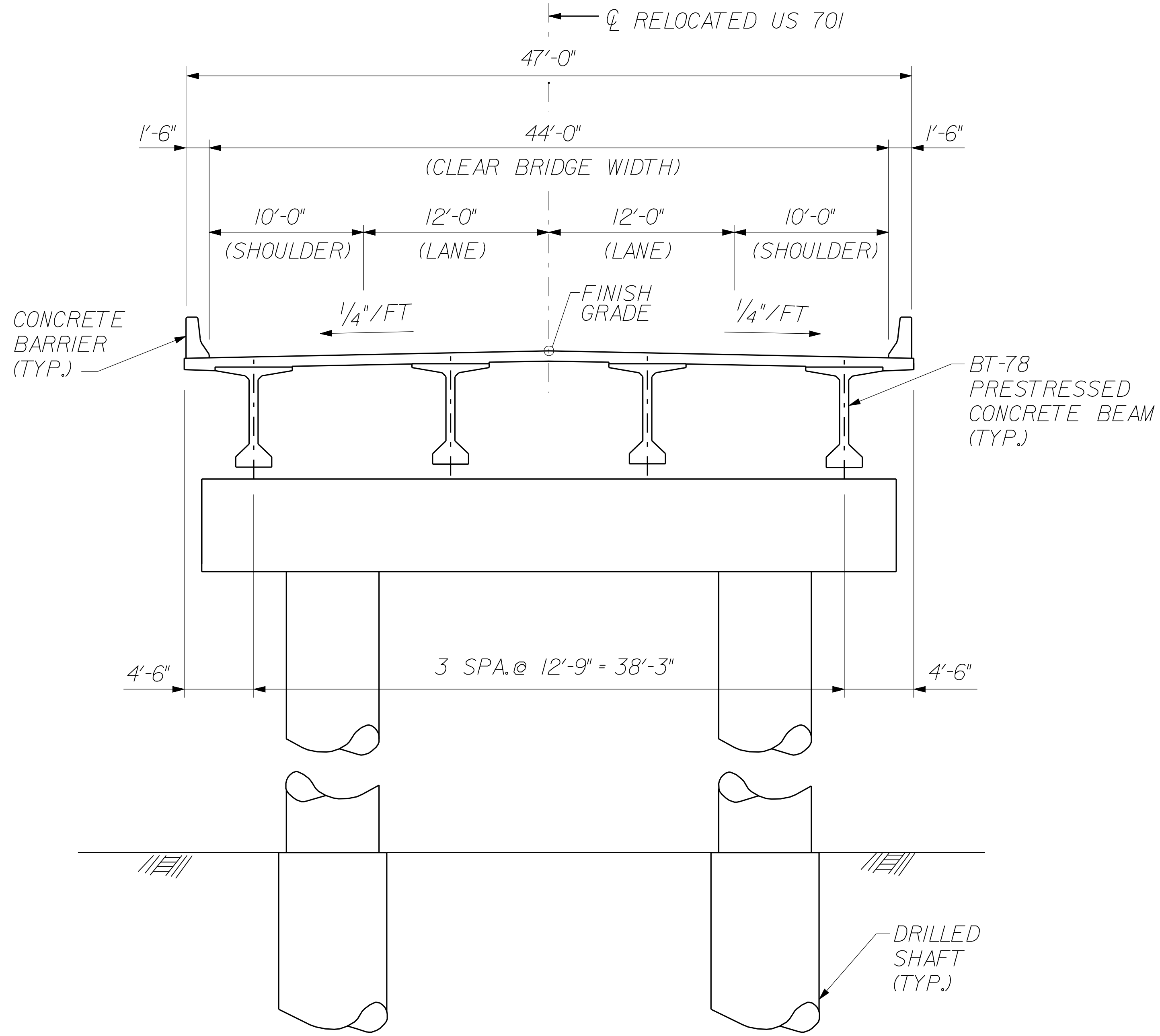
GREAT PEE DEE RIVER BRIDGE
PLAN & ELEVATION - ALTERNATIVE C
FIGURE 16



TYPICAL SECTION

APPROACH SPAN UNITS

SCALE: 1" = 10'-0"



TYPICAL SECTION

MAIN SPAN UNIT

SCALE: 1" = 10'-0"

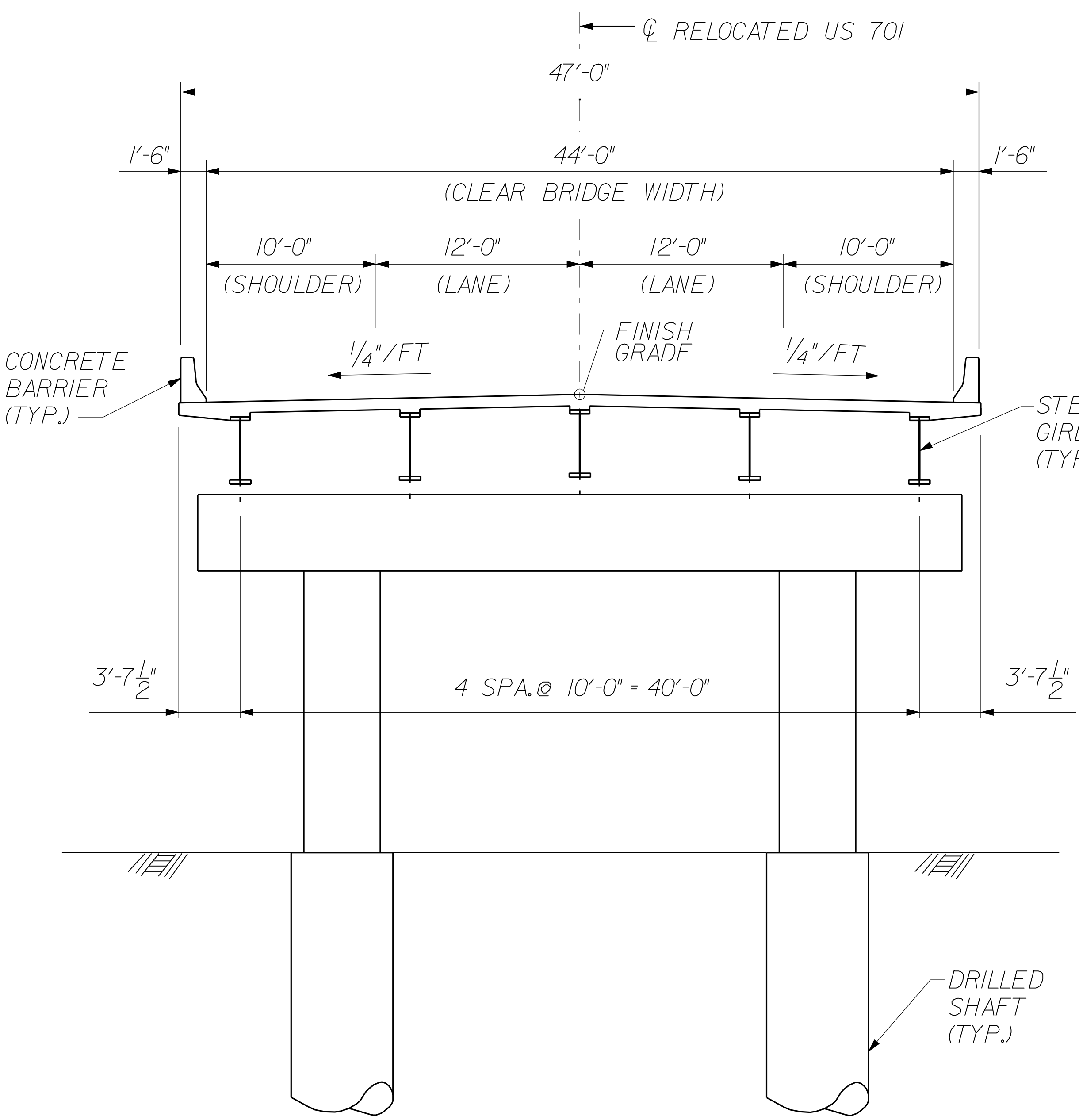
ALTERNATIVE A

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& YAUHANNAH LAKE

HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

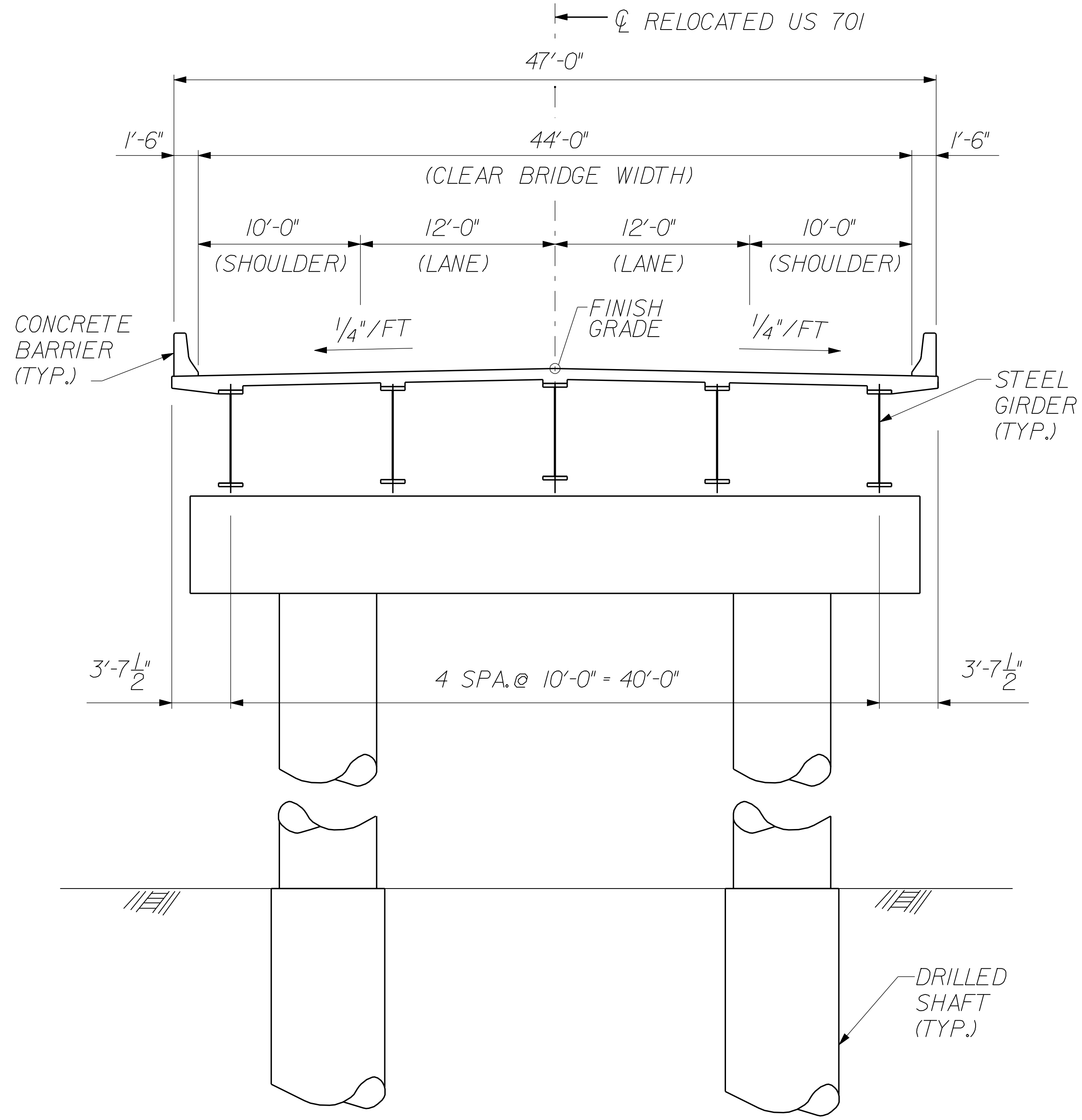
GREAT PEE DEE RIVER BRIDGE
TYPICAL SECTIONS
ALTERNATIVE A
FIGURE 17



TYPICAL SECTION

APPROACH SPAN UNITS

SCALE: 1" = 10'-0"



TYPICAL SECTION

MAIN SPAN UNIT

SCALE: 1" = 10'-0"

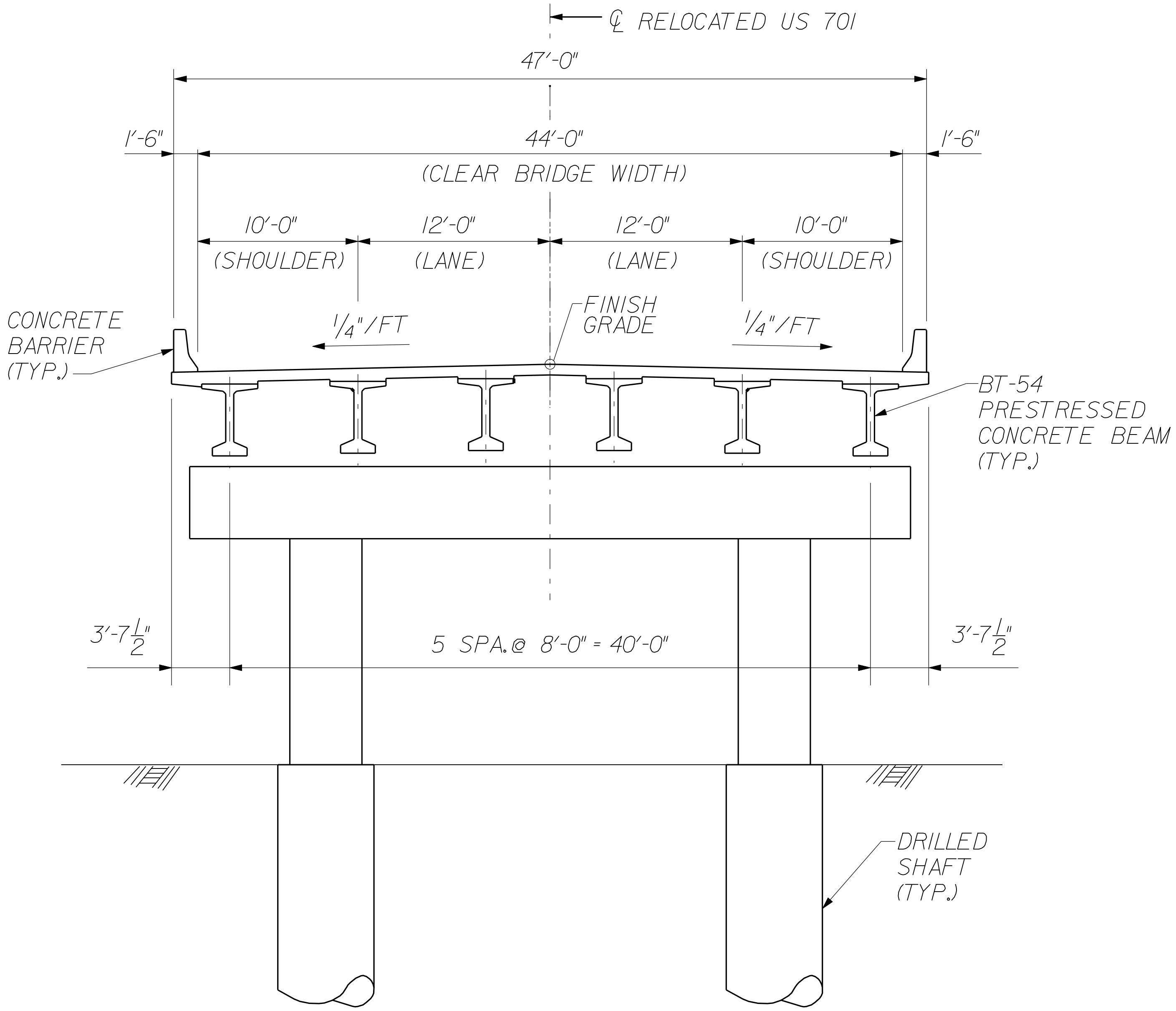
ALTERNATIVE B

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& YAUHANNAH LAKE

HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

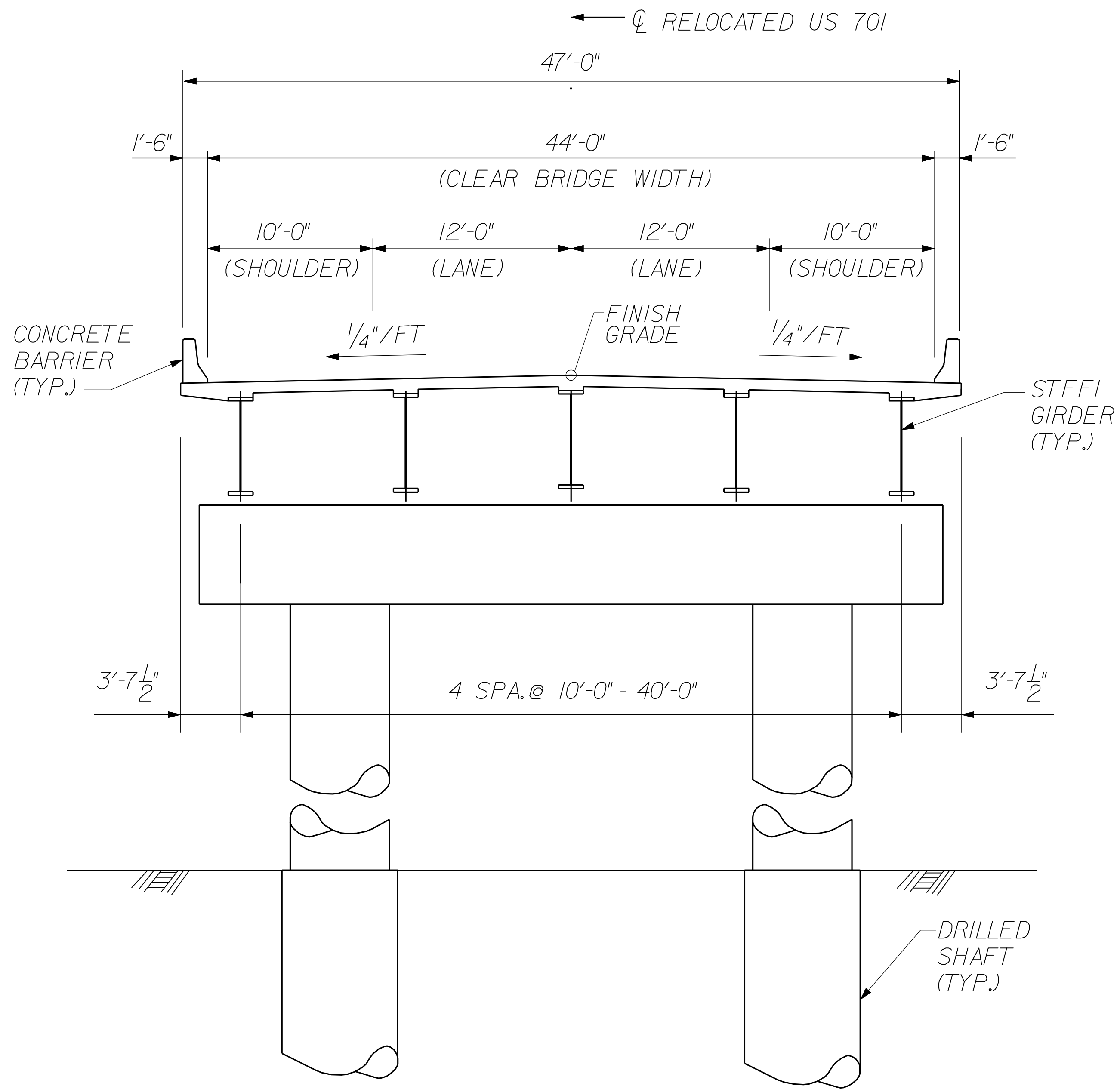
GREAT PEE DEE RIVER BRIDGE
TYPICAL SECTIONS
ALTERNATIVE B
FIGURE 18



TYPICAL SECTION

APPROACH SPAN UNITS

SCALE: 1" = 10'-0"



TYPICAL SECTION

MAIN SPAN UNIT

SCALE: 1" = 10'-0"

ALTERNATIVE C

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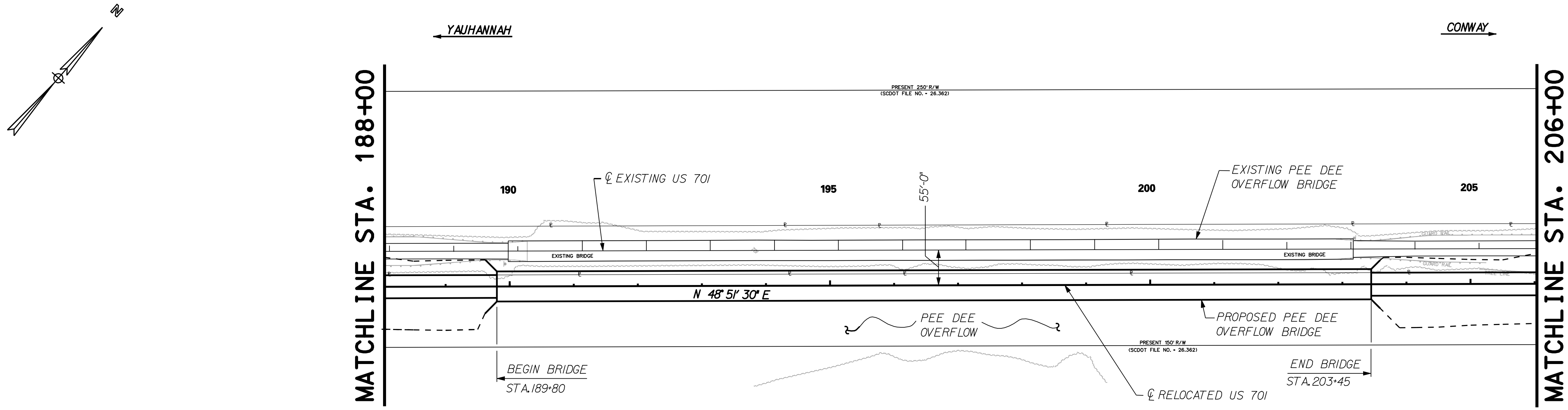
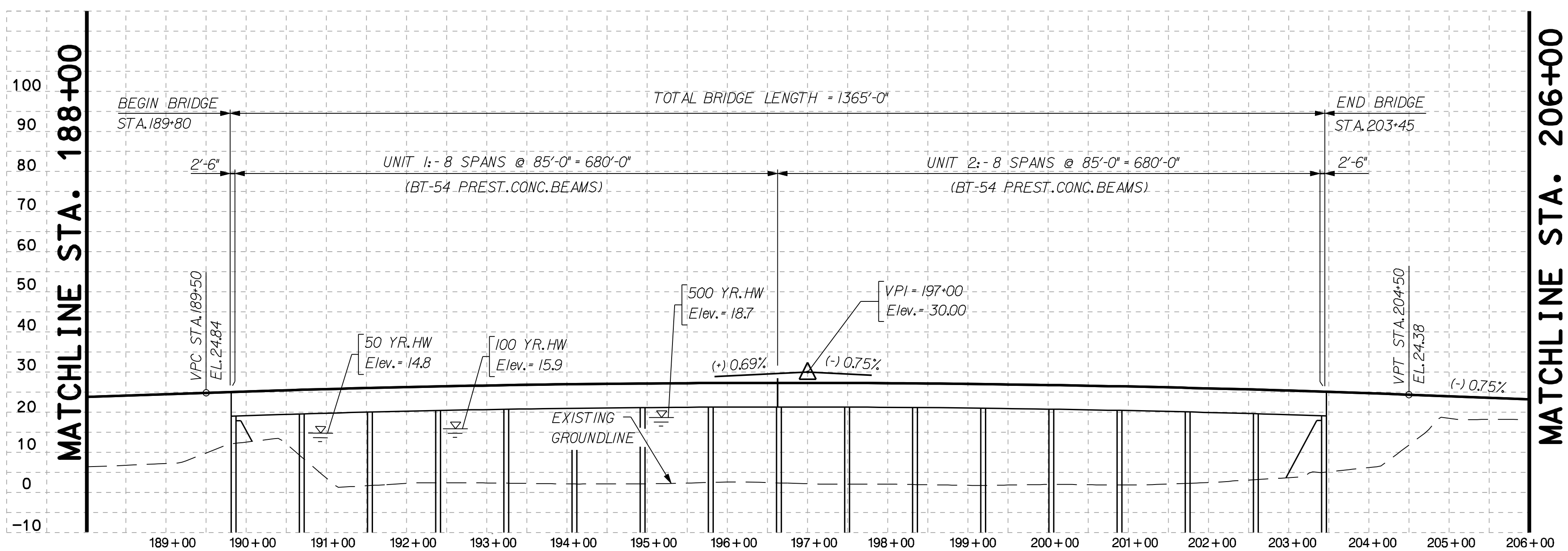
REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& YAUHANNAH LAKE

HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

GREAT PEE DEE RIVER BRIDGE
TYPICAL SECTIONS
ALTERNATIVE C
FIGURE 19



PLAN
SCALE: 1" = 200'



ELEVATION
H SCALE: 1" = 200'
V SCALE: 1" = 40'

NOTE: DELINEATED WETLANDS NOT SHOWN.

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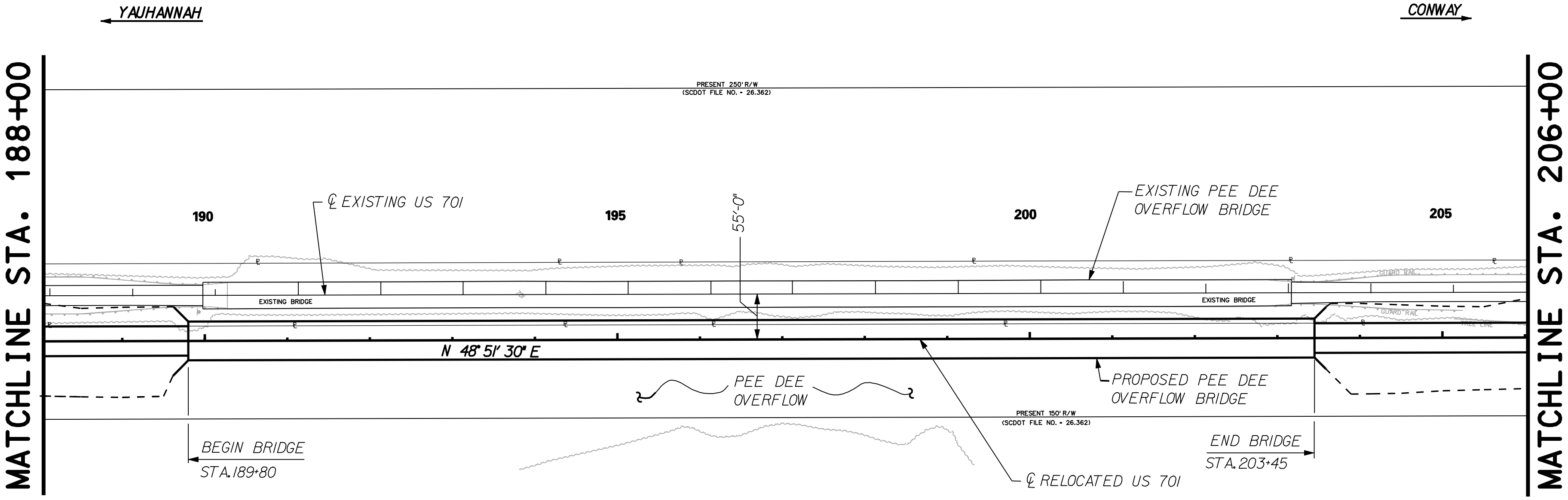
REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& YAUHANNAH LAKE

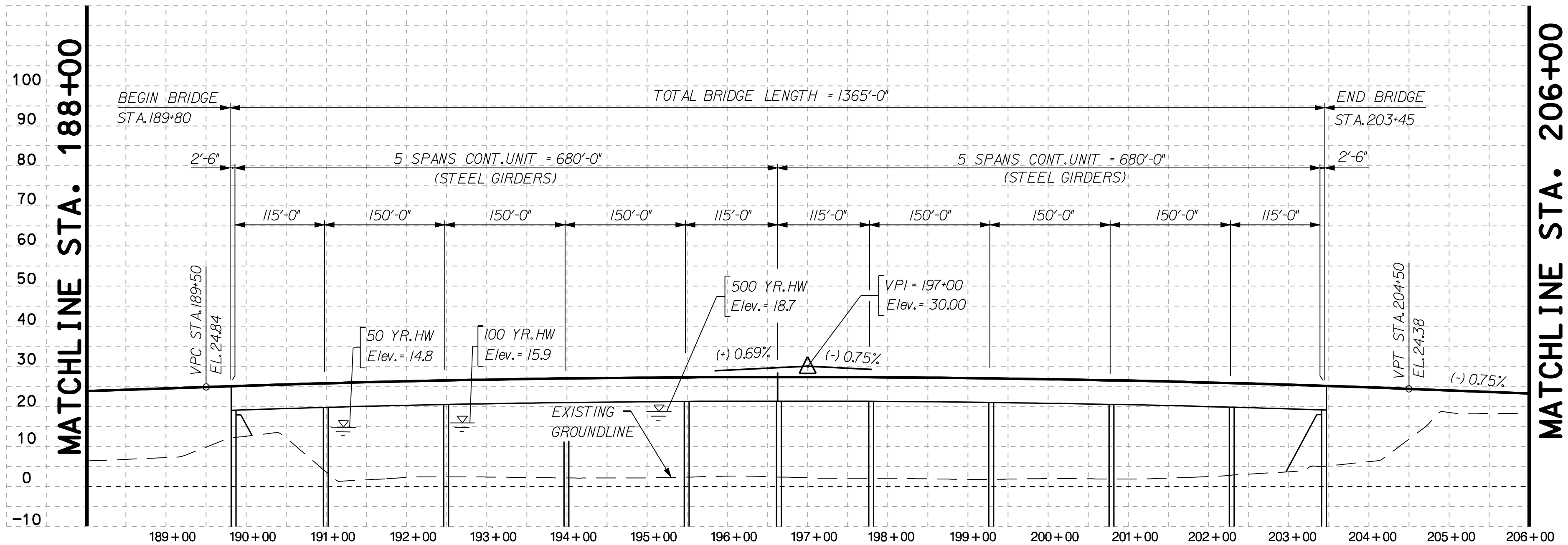
HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

PEE DEE OVERFLOW
PLAN & ELEVATION - ALTERNATIVE A
FIGURE 20



PLAN

SCALE: 1" = 200'



ELEVATION

H SCALE: 1" = 200'
V SCALE: 1" = 40'

NOTE: DELINEATED WETLANDS NOT SHOWN.

SCDOT
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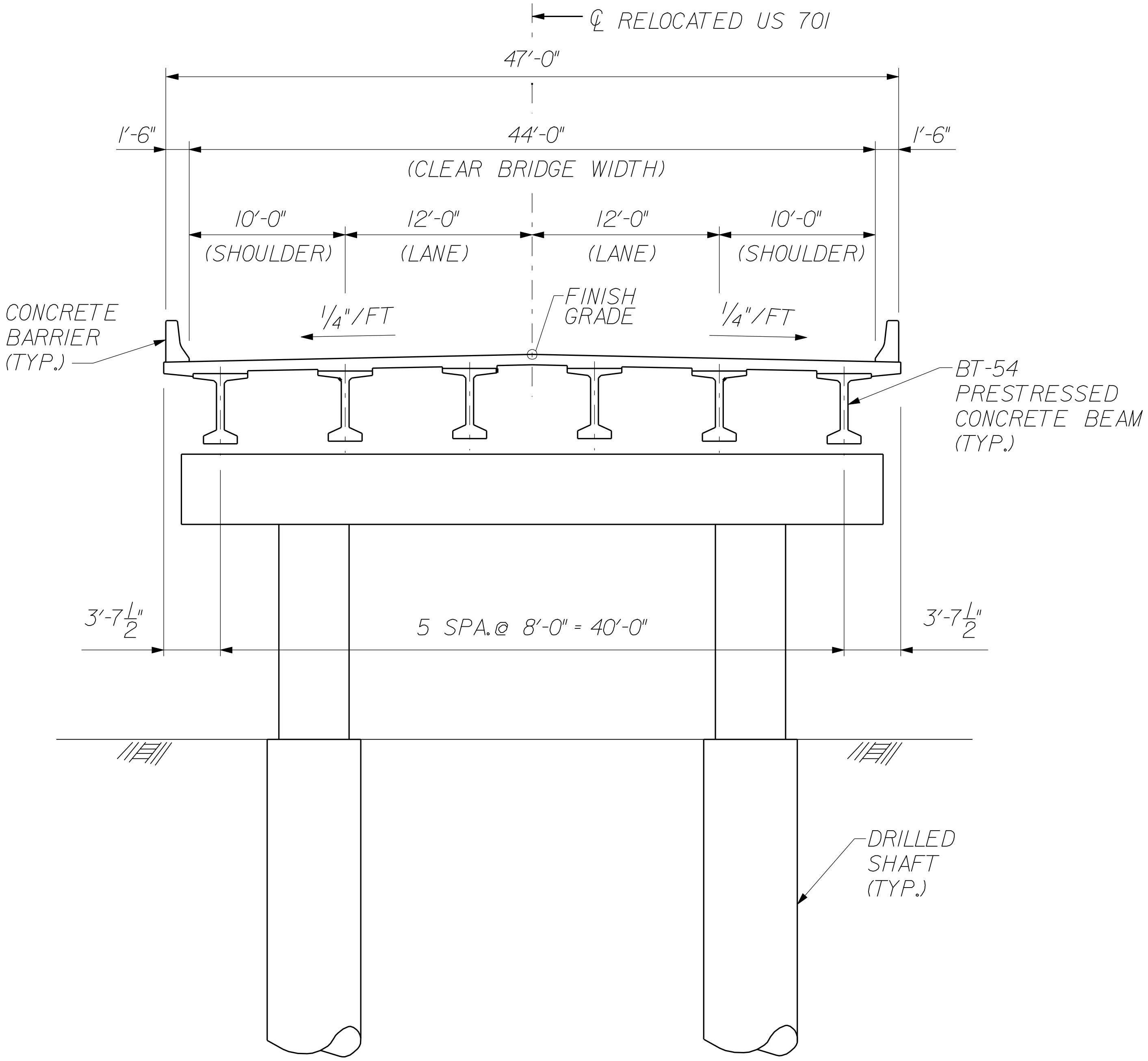
REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& YAUHANNAH LAKE

HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

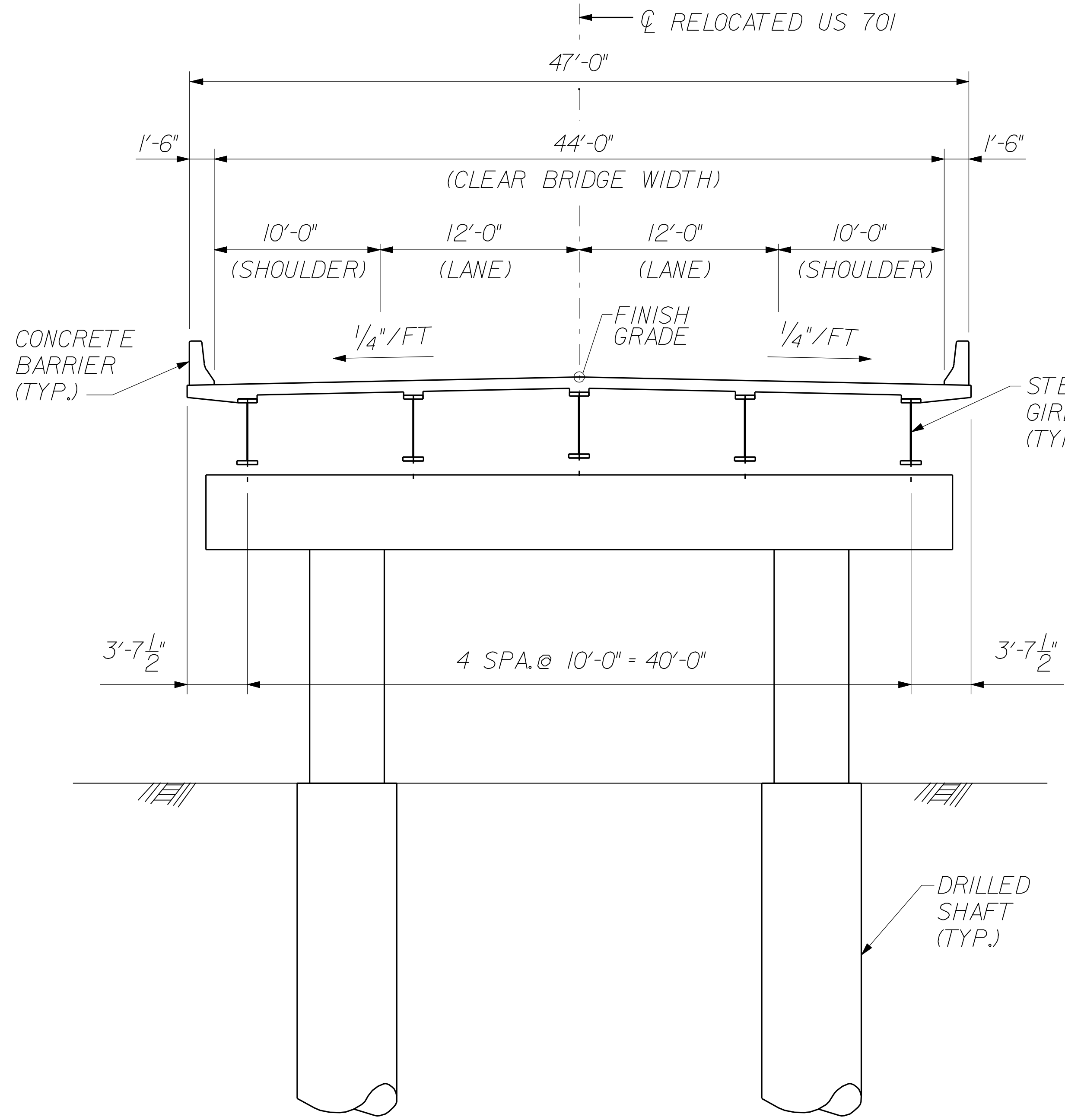
PEE DEE OVERFLOW
PLAN & ELEVATION - ALTERNATIVE B
FIGURE 21



TYPICAL SECTION

ALTERNATIVE A

SCALE: 1" = 10'-0"



TYPICAL SECTION

ALTERNATIVE B

SCALE: 1" = 10'-0"

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SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& YAUHANNAH LAKE

HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

PEE DEE OVERFLOW BRIDGE
TYPICAL SECTIONS
FIGURE 22


τβα Tuhin Basu & Associates, Inc.