BRIDGE HYDRAULIC DESIGN REPORT

I-95 (US 15/ US 301) NB AND SB
OVER LAKE MARION AND LAKE MARION RELIEF
DESIGN-BUILD PREPERATION PROJECT
CLARENDON/ ORANGEBURG COUNTY, SOUTH CAROLINA

PROJECT ID P041130

Hydraulic Design Reference for this study is the:
2009 Edition of SCDOT's Requirements for Hydraulic Design Studies

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Area of Interest: Two-Dimensional Model Extents – Terrain at Bridges

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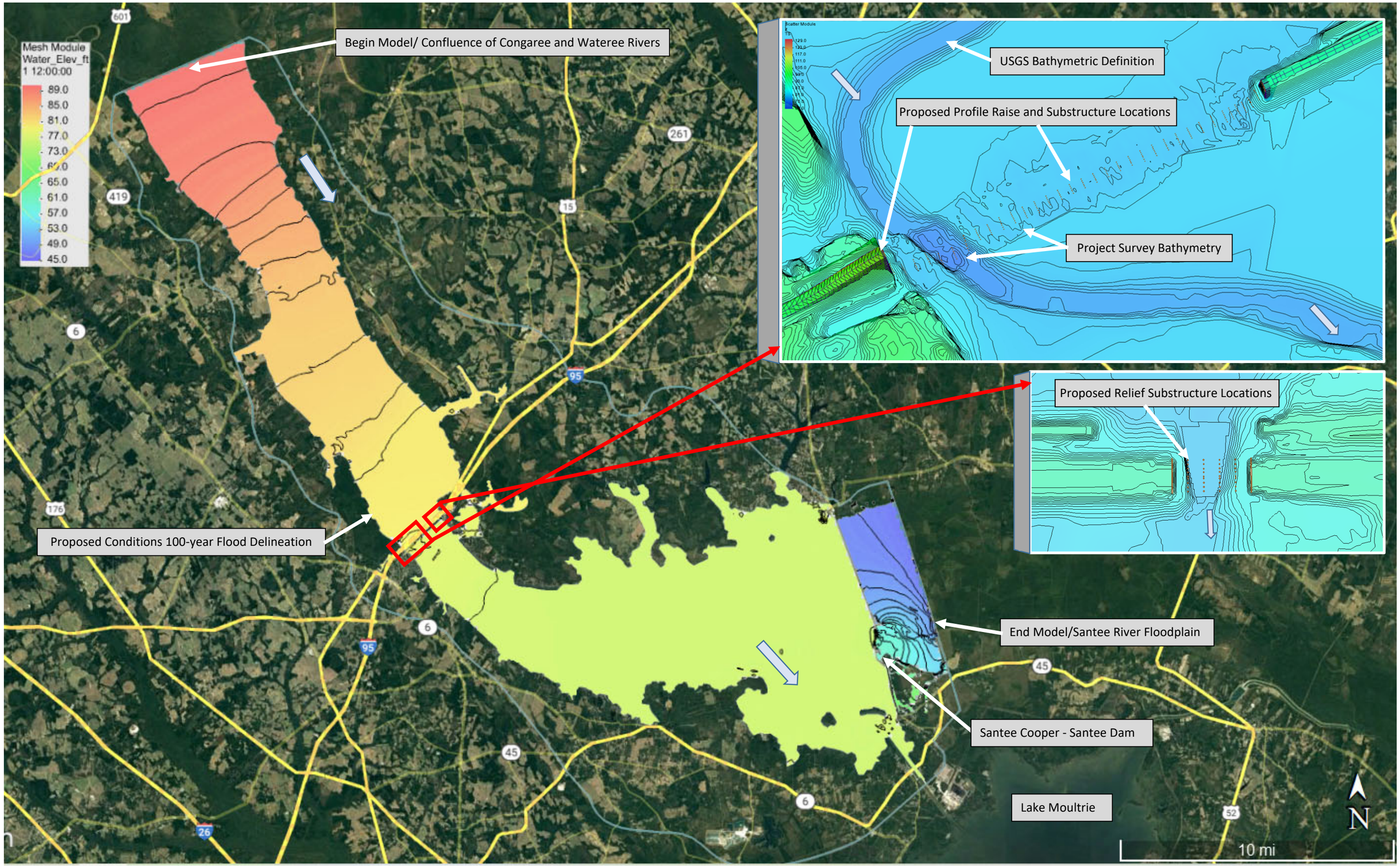
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Introduction

I-95 NB/SB Bridge Replacements over Lake Marion and Lake Marion Relief Hydrologic and Hydraulic Study

June 2023: Clarendon/ Orangeburg County, South Carolina

Project Description

TranSystems prepared this report to provide engineering calculations showing that the proposed bridges at the I-95 crossing over Lake Marion in Clarendon/ Orangeburg County, South Carolina and the I-95 crossing over Lake Marion Relief in Clarendon County will meet SCDOT's hydraulic design criteria for this project. The purpose of the project is to maintain connectivity and a safe interstate facility for the traveling public along I-95 over Lake Marion. Portions of the I-95 bridges will soon be in poor condition and do not meet current design standards for vehicle loads.

This project involves the replacement of the existing 85-span 4,500'-0" long by 35'-0" wide northbound and southbound lanes of I-95 over Lake Marion with a single bridge 4,523'-8" long by 137'-5.5" wide prestressed concrete girder bridge. To maintain the existing navigational channel and avoid all existing foundation elements, the span configuration shall consist of five 76'-0" spans, a 77'-4" span, twenty-three 140'-0" spans, two 160'-0" main spans, three 140'-0" spans, and a 106'-4" span. This configuration will utilize twelve continuous prestressed beam sections and an end bridge prestressed beam span.

This project also involves the replacement of the existing 9-span 360'-0" long by 35'-0" wide northbound and southbound lanes of I-95 over Lake Marion Relief (located at the northeast portion of the I-95 crossing) with a two separate 375'-0" long bridges separated by a 5-inch open joint in the middle. The northbound lane structure will be 72'-0" out to out and the southbound lane structure will be 89'-4.5" out to out totaling a final width 162'-7.5" inclusive of the 5-inch open gap. Both relief bridge structures will be prestressed concrete girder bridges. To avoid all existing foundation elements, the span configuration shall consist of five 75'-0" spans. This configuration will utilize two approach spans and a continuous prestressed beam section.

The bridges are located seven miles south of Summerton, South Carolina in Orangeburg County District 2/ Clarendon County District 1 and are not eligible for the National Register of Historic Places.

The existing NB and SB bridges carrying I-95 over Lake Marion (Asset IDs 05249 and 05258, respectively) were built in 1968 and underwent repairs in 2016. The NB and SB structure numbers are 1410009510100 and 1410009530100, respectively. The design load for both bridges are coded 5 or MS 18 / HS 20. The latest routine inspection for the NB bridge (conducted on May 7, 2021) concluded a deck, superstructure, and substructure coding of 7, a channel code of 8, and a water adequacy coding of 6. The Item 113 scour code was 3, scour critical. The latest routine inspection for the SB bridge (conducted on December 20, 2022) concluded a deck, superstructure, and substructure rating of 5, 6, 5, respectively. The inspection concluded a channel code of 8 and a water adequacy coding of 6. The Item 113 scour code was 9, foundations above floodwater (which is should not be applicable to spread footings below a lake). Both bridges have spill-through abutments with fair or no riprap under the bridge. Utilities include electrical lines running parallel and 300 feet downstream of the NB bridge as well as a SCDOT signal beam running across the lake between the NB and SB bridges.

The existing NB and SB bridges carrying I-95 over Lake Marion Relief (Asset IDs 05250 and 05259, respectively) were built in 1968. The NB and SB structure numbers are 1410009510200 and 1410009530200, respectively. The design load for both bridges are coded 5 or MS 18 / HS 20. The latest routine inspection for the NB bridge (conducted on March 1, 2022) concluded a deck, superstructure, and substructure coding of 6, a channel code of 7, and a water adequacy coding of 6. The Item 113 scour code was 5, Foundation Stable; scour within the limits of footings or piles. The latest routine inspection for the SB bridge (conducted on December 28, 2021) concluded a deck, superstructure, and substructure rating of 7, a channel code of 7 and a water adequacy coding of 8. The Item 113 scour code was 5, Foundation Stable; scour within the limits of footings or piles. Both bridges have spill-through abutments with fair conditions riprap under the bridge. Utilities include electrical lines running parallel and 300 feet downstream of the NB bridge.

The proposed bridges over Lake Marion and Lake Marion Relief will be stage construct, beginning with a Stage 1 construction between the existing bridges. Maintaining the existing alignment was the only viable alternative that fell within environmental permitting constraints related to disturbed land at the proposed begin and end bridge tie-ins.

The proposed bridges over Lake Marion and Lake Marion Relief will be designed for a load rating code of A for HL93 and will include adequate shoulders, a future lane in each direction, and a shared-use path protected by a median barrier with fence.

Hydraulic Analysis Requirements

A Level 1 and Level 2 analysis should apply to all designed bridges and a Level 3 analysis should be applied in cases where one-dimensional flow analysis is not adequate (SCDOT Requirements for Hydraulic Design Studies (RHDS) 1. Analysis Procedures). The proposed bridge is a newly designed bridge and will require a Level 1 and Level 2 analysis. The conditions at the project site cannot be analyzed through one-dimensional modeling thus a Level 3 analysis was conducted. The conditions conducive to two-dimensional modeling include:

- A 19,000-foot-wide floodplain upstream of I-95.
- Multiple Openings - Lake Marion, Lake Marion Relief, and Cantey Bay.
- Curve Linear flow across the face of the main bridge.
- Approximately 3,700 feet of flood flow running along the upstream embankment.
- Large area eddying downstream of I-95 - Between main bridge and relief bridge.
- Downstream Boundary Condition - Santee Dam.

1.1 Design Criteria

1.1.1 Design Frequencies

Both proposed bridges are located on an interstate and thus the design storm is the 50-year flood.

1.1.2 Floodplain Requirements

The Lake Marion floodplain at the proposed crossing is a FEMA Zone AE floodplain, meaning the floodplain is subject to inundation by the 1% AEP flood and base flood elevations have been determined. Even though a detailed hydraulic analysis has been performed, a regulatory Floodway has not been established. This aligns with the Hydraulic Design Bulletin (HDB) 2019-4 Section 1.1.2.2 criteria; Special Flood Hazard Areas (SFHA) without a floodway set by a detailed model. A “No Impact” will be analyzed for the bridge replacements of I-95 NB and SB over Lake Marion and Lake Marion

Relief as defined by HDB 2019-4 1.1.2.2 for SFHAs without a floodway, by demonstrating that the proposed hydraulic design results in no increase in the 1% AEP flood profile for published and unpublished cross sections within the provided FEMA model once the effective FEMA model has been provided by the FEMA Engineering Library (FEMA Engineering Library response included in Correspondence section of this study). There are no structures upstream of the bridges and no risk is expected as a result of the proposed conditions backwater.

1.1.3 Flow Velocities

Flow velocities during the design flood, 50-year, decrease from 2.78 ft/s in the existing conditions to 2.70 ft/s in the proposed conditions. Flow velocities during the base flood, 100-year, decrease from 2.97 ft/s to 2.95 ft/s. Minimum contraction scour is expected to occur in the channel and overbank regions of I-95 over Lake Marion. Since Lake Marion Relief does not have a defined channel in the vicinity of the project, all areas beneath the relief bridge between the limits of the abutment regions was considered as the overbank region.

1.1.4 Bridge Scour

An in-depth scour analysis was conducted for the proposed bridges carrying I-95 over Lake Marion and Lake Marion Relief. Ultimately the USGS Envelope Curve Method was selected as the best representation of scour based on the project and terrain characteristics. The in-depth scour discussion can be found in Level 2 Procedure Step 9 and scour calculations are displayed in Appendix III: Scour Determination.

The Hydraulic Engineer of Record will work closely with the geotechnical engineer after the completion of the geotechnical analyses (ongoing during the submission of this study) to ensure foundational stability of all bents in the result of a 500-year flood event. Through additional analyses, the Limestone encountered at all locations under the proposed bridge may exhibit properties associated with a scour resistant material and would not be expected to scour within the service life of the bridge. Combined with the low magnitude flood velocities, scour would not be expected to penetrate the Limestone. The pile configuration used at all intermediate bents will be designed to achieve foundation stability assuming all material above the Limestone washes away during the 500-year flood and is not replaced by upstream sedimentation transport.

1.1.5 Design Freeboard

The design freeboard over the design flood, 50-year, was 2.0 feet as outlined in the SCDOT Requirements for Hydraulic Design Studies (RHDS) 1.1.5.1 Freeboard for Riverine Bridges, but the controlling freeboard for the I-95 bridges over Lake Marion was 8.0 feet above maximum operating pool elevation as outline in HDB 2019-4 Section 1.1.5.2. The maximum operating pool elevation at I-95 as provided in the existing plans (approved 9/3/1968) was 76.8 feet (NGVD29); 76 feet (NAVD88). Thus, the minimum low chord to meet freeboard criteria was 84 feet. The low chord of the proposed bridges is 84.2 feet and is located on the upstation side of Span 7, the first 140-foot span after the shorter causeway spans.

The design navigational clearance as set by the coast Guard Requirements/Permit is 50 feet above the maximum operating pool elevation of 76.8 feet (NGVD29); 76 feet (NAVD88). Thus, the minimum low chord to meet freeboard criteria was 126 feet. The low chord of the main spans over the navigational channel is 126.12 feet.

1.1.6 Bridge Abutment Protection

Riprap will be placed on the bridge end fills per SCDOT's standard drawing. The end fill slopes and riprap will extend the appropriate distance upstream of the southbound bridge, extend under the bridges, and extend the appropriate distance downstream of the northbound bridge.

1.1.7 Guide Banks

The Lake Marion floodplain upstream of I-95 is approximately 19,000 feet wide and guidebanks were initially considered for additional abutment protection, however the approach flow outside of the proposed bridge limits to the west is not significant and the approach flow to the east could be considered significant, but is relieved through the proposed Lake Marion Relief bridge. Guidebank calculations were computed using methods prescribed in HEC-23. The recommend guidebank length is below the limits of HEC-23 Figure 10.3 Length of Guidebank and guidebanks are not required for the large embankment flow computed by the two-dimensional hydraulic model from the stagnation point located near the end bridge of I-95 over Lake Marion Relief to the proposed begin bridge of I-95 over Lake Marion.

No guidebanks are recommended upstream of the I-95 over Lake Marion or I-95 over Lake Marion Relief bridges. Guidebanks cannot be placed west of the I-95 over Lake Marion bridge nor east of the Lake Marion Relief bridge due to the geometry of the crossing and location of the bridges on the far edges of the floodplain.

Level 1 Procedure

Step 1 Stream Characteristics

Lake Marion in the vicinity of the project is a wide perennial lake with a silt-clay bed material. The lake is set in a low relief valley with a wide floodplain and little to no natural levees. The floodplain is incised with non-alluvial channel boundaries covered greater than 90 percent by trees along the floodplain banks. Lake Marion has defined channel, but the channel is located nearly 38 feet below the surface of the lake and was determined to not accurately represent the sinuosity of the lake. The floodplain as a whole has straight sinuosity, is not braided, is not branched, of eqiwidth, and has narrow to no point bars.

Step 2 Land Use Changes

The drainage area of I-95 at Lake Marion extends northwest of the crossing through the state of South Carolina and into North Carolina to the Great Smokey Mountain border with Tennessee. Due to the magnitude of the drainage area, the size of Lake Marion, and the downstream regulation of the Santee Dam land use changes were determined to not affect future hydraulic results of Lake Marion at the proposed I-95 bridges. In comparing the Orangeburg Current Land Use Map to the Future Land use map (see Appendix I: Additional Information – Clarendon County Comprehensive Plan 2018-2028 was not available) there is no future changes in the vicinity of the project. Since the future land use is expected to produce the same runoff as the current conditions, the project site is not expected to experience a change in the sediment supply at the bridge.

Step 3 Overall Stability

SCDOT RHDS references Table 3.2 and Figure 3.2 in HEC-20 (2001) to assess the overall stream stability. These references are reflected in HEC-20 (2012) as Table 4.3 and Figure 4.2 which were used to assess overall stream stability for this study.

The Lake Marion floodplain in the vicinity of the project has a low sinuous ratio which indicates the floodplain and flood flow are nearly straight. Lake Marion does not have a defined channel influenced by these factors since channel responses cannot be determined for waterways with channels over 38 feet below the water surface. Floodplain bank response for the lake conditions and heavily vegetated banks was determined to be stable.

Step 4 Lateral Stability

The original bridge plans for both twin bridges over Lake Marion and Lake Marion Relief were compared to the project survey to determine lateral stability of the floodplain. The floodplain banks as captured in the project survey were at similar locations compared to the floodplain banks as constructed. Combined with the well vegetated floodplain banks and relatively low velocities flowing along the floodplain banks, as determined by the hydraulic model, the floodplain banks were determined to be laterally stable.

Step 5 Vertical Stability

Neither aggradation nor degradation of bed material was observed at I-95 over Lake Marion nor I-95 over Lake Marion Relief. For these reasons and since proposed site conditions will be similar to existing site conditions, neither aggradation nor degradation are expected in the vicinity of the proposed bridge.

Step 6 Debris Potential

The existing Lake Marion bridge configurations have a higher risk of debris accumulation as a result of the 40-foot spans over the causeway located on the eastern side of the Lake Marion Crossing. The existing Lake Marion Relief bridge configurations also have a higher risk of debris accumulation as a result of the 40-foot spans. The proposed bridge over Lake Marion will have fewer bents in the causeway and a lower debris accumulation potential using 76’-0” spans through the causeway. The proposed bridge over Lake Marion Relief will also have fewer bents in and a lower debris accumulation potential using 75’-0” spans across the bridge.

Step 7 Stream Response

Lake Marion in the vicinity of I-95 has a defined channel over 38 feet below the lake's surface; therefore the lake and floodplain banks will be evaluated with respect to stream response.

The existing conditions are laterally and vertically stable and the insignificant future land use is not expected to influence the Lake Marion floodplain. The proposed bridges add hydraulic opening with increased bridge length and raised low chord elevations, reduce potential for debris accumulation, and improves backwater upstream of I-95. Thus, Lake Marion's overall response is expected to be positive.

Even though the overall stream response is expected to be positive, the proposed bridges will be susceptible to scour and a hydraulic design is required per the project RFP.

For these reasons a Level 2 Analysis was required.

Level 2 Procedure

Step 1 Flood History and Hydrology

A. Flood History

The existing bridge plans for Lake Marion and Lake Marion Relief indicate a maximum lake level of 76.8 feet (NGVD29) presumably a result of the downstream regulation controlled by the Santee Dam. When converted to NAVD88 using NOAA's VERTCON, the high-water mark is 76 feet (NAVD88). This elevation would result in excessive hydraulic clearance from the existing and proposed low chord elevations of 122.69 feet and 126.12 feet, respectively.

The United States Geological Survey (USGS) has a gage representative of flood history before the completion of Lake Marion located between I-95 and the Santee Dam (approximately 13 miles downstream of I-95). USGS Gage 02170000 was in service from 1908 until 1941 and captured a historic flood before the construction of the Santee Dam and thus the completion of Lake Marion on July 21st, 1916. This historic flood produced a High Water elevation of 66.19 feet (NAVD88) and the discharge was captured as 374,000 cfs.

USGS Gage 02170001 is located at the Santee Dam spillway (approximately 19 miles downstream of I-95), but has only been in service since 2007 thus has only captured regulated flood elevations in the years since. Additionally, discharge is not captured nor recorded at this gage.

The Clarendon County and Orangeburg County Flood Insurance Studies (FIS) contain little information on Lake Marion and do not contain any flood history on Lake Marion.

B. Bridge Site Scour History

The latest routine inspection reports for the four existing bridges do not indicate a scour history nor scour concerns. All inspection reports note large riprap at the water lines and to reference the underwater inspection report. The underwater inspection reports were completed by Collins Engineers Inc. and indicate some variation of lakebed profiles from 2016 to 2021, but no significant scour under the bridges. All Inspection Reports are located in Appendix I: Additional Information.

C. Hydrology

The hydrology adopted for this study was calculated using USGS's PeakFQ Version 7.4 and utilized gage data from USGS Gage 02170000 as recommended by Authors Anthony Gotvald and Toby Feaster of "Magnitude and Frequency of Floods for Rural Streams in GA, SC, and NC, 2017-Results" Recently republished on April 28, 2023. Peakflow gage data was recorded from 1908 to 1941. Since Lake Marion was completed in 1941, the peakflow for that year was noted as being regulated and was thus removed from the analysis per USGS recommendation. The resulting PeakFQ discharges would be representative of conditions prior to the construction of Lake Marion and are considered conservative values since there is no regulation of flood events in the vicinity of the project crossing.

The drainage area was determined to be 14,400 square miles and extends northwest through the state of South Carolina to the North Carolina-Tennessee border at the Great Smokey Mountains. Since the South Carolina regression equations upper limit for drainage area is 9,000 square miles, USGS StreamStats was not recommended for use in determining applicable discharges for flood events on Lake Marion. However, StreamStats was used to delineate the drainage area and compute an impervious area of 3.37 percent using the National Land Cover Database of 2006. The drainage area of I-95 at Lake Marion is primarily located in South Carolina Hydrological Region 1 (77.4%) and partially located in South Carolina Hydrological Regions 2, 3, and 4 (9.9%, 6.2%, and 6.4%, respectively).

Flood discharges used in this study are presented below in Table 1 and the full PeakFQ output is presented in Figure 1.

Table 1: StreamStats Hydrology Adopted – Four Hole Swamp

Storm	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Q (cfs)	90,640	171,500	245,500	366,700	480,400	616,900	1,046,000

Figure 1: USGS PeakFQ Output – USGS Gage 02170000

ANNUAL EXCEEDANCE PROBABILITY	<- EMA ESTIMATE -> WITH REG SKEW	WITHOUT REG SKEW	<- FOR EMA ESTIMATE WITH REG SKEW -> LOG VARIANCE OF EST.	<-CONFIDENCE LIMITS-> 5.0% LOWER	95.0% UPPER
0.9950	18550.	18550.	0.0250	7813.0	29770.0
0.9900	21140.	21140.	0.0184	9994.0	31720.0
0.9500	30960.	30960.	0.0082	18770.0	41230.0
0.9000	38510.	38510.	0.0059	26120.0	50560.0
0.8000	50880.	50880.	0.0049	37820.0	66880.0
0.6667	66950.	66950.	0.0049	50790.0	88200.0
0.5000	90640.	90640.	0.0052	68290.0	121300.0
0.4292	103200.	103200.	0.0054	77470.0	140000.0
0.2000	171500.	171500.	0.0073	126600.0	257700.0
0.1000	245500.	245500.	0.0106	175700.0	431700.0
0.0400	366700.	366700.	0.0183	246600.0	886700.0
0.0200	480400.	480400.	0.0270	305100.0	1592000.0
0.0100	616900.	616900.	0.0383	367800.0	2920000.0
0.0050	780300.	780300.	0.0523	434800.0	4745000.0
0.0020	1046000.	1046000.	0.0753	530500.0	8951000.0

D. Develop Comparative Data

Comparative data was compiled for the nearest upstream and downstream crossings. The nearest upstream crossing is US 601 over the Congaree River located 20.5 miles upstream of I-95 and on the Richland County-Calhoun County border. The drainage area associated with US 601 over the Congaree River is 8,520 square miles and is significantly less than the I-95 drainage area because the US 601 drainage area is upstream of the Wateree River confluence. The nearest downstream crossing is US 52 over the Santee River located 31 miles downstream of I-95 and on the Berkeley County-Calhoun County border. US 52 over the Santee River has an insignificant drainage area between the Santee Dam and the crossing for use as a comparison. Ultimately, neither crossing was determined to be comparable to the I-95 bridges over Lake Marion. The I-95 crossing of Lake Marion is a unique crossing and not comparable to other bridges within the state.

Table 2: Comparative Data Summary

	US 601 over Congaree River	I-95 over Lake Marion	US 52 over Santee River
Distance from Bridge (mi.)	20.5	New Bridge	31.0
Drainage Area (sq. mi.)	8,520	14,400	400*
FEMA Zone	A	AE	A
Structure Length (ft)	1,760	4,523.67	1,655

**Drainage Area downstream of Santee Dam and upstream of crossing.*

<u>Step 2</u> Evaluate Hydraulic Conditions

A. Evaluate Field Conditions

A site visit was conducted on 7/29/2022 to evaluate hydraulic conditions at I-95 over Lake Marion and I-95 over Lake Marion Relief, determine Manning's "n" coefficients, and conceptualize proposed bridge alternatives/ alternate alignments.

The bridge configuration of I-95 NB and SB lane over Lake Marion and Lake Marion Relief were confirmed during the site visit. The original two braced concrete columns and four concrete piles were observed at the main spans and causeway spans, respectively. All piles displayed dark water lines and approximately a foot of mudlines near the lake's surface. The two largest spans over the Lake Marion navigational channel consisted of steel girder beams and were located at the crest of a vertical curve which tied into the southern banks relatively quickly, but gradually transitioned into a sag curve over the causeway portion of the Lake Marion Bridge and an apparent zero-grade over the northern portion of the Lake Marion Bridge. All other spans including the Lake Marion Relief Bridge consisted of prestressed concrete girder beams and the zero-grade appeared to continue across the roadway embankment within Lake Marion and extend through the Lake Marion Relief bridge. The asphalt bridge decks were in good condition and a metal roadway guardrail was observed at all four bridges in front of the originally constructed concrete bridge railings. The spill through abutments at all four bridges were in good condition with good condition to no riprap observed. Evidence of past flooding could not be observed due to the lake water and depth at each bent. There was no debris observed at the time of the site visit. There was no defined channel observed during the site visit. No vegetation or signs of aggradation (sand deposits) were observed in the floodplain or under the bridge. The floodplain in the vicinity of the bridge was also absent of trees, fallen trees, and vegetation. Lake Marion was calm and rippling slowly at the time of the site visit.

In addition to the NB and SB bridges of Lake Marion and Lake Marion Relief, the closed US 301 and US 15 bridges were observed running parallel to and upstream of the I-95 bridges. The closed bridges, while a worn concrete color on the surface, appeared to be in fair to good condition throughout the crossing. The railings of the closed bridges consisted of aesthetic metal panels bounded by concrete end caps. The closed bridges over Lake Marion and Lake Marion Relief included more bridge length in lieu of roadway embankment than the existing I-95 bridges. The closed road over Lake Marion and between the closed bridges was in a deteriorated condition with trees and vegetation beginning to grow on the roadway. Immediately upstream of the closed bridges and scattered along the Lake Marion crossing were three old intermediate bents less than half the height of the existing bridges. Adjacent to the causeway portion of the Lake Marion closed bridges there were three old bridge spans intact, each with three intermediate bents and one with advertising billboards.

An electrical line was observed well above the bridge deck elevations running parallel and downstream of the I-95 bridges. From the bridge deck, the four metal legs of the transmission towers appeared orange, likely an indication of rust.

Residential and commercial structures line the upstream and downstream banks of Lake Marion in the vicinity of the I-95 crossings. Most of the structures are located very close to the floodplain boundary and most of those structures have docks built into Lake Marion. At the I-95 approach from the south and adjacent to the Lake Marion bridges were resorts and lake homes lining a small upstream tributary, Chapel Branch. Also, a large golf course community, Santee Cooper Country Club, is built on the lake's banks immediately downstream of I-95. Along I-95 and located a short distance southwest of the Lake Marion crossing was a state-owned rest stop. At the I-95 approach from the north and adjacent to the Lake Marion Relief bridges were residential structures primarily lining Lake Marion's upstream banks. The residential structures wrap around northeast until a peninsula thins bounded by Cantey Bay (an additional overflow crossing of I-95). Numerous boat docks/ marinas, RV resorts, and a few commercial structures were observed at the I-95 approach from the north and downstream of I-95.

B. Hydraulic Analysis

A hydraulic analysis was performed to analyze the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year flood events as prescribed in the RHDS Section 1.3.1. The 2-year flood profile represents the mean annual flood or the dominant, bank-full flood that shapes the channel. The velocities from the 2-year flood were used to evaluate the stresses that are modifying the floodplain banks. As discussed above, the 50-year flood event is the design storm based on the roadway classification of I-95. Design freeboard applies to the proposed 50 flood event. In addition to the freeboard criteria outline in the RHDS, project specific freeboard over the navigational channel as set by the US Coast Guard of 50.0 feet and freeboard over the approach spans as outlined in SCDOT HDB 2019-4 Section 1.1.5.2 of 8.0 feet above the maximum operating pool elevation of Lake Marion was also met in the proposed design. The 10-, 50-, 100-, and 500-year flood profiles are used for environmental permitting, regulatory agencies, and theoretical scour computations.

The hydraulic analyses of I-95 over Lake Marion and Lake Marion Relief were performed in accordance with procedures outlined in Federal Highway Administration's (FHWA) Publication No. FHWA-HIF-19-061, Two-Dimensional Hydraulic Modeling for Highways in the River Environment – Reference Document. As discussed above, the hydraulic analysis of the complex system on a wide floodplain, with multiple openings, and a controlling downstream dam was conducive to a two-dimensional analysis. Aquaveo's Surface-water Modeling Systems (SMS) version 13.2.13 coupled with Sedimentation and River Hydraulics Two-Dimension (SRH-2D) version 3.5.0 was the SCDOT approved software used in this study.

The basis of the new hydraulic model was the topography data in the form of project survey and available LiDAR of varying densities based on locations of hydraulic importance such as the I-95 crossing, the Santee Dam spillway, and the diversion canal to Lake Moultrie. All topographic data was obtained in the North American Vertical Datum of 1988 (NAVD 88) and all horizontal datums from acquired data were displayed in NAD83 State Plane South Carolina FIPS 3900 (U.S. Feet) for use in the hydraulic model. Available USGS LiDAR was obtained and trimmed to fit the hydraulic model extents.

The hydraulic model extends approximately 19 miles upstream of I-95 to the confluence of the Congaree and Wateree Rivers. The limits of the model allow the backwater induced by I-95 crossings to dissipate withing the limits of the hydraulic model per SCDOT RHDS 1.3.1 Step 2 B. A sensitivity analysis was performed per SCDOT RHDS 1.3.1 Step 2 B which resulted in increased downstream limits of the hydraulic model until the starting elevation of the Known Downstream Water Surface Elevation boundary condition did not affect the computed high-water depth at the twin bridges. Initially, the downstream limit was set at the Santee Dam and the boundary conditions reflected provided information from the controlling authority, Santee Cooper. However, this method forced hydraulic results at the dam rather than calculated results at the dam. As a result of the sensitivity analysis and to allow for calibration at the Santee Dam, the downstream limits of the hydraulic model was moved approximately 11,000 feet downstream of the dam or just over 19 miles downstream of I-95. The final hydraulic model includes a river reach profile approximately 47 miles in length along Lake Marion/ Santee River and encompasses an area of approximately 375 square miles.

The LiDAR obtained for the model included multiple USGS OPR SC_East_Central_2017_D18 LiDAR tiles as well as 1/3 arc second LiDAR data from USGS (USGS_13_n34w081_US FT) for terrain upstream and downstream of I-95. In addition to topographical terrain, the bathymetry of Lake Marion was provided by Santee Cooper and incorporated into the LiDAR. The bathymetry was provided in the form of USGS 4-foot contours and extend from the Santee Dam to an area approximately 11.5 miles upstream of I-95. Lastly the project survey was burned into the final hydraulic model scatterset as the top priority of topographical and bathymetrical data.

The existing conditions begin at the confluence of the Congaree and Wateree Rivers to allow for the significant flood discharges to normalize within the floodplain before interaction with the Stillwater of Lake Marion. The existing conditions mesh generation adequately represented the upstream and downstream floodplains, the entirety of the lakebed, the underlying channel, Lake Marion's banks/ boundary, the elevation rise encompassing Lake Marion, the embankments associated with the closed US 301/ US 15 and current I-95 crossings, the northern and southern earthen dams extending from Santee Dam, and the Santee Dam concrete spillway. Meticulous efforts were taken to provide mesh density in areas of hydraulic importance while distributing element density to the model boundaries using the mesh generation bias functions. The areas of importance such as the two bridge crossings required a smaller mesh size to capture the existing and proposed hole-in-mesh piers, but the total number of mesh elements is a finite number, or the simulation will not run correctly. Thus, a

heavy bias was utilized to expand element sizes quickly from the piers to the floodplain and keep the total number of elements below 150,000. The same meshing techniques were utilized at the Santee Dam to allow for a considerable number of calculations through the dam's spillway and along the dam's embankments while maintaining the efficiency of mesh elements in areas of lesser hydraulic importance. Minimal calibration was needed to closely match the FEMA Zone AE floodplain delineation within the limits of the existing conditions hydraulic model and there was no FEMA Regulatory Floodway to consider in the analysis.

The natural conditions consisted of the calibrated existing conditions with the removal of the I-95 roadway embankments and hole-in-mesh pier elements within Lake Marion. The roadway embankments were also removed along the banks of Lake Marion and further northeast of the crossing to allow for overflow discharges to pass through the area naturally. The Manning's "n" Materials Coverage was updated accordingly to account for the changes in terrain at the crossings.

The proposed conditions consisted of the calibrated existing conditions, but with the proposed bridge configurations and proposed alignments determined to best avoid existing bridge foundations, maintain the navigational channel, and limit the environmental impact adhering to the project's environmental criteria. The Manning's "n" Materials Coverage was updated accordingly to account for the changes in terrain at the crossings. SMS 3D Bridge coverages were also utilized to visualize the proposed bridges over Lake Marion and Lake Marion relief as well as portions of the Santee Dam. The closed dam scenario or Santee Dam crest at elevation 75 feet (74.151 feet NAVD88) was used to compute worst-case water surface elevations at I-95. Additionally, a proposed condition was constructed specifically to analyze scour. The proposed scour conditions consist of equivalent pier lengths as defined in HEC-18 at each intermediate bent. The open dam scenario or Santee Dam crest at elevation 63 feet (62.151 feet NAVD88) was used to compute the worst-case velocity results at I-95 for the scour specific condition.

The proposed conditions marginally improves the hydraulic opening at the bridge ends, but replaces many smaller intermediate bents with significantly larger columns ultimately resulting in slightly higher elevations than existing conditions. Smaller piers may improve the water surface elevations.

The proposed bridge configuration, proposed pile diameters, and proposed vertical alignment were based on conceptual bridge plans and are subject to change based on finalized design. Thus, the hydraulic results at both I-95 over Lake Marion and I-95 over Lake Marion Relief are also subject to change based on the final design of the proposed bridges.

Figure 2: Existing Bridge Configuration Visual

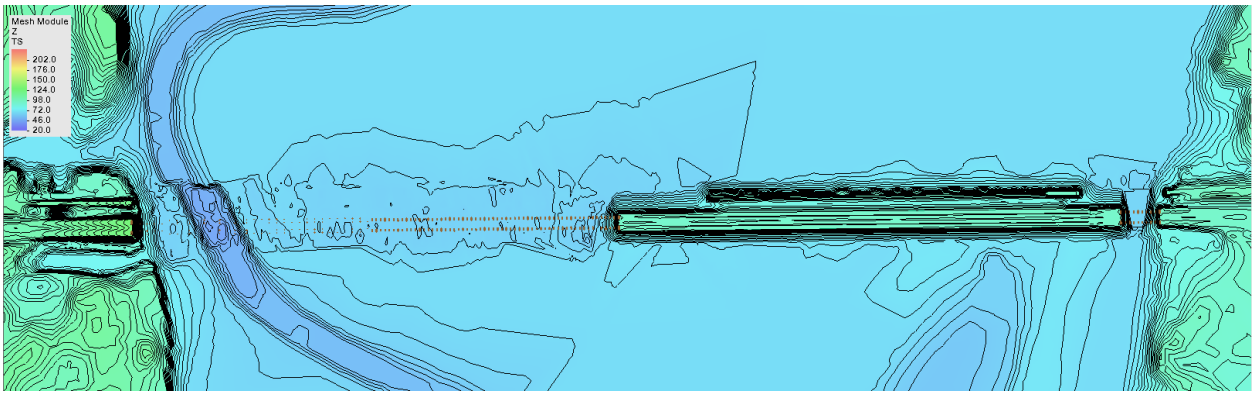


Figure 3: Proposed Bridge Configuration Visual

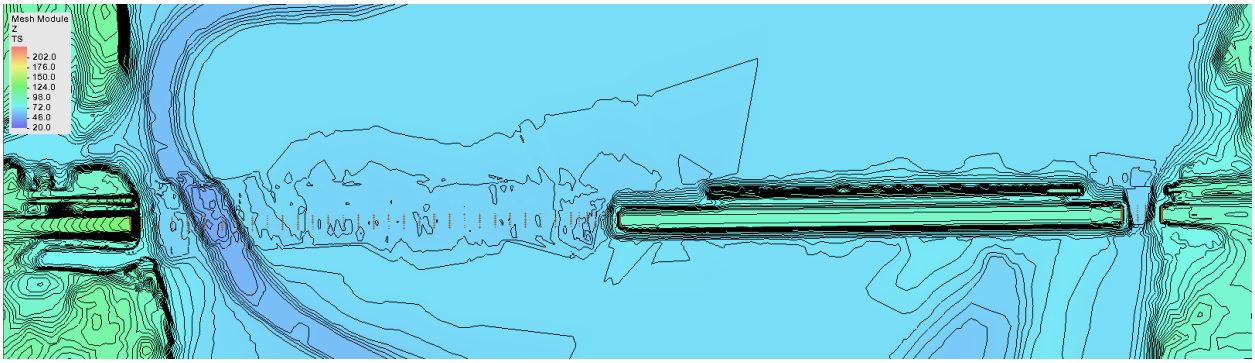


Figure 4: Downstream Extents of Model – Santee Dam Closed Scenario (74.151 feet NAVD88)

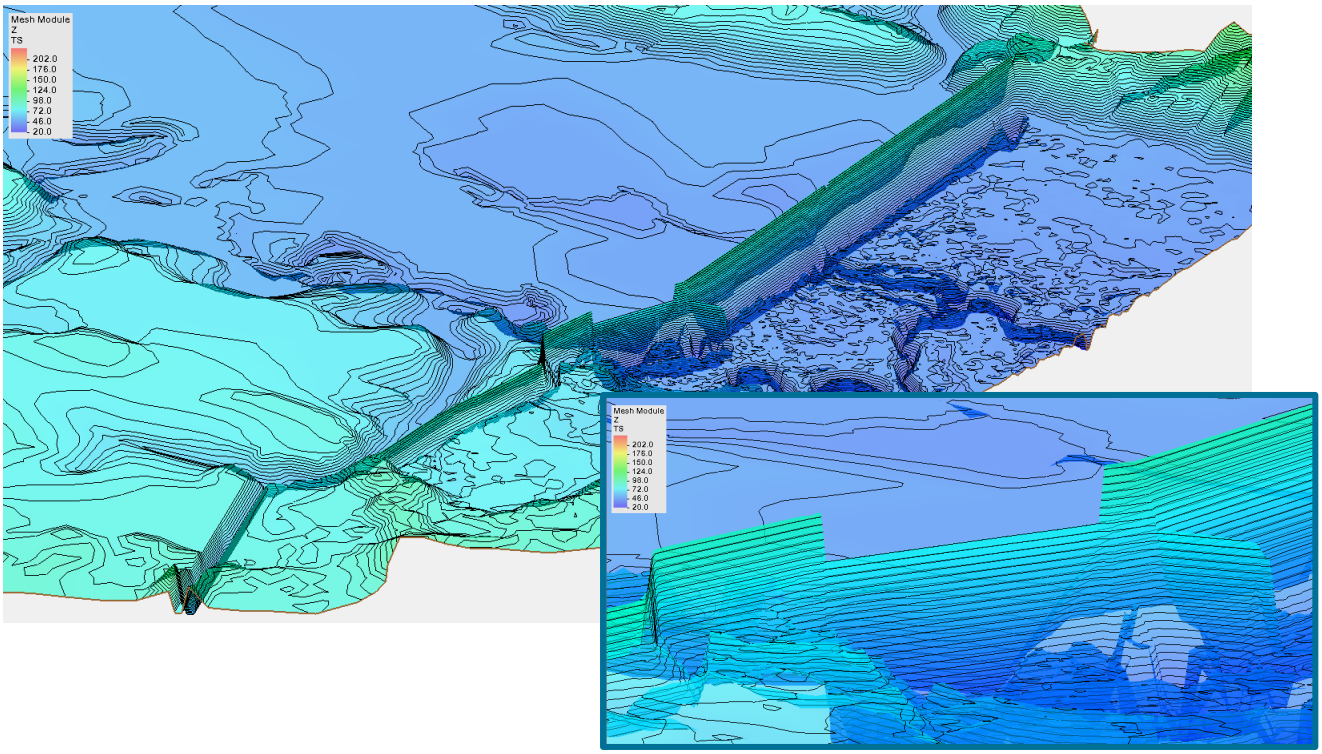


Figure 5: Proposed Bridge Configurations and Santee Dam – 3D Coverages (Visual)

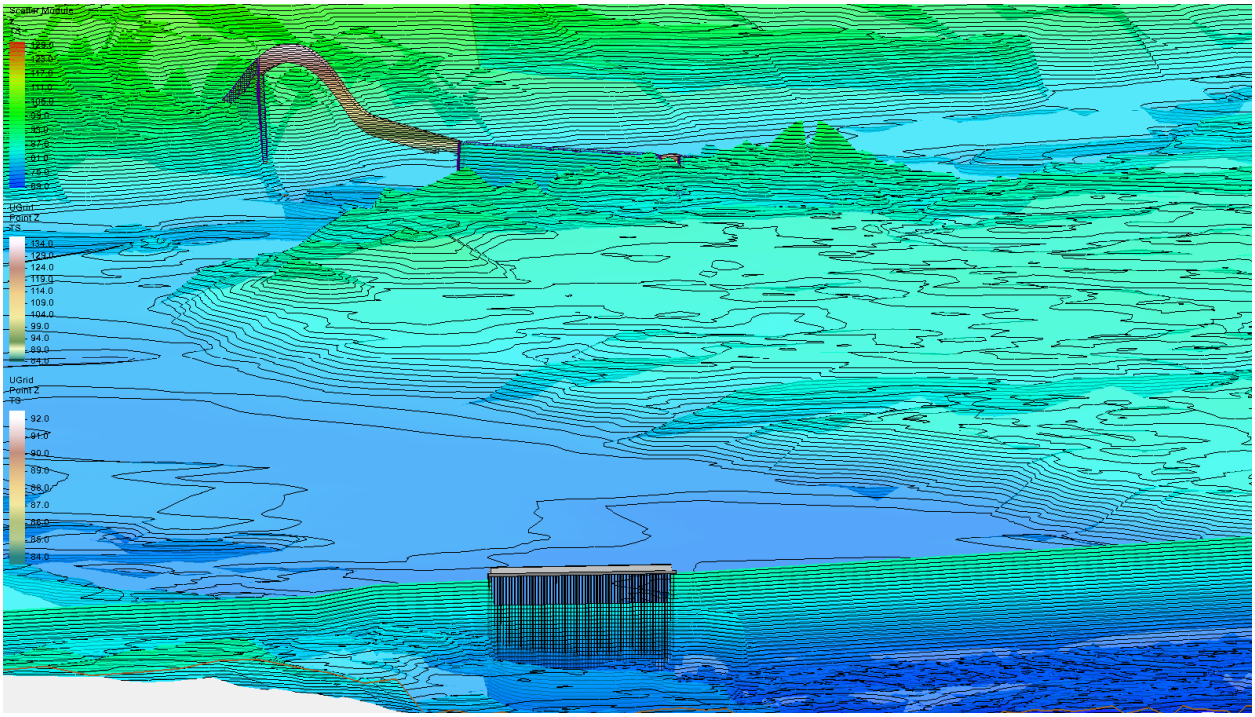


Figure 6: Santee cooper Hydro Electric Dam – Gates

**Santee Dam controlled spilling image from The Berkeley Independent – February 18th, 2021.*

Figure 7: Hydraulic Model Terrain and Proposed 50yr Flood Elevations

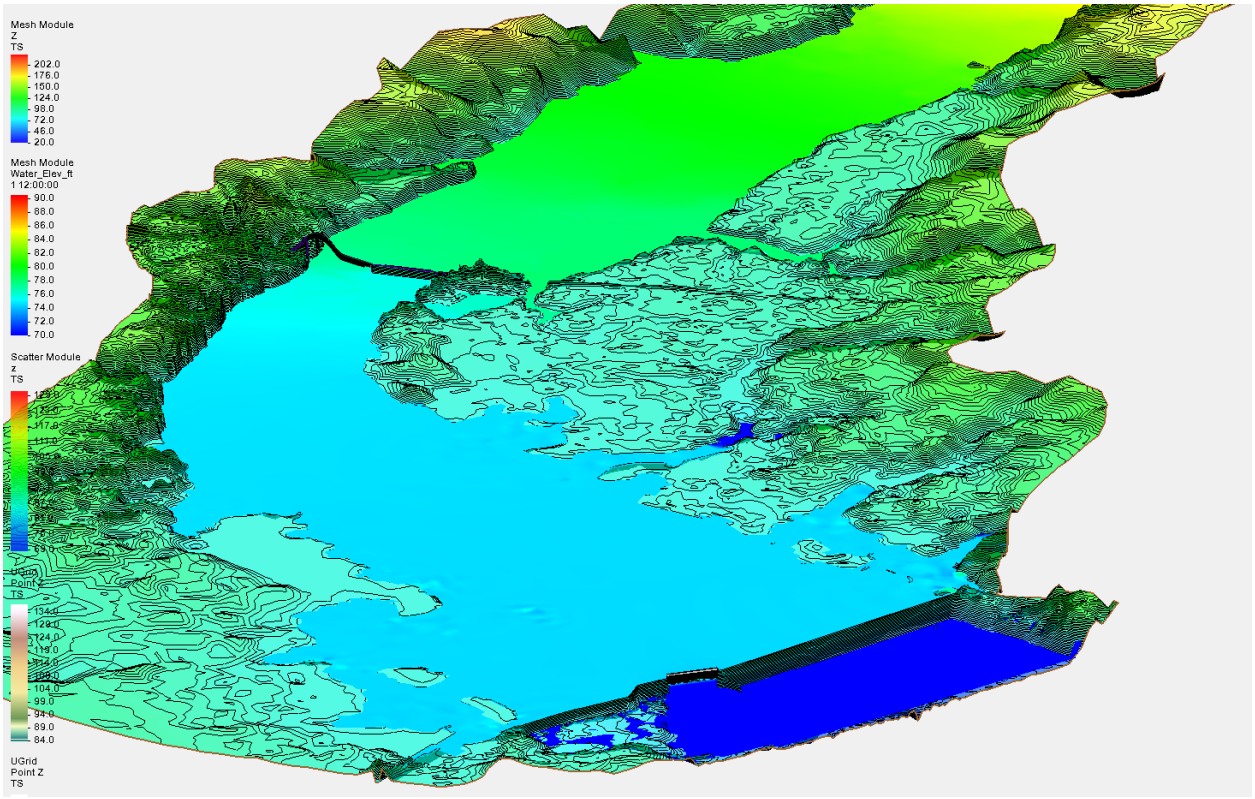
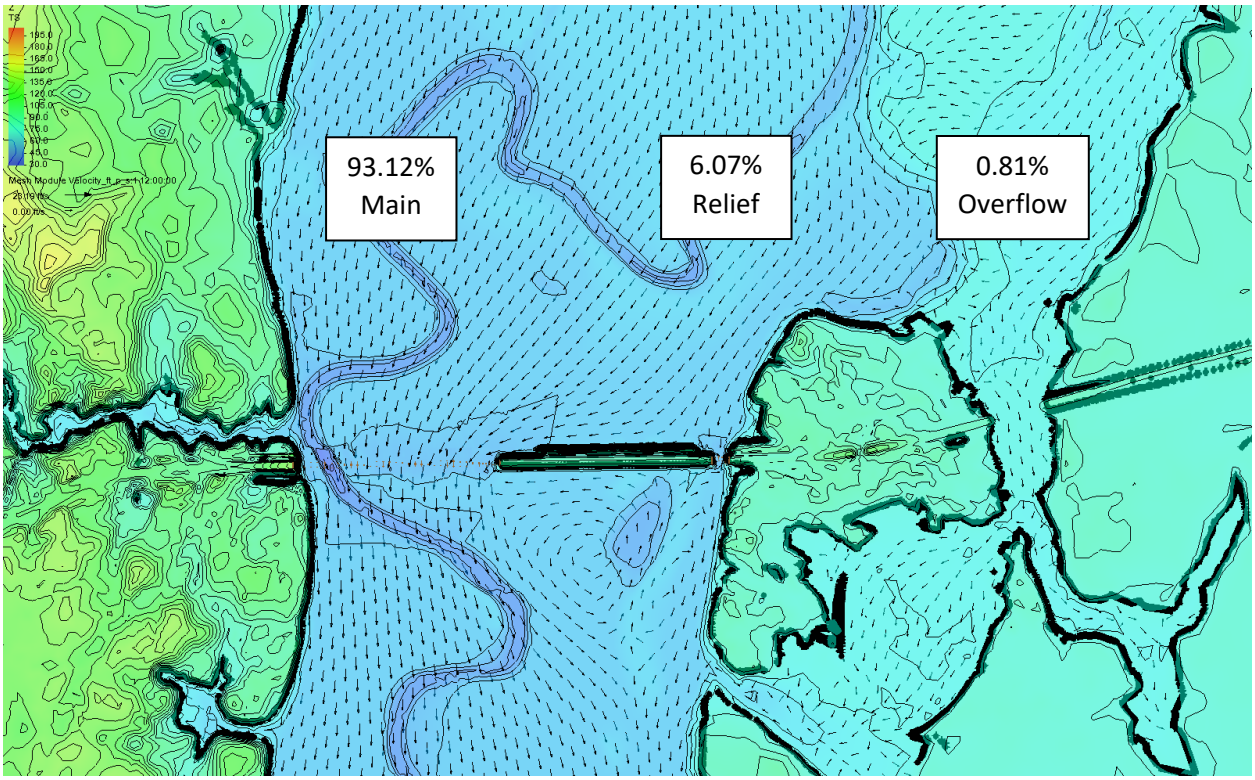


Figure 8: Flow Distribution – Proposed 100yr Flood



Figures detailing the hydraulic model components, hydraulic output, and velocity flow vectors can be found in Appendix IV: Hydraulic Model Output.

A summary of the hydraulic analysis results are presented in Tables 3 – 8 below.

Table 3: Natural Conditions Output – I-95 over Lake Marion

	Floodstage (ft)	Channel Velocities (ft/s)
50-Year Storm	76.08	3.12
100-Year Storm	77.67	3.56
500-Year Storm	82.82	4.57

Table 4: Existing Conditions Output – I-95 over Lake Marion

	Floodstage (ft)	Channel Velocities (ft/s)	Backwater (ft)
50-Year Storm	76.80	9.27	1.00
100-Year Storm	78.36	11.33	1.37
500-Year Storm	82.97	14.07	1.50

Table 5: Proposed Conditions Output – I-95 over Lake Marion

	Floodstage (ft)	Channel Velocities (ft/s)	Backwater (ft)
50-Year Storm	76.86	9.72	0.97
100-Year Storm	78.75	11.18	1.47
500-Year Storm	83.15	15.50	1.60

Notes:
Floodstage Elevations and velocities were retrieved upstream of the proposed bridges' local influence.
Backwater was calculated at the approach section of each bridge.
Backwater variance will be requested for lake conditions and overall width of crossing.

Table 6: Natural Conditions Output – I-95 over Lake Marion Relief

	Floodstage (ft)	Channel Velocities (ft/s)
50-Year Storm	76.05	3.12
100-Year Storm	77.64	3.65
500-Year Storm	82.76	4.62

Table 7: Existing Conditions Output – I-95 over Lake Marion Relief

	Floodstage (ft)	Channel Velocities (ft/s)	Backwater (ft)
50-Year Storm	77.11	6.75	1.40
100-Year Storm	78.90	7.92	3.21
500-Year Storm	83.65	10.53	2.23

Table 8: Proposed Conditions Output – I-95 over Lake Marion Relief

	Floodstage (ft)	Channel Velocities (ft/s)	Backwater (ft)
50-Year Storm	77.18	7.29	1.39
100-Year Storm	78.97	8.41	3.30
500-Year Storm	83.78	10.50	2.34

Notes:
Floodstage Elevations and velocities were retrieved upstream of the proposed bridges' local influence.
Backwater was calculated at the approach section of each bridge.
Backwater variance will be requested for lake conditions and overall width of crossing.

C. FEMA Analysis

The FEMA Engineering Library search for the FEMA Effective Model was on ongoing at the time of submittal for this study. Therefore, a FEMA analysis could not be conducted. See correspondence section for FEMA Engineering Library response.

In reviewing the available Clarendon County and Orangeburg County FISs, there was limited data available for Lake Marion. There were no published elevations, river profiles, or cross sections for Lake Marion and it would be unlikely that a hydraulic model exists for the crossing even though the FIRM Maps indicate a FEMA Zone AE. See Appendix II: Additional Information for FIRM Maps. Should a one-dimensional hydraulic model exist for I-95 over Lake Marion, the increased hydraulic opening of the proposed conditions combined with less pier width obstructing the face of the bridge compared to existing conditions would be expected to produce a small decrease in water surface elevation and achieve a FEMA "no-rise".

Figure 9: FEMA FIS Clarendon County Summary of Stillwater Elevations

TABLE 4 - SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD)			
	10-percent chance	2-percent chance	1-percent chance	0.2-percent chance
LAKE MARION				
Within County	75.8	75.8	75.8	76.5

Step 3 Bed and Bank Material

Soil borings are ongoing at the time of submission for this study. A subsurface fence diagram was prepared as part of a geotechnical exploration on August 12, 2010. The fence diagram indicates Very Soft to Stiff Clays and Silts along the bed of Lake Marion for a depth ranging from 10 to 15 feet. The clays and silts are followed by Very Loose to Medium Dense Sand for the proceeding 5 to 15 feet. All boring then show termination some distance into Limestone located beneath the loose to medium sand at all locations under the bridge.

<u>Step 4</u> Evaluate Watershed Sediment Yield

As discussed above the land use changes cover a vast area and the land use changes presented in the Orangeburg County Comprehensive plan of 2018 indicates no changes in regard to sediment yield at I-95 over Lake Marion. This land use information coupled with no evidence of recent aggradation or degradation observed during the site visits indicates there is no need for additional sedimentation modeling.

<u>Step 5</u> Incipient Motion Analysis

Incipient motion is the condition where the hydraulic forces acting on a sediment particle are equal to the forces resisting motion (HEC-20 4th Edition Section 6.4.2). Incipient motion conditions can be analyzed using the following equation developed from the Shields diagram:

$$\boldsymbol{D_c = \frac{\tau_o}{K_s(\gamma_s - \gamma)}}$$

where:

D_c = diameter of the sediment partical at the critical condition, ft

τ_o = boundary shear stress, lb/ft^2

γ = specific weight of water, lb/ft^3

γ_s = specific weight of sediment, lb/ft^3

K_s = dimensionless coefficient, Shields parameter

The average boundary shear stress of the 100-year storm event was computed by the hydraulic model at the upstream face cross section of the proposed bridge and at a magnitude of 0.25 lb/ft^2. The specific weight of water is 62.4 lb/ft^3 . The specific gravity of the sediment as determined by the nearby US 301 over Four Hole Swamp geotechnical soil report was 2.630 which yields a specific weight of 164.12 lb/ft^3 . The Shields parameter was 0.047 as prescribed in HEC-20 4th Edition for sand sized particles. These values produce the equation and results below:

$$\boldsymbol{D_c = \frac{0.25}{0.047(164.12 - 62.4)} = 0.0522\ ft}$$

The mean and maximum particle size captured in the soil test borings was 0.218 and 20.0 millimeters or 0.000715 feet and 0.0656 feet, respectively. The computed critical condition particle size is between these two values which indicates that most, but not all sediment at the location of maximum shear stress is subject to incipient motion.

Step 6 Evaluate Armoring Potential

The soil test borings of nearby US 301 over Four Hole Swamp indicated relatively small particle sizes, the majority of which are subject to incipient motion even at the average shear stresses produced by the 2-year storm event. Coupled with the lack of large materials on the lake's banks observed during the site visits, it was determined that there is little to no potential for armoring in the vicinity of the project.

Step 7 Evaluating Rating Curve Shift

Due to the lack of an applicable USGS gage (gage with data in recent years/ post completion of Lake Marion) on Lake Marion as discussed above, an evaluation of long-term rating curve shifts was unable to be determined. Additionally, the factors such as slope of stream, roughness of channel, and backwater effects are very unlikely to change on Lake Marion due to the scale and characteristics of the lake, thus a shift in rating curve is unlikely.

Step 8 Design Bridge

A. Establish Minimum Low Chord

The proposed conditions 50-year storm produced a maximum water surface elevation at the upstream face of the bridge of 76.95 feet. According to the RHDS, the minimum low chord of the proposed bridge should be 78.95 feet to provide two feet of feet of freeboard, but the controlling freeboard for the I-95 bridges over Lake Marion bridge replacements were 50.0 feet above maximum operating pool elevation as required by the US Coast Guard and 8.0 feet above maximum operating pool elevation as outline in HDB 2019-4 Section 1.1.5.2.

The maximum operating pool elevation at I-95 as provided in the existing plans (approved 9/3/1968) was 76.8 feet (NGVD29); 76 feet (NAVD88). Thus, the minimum low chord to meet freeboard criteria was 84 feet. The low chord of the proposed bridges is 126.12 feet.

B. Establish Orientation of Bridge Substructure

The orientation of the I-95 bridge replacements over Lake Marion and Lake Marion Relief were set by the project's environmental impact criteria. The staged construction will replace the northbound and southbound bridges along the existing roadway alignment, but with a different vertical profile. The floodplain flows 90-degrees to the I-95 crossing which crosses at the narrowest point of Lake Marion.

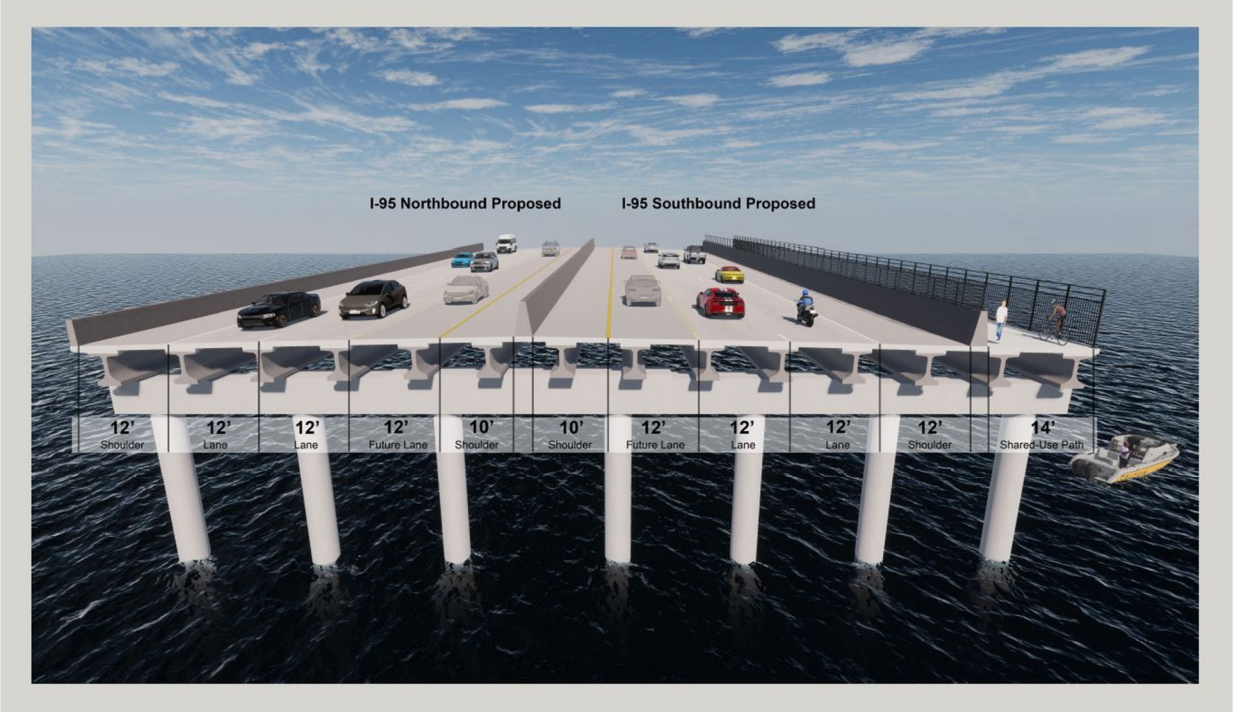
C. Set Bridge Geometry

As outlined in the project description, a continuous span concrete girder bridge built perpendicular to the floodplain was selected as the most practical design for both I-95 bridges replacements over Lake Marion and Lake Marion Relief. The 4523'-8" bridge configuration over Lake Marion and 375'-0" bridge configuration over Lake Marion Relief effectively spans the Lake Marion floodplain adhering to project backwater criteria, avoiding existing foundation elements, and maintaining the existing navigational channel clearance as set by the coast Guard Requirements/Permit (100 feet horizontal).

D. Set Location of Bridge Ends

The RHDS states that the new bridge ends should not be located inside the existing bridge ends unless the cost is prohibitive. The proposed bridges were designed outside the limits of the existing bridges. The proposed Lake Marion bridge was lengthened 23'-8" and the proposed Lake Marion Relief bridge was lengthened 15 feet. The required ten feet of setback as outlined in Section 1.1.10 of SCDOT's HDB No. 2019-4 was not considered since there the defined channel in the vicinity of I-95 over Lake Marion is over 38 feet underwater and the existing navigational channel must be maintained.

Figure 10: Proposed Main Bridge Typical Section – As Presented on SCDOT Project Website



E. Evaluate Hydraulic Performance

The proposed bridge configurations were input into the two-dimensional hydraulic software and simulated with the PeakFQ discharges as discussed above. The proposed bridge configurations and profile grade raise produced results that met the hydraulic criteria as outlined above.

F. Evaluate Need for Channel Reconstruction

Since Lake Marion's water surface is maintained and the channel is over 38 feet below the surface, there was no need for channel reconstruction at I-95 over Lake Marion nor I-95 over Lake Marion Relief. Since the proposed abutment slopes are outside the limits of the existing bridge, the roadway embankments and proposed abutment slopes will need to be reconstructed at the end bents of each bridge.

Step 9 Scour Analysis

Topographic Map Data (supplemented by site visits and project survey) indicates that the Lake Marion floodplain is wide and flat. The lake/swampy conditions dominate the upstream and downstream floodplain. These conditions align with the department's preference for the utilization of the USGS Bridge-Scour Envelope Curves for the prediction of scour at the proposed bridge. Even though the associate drainage area far exceeds the limits of the Envelope Curves, the wide floodplain and extensive embankment lengths produce large abutment scour holes and minor clear-water contraction scour using the envelope Curves, as expected. A HEC-18 analysis was performed to check the envelope curve computations, but the three abutment scour computation methods prescribed in HEC-18 are known to over predict abutment scour while the USGS Bridge-Scour Envelope Curves based on over 80 years of observed data in South Carolina. After reviewing the results of both methods, it was determined that the USGS Envelope Curves would provide the better estimate of scour where significant embankment flow and abutment scour is expected.

The summation of the proposed bridge lengths is 4,899 feet and provides a hydraulic opening equal to 36 percent of the 100-year floodplain width (13,475 feet) indicating a large amount of embankment flow and consequently abutment scour. The proposed bridge will not be located in the center of the floodplain, increasing the embankment length to the east of the proposed bridge over Lake Marion (left embankment length of 3,700 feet) and resulting in increased predicted abutment scour depths. This aligns with the USGS Bridge-Scour Envelope Curve scour guidance for bridge lengths in excess of 240 feet with no defined channel; two separate abutment scour holes will form at depths determined by the geometric contraction ratio and each embankment length. The summation of clear-water contraction scour and local pier scour will occur between the abutment scour holes.

Utilizing the Geometric Contraction Ratio equation $m = 1 – (b / B)$ where b is the length of the bridge and B is the largest 100-year floodplain width measured within 1 bridge length upstream form the bridge, the Geometric Contraction Ratio was 0.64.

Using the spreadsheet's Automatic Calculation function, the Original Clear-Water Abutment-Scour Curves predict 100-year scour depths of 18.69 and 14.59 feet at the Left and Right Abutments of the proposed Lake Marion Bridge, respectively. The relative increase in theoretical Clear-Water Abutment scour from the 100- to 500-year flows utilizes a coefficient of 1.21 and results in 500-year scour depths of 22.60 and 17.70 feet at the Left and Right abutments of the proposed Lake Marion Bridge, respectively. Each abutment scour hole is predicted to have a topwidth of 70 feet (maximum abutment

scour topwidth allowed by spreadsheet for bridges greater than 240 feet) and the m range checks as well as the embankment length range check for the Original Curve were OK and CAUTION, respectively.

Using the spreadsheet's Automatic Calculation function, the Original Clear-Water Abutment-Scour Curves predict 100-year scour depths of 18.23 and 16.10 feet at the Left and Right Abutments of the proposed Lake Marion Relief Bridge, respectively. The relative increase in theoretical Clear-Water Abutment scour from the 100- to 500-year flows utilizes a coefficient of 1.21 and results in 500-year scour depths of 22.10 and 18.30 feet at the Left and Right abutments of the proposed Lake Marion Relief ridge, respectively. Each abutment scour hole is predicted to have a topwidth of 70 feet (maximum abutment scour topwidth allowed by spreadsheet for bridges greater than 240 feet) and the m range checks as well as the embankment length range check for the Original Curve were OK and CAUTION, respectively.

While the abutment scour magnitude is significant, Limestone is encountered at all locations under the proposed bridges at approximate elevation 35 feet. Since the geotechnical borings and analysis are ongoing during the time of submission for this study at was assumed that the nearby US 301 over Four Hole Swamp, located approximately 22 miles west of I-95 at Lake Marion, geotechnical analysis would also apply at Lake Marion. The US 301 over Four Hole Swamp geotechnical analysis determined the limestone to be Santee Limestone Formation. Should the limestone formation be found at Lake Marion, the following would apply. Santee Limestone formation is classified as strongly cemented silty sand and silt. The top of the Santee Limestone Formation consists of 10 to 20 feet thick caprock with Stand Penetration (SPT) blow count of 100+ and a uniaxial compressive strength ranging from 452 to 4688 psi. Below the bottom of the caprock the Santee Limestone Formation SPT blow count range of 20 to 100+ and an average uniaxial compressive strength of 325 psi. Hydraulic Engineering Circular No. 18 (HEC-18) Table 4.14 describes this compressive strength as Rock. Rock is a scour resistant material and is not expected to scour within the service life of the bridge; therefore, the maximum scour depths cannot exceed into the Santee Limestone Formation. Additionally, the proposed PSC piles at the intermediate bent footings cannot be driven into the Santee Limestone Formation due to strongly cemented caprock and will require predrilling. This would mean that the large abutment scour holes computed for the 500 and 100-year flood events would terminate at the limestone resulting in less scour than predicted by the USGS Bridge-Scour Envelope Curves.

A scour analysis summary is presented in Table 9. The GCR graphics used in the scour analysis and the USGS Envelope Curve spreadsheet has been recorded in Appendix III: Scour Documentation.

Table 9: Scour Analysis Summary – USGS Bridge-Scour Envelope Curve Spreadsheet

	Left Abutment Clear-Water (ft)	Left Overbank Clear-Water (ft/s)	Channel Live-Bed (ft/s)	Right Overbank Clear-Water (ft)	Right Abutment Clear-Water (ft)	Local Pier Overbank (ft)
500-Year Scour 0.2 % AEP	18.8 Original Curve	7.0	N/A	7.0	18.9 Original Curve	3.9
100-Year Scour 1% AEP	15.5 Original Curve	4.8	N/A	4.8	15.6 Original Curve	4.3

Step 10 Risk Assessment

In summary no risks were determined for the bridge replacements of I-95 over Lake Marion and Lake Marion Relief from the risk assessment forms found in the SCDOT RHDS Section 1.6.4. This was the result of the proposed structures increased hydraulic opening both in the horizontal and vertical dimensions, no defined channel to disturb, and an overall decrease in backwater when compared to existing conditions even though there are no structures or property located upstream of I-95 to adversely affect. The risk assessment has determined the most economical design for the crossing within the design constraints has been recommended. The risk assessment form is located in Appendix VI: Hydraulic and NEPA Forms.

Additional Computations

SCDOT Class B riprap with Class 2 Type C geotextile fabric shall be used to protect both abutment slopes. The riprap shall be entrenched two feet into the excavated overbanks as prescribed in SCDOT HDB 2019-4 Section 1.1.6. and SCDOT Standard 804-105-00

SCDOT Bridge Design Manual Section 18.2.3 allows consultants to use HEC-21 Design of Bridge Deck Drainage to determine inlet spacing on the bridge deck. Due to the vertical curve located on both the southbound and northbound bridges, methods prescribed HEC-21 were used in place of the simplified constant grade Equation 18.2-1 presented in the SCDOT Bridge Design Manual. The worst-case rainfall intensity was retrieved from the SCDOT Database for Orangeburg County as prescribed in Hydraulic Bulletin No 2019-2. The worst-case rainfall intensity for the 10-year storm is coupled

with a Time of Concentration of 5 minutes and was retrieved as 8.33 inches/hour. The design spread was retrieved from the SCDOT Bridge Design Manual Figure 18.2-1 for facilities with a design ADT greater than 10,000 vpd and a design speed greater than 45 mph. Figure 18.2-1 indicates the shoulder width should be used as the design spread. The proposed shoulder width and design spread was 12 feet for I-95 over Lake Marion and 12.02 feet for I-95 over Lake Marion Relief.

Using the methods prescribed in HEC-21 the initial required inlet for I-95 over Lake Marion was at 645 feet from the high point on the bridge and the total spread without inlets was 28.52 feet at station 5223+51.00. Utilizing 6" Scupper drains spaced at 20, 30, and 40 feet, the maximum spread was determined to be 7.53 feet, 9.56 feet, and 11.32 feet, respectively (at station 5223+51). Using the methods prescribed in HEC-21 the proposed I-95 bridge over Lake Marion Relief is hydraulically sufficient without the use of deck drains. The maximum spread without deck drains was 11.34 feet at station 5177+28.00. Utilizing 6" Scupper drains spaced at 20, 30, and 40 feet, the maximum spread was determined to be 7.78 feet, 8.94 feet, and 9.48 feet, respectively (at station 5177+28).

Even though deck drain inlets greater than 30 feet on either side of each bridge would be sufficient for deck drain runoff, it is recommended include deck drain inlets spaced at 30 feet on either side of the bridge and omitted within 5 feet of intermediate bents to aid in deck drain runoff and increase the overall safety of the proposed bridges. There are no environmental factors or endangered species habitats precluding the runoff into Lake Marion and 6-inch scuppers are recommended to be placed on each proposed bridge. See Appendix II: Supporting Calculations for

Summary

The replacement bridges of I-95 over Lake Marion and Lake Marion Relief will utilize a 4523'-8" continuous prestressed concrete beam bridge and a 375'-8" continuous prestressed concrete beam bridge, respectively as the most cost-effective replacement bridges that provide acceptable freeboard, velocity results, and backwater values within project specific guidelines.

References

TranSystems utilized the following for this study:

- South Carolina Department of Transportation Requirements for Hydraulic Design Studies, May 26th 2009 Edition.

- South Carolina Department of Transportation Hydraulic Design Bulletin No. 2019-4, George R. Bedenbaugh, Jr. P.E., September 25, 2019.

- *Computer Assisted Floodplain Hydrology & Hydraulics*, Daniel H. Hogan, McGraw-Hill, New York, 1989.

- Hydraulic Engineering Circular No. 18 (HEC-18) *Evaluating Scour at Bridges*, (FHWA- NH1-01-001), dated April 2012, Fifth Edition.

- Hydraulic Engineering Circular No. 20 (HEC-20) *Stream Stability at Highway Structures* (FHWA-NHI-01-002) dated April 2012, Fourth Edition.

- Hydraulic Engineering Circular No. 23 (HEC-23) Bridge Scour and Stream Instability Countermeasures (FHWA-NHI-01-003) dated September 2009, Third Edition.

- Hydrologic Engineering Center (HEC) River Analysis System (HEC-RAS) Hydraulic Reference Manual Version 4.1, dated January 2010.

- Hydrologic Engineering Center (HEC) River Analysis System (HEC-RAS) Hydraulic Reference Manual Version 5.0, dated February 2016.

- The United States Geological Survey (USGS) publication, *Guide for selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains*, George J. Arcement, Jr., and Verne R. Schneider—1992 (2nd Printing); Water- Supply Paper 2339.

- The United States Geological Survey (USGS) publication, *Roughness Characteristics of Natural Channels*, Harry H. Barnes, Jr.—1987 (3rd Printing), Water-Supply Paper 1849.

- The United States Geological Survey (USGS) publication, *Techniques for Estimating Magnitude and Frequency of Floods in Rural Basins of Georgia*--1993, Water Resources Investigations Report 93-4016

Appendix I:
Supporting Calculations

TRANSYSTEMS

HYDRAULIC TABLES

	NATURAL CONDITIONS		--EXISTING CONDITIONS--		--PROPOSED CONDITIONS--	
	Lake Marion Main	*Lake Marion Relief*	*Lake Marion Main*	*Lake Marion Relief*	*Lake Marion Main*	*Lake Marion Relief*
2-YEAR FLOODSTAGE ELEVATION AT BRIDGE (ft)	74.14	74.14	74.15	74.18	74.18	74.19
50 - YEAR						
FLOODSTAGE AT BRIDGE (ft)	76.08	76.05	76.80	77.11	76.86	77.18
FLOODSTAGE AT APPROACH (ft)	76.32	76.10	77.32	77.50	77.29	77.49
AREA UNDER FLOODSTAGE (ft^2)	**********	**********	76,231	4,824	77,076	5,040
DISCHARGE THROUGH BRIDGE (cfs)	**********	**********	449,002	26,871	450,897	27,367
DISCHARGE OVER ROADWAY (cfs)	**********	**********	0	0	0	0
CHANNEL VELOCITY (f/s)	3.09	3.12	9.27	6.75	9.72	7.29
MEAN VELOCITY (f/s) AT BRIDGE	**********	**********	5.89	5.57	5.85	5.43
BACKWATER HEIGHT (ft)	**********	**********	**1.00**	**1.40**	**0.97**	**1.39**
100 - YEAR						
FLOODSTAGE AT BRIDGE (ft)	77.67	77.64	78.36	78.90	78.75	78.97
FLOODSTAGE AT APPROACH (ft)	77.68	76.10	79.05	79.31	79.15	79.40
AREA UNDER FLOODSTAGE (ft^2)	**********	**********	81,301	5,931	82,469	5,546
DISCHARGE THROUGH BRIDGE (cfs)	**********	**********	573,170	34,935	571,513	36,107
DISCHARGE OVER ROADWAY (cfs)	**********	**********	0	0	0	0
CHANNEL VELOCITY (f/s)	3.56	3.65	11.33	7.92	11.18	8.41
MEAN VELOCITY (f/s) AT BRIDGE	**********	**********	7.05	5.89	6.93	6.51
BACKWATER HEIGHT (ft)	**********	**********	**1.37**	**3.21**	**1.47**	**3.30**
500 - YEAR						
FLOODSTAGE AT BRIDGE (ft)	82.82	82.76	82.97	83.65	83.15	83.78
FLOODSTAGE AT APPROACH (ft)	83.18	82.81	84.68	85.04	84.78	85.15
AREA UNDER FLOODSTAGE (ft^2)	**********	**********	98,433	7,234	111,861	7,241
DISCHARGE THROUGH BRIDGE (cfs)	**********	**********	942,987	59,899	942,992	61,619
DISCHARGE OVER ROADWAY (cfs)	**********	**********	0	0	0	0
CHANNEL VELOCITY (f/s)	4.57	4.62	14.07	10.53	15.50	10.50
MEAN VELOCITY (f/s) AT BRIDGE	**********	**********	9.58	8.28	8.43	8.51
BACKWATER HEIGHT (ft)	**********	**********	**1.50**	**2.23**	**1.60**	**2.34**

Freeboard Calculations

I-95 over Lake Marion

PROPOSED 4523'-8" FT BRIDGE

NAVIGATIONAL CHANNEL

MIN PROFILE GRADE ELEVATION	135.62
DEPTH OF CROSS SLOPE	1.65
DEPTH OF DECK + HAUNCH	1.68
DEPTH OF BEAM (BT-74)	6.17
BOTTOM OF BEAM ELEVATION	126.12

NAVIGATIONAL CHANNEL

BOTTOM OF BEAM ELEVATION	126.12
NORMAL OPERATING POOL ELEVATION (NAVD88)	76.12
CLEARANCE	50.00

50 FT CLEARANCE REQUIRED

APPROACH SPANS

MIN PROFILE GRADE ELEVATION	90.37
DEPTH OF CROSS SLOPE	1.65
DEPTH OF DECK + HAUNCH	1.60
DEPTH OF BEAM (FIB-36)	3.00
BOTTOM OF BEAM ELEVATION	84.12

APPROACH SPANS

LOW CHORD ELEVATION	84.12
NORMAL OPERATING POOL ELEVATION (NAVD88)	76.12
CLEARANCE	8.00

8 FT CLEARANCE REQUIRED

APPROACH SPANS

MINIMUM BOTTOM OF BEAM ELEVATION	84.12
50 YEAR FLOODSTAGE ELEVATION (USGS)*	76.86
CLEARANCE	7.26

2 FT CLEARANCE REQUIRED

APPROACH SPANS

MINIMUM BOTTOM OF BEAM ELEVATION	84.12
100 YEAR FLOODSTAGE ELEVATION(USGS)*	78.75
CLEARANCE	5.37

1 FT CLEARANCE REQUIRED

Freeboard Calculations

I-95 over Lake Marion Relief

PROPOSED 375'-0" FT BRIDGE

APPROACH SPANS

MIN PROFILE GRADE ELEVATION DEPTH	90.37
OF CROSS SLOPE	1.65
DEPTH OF DECK + HAUNCH	1.60
DEPTH OF BEAM (FIB-36)	3.00
BOTTOM OF BEAM ELEVATION	84.12

APPROACH SPANS

LOW CHORD ELEVATION	84.12
NORMAL OPERATING POOL ELEVATION (NAVD88)	76.12
CLEARANCE	#REF!

8 FT CLEARANCE REQUIRED

APPROACH SPANS

MINIMUM BOTTOM OF BEAM ELEVATION 50	84.12
YEAR FLOODSTAGE ELEVATION (USGS)*	77.18
CLEARANCE	6.94

2 FT CLEARANCE REQUIRED

APPROACH SPANS

MINIMUM BOTTOM OF BEAM ELEVATION 100	84.12
YEAR FLOODSTAGE ELEVATION(USGS)*	78.97
CLEARANCE	5.15

1 FT CLEARANCE REQUIRED

FHWA Guide Bank Calculations

I-95 over Lake Marion

100 year Flow (Q_t) =	616900
*100 year Bridge Velocity (V_{br}) =	9.95

Left (North) Abutment		Right (South) Abutment	
Bridge Station	522350	Bridge Station	526875
100-yr Wetted Station	526895	100-yr Wetted Station	526970
Bank Station	530395	Bank Station	527445
X=	3500	X=	475

From SMS SRH-2D Output			
Left overbank Q (cfs)	454398.00	Right overbank Q (cfs)	35862.00
Left overbank D (ft)	21.04	Right overbank D (ft)	18.72
Left overbank V (ft/s)	6.10	Right overbank V (ft/s)	4.43

$Q_f = Q_{ob} - (X)(D)(V)$

$Q_{f\ left}$= 5194

$Q_f = Q_{ob} - (X)(D)(V)$

$Q_{f\ right}$= -3530

Approach flow between bridge stations = $Q_b = Q_t - Q_{f\ left} - Q_{f\ right}$ = 615236

$Q_a = Q_b$/Bridge length * 100

Q_a = 820314

*Q_f/Q_a= 0.01

*Q_f/Q_a= 0.00

* For use in Figure 10.3 (HEC-23)

Guide Bank length = 0

Guide Bank length = 0

Guide Banks Not Required

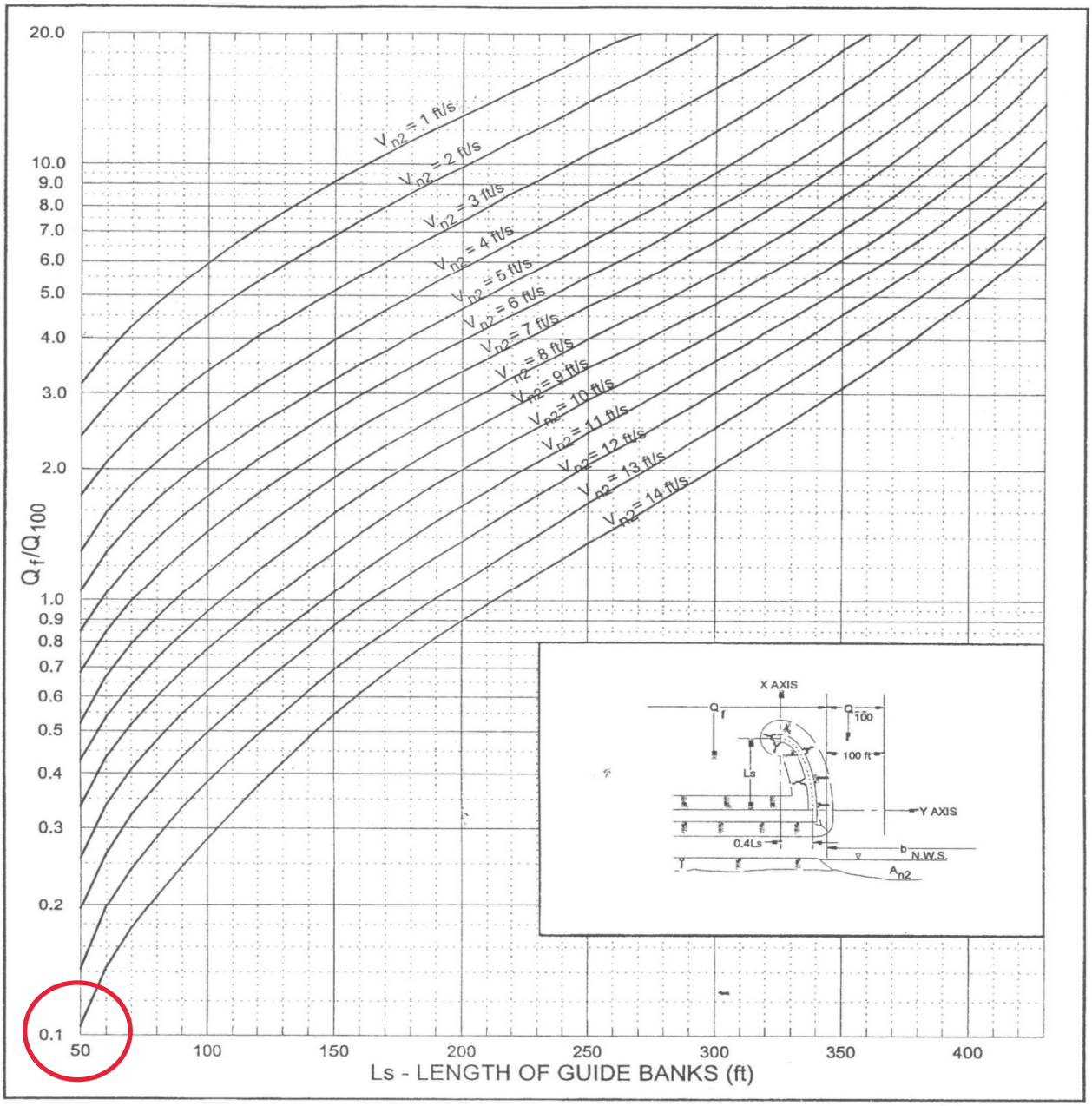


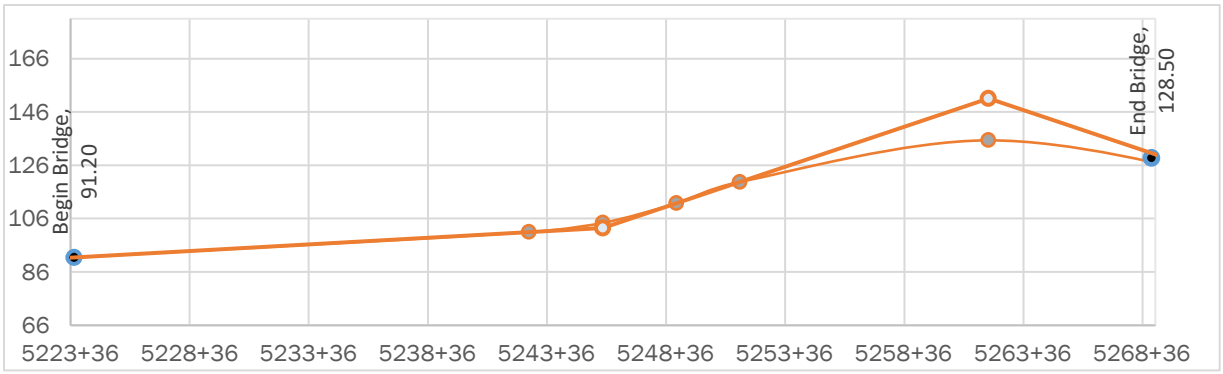
Figure 10.3. English version of nomograph to determine guidebank length (after Bradley).[1]

Deck Drain Calculations - I-95 over Lake Marion

Clarendon/ Orangeburg County, South Carolina

TRANSYSTEMS

VERTICAL CURVE

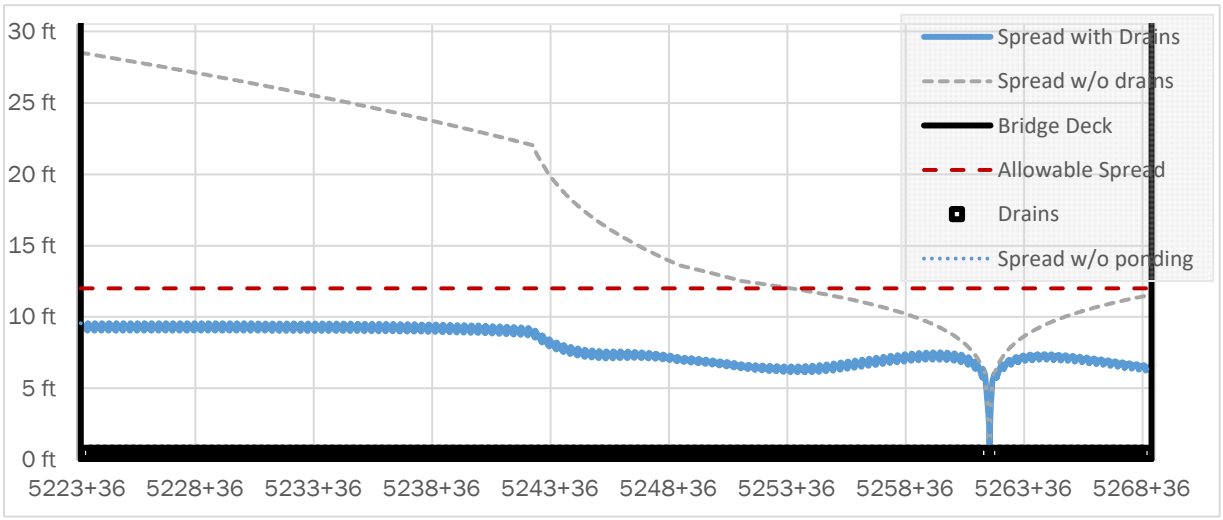


DESIGN DATA

T	=	12.00	ft	*Maximum allowable spread*
n	=	0.016	-	*Manning's coefficient -- typically, n = 0.016*
C	=	0.90	-	*Runoff -- typically, C = 0.9 for pavements*
i	=	8.33	in/hr	*Design intensity*

BRIDGE DATA

Beg	=	5223+51.00	-	*Beginning station of bridge*
End	=	5268+74.67	-	*End station of bridge*



ANALYSIS SUMMARY

The maximum spread without drains is 28.52 ft at station 5223+51.00

The maximum spread with drains included is 9.56 ft at station 5223+51.00

With an allowable spread of 12.00 ft, this bridge is hydraulicaly sufficienct.

Deck Drains included in analysis were spaced at 30 feet through the length of bridge.

DECK DRAIN ANALYSIS REPORT

VERTICAL CURVE DATA

PVI Station	PVI Elevation	LVC
5222+78.00	90.84	-
5245+70.00	102.30	620.00
5261+90.00	150.90	2090.00
5279+20.00	99.00	-

HYDRAULIC WIDTH (WIDTH BEING COLLECTED)

Station	Width (ft)
00+00.00	60.29

SUPERELEVATION DATA

Station	SE Rate (%)
00+00.00	2.0%
00+35.17	2.5%

CLOSED PIPE SYSTEM OUTPUT

No closed system enetered

DECK DRAIN SUMMARY TABLE

Drain No.	Station	Flow (cfs)	Efficiency	Spread (ft)
1	5223+80.00	2.187	14.2 %	9.31
2	5224+10.00	2.187	14.2 %	9.31
3	5224+40.00	2.187	14.2 %	9.31
4	5224+70.00	2.187	14.2 %	9.31
5	5225+00.00	2.187	14.2 %	9.31
6	5225+30.00	2.187	14.2 %	9.31
7	5225+60.00	2.187	14.2 %	9.31
8	5225+90.00	2.187	14.2 %	9.31
9	5226+20.00	2.187	14.2 %	9.31
10	5226+50.00	2.187	14.2 %	9.31
11	5226+80.00	2.186	14.2 %	9.31
12	5227+10.00	2.186	14.2 %	9.31
13	5227+40.00	2.186	14.2 %	9.31
14	5227+70.00	2.186	14.2 %	9.31
15	5228+00.00	2.186	14.2 %	9.31
16	5228+30.00	2.186	14.2 %	9.31
17	5228+60.00	2.185	14.2 %	9.31
18	5228+90.00	2.185	14.2 %	9.31
19	5229+20.00	2.185	14.2 %	9.31
20	5229+50.00	2.185	14.2 %	9.31
21	5229+80.00	2.184	14.2 %	9.31
22	5230+10.00	2.184	14.2 %	9.31
23	5230+40.00	2.184	14.2 %	9.31
24	5230+70.00	2.183	14.2 %	9.31

25	5231+00.00	2.183	14.2 %	9.31
26	5231+30.00	2.182	14.2 %	9.31
27	5231+60.00	2.182	14.2 %	9.30
28	5231+90.00	2.181	14.2 %	9.30
29	5232+20.00	2.180	14.2 %	9.30
30	5232+50.00	2.180	14.3 %	9.30
31	5232+80.00	2.179	14.3 %	9.30
32	5233+10.00	2.178	14.3 %	9.30
33	5233+40.00	2.177	14.3 %	9.30
34	5233+70.00	2.176	14.3 %	9.30
35	5234+00.00	2.175	14.3 %	9.29
36	5234+30.00	2.173	14.3 %	9.29
37	5234+60.00	2.172	14.3 %	9.29
38	5234+90.00	2.170	14.3 %	9.29
39	5235+20.00	2.168	14.3 %	9.28
40	5235+50.00	2.166	14.3 %	9.28
41	5235+80.00	2.164	14.3 %	9.28
42	5236+10.00	2.162	14.3 %	9.27
43	5236+40.00	2.159	14.3 %	9.27
44	5236+70.00	2.157	14.3 %	9.26
45	5237+00.00	2.153	14.3 %	9.26
46	5237+30.00	2.150	14.3 %	9.25
47	5237+60.00	2.146	14.3 %	9.25
48	5237+90.00	2.142	14.3 %	9.24
49	5238+20.00	2.137	14.4 %	9.23
50	5238+50.00	2.132	14.4 %	9.22
51	5238+80.00	2.127	14.4 %	9.21
52	5239+10.00	2.121	14.4 %	9.20
53	5239+40.00	2.114	14.4 %	9.19
54	5239+70.00	2.106	14.4 %	9.18
55	5240+00.00	2.098	14.4 %	9.17
56	5240+30.00	2.089	14.5 %	9.15
57	5240+60.00	2.079	14.5 %	9.13
58	5240+90.00	2.068	14.5 %	9.12
59	5241+20.00	2.056	14.6 %	9.09
60	5241+50.00	2.043	14.6 %	9.07
61	5241+80.00	2.028	14.6 %	9.05
62	5242+10.00	2.012	14.7 %	9.02
63	5242+40.00	1.994	14.7 %	8.99
64	5242+70.00	1.977	14.9 %	8.83
65	5243+00.00	1.967	15.3 %	8.48
66	5243+30.00	1.964	15.7 %	8.20
67	5243+60.00	1.968	16.0 %	7.98
68	5243+90.00	1.978	16.3 %	7.81
69	5244+20.00	1.996	16.5 %	7.67
70	5244+50.00	2.021	16.7 %	7.56
71	5244+80.00	2.055	16.8 %	7.48

72	5245+10.00	2.098	16.9 %	7.42
73	5245+40.00	2.151	16.9 %	7.38
74	5245+70.00	2.216	17.0 %	7.36
75	5246+00.00	2.284	16.6 %	7.36
76	5246+30.00	2.354	16.2 %	7.36
77	5246+60.00	2.415	15.4 %	7.36
78	5246+90.00	2.466	14.7 %	7.35
79	5247+20.00	2.506	14.0 %	7.33
80	5247+50.00	2.533	13.4 %	7.30
81	5247+80.00	2.547	12.8 %	7.26
82	5248+10.00	2.548	12.2 %	7.21
83	5248+40.00	2.534	11.7 %	7.14
84	5248+70.00	2.505	11.3 %	7.06
85	5249+00.00	2.470	11.2 %	7.01
86	5249+30.00	2.432	11.2 %	6.97
87	5249+60.00	2.391	11.3 %	6.92
88	5249+90.00	2.347	11.4 %	6.87
89	5250+20.00	2.300	11.5 %	6.82
90	5250+50.00	2.250	11.6 %	6.76
91	5250+80.00	2.196	11.7 %	6.70
92	5251+10.00	2.139	11.9 %	6.63
93	5251+40.00	2.076	12.0 %	6.56
94	5251+70.00	2.017	12.5 %	6.51
95	5252+00.00	1.961	13.0 %	6.47
96	5252+30.00	1.909	13.6 %	6.43
97	5252+60.00	1.861	14.2 %	6.40
98	5252+90.00	1.818	14.7 %	6.38
99	5253+20.00	1.779	15.3 %	6.36
100	5253+50.00	1.746	15.9 %	6.35
101	5253+80.00	1.718	16.5 %	6.35
102	5254+10.00	1.696	17.1 %	6.36
103	5254+40.00	1.682	17.6 %	6.37
104	5254+70.00	1.675	18.2 %	6.41
105	5255+00.00	1.676	18.6 %	6.45
106	5255+30.00	1.681	18.8 %	6.51
107	5255+60.00	1.686	18.8 %	6.58
108	5255+90.00	1.689	18.6 %	6.64
109	5256+20.00	1.689	18.5 %	6.71
110	5256+50.00	1.687	18.3 %	6.78
111	5256+80.00	1.682	18.2 %	6.84
112	5257+10.00	1.672	18.1 %	6.91
113	5257+40.00	1.658	17.9 %	6.97
114	5257+70.00	1.639	17.8 %	7.03
115	5258+00.00	1.613	17.7 %	7.09
116	5258+30.00	1.580	17.6 %	7.15
117	5258+60.00	1.540	17.6 %	7.19
118	5258+90.00	1.490	17.5 %	7.23

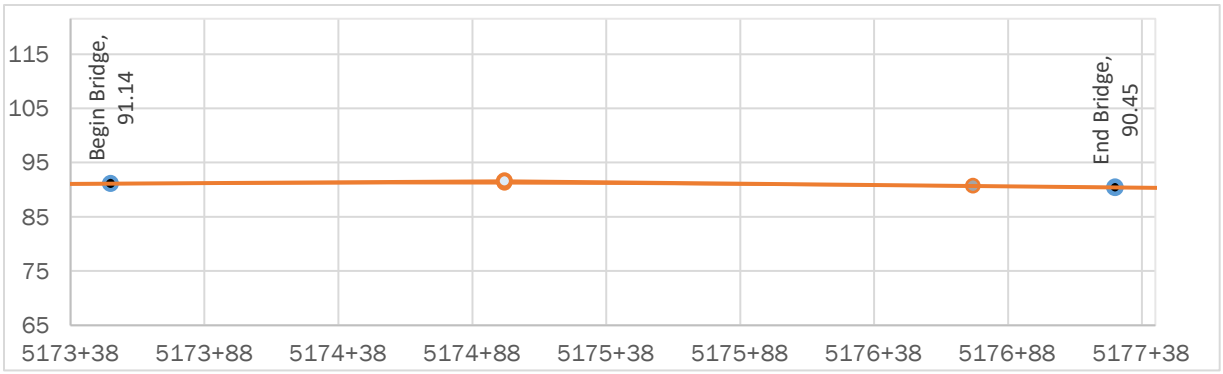
119	5259+20.00	1.429	17.5 %	7.27
120	5259+50.00	1.357	17.6 %	7.28
121	5259+80.00	1.270	17.7 %	7.28
122	5260+10.00	1.168	17.9 %	7.26
123	5260+40.00	1.047	18.2 %	7.21
124	5260+70.00	0.905	18.7 %	7.11
125	5261+00.00	0.739	19.6 %	6.94
126	5261+30.00	0.543	21.3 %	6.65
127	5261+60.00	0.311	25.7 %	6.09
128	5262+20.00	0.311	25.7 %	6.09
129	5262+50.00	0.543	21.3 %	6.65
130	5262+80.00	0.739	19.6 %	6.94
131	5263+10.00	0.905	18.7 %	7.11
132	5263+40.00	1.047	18.2 %	7.21
133	5263+70.00	1.168	17.9 %	7.26
134	5264+00.00	1.270	17.7 %	7.28
135	5264+30.00	1.357	17.6 %	7.28
136	5264+60.00	1.429	17.5 %	7.27
137	5264+90.00	1.490	17.5 %	7.23
138	5265+20.00	1.540	17.6 %	7.19
139	5265+50.00	1.580	17.6 %	7.15
140	5265+80.00	1.613	17.7 %	7.09
141	5266+10.00	1.639	17.8 %	7.03
142	5266+40.00	1.658	17.9 %	6.97
143	5266+70.00	1.672	18.1 %	6.91
144	5267+00.00	1.682	18.2 %	6.84
145	5267+30.00	1.687	18.3 %	6.78
146	5267+60.00	1.689	18.5 %	6.71
147	5267+90.00	1.689	18.6 %	6.64
148	5268+20.00	1.686	18.8 %	6.58
149	5268+50.00	1.681	18.8 %	6.51

Deck Drain Calculations - I-95 over Lake Marion Relief

Clarendon/ Orangeburg County, South Carolina

TRANSYSTEMS

VERTICAL CURVE

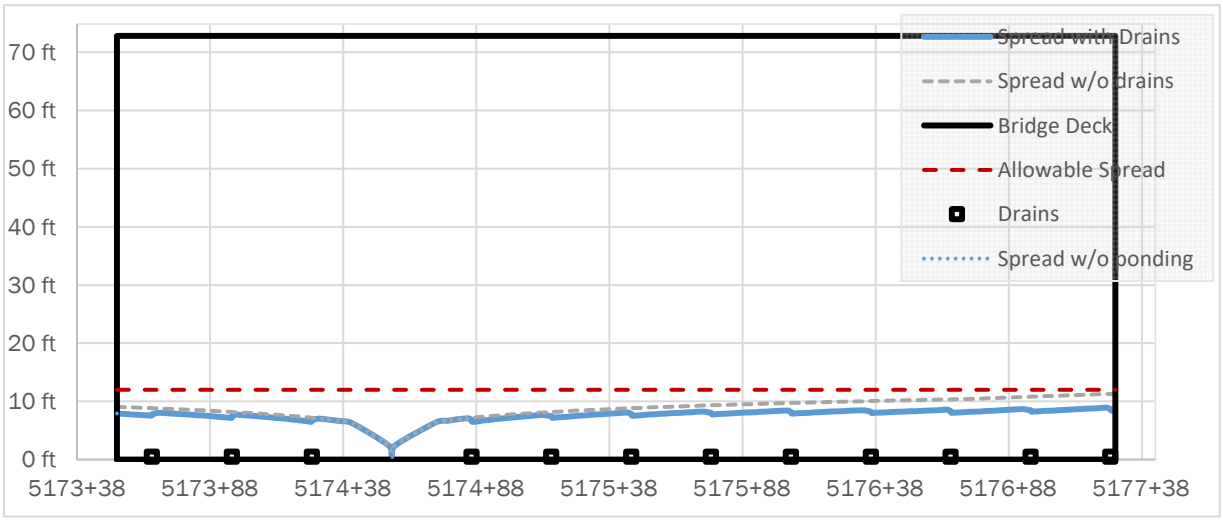


DESIGN DATA

T	=	12.02	ft	*Maximum allowable spread*
n	=	0.016	-	*Manning's coefficient -- typically, n = 0.016*
C	=	0.90	-	*Runoff -- typically, C = 0.9 for pavements*
i	=	8.33	in/hr	*Design intensity*

BRIDGE DATA

Beg	=	5173+53.00	-	*Beginning station of bridge*
End	=	5177+28.00	-	*End station of bridge*



ANALYSIS SUMMARY

The maximum spread without drains is 11.34 ft at station 5177+28.00

The maximum spread with drains included is 8.94 ft at station 5177+25.00

With an allowable spread of 12.02 ft, this bridge is hydraulicaly sufficienct.

Deck Drains included in analysis were spaced at 30 feet through the length of bridge.

DECK DRAIN ANALYSIS REPORT

VERTICAL CURVE DATA

PVI Station	PVI Elevation	LVC
5171+00.00	90.39	-
5175+00.00	91.59	350.00
5178+10.00	90.04	-

HYDRAULIC WIDTH (WIDTH BEING COLLECTED)

Station	Width (ft)
00+00.00	72.83

SUPERELEVATION DATA

Station	SE Rate (%)
00+00.00	2.0%
00+34.06	2.5%

CLOSED PIPE SYSTEM OUTPUT

No closed system enetered

DECK DRAIN SUMMARY TABLE

Drain No.	Station	Flow (cfs)	Efficiency	Spread (ft)
1	5173+66.25	0.907	17.9 %	7.85
2	5173+96.25	0.661	19.7 %	7.49
3	5174+26.25	0.376	24.3 %	6.84
4	5174+86.25	0.376	24.3 %	6.84
5	5175+16.25	0.661	19.7 %	7.49
6	5175+46.25	0.907	17.9 %	7.85
7	5175+76.25	1.120	17.0 %	8.07
8	5176+06.25	1.306	16.4 %	8.20
9	5176+36.25	1.468	16.1 %	8.29
10	5176+66.25	1.608	15.8 %	8.34
11	5176+96.25	1.730	15.5 %	8.51
12	5177+26.25	1.838	15.2 %	8.71

Rainfall Intensity Values
Utilized by South Carolina Department of Transportation

Rainfall intensity values utilized by the South Carolina Department of Transportation are computed by the following formula:

$$i = \frac{a}{(b+Tc)^c}$$

where: i = rainfall intensity in inches per hour,
Tc = time of concentration in minutes,
and a, b, and c are coefficients.

The coefficients for the 2-, 5-, 10-, 25-, 50-, and 100-year rainfall events are given in the table below for each county in South Carolina. The intensity values for time of concentration of 5, 10, 15, 30, and 60 minutes are also listed in the table for the same frequencies. To use these values compute the time of concentration for the drainage area using the velocity method in the NRCS TR-55 manual. Pick the appropriate county in the tables below to determine the appropriate coefficients. Then apply the equation to obtain the intensity value.

CLARENDON								
Frequency (years)	Rational Coefficients			Rainfall Intensity (“/hr) for Time of Concentration (T_c)				
	a	b	c	T_c = 5	T_c = 10	T_c = 15	T_c = 30	T_c = 60
2	66.5400	11.3400	0.8380	6.40	5.12	4.29	2.94	1.86
5	57.3800	9.9650	0.7600	7.34	5.90	4.97	3.48	2.27
10	51.3800	8.4830	0.6994	8.33	6.68	5.65	4.00	2.67
25	43.4700	6.6400	0.6248	9.38	7.50	6.37	4.58	3.15
50	40.6400	5.6410	0.5805	10.30	8.24	7.01	5.11	3.58
100	36.0600	4.1400	0.5284	11.20	8.89	7.58	5.58	4.00

Appendix II: Additional Information

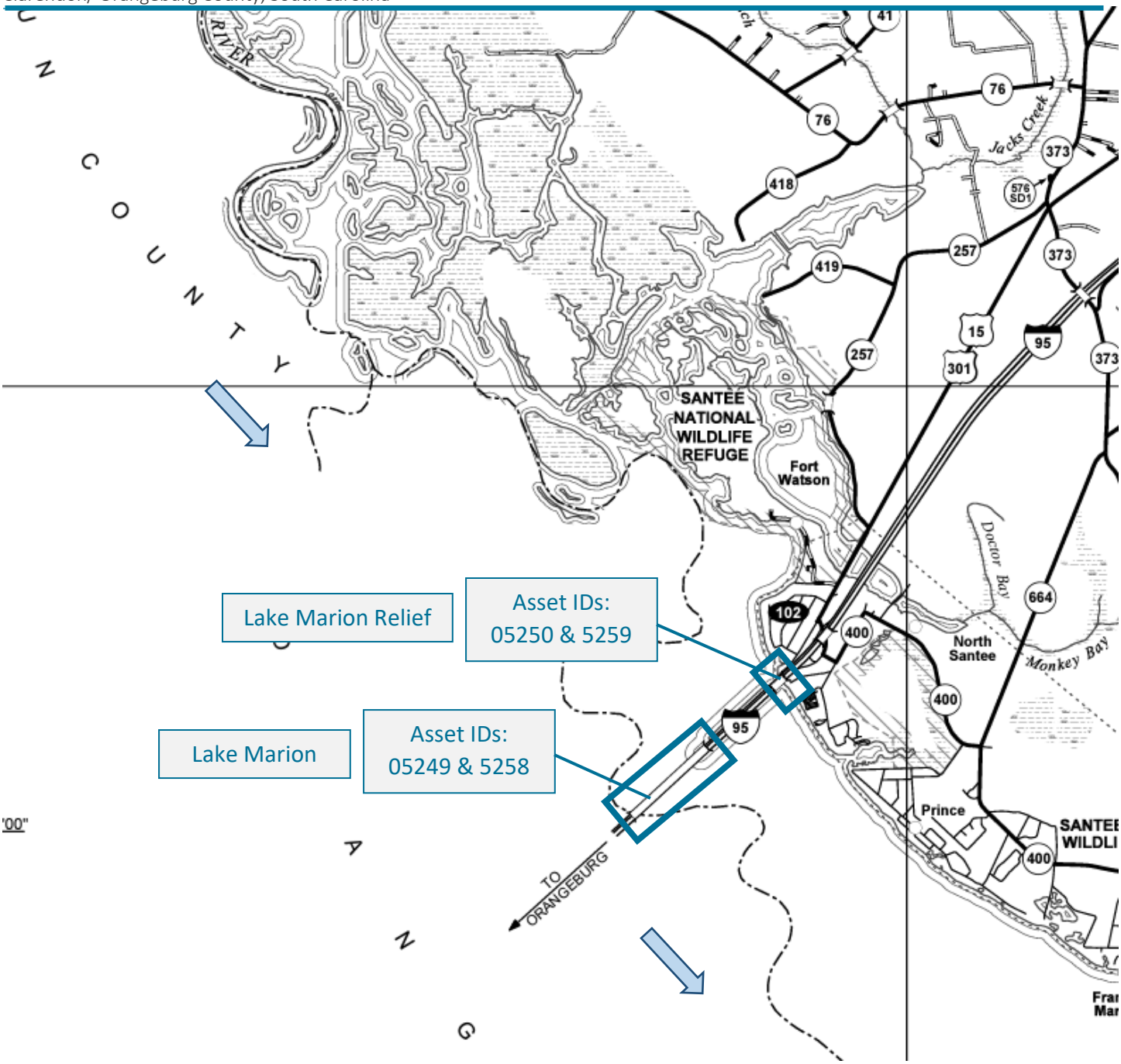
TRANSYSTEMS

Location Maps

TRANSYSTEMS

Location Map – I-95 over Lake Marion and Lake Marion Relief

Clarendon/ Orangeburg County, South Carolina



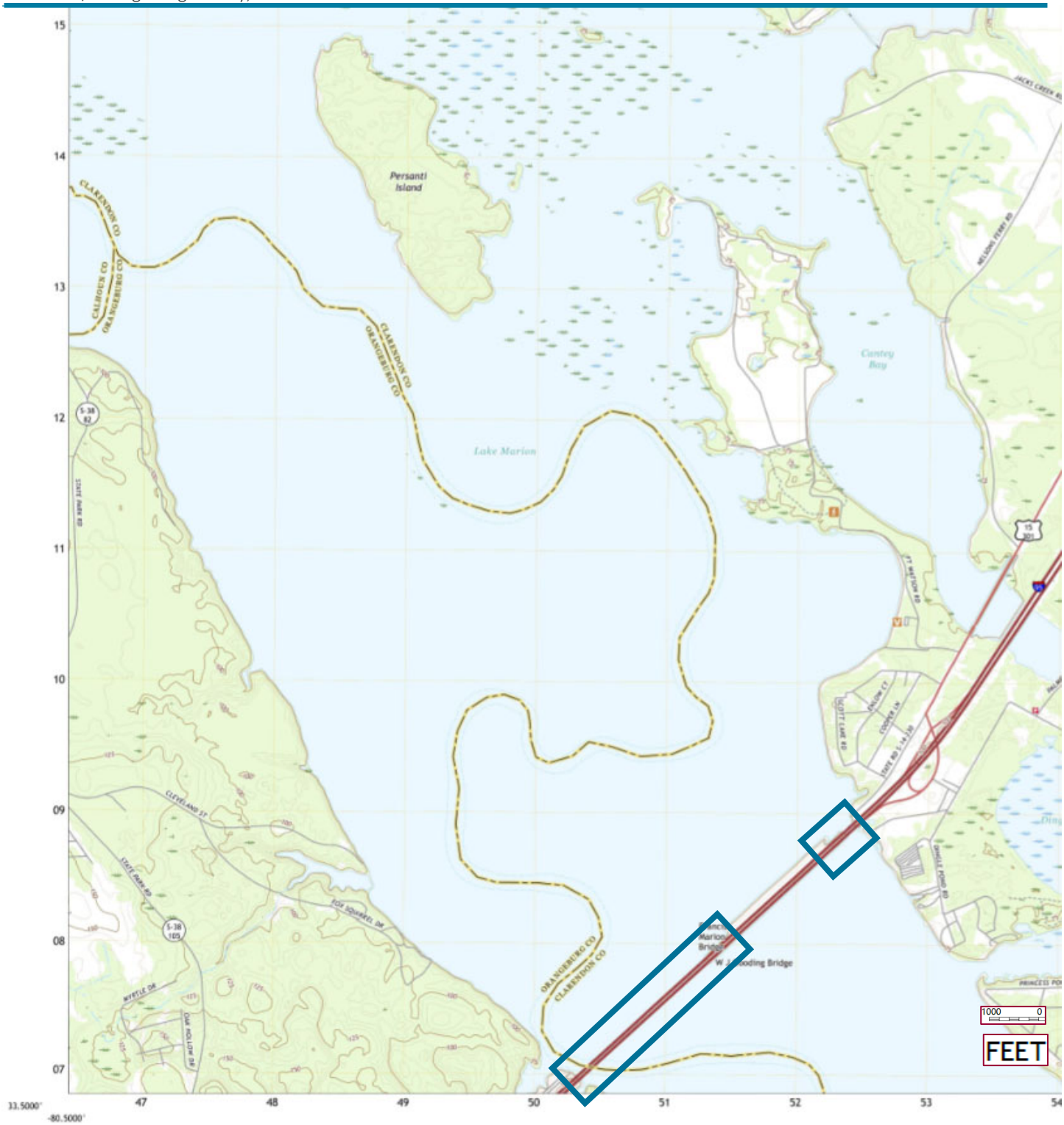
ORANGEBURG COUNTY MAP 2016

Project Title: I-95 over Lake Marion and Lake Marion Relief
Location: Clarendon/ Orangeburg County, South Carolina
Structure ID: 3820030110800 & 3820030130800
Source of Map: info2.scdot.org

N

Location Map – I-95 over Lake Marion and Lake Marion Relief

Clarendon/ Orangeburg County, South Carolina



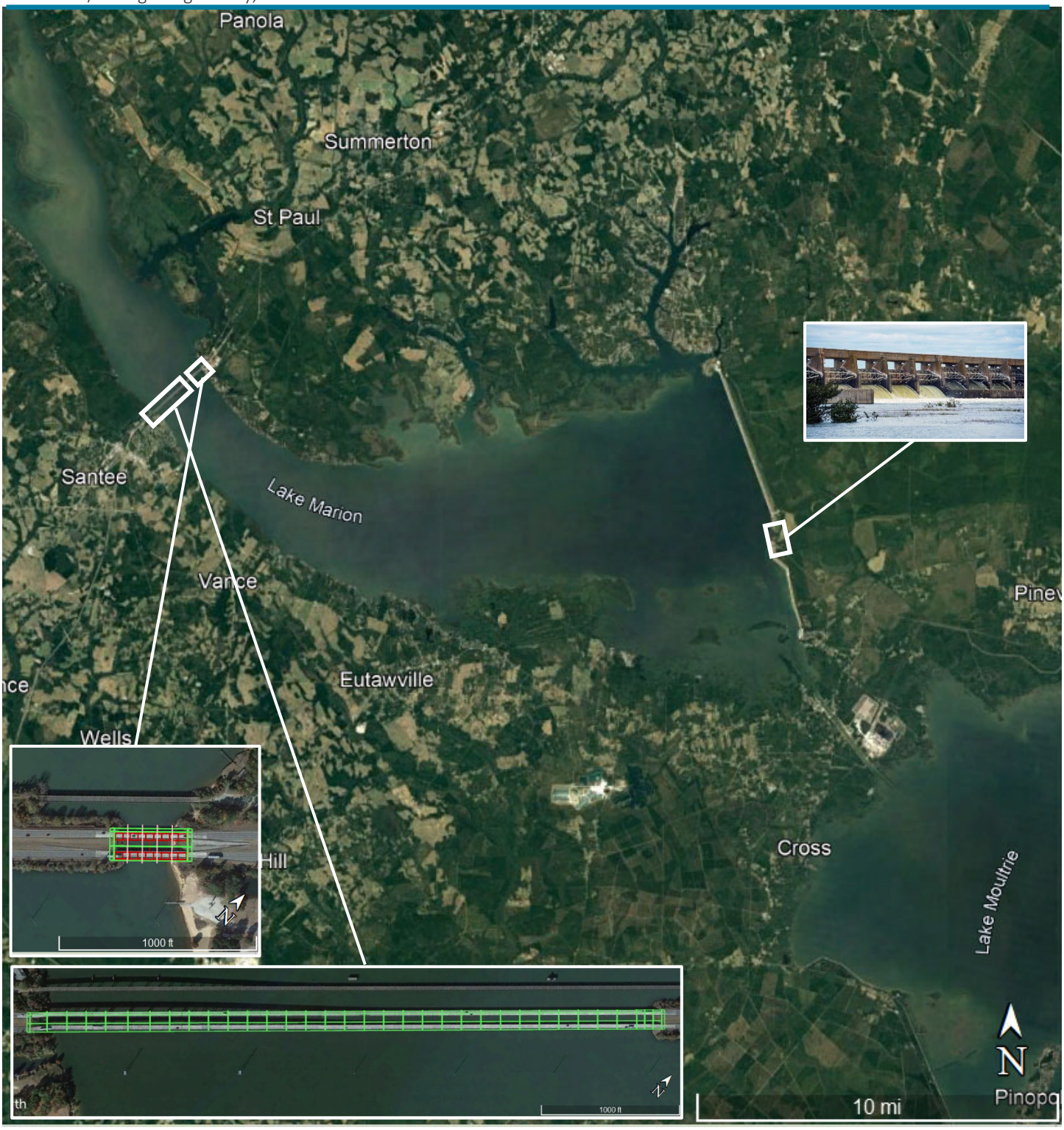
QUADRANGLE MAP: SC_SAINT_PAUL_2020

Project Title: I-95 over Lake Marion and Lake Marion Relief
Location: Clarendon/ Orangeburg County, South Carolina
Structure ID: 3820030110800 & 3820030130800
Source of Map: info2.scdot.org

N

Location Map - I-95 over Lake Marion and Lake Marion Relief

Clarendon/ Orangeburg County, South Carolina



COORDINATES: 33°27’26.71” N , -80°38’52.08 W

Project Title: I-95 over Lake Marion and Lake Marion Relief
Location: Clarendon/ Orangeburg County, South Carolina
Structure ID: 3820030110800 & 3820030130800
Source of Map: Google Earth Pro

N

Project Photographs

TRANSYSTEMS

I-95 over Lake Marion looking west and upstream.

I-95 over Lake Marion downstream face and navigation channel looking upstream.

I-95 over Lake Marion upstream face profile looking downstream.

I-95 over Lake Marion/ Utility Lines/ Abandoned US 301 looking west.

I-95 over Lake Marion main spans looking west and downstation.

I-95 over Lake Marion main spans looking east and upstation

I-95 over Lake Marion Relief approach looking east and upstation.

I-95 over Lake Marion Relief downstream face looking upstream.

I-95 Embankment on Lake Marion looking west and downstation.

I-95 Embankment on Lake Marion looking east and upstation.

I-95 over Lake Marion North Approach Roadway.

I-95 over Lake Marion South Approach Roadway.

Lake Marion upstream face of main spans looking east.

Lake Marion downstream face of main spans looking east.

Lake Marion large span substructure, typ.

Lake Marion causeway span substructure, typ.

Lake Marion two main spans superstructure (steel), typ.

Lake Marion all other spans superstructure (concrete), typ.

Lake Marion deck condition, typ.

Lake Marion railing condition, typ.

Lake Marion southwest abutments looking downstation.

Lake Marion southeast abutments looking downstation.

Lake Marion northwest abutments looking upstation.

Lake Marion northeast abutments looking upstation.

I-95 over Lake Marion Relief North Approach Roadway.

I-95 over Lake Marion Relief South Approach Roadway.

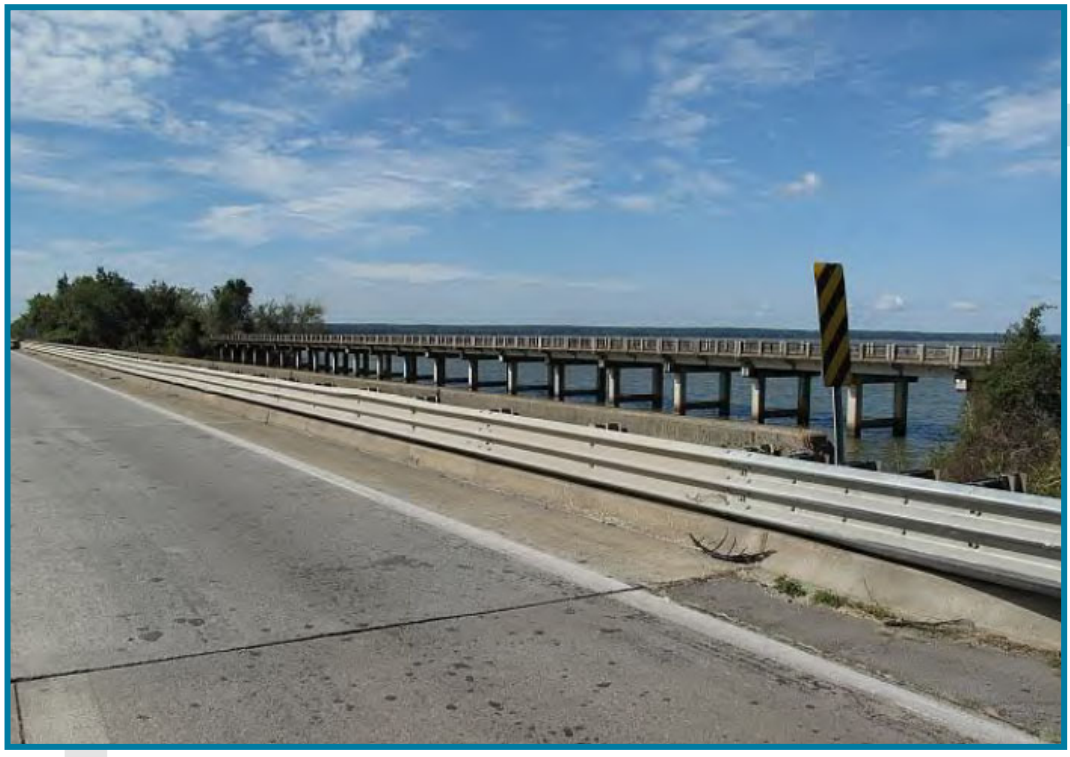
I-95 over Lake Marion Relief upstream face looking east.

I-95 over Lake Marion Relief downstream face looking east.

I-95 over Lake Marion Relief substructure, typ.

I-95 over Lake Marion Relief superstructure, typ.

I-95 over Lake Marion Relief deck condition, typ.



I-95 over Lake Marion Relief railing condition, typ.

I-95 over Lake Marion Relief southern abutment condition, typ.

I-95 over Lake Marion Relief northern abutment condition, typ.

Hydrology Documentation

TRANSYSTEMS

Peak FQ recommended for use by USGS Authors

1 / return period = AEP

Therefore; **Return Period = 1 / AEP**

AEP (decimal)	Return Period (yr)	With Reg Skew (cfs)	Without Reg Skew (cfs)
0.9950	**1.0050**	18,550	18,550
0.9900	**1.0101**	21,400	21,400
0.9500	**1.0526**	30,960	30,960
0.9000	**1.1111**	38,510	38,510
0.8000	**1.2500**	50,880	50,880
0.6670	**1.4993**	66,950	66,950
0.5000	**2.0000**	90,640	90,640
0.4292	**2.3299**	103,200	103,200
0.2000	**5.0000**	171,500	171,500
0.1000	**10.000**	245,500	245,500
0.0400	**25.000**	366,700	366,700
0.0200	**50.000**	480,400	480,400
0.0100	**100.00**	616,900	616,900
0.0050	**200.00**	780,300	780,300
0.0020	**500.00**	1,046,000	1,046,000

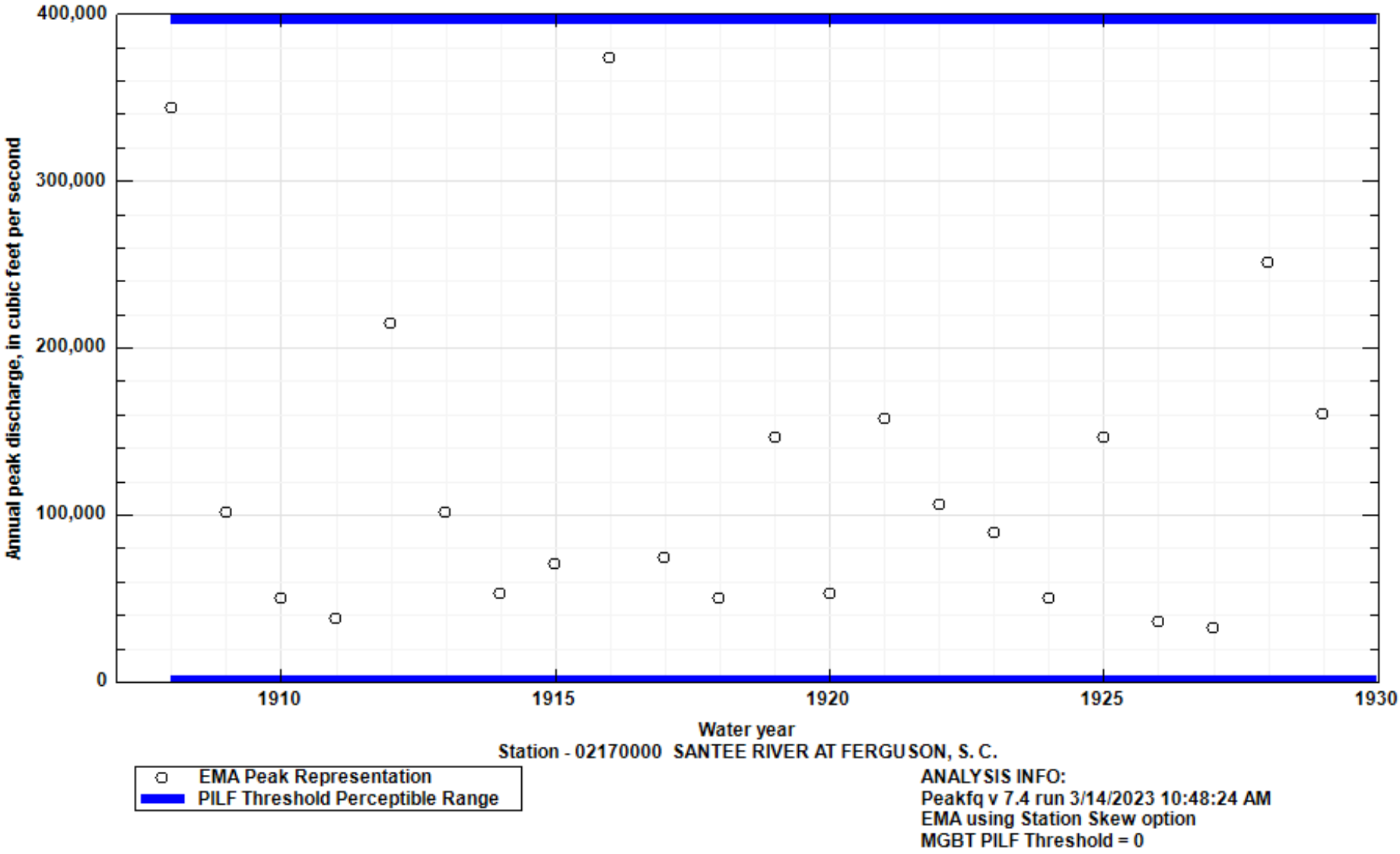
The gage service life was 33-years and 11 points were not used = 22 years of peak flood data.

The largest outlier was 344,000 cfs which is a little less than the 25-year flood.

Peak FQ station skew is using the largest event and service life to develop discharge curve.

US Geological Survey
PeakFQ Flood Frequency Analysis, Version 7.4 dated 5/ 4/2022
#
Analyzed: 03/14/2023 10:48
#
Empirical Frequency Curves
Station - 02170000 SANTEE RIVER AT FERGUSON, S. C.

WaterYr	RankedQ	EMAEst	ThreshLow	ThreshUp	IntvLow	IntvHigh
1916	374000.0	0.0434	0.	INF		
1908	344000.0	0.0869	0.	INF		
1928	251000.0	0.1303	0.	INF		
1912	215000.0	0.1738	0.	INF		
1929	160000.0	0.2173	0.	INF		
1921	158000.0	0.2608	0.	INF		
1919	146000.0	0.3478	0.	INF		
1925	146000.0	0.3043	0.	INF		
1922	106000.0	0.3913	0.	INF		
1909	101000.0	0.4783	0.	INF		
1913	101000.0	0.4348	0.	INF		
1923	89000.0	0.5217	0.	INF		
1917	74000.0	0.5652	0.	INF		
1915	71000.0	0.6087	0.	INF		
1914	53000.0	0.6957	0.	INF		
1920	53000.0	0.6522	0.	INF		
1910	50000.0	0.8262	0.	INF		
1918	50000.0	0.7827	0.	INF		
1924	50000.0	0.7392	0.	INF		
1911	38000.0	0.8697	0.	INF		
1926	35900.0	0.9131	0.	INF		
1927	32500.0	0.9566	0.	INF		
1931	-26000.0	0.2173	0.	INF		
1938	-38000.0	0.2173	0.	INF		
1934	-47000.0	0.2173	0.	INF		
1935	-47000.0	0.2173	0.	INF		
1932	-53000.0	0.2173	0.	INF		
1933	-56000.0	0.2173	0.	INF		
1940	-56000.0	0.2173	0.	INF		
1937	-59000.0	0.2173	0.	INF		
1939	-86000.0	0.2173	0.	INF		
1936	-245000.0	0.2173	0.	INF		
1930	-263000.0	0.2173	0.	INF		


400,000
300,000
200,000
100,000
0
Annual peak discharge, in cubic feet per second
1910
1915
1920
1925
1930
Water year
Station - 02170000 SANTEE RIVER AT FERGUSON, S. C.
EMA Peak Representation
PILF Threshold Perceptible Range
ANALYSIS INFO:
Peakfq v 7.4 run 3/14/2023 10:48:24 AM
EMA using Station Skew option
MGBT PILF Threshold = 0

1

```
  Program PeakFq           U. S. GEOLOGICAL SURVEY             Seq.002.000
  Version 7.4         Annual peak flow frequency analysis      Run Date / Time
  5/ 4/2022                                                     03/14/2023 10:48

                         --- PROCESSING OPTIONS ---

                      Plot option         = Graphics device
                      Basin char output   = WATSTORE
                      Print option        = Yes
                      Debug print         = No
                      Input peaks listing = Long
                      Input peaks format  = WATSTORE peak file

                      Input files used:
                         peaks (ascii)  - C:\Users\raokasha\Desktop\Lake
Marion\Hydrology\PEAK_1941EXCLUDED.TXT

                         specifications - C:\Users\raokasha\Desktop\Lake
Marion\Hydrology\PKFQWPSF.TMP

                      Output file(s):
                         main - C:\Users\raokasha\Desktop\Lake
Marion\Hydrology\PEAK_1941EXCLUDED.PRT

                         bcd  - C:\Users\raokasha\Desktop\Lake
Marion\Hydrology\PEAK_1941EXCLUDED.BCD



  ***  User responsible for assessment and interpretation of the following analysis
 ***

1


  Program PeakFq           U. S. GEOLOGICAL SURVEY             Seq.001.001
  Version 7.4         Annual peak flow frequency analysis      Run Date / Time
  5/ 4/2022                                                     03/14/2023 10:48

              Station - 02170000  SANTEE RIVER AT FERGUSON, S. C.


                    TABLE 1 - INPUT DATA SUMMARY

                Number of peaks in record           =       33
                Peaks not used in analysis          =       11
                Gaged peaks in analysis             =       22
                Historic peaks in analysis          =        0
                Beginning Year                      =     1908
```

```
Ending Year                            =     1940
Historical Period Length               =       33
Skew option                            = STATION SKEW
Regional skew                          =   -0.080
     Standard error                    =    0.550
     Mean Square error                 =    0.303
Gage base discharge                    =      0.0
User supplied high outlier threshold =   --
User supplied PILF (LO) criterion    =   --
Plotting position parameter            =     0.00
Type of analysis                              EMA
PILF (LO) Test Method                         MGBT
Perceptible Ranges:
    Start Year  End Year  Lower Bound  Upper Bound
          1908      1940          0.0          INF    DEFAULT

Interval Data                     =   None Specified
```

TABLE 2 - DIAGNOSTIC MESSAGE AND PILF RESULTS

```
**WCF109W-PEAKS WITH MINUS-FLAGGED DISCHARGES WERE BYPASSED.      11
**WCF113W-NUMBER OF SYSTEMATIC PEAKS HAS BEEN REDUCED TO NSYS =   22
 *WCF151I-17B WEIGHTED SKEW REPLACED BY USER OPTION.     0.155     0.354  -1
**WCF233W-EXPECTED PROB OUT OF RANGE AT TAB PROB.   0.00000   0.00001
  WCF002J-CALCS COMPLETED.  RETURN CODE =  2
  EMA002W-CONFIDENCE INTERVALS ARE NOT EXACT IF HISTORIC PERIOD > 0


  MULTIPLE GRUBBS-BECK TEST RESULTS
  MULTIPLE GRUBBS-BECK PILF THRESHOLD     N/A
  NUMBER OF PILFS IDENTIFIED                0


                    Kendall's Tau Parameters

                                       MEDIAN   No. of
                    TAU    P-VALUE     SLOPE   PEAKS
              ----------------------------------------
  GAGED PEAKS     -0.039      0.821   -300.000    22
```

Station - 02170000 SANTEE RIVER AT FERGUSON, S. C.

TABLE 3 - ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	LOGARITHMIC		
	MEAN	STANDARD DEVIATION	SKEW
EMA WITHOUT REG SKEW	4.9759	0.3153	0.354
EMA WITH REG SKEW	4.9759	0.3153	0.354

EMA ESTIMATE OF MSE OF SKEW WITHOUT REG SKEW 0.2558
EMA ESTIMATE OF MSE OF SKEW W/GAGED PEAKS ONLY (AT-SITE) 0.2558

TABLE 4 - ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL EXCEEDANCE PROBABILITY	<- EMA ESTIMATE -> WITH REG SKEW	WITHOUT REG SKEW	<- FOR EMA ESTIMATE WITH REG SKEW -> LOG VARIANCE OF EST.	<-CONFIDENCE LIMITS-> 5.0% LOWER	95.0% UPPER
0.9950	18550.	18550.	0.0250	7813.0	29770.0
0.9900	21140.	21140.	0.0184	9994.0	31720.0
0.9500	30960.	30960.	0.0082	18770.0	41230.0
0.9000	38510.	38510.	0.0059	26120.0	50560.0
0.8000	50880.	50880.	0.0049	37820.0	66880.0
0.6667	66950.	66950.	0.0049	50790.0	88200.0
0.5000	90640.	90640.	0.0052	68290.0	121300.0
0.4292	103200.	103200.	0.0054	77470.0	140000.0
0.2000	171500.	171500.	0.0073	126600.0	257700.0
0.1000	245500.	245500.	0.0106	175700.0	431700.0
0.0400	366700.	366700.	0.0183	246600.0	886700.0
0.0200	480400.	480400.	0.0270	305100.0	1592000.0
0.0100	616900.	616900.	0.0383	367800.0	2920000.0
0.0050	780300.	780300.	0.0523	434800.0	4745000.0
0.0020	1046000.	1046000.	0.0753	530500.0	8951000.0

*Note: If Station Skew option is selected then EMA ESTIMATE WITH REG SKEW will display values for and be equal to EMA ESTIMATE WITHOUT REG SKEW.

Station - 02170000 SANTEE RIVER AT FERGUSON, S. C.

TABLE 5 - INPUT DATA LISTING

WATER YEAR	PEAK VALUE	PEAKFQ CODES	FLOW INTERVALS (WHERE LOWER BOUND NOT = UPPER BOUND) LOWER BOUND	UPPER BOUND	REMARKS
1908	344000.0				
1909	101000.0				
1910	50000.0				
1911	38000.0				
1912	215000.0				
1913	101000.0				
1914	53000.0				
1915	71000.0				
1916	374000.0				
1917	74000.0				
1918	50000.0				
1919	146000.0				
1920	53000.0				
1921	158000.0				
1922	106000.0				
1923	89000.0				
1924	50000.0				
1925	146000.0				
1926	35900.0				
1927	32500.0				
1928	251000.0				
1929	160000.0				
1930	-263000.0	K			
1931	-26000.0	K			
1932	-53000.0	K			
1933	-56000.0	K			
1934	-47000.0	K			
1935	-47000.0	K			
1936	-245000.0	K			
1937	-59000.0	K			
1938	-38000.0	K			
1939	-86000.0	K			
1940	-56000.0	K			

Explanation of peak discharge qualification codes

PeakFQ CODE	NWIS CODE	DEFINITION
D	3	Dam failure, non-recurrent flow anomaly

G	8	Discharge greater than stated value
X	3+8	Both of the above
L	4	Discharge less than stated value
K	6 OR C	Known effect of regulation or urbanization
O	O	Opportunistic peak
H	7	Historic peak

- Minus-flagged discharge -- Not used in computation
  -8888.0 -- No discharge value given
- Minus-flagged water year -- Historic peak used in computation

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.001.004
Version 7.4 Annual peak flow frequency analysis Run Date / Time
5/ 4/2022 03/14/2023 10:48

Station - 02170000 SANTEE RIVER AT FERGUSON, S. C.

TABLE 6 - EMPIRICAL FREQUENCY CURVES -- HIRSCH-STEDINGER PLOTTING POSITIONS

WATER YEAR	RANKED DISCHARGE	EMA ESTIMATE	FLOW INTERVALS (WHERE LOWER BOUND NOT = UPPER BOUND) LOWER BOUND	UPPER BOUND
1916	374000.0	0.0434		
1908	344000.0	0.0869		
1928	251000.0	0.1303		
1912	215000.0	0.1738		
1929	160000.0	0.2173		
1921	158000.0	0.2608		
1919	146000.0	0.3478		
1925	146000.0	0.3043		
1922	106000.0	0.3913		
1909	101000.0	0.4783		
1913	101000.0	0.4348		
1923	89000.0	0.5217		
1917	74000.0	0.5652		
1915	71000.0	0.6087		
1914	53000.0	0.6957		
1920	53000.0	0.6522		
1910	50000.0	0.8262		
1918	50000.0	0.7827		
1924	50000.0	0.7392		
1911	38000.0	0.8697		
1926	35900.0	0.9131		
1927	32500.0	0.9566		

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.001.005
Version 7.4 Annual peak flow frequency analysis Run Date / Time
5/ 4/2022 03/14/2023 10:48

Station - 02170000 SANTEE RIVER AT FERGUSON, S. C.

TABLE 7 - EMA REPRESENTATION OF DATA

<---- USER-ENTERED ----><-------- FINAL ------->

WATER YEAR	<----- OBSERVED ----> Q_LOWER	Q_UPPER	<-------- EMA -------> Q_LOWER	Q_UPPER	<- PERCEPTIBLE RANGES -> LOWER	UPPER	<- PERCEPTIBLE RANGES -> LOWER	UPPER
1908	344000.0	344000.0	344000.0	344000.0	0.0	INF	0.0	INF
1909	101000.0	101000.0	101000.0	101000.0	0.0	INF	0.0	INF
1910	50000.0	50000.0	50000.0	50000.0	0.0	INF	0.0	INF
1911	38000.0	38000.0	38000.0	38000.0	0.0	INF	0.0	INF
1912	215000.0	215000.0	215000.0	215000.0	0.0	INF	0.0	INF
1913	101000.0	101000.0	101000.0	101000.0	0.0	INF	0.0	INF
1914	53000.0	53000.0	53000.0	53000.0	0.0	INF	0.0	INF
1915	71000.0	71000.0	71000.0	71000.0	0.0	INF	0.0	INF
1916	374000.0	374000.0	374000.0	374000.0	0.0	INF	0.0	INF
1917	74000.0	74000.0	74000.0	74000.0	0.0	INF	0.0	INF
1918	50000.0	50000.0	50000.0	50000.0	0.0	INF	0.0	INF
1919	146000.0	146000.0	146000.0	146000.0	0.0	INF	0.0	INF
1920	53000.0	53000.0	53000.0	53000.0	0.0	INF	0.0	INF
1921	158000.0	158000.0	158000.0	158000.0	0.0	INF	0.0	INF
1922	106000.0	106000.0	106000.0	106000.0	0.0	INF	0.0	INF
1923	89000.0	89000.0	89000.0	89000.0	0.0	INF	0.0	INF

```
   1924    50000.0    50000.0    50000.0    50000.0         0.0         INF
0.0         INF
   1925   146000.0   146000.0   146000.0   146000.0         0.0         INF
0.0         INF
   1926    35900.0    35900.0    35900.0    35900.0         0.0         INF
0.0         INF
   1927    32500.0    32500.0    32500.0    32500.0         0.0         INF
0.0         INF
   1928   251000.0   251000.0   251000.0   251000.0         0.0         INF
0.0         INF
   1929   160000.0   160000.0   160000.0   160000.0         0.0         INF
0.0         INF
1



 End PeakFQ analysis.
   Stations processed :       1
   Number of errors   :       0
   Stations skipped   :       0
   Station years      :      33


Data records may have been ignored for the stations listed below.
(Card type must be Y, Z, N, H, I, 2, 3, 4,  or *.)
(2, 4, and * records are ignored.)

 For the station below, the following records were ignored:

 FINISHED PROCESSING STATION:  02170000       USGS SANTEE RIVER AT FERGUSON, S.


 For the station below, the following records were ignored:

 FINISHED PROCESSING STATION:
```

StreamStats Report

Region ID: SC
Workspace ID: SC20230227175534426000
Clicked Point (Latitude, Longitude): 33.51077, -80.44537
Time: 2023-02-27 12:56:01 -0500

Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	14400	square miles
I24H50Y	Maximum 24-hour precipitation that occurs on average once in 50 years	7.4	inches
LC06DEV	Percentage of land-use from NLCD 2006 classes 21-24	15.2	percent
LC06IMP	Percentage of impervious area determined from NLCD 2006 impervious dataset	3.37	percent
PCTREG1	Percentage of drainage area located in Region 1 - Piedmont / Ridge and Valley	77.4	percent
PCTREG2	Percentage of drainage area located in Region 2 - Blue Ridge	9.9	percent
PCTREG3	Percentage of drainage area located in Region 3 - Sandhills	6.2	percent
PCTREG4	Percentage of drainage area located in Region 4 - Coastal Plains	6.4	percent
PCTREG5	Percentage of drainage area located in Region 5 - Lower Tifton Uplands	0	percent

General Disclaimers

The delineation point is in an exclusion area. CAUTION: AREA OF REGULATION EQUATIONS DO NOT APPLY

Peak-Flow Statistics

Peak-Flow Statistics Parameters [99.9 Percent (14400 square miles) Peak Southeast US over 1 sqmi 2009 5156]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	14400	square miles	1	9000

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
PCTREG1	Percent Area in Region 1	77.4	percent	0	100
PCTREG2	Percent Area in Region 2	9.9	percent	0	100
PCTREG3	Percent Area in Region 3	6.2	percent	0	100
PCTREG4	Percent Area in Region 4	6.4	percent	0	100
PCTREG5	Percent Area in Region 5	0	percent	0	100

Peak-Flow Statistics Disclaimers [99.9 Percent (14400 square miles) Peak Southeast US over 1 sqmi 2009 5156]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Peak-Flow Statistics Flow Report [99.9 Percent (14400 square miles) Peak Southeast US over 1 sqmi 2009 5156]

Statistic	Value	Unit
50-percent AEP flood	77000	ft^3/s
20-percent AEP flood	116000	ft^3/s
10-percent AEP flood	143000	ft^3/s
4-percent AEP flood	175000	ft^3/s
2-percent AEP flood	203000	ft^3/s
1-percent AEP flood	227000	ft^3/s
0.5-percent AEP flood	249000	ft^3/s
0.2-percent AEP flood	284000	ft^3/s

Peak-Flow Statistics Citations

Feaster, T.D., Gotvald, A.J., and Weaver, J.C.,2009, Magnitude and Frequency of Rural Floods in the Southeastern United States, 2006: Volume 3, South Carolina: U.S. Geological Survey Scientific Investigations Report 2009-5156, 226 p. (http://pubs.usgs.gov/sir/2009/5156/)

USGS Data Disclaimer: Unless otherwise stated, all data, metadata and related materials are considered to satisfy the quality standards relative to the purpose for which the data were collected. Although these data and associated metadata have been reviewed for accuracy and completeness and approved for release by the U.S. Geological Survey (USGS), no warranty expressed or implied is made regarding the display or utility of the data for other purposes, nor on all computer systems, nor shall the act of distribution constitute any such warranty.

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Application Version: 4.13.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

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- Full News

Peak Streamflow for the Nation

USGS 02170000 SANTEE RIVER AT FERGUSON, S. C.

Orangeburg County, South Carolina
Hydrologic Unit Code 03050111
Latitude 33°26'15", Longitude 80°16'20" NAD27
Drainage area 14,600.00 square miles
Gage datum 42.30 feet above NGVD29

Output formats

Table
Graph
Tab-separated file
peakfq (watstore) format
Reselect output format

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1916	1916-07-21	24.74	374,000[5]
1908	1908-08-31	23.70	344,000[5]
1930	1929-10-07	21.04	263,000[6]
1928	1928-08-22	20.60	251,000[5]
1936	1936-04-11	20.42	245,000[6]
1912	1912-03-20	19.44	215,000[5]
1929	1929-03-10	17.55	160,000[5]

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1921	1921-02-15	17.47	158,000[5]
1919	1919-07-27	17.12	146,000[5]
1925	1925-01-23	17.13	146,000[5]
1922	1922-02-21	15.77	106,000[5]
1909	1909-06-10	15.62	101,000[5]
1913	1913-03-21	15.56	101,000[5]
1923	1923-03-23	15.20	89,000[5]
1939	1939-03-07	15.10	86,000[6]
1917	1917-03-10	14.70	74,000[5]
1915	1915-01-24	14.65	71,000[5]
1937	1937-01-11	14.19	59,000[6]
1933	1933-01-03	14.08	56,000[6]
1940	1940-08-21	14.07	56,000[6]
1914	1914-01-07	14.02	53,000[5]
1920	1920-04-03	14.00	53,000[5]
1932	1932-01-15	13.95	53,000[6]
1910	1910-03-09	13.90	50,000[5]
1918	1918-02-06	13.90	50,000[5]
1924	1924-01-23	13.87	50,000[5]
1941	1941-07-24		48,000[1,6]
1934	1934-06-12	13.80	47,000[6]
1935	1934-10-17	13.81	47,000[6]
1911	1911-01-10	13.47	38,000[5]
1938	1937-10-27	13.54	38,000[6]
1926	1926-03-03	13.43	35,900[5]
1927	1927-03-02	13.30	32,500[5]
1931	1931-01-19	12.88	26,000[6]

?

Peak Streamflow Qualification Codes.

- 1 -- Discharge is a Maximum Daily Average
- 5 -- Discharge affected to unknown degree by Regulation or Diversion
- 6 -- Discharge affected by Regulation or Diversion

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U.S. Department of the Interior | U.S. Geological Survey

Title: Surface Water for USA: Peak Streamflow
URL: https://nwis.waterdata.usgs.gov/nwis/peak?

Page Contact Information: USGS Water Data Support Team
Page Last Modified: 2023-06-02 10:54:39 EDT
0.18 0.17 nadww01

Two-Dimensional Hydraulic Modeling Report

FEMA FIRM
(Orangeburg and Clarendon County)

TRANSYSTEMS

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

0 0 300 600 METERS

615000 FT

CLARENDON COUNTY
ORANGEBURG COUNTY

RD

Orangeburg County
Unincorporated Areas
450160

BRIDGE

15

95

ZONE AE
(EL 76)

CLARENDON COUNTY
ORANGEBURG COUNTY

LAKE MARION

610000 FT

33º 30' 00"

80º 26' 15"

JOINS PANEL 0455

2160000 FT

2165000 FT

2170000 FT

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0265C

FIRM

FLOOD INSURANCE RATE MAP

ORANGEBURG COUNTY, SOUTH CAROLINA

AND INCORPORATED AREAS

PANEL 265 OF 760

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ORANGEBURG COUNTY	450160	0265	C

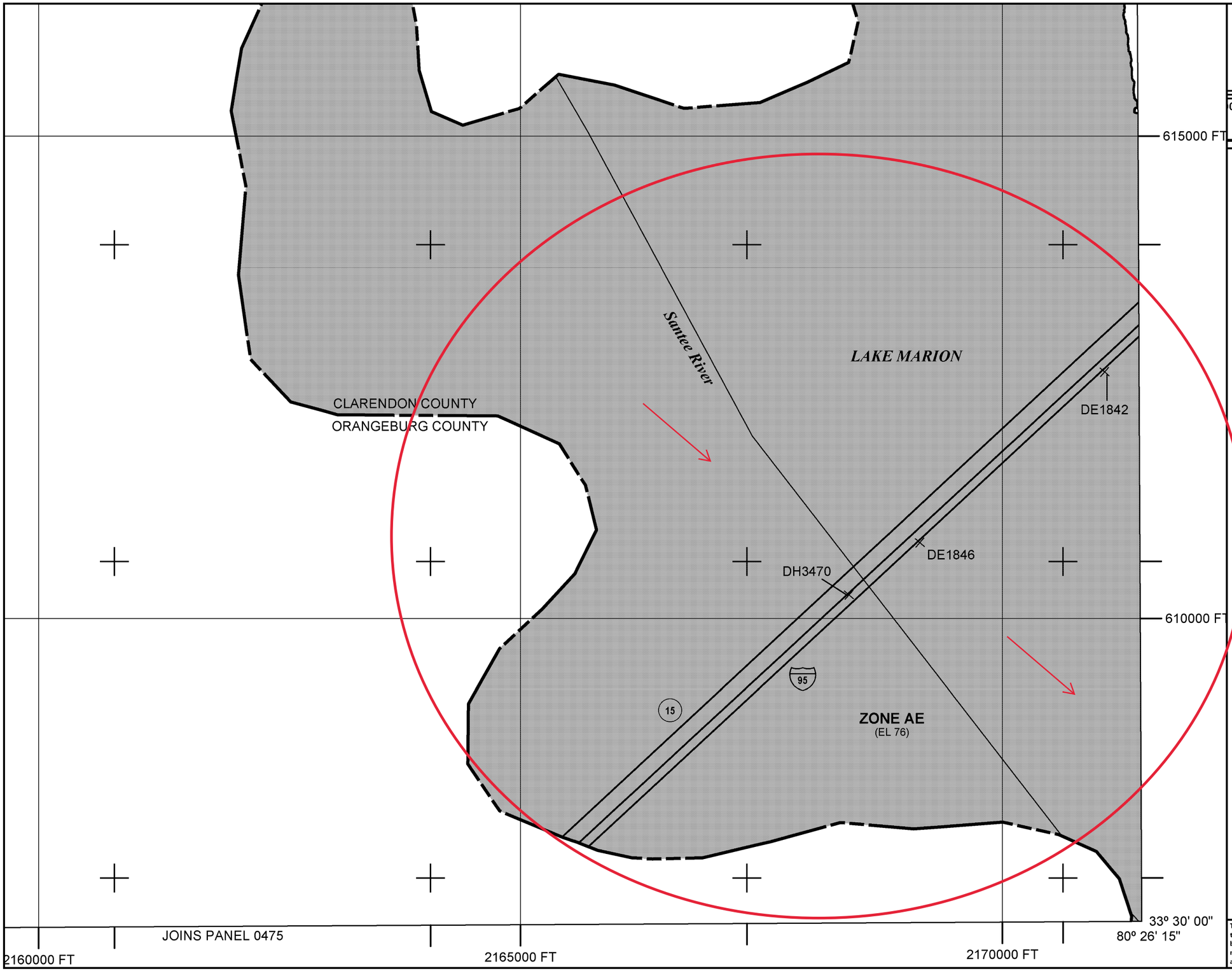
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
45075C0265C

EFFECTIVE DATE
JANUARY 16, 2014

Federal Emergency Management Agency

This is an official FIRMette showing a portion of the above-referenced flood map created from the MSC FIRMette Web tool. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For additional information about how to make sure the map is current, please see the Flood Hazard Mapping Updates Overview Fact Sheet available on the FEMA Flood Map Service Center home page at https://msc.fema.gov.



MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

0 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0365C

FIRM

FLOOD INSURANCE RATE MAP

CLARENDON COUNTY, SOUTH CAROLINA AND INCORPORATED AREAS

PANEL 365 OF 550

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CLARENDON COUNTY	450051	0365	C

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
45027C0365C

EFFECTIVE DATE
AUGUST 19, 2013

Federal Emergency Management Agency

This is an official FIRMette showing a portion of the above-referenced flood map created from the MSC FIRMette Web tool. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For additional information about how to make sure the map is current, please see the Flood Hazard Mapping Updates Overview Fact Sheet available on the FEMA Flood Map Service Center home page at https://msc.fema.gov.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

0 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0370C

FIRM

FLOOD INSURANCE RATE MAP

CLARENDON COUNTY, SOUTH CAROLINA AND INCORPORATED AREAS

PANEL 370 OF 550

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CLARENDON COUNTY	450051	0370	C

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
45027C0370C

EFFECTIVE DATE
AUGUST 19, 2013

Federal Emergency Management Agency

This is an official FIRMette showing a portion of the above-referenced flood map created from the MSC FIRMette Web tool. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For additional information about how to make sure the map is current, please see the Flood Hazard Mapping Updates Overview Fact Sheet available on the FEMA Flood Map Service Center home page at https://msc.fema.gov.

Inspection Reports
(Inspection & Underwater Reports)

TRANSYSTEMS

SCDOT BRIDGE INSPECTION FORM

(008) BRIDGE ID:	1410009510100	(005) ROUTE:	CLARENDON I-95
(420) ASSET NO:	5249	(006) CROSSING:	LAKE MARION
(419) RAMP NO:		(009) LOCATION:	7MI S OF SUMMERTON
(026) FUNCTIONAL CLASS:	1	(016) LAT: 33d 30m 18.67s	(017) LON: 80d 27m 8.91s

GENERAL BRIDGE DATA

	EXISTING	REVISED		EXISTING	REVISED
(027) Year Built	1968		(042) Type Serv; On(A) Und(B)	1 5	
(106) Year Recon	0		(028) Lanes; On(A) Und(B)	2 0	
(031) Design Load	5		(107) Deck Struct	1	
(36A) Railings	1		(108) Wear Surf/Membrane/Prot	1 0 0	
(36B) Transitions	1			MAT-SUP-SUB	MAT-SUP-SUB
(36C) Appr Guard	1		(043) Main Original (A)	4 2 1	
(36D) Appr Guard End	1		Main Reconst (B)		
(037) History	5		(044) Appr Orginal (A)	1 04 5	
(319) Last Paint Date	11/1999		Appr Reconst (B)		

GEOMETRIC DATA

	EXISTING	REVISED		EXISTING		REVISED	
(032) Appr Rdway	38			FT	IN	FT	IN
(033) Bridge Median	0		(053) Vert Clr Above Deck	99	99		
(034) Skew	0		(54A) Vert Clear Ref	N			
(035) Flared	0		(54B) Vert Clear Right	0	0	0	0
(045) # Main Spans	5		(54C) Vert Clear Left	0	0	0	0
(046) # Appr Spans	80		(10A) Great Min Clr Over/Und	99	99		
(048) Max Span Lgth	140		(10B) Great Min Right	99	99		
(308) Appr Span Lgth	40		(10C) Great Min Left	99	99		
(049) Struct Length	4500						
(47A) Horz Clear Right	31		(55A) Lat Clear Ref	N			
(47B) Horz Clear Left	0		(55B) Lat Clear Right	0			
(47UA) Horz Clear Right	0	0	(056) Lat Clear Left	0			
(47UB) Horz Clear Left	0	0					
(50B) Sidewalk Right	0		(038) Navigation Cont	0			
(50A) Sidewalk Left	0		(039) Nav Vert Clear	50			
(051) Curb to Curb	31		(040) Nav Horz Clear	100			
(052) Deck Out-Out	35.20		(111) Nav Pier Port	2			

RATINGS DATA

	EXISTING	REVISED		EXISTING		REVISED	
(58) Deck	5		(041) Traffic Status	A			
(59) Super Str	5		(063) Rating Method	8			
(60) Sub Str	5		(064) Operating Method	1.10		1.12	
(061) Channel	6		(065) Rating Method	8			
(062) Culv Ret	N		(066) Inventory Rating	0.69			
(071) Water Adeq	6		(411) Date Rated	10/2021		12/2022	
(072) Appr Rdway	8		(418) Conditions During Rating	5 5 5			
(113) Scour Critical	9			Freq	Mth/Year	Freq	Mth/Year
(067) Structure	5		(091, 090) Routine Insp	24	10/2021	24	10/2021
(068) Deck Geom	4		(92A, 93A) Fracture Critical	N			
(069) Underclear	N		(92B, 93B) Underwater Insp	Y60	02/2021	Y60	02/2021
(070) Bridge Post	5		(92C, 93C) Special Insp	N	08/2018	N	

Inspection Leader:	HUDSON YOST, AI	Reviewed By:	
Date:		Date:	

Bridge Element Group Textual Data

Bridge ID: 14-1-00095-1-01-00

14 Dec 2022

Abutments and/or Headwalls:

N/A

Bents and/or Piers:

BENTS #59-85 HAVE 2) R/C COLUMNS WITH EITHER 1 OR 2 R/C STRUTS; BENTS #2-58 HAVE 4 21" OCT. PRESTRESSED CONCRETE PILES (BENTS #12, 24, 36, AND 48 HAVE TANDEM FASCIA PILES), ALL W/ R/C CAPS //

-MOD. TO HEAVY ABRASION (1/2-3/4") AT SPLASH ZONE ON ALL COLUMNS AND PILES;
-H.L. TO MODERATE,, WITH WIDE VERT. CRACKS (WIDE CR., FROM ~1/16” AND UP TO ~1/8”, AND MOSTLY ON ~HALF OF FASCIA PILE) IN MOST PRESTR. PILES AT SPLASH ZONE, FOR LOCATION SPECIFIC NOTES SEE UNDERWATER REPORT;
-LARGE SPALLS ON BT#12 AND 26 WITH R/S EXPOSED;
-COL #1 ON BT82 IS UNDERMINED, PER U/W REPORT;
-H.L. FLEXURE CRACKS IN THRU-OUT CAPS, GENERALLY SPACED AT 1-3’;

FOR LOCATION SPECIFIC NOTES SEE SKETCH SHEET

Bearings:

16) EXPANSION ROCKERS BEARING AND 8) FIXED SHOE BEARINGS UNDER STEEL GIRDERS; 110) STEEL ROCKER PLATES UNDER PRESTRESSED BEAMS; FELT PADS UNDER ALL CONCRETE TEE BEAMS;
-MODERATE TO HEAVY RUST, NUMEROUS CREVICE COMPACTION ON STEEL BEARING;
-SEVERAL ROCKER BEARING HAVE MISALIGNMENT BUT STILL APPEARS TO HAVE MOVEMENT;

FOR LOCATION SPECIFIC NOTES SEE SKETCH SHEET

Girders/Floor Beams/Stringers and/or Beams:

_5 SPANS OF 4 CONTINUOUS STEEL BEAMS (2@110’ + 3@140’) __
-MINOR SURFACE RUST THRU-OUT STEEL GIRDERS (99%);
-THE MOD. TO HEAVY RUST (WITH SOME AREAS OF SECTION LOSS) ARE USUALLY ON BEAM ENDS OVER BEARING AREA (1%);

_22 SPANS OF 5 PRESTRESSED CONCRETE BEAMS (70’)__
-TYPICAL CRACKING TO SPALLING ON GROUTED BEAM ENDS;
-BEAM SOLE PLATE HAVE MODERATE TO HEAVY RUST CAUSING ADJACENT CRACKING;
-SHALLOW SPALLS ON UNDERSIDE WITH P/S EXPOSED ON SOME BEAMS ENDS AND ON BOTTOMS;

_58 SPANS OF 5 CONC. "T" BEAMS (40’)__
-HAIRLINE FLEXURE CRACKING IN TEE BEAMS GENERAL SPACED @ 1’;

GENERAL
-ALL DIAPH'S HAVE MINOR CRACKING TO SPALLS RANGING FROM SMALL TO SEVERAL SQ FEET THRU-OUT BRIDGE W/ SOME HAVING EXPOSED R/S (MOST OF THE SPALLING IS ON THE NORTH SIDE DIAPHRAGMS ON TEE BEAM SPANS);
-CORROSION THROUGHOUT DIAPHRAGMS

FOR LOCATION SPECIFIC NOTES SEE SKETCH SHEET

Truss Members:

N/A

Expansion Joints:

-2 STEEL OPEN FINGER JOINTS ON BENTS #80 + 75 (END OF STEEL SPANS);
-FUNCTIONING WELL WITH NO MORE THAN A 1/4" VERT. OFFSET, BUT MINOR RUST THRU-OUT (MAINLY ON UNDER SIDE);
-SPALLING THROUGHOUT FULL LENGTH OF JOINTS UP TO 3" IN DIAM.
-MAP CRACKING UP TO 1/16" WIDE THROUGHOUT FULL LENGTH OF JOINTS

-80-POURABLE EXPANSION JOINTS ON ALL OTHERS;
-SILICON JOINTS PLACED IN 2009; WITH SOME AREAS OF LOSS OF ADHESION (~UP TO 10% HAVE LOST ADHESION IN CS2 AND UP TO ~1% HAVE LOST ADHESION IN CS3);

FOR LOCATION SPECIFIC NOTES SEE SKETCH SHEET

Decks and/or Slabs:

6.5" R/C DECK WITH NO ADDITIONAL OVERLAY; 58 SPANS@40', 22 SPANS@70, 2@110', AND 3@140';
-LIGHT PATTERN OF HAIRLINE TO 1/16" MAP CRACKING WITH AREAS OF HEAVY PATTERN MAP CRACKING AND MINOR SPALLING NEAR JOINTS;
-LIGHT SCALING, AND WEARING;
-SMALL TO LARGE (1/2” TO 1”) POP-OUTS THRU DECK;
-HAIRLINE WITH UP TO 0.1875” WIDE TRANSVERSE CRACKS OVER STEEL SUPERSTRUCTURES;

FOR LOCATION SPECIFIC NOTES SEE SKETCH SHEET

Curbs:

18" CONCRETE SAFETY CURB/
-CURB REVEAL: ALL CORNER ARE ~10”
-LIGHT ABRASION AT CURB AND DECK CORNERS FROM RAIN RUNOFF;

Bridge Railing/Parapets and/or Median Barriers:

1-CONCRETE RAILING AND POSTS WITH METAL THRIEBEAM RAILING RETRO FITTED ACROSS BRIDGE;
1-METAL THRIEBEAM TRANSITIONS WITH METAL POST;
1-STANDARD "W" BEAM G.R. WITH TIMBER AND METAL POSTS ON THREE APPROACHES;
1-LONG EXTENDED/CONTINUOUS G.R. SERVES AS END TREATMENTS;

-SOME MOD. DAMAGE TO RAILING THROUGHOUT BRIDGE (~1%);
-SOME AREAS OF DAMAGE IN CONCRETE RAILING, BUT NOT IN ELEMENTS DUE TO METAL RAILING FACING TRAFFIC;

Paint Systems:

GIRDERS=EST. @ 43,878 SF OF PAINTED SURFACE:
-STEEL GIRDERS ARE IN SATISFACTORY CONDITION DUE TO BEING PAINTED BY CONTRACTOR IN NOVEMBER 1999;
-SOME LIGHT SURFACE RUST ON BEAMS AND CROSS BRACING/DIAPHRAGMS, WITH SOME AREAS OF MAJOR RUST AND SECTION LOSS NEAR BEAM ENDS;
~2%-FAILED IN EFFECTIVENESS;
~7%-LIMITED IN EFFECTIVENESS
~91% -FULLY IN EFFECTIVENESS
-BEARINGS UNDER PRESTRESSED BEAMS ARE GENERALLY IN POOR CONDITION, AND WILL NEED TO BE REHABILITATED IN THE NEAR FUTURE;

Waterway and Scour:

UNDERWATER INSPECTION PERFORMED 02/25/2021, SEE UNDERWATER BRIDGE INSPECTION REPORT
8-VERY GOOD:
-LAKE ALIGNMENT WITH LOW FLOW CHANNEL;
-LARGE WELL PLACED RIPRAP AT BRIDGE ENDS
-HEAVY VEGETATION ON UNDER BRIDGE AND ON SIDE SLOPE;

Fender System:

N/A

Roadway Alignment:

8-VERY GOOD: STRAIGHT HORIZONTAL ALIGNMENT AND SLIGHT VERTICAL CURVE AT BEGINNING, BUT NO SPEED REDUCTION IS NECESSARY;

Traffic Signs:

-BRIDGE END PANELS ON APPROACH END ONLY;
-SPAN #57 HAS "NO STOPPING ON BRIDGE" SIGNAGE;
-SPAN #50 HAS 100 MILE MARKER SIGNAGE;
-NAVIGATIONAL LIGHTS HAVE BEEN DISCONNECTED, DATE UNKNOWN;

Encroachments:

ELECTRICAL LINE FOR NAVIGATIONAL LIGHTS ON BENT #78 RIGHT SIDE (DISCONNECTED);

Miscellaneous Notes:

BRIDGE ORIENTATION: Labeling diagram orientation is the opposite direction as the historic orientation of the bridge (N-S).

Bridge Asset ID is located on the southeast corner of the bridge.

Bridge Inspected on 10/11/2021. Cloudy, 75 degrees.
BITL: Eric Beach, Collins Engineers, Inc.
Assistants: Douglas McLendon, PE, Zane Peterson, Mikayla Young

Bridge Element Level Data

14 Dec 2022

					Quantity in Each Condition State				
Element No	Element Name/Description	Units	Env	Defect	1	2	3	4	Total Qty
107	Steel Open Girder/Beam	feet	4	Yes					
107	Corrosion	feet	4	1000	0	2531	25	0	2556
107	Steel Open Girder/Beam	feet	4	Yes	0	2531	25	0	2556
109	Prestressed Concrete Open Girder/Beam	feet	4	Yes					
109	Delamination/Spall/Patched Area	feet	4	1080	0	110	0	0	110
109	Exposed Rebar	feet	4	1090	0	1	0	0	1
109	Exposed Prestressing	feet	4	1100	0	0	90	0	90
109	Cracking (PSC)	feet	4	1110	0	0	271	0	271
109	Prestressed Concrete Open Girder/Beam	feet	4	Yes	7228	111	361	0	7700
110	Reinforced Concrete Open Girder/Beam	feet	4	Yes					
110	Exposed Rebar	feet	4	1090	0	28	0	0	28
110	Cracking (RC and Other)	feet	4	1130	11572	0	0	0	11572
110	Reinforced Concrete Open Girder/Beam	feet	4	Yes	11572	28	0	0	11600
12	Reinforced Concrete Deck	sq feet	4	Yes					
12	Exposed Rebar	sq feet	4	1090	0	8	0	0	8
12	Cracking (RC and Other)	sq feet	4	1130	0	145725	6813	0	152538
12	Abrasion/Wear (PSC/RC)	sq feet	4	1190	0	2920	12	0	2932
12	Delamination/Spall/Patched Area/Pothole (Wearing Surfaces)	sq feet	4	3210	0	2000	22	0	2022
12	Reinforced Concrete Deck	sq feet	4	Yes	0	150653	6847	0	157500
205	Reinforced Concrete Column	each	1	Yes					
205	Delamination/Spall/Patched Area	each	1	1080	0	0	24	0	24
205	Abrasion/Wear (PSC/RC)	each	1	1190	0	28	0	0	28
205	Scour	each	1	6000	0	0	2	0	2
205	Reinforced Concrete Column	each	1	Yes	0	28	26	0	54
215	Reinforced Concrete Abutment	feet	4	No	64	0	0	0	64
226	Prestressed Concrete Pile	each	1	Yes					
226	Exposed Prestressing	each	1	1100	0	2	0	0	2
226	Cracking (PSC)	each	1	1110	0	0	73	0	73
226	Abrasion/Wear (PSC/RC)	each	1	1190	0	157	0	0	157
226	Prestressed Concrete Pile	each	1	Yes	0	159	73	0	232

234	Reinforced Concrete Pier Cap	feet	4	Yes					
234	Exposed Rebar	feet	4	1090	0	2	0	0	2
234	Cracking (RC and Other)	feet	4	1130	2663	55	0	0	2718
234	Reinforced Concrete Pier Cap	feet	4	Yes	2663	57	0	0	2720
301	Pourable Joint Seal	feet	3	Yes					
301	Seal Adhesion	feet	3	2320	0	280	28	0	308
301	Pourable Joint Seal	feet	3	Yes	2492	280	28	0	2800
305	Assembly Joint Without Seal	feet	1	Yes					
305	Metal Deterioration or Damage	feet	1	2370	0	62	0	0	62
305	Assembly Joint Without Seal	feet	1	Yes	0	62	0	0	62
311	Movable Bearing	each	2	Yes					
311	Corrosion	each	2	1000	0	0	124	0	124
311	Alignment	each	2	2220	0	0	0	2	2
311	Movable Bearing	each	2	Yes	0	0	126	2	128
313	Fixed Bearing	each	2	Yes					
313	Corrosion	each	2	1000	0	0	118	0	118
313	Fixed Bearing	each	2	Yes	0	0	118	0	118
330	Metal Bridge Railing	feet	3	Yes					
330	Damage	feet	3	7000	0	0	1400	0	1400
330	Metal Bridge Railing	feet	3	Yes	7600	0	1400	0	9000
515	Steel Protective Coating	sq feet	1	Yes					
515	Effectiveness (Steel Protective Coatings)	sq feet	1	3440	39928	0	3072	878	43878
515	Steel Protective Coating	sq feet	1	Yes	39928	0	3072	878	43878

Inventory Photograph Form

Asset ID Number:	5249	Bridge Inspection Date:	10/11/2021

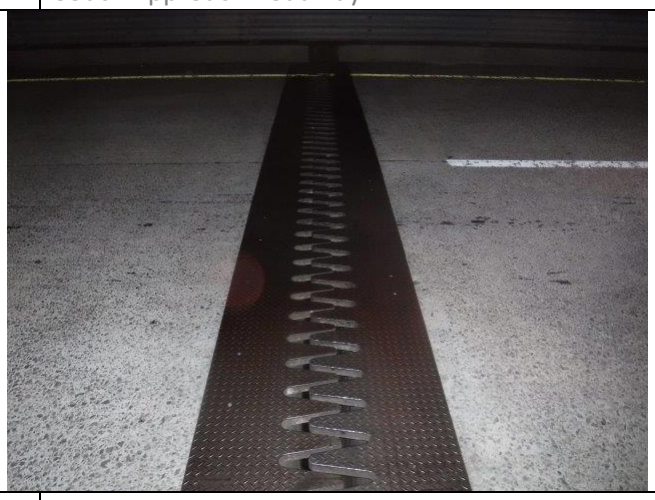
1 Top of Deck from Downstation Approach (Looking Upstation)

2 Top of Deck from Upstation Approach (Looking Downstation)

3 North Approach Roadway

4 South Approach Roadway

5 Bridge Joint Condition Photograph



6 Bridge Joint Condition Photograph

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Consultant: For Repair Rec.? ☐

Photograph Form

Asset ID Number:	5249	Bridge Inspection Date:	10/11/2021

7 West Elevation

8 East Elevation

9 Deck Condition Photograph

10 Substructure Condition Photograph

11 Substructure Condition Photograph

12 Superstructure Condition Photograph (Prestressed Concrete)

Save This Document | PDF This Form | Add Page (Works on Pg 1 Only)

Consultant: For Repair Rec.? ☐

Photograph Form

Asset ID Number:	5249	Bridge Inspection Date:	10/11/2021

13 Superstructure Condition Photograph (Steel)

14 Superstructure Condition Photograph (Reinforced Concrete)

15 Bridge Barrier/Railing

16 Rail Transitions

17 Approach Guardrail

18 End Guardrail Treatment

Save This Document | PDF This Form | Add Page (Works on Pg 1 Only)

Consultant: For Repair Rec.? ☐

1 UNDERWATER INSPECTION EXECUTIVE SUMMARY

INSPECTION SUMMARY				
ASSET ID:	5249		UW INSP. DATE:	02/25/2021
DISTRICT:	7		MAX WATER DEPTH:	37.8 FEET
COUNTY:	CLARENDON COUNTY		MAX WATER VELOCITY	0.3 FPS
ROUTE:	I-95 NB		WATER TEMP.:	60°F
WATERWAY:	LAKE MARION		UW VISABILITY:	2.0 FEET
INVENTORY DIRECTION:	EAST TO WEST		SUBSTRUCT. TYPE	P/S CONC. OCTAGONAL PILE AND REIN. CONC. COLUMN
SSU INSPECTED:	BENTS 3 THROUGH 84		SUBSTRUCT. SIZE:	21 INCH AND VARIOUS SIZE SQUARE
TEAM LEADER:	BRIAN RHETT, P.E.		BRIDGE INSPECTION ACCESS:	BOAT
DIVE INSPECTORS:	W. GWALTNEY		BOAT LAUNCH: SANTEE STATE PARK	
TENDERS:	W. MOORE		LATITUDE (DD):	N33.512745
ADDITIONAL TEAM MEMBER(S):	NA		LONGITUDE (DD):	W80.475084

CRITICAL FINDINGS: No critical findings were made during this inspection.
REPAIRS RECOMMENDED: There are no repair recommendations at this time.
SCOUR CRITICAL: No significant signs of scour observed.
LOAD RATING: No load rating recommended.

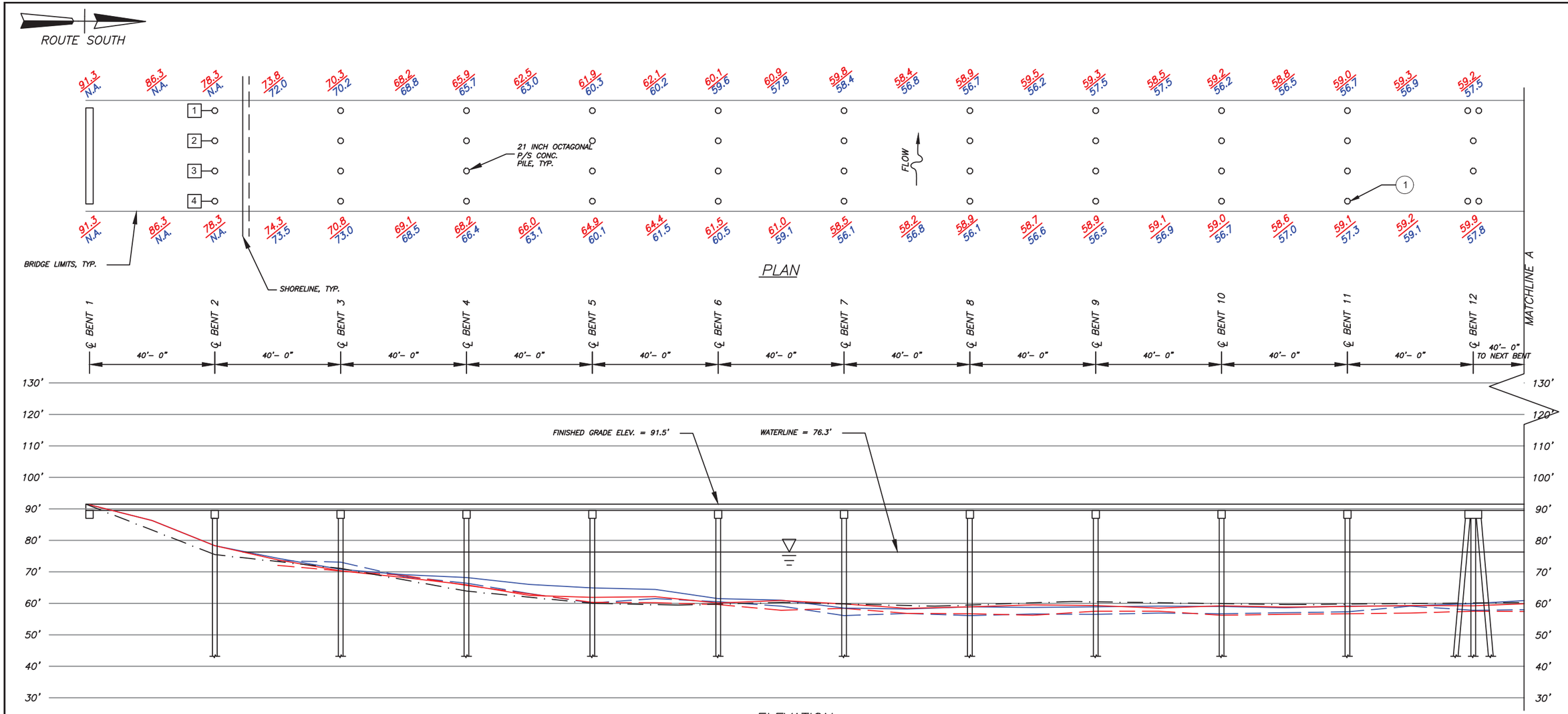
Element and Condition State Ratings of inspected elements can be found in the Bridge Inspection Online Application (BIO).

2 INTRODUCTION

2.1 Purpose and Scope

SCDOT Bridge Asset ID 5249 carries I-95 NB over Lake Marion in Clarendon County, South Carolina. On 02/25/2021, Collins Engineers, Inc. performed a routine underwater inspection at the bridge to evaluate the condition of all applicable submerged substructure units (SSUs). This report includes a general description of the investigation method, a detailed description of the conditions observed, photographs of typical conditions and deficiencies, and bridge and channel drawings.

The scope of the investigation included a visual and/or tactile inspection of all accessible SSUs located in the water from the high-water mark to the channel bottom. Depth soundings and channel velocity measurements were taken along the bridge's upstream and downstream fascias to assist in scour identification and the documentation of the channel's condition. Inspection was conducted



INSPECTION NOTES:

1. SUBMERGED CONCRETE PILES (BENTS 3 TO 58) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO 1 FOOT BELOW THE WATERLINE AND UP TO 3/16 INCH DEEP, FROM 1 FOOT BELOW THE WATERLINE TO THE CHANNEL BOTTOM. CRACKS SIZED UP TO 1/4 INCHES WIDE WERE TYPICALLY OBSERVED AT THE WATERLINE RANGING FROM UP TO 3 FEET ABOVE THE WATERLINE TO 2 FEET BELOW THE WATERLINE. SEE TABLE A.2 IN APPENDIX A FOR DETAILED CRACK LOCATIONS, SIZES, AND QUANTITIES. CONCRETE PILES TYPICALLY EXHIBITED (UNRAVELLING) ROUNDED CORNERS UP TO 3 INCH VERTICAL BY 1 INCH WIDE BY 1/2 INCH PENETRATION AT ISOLATED LOCATIONS.
2. SUBMERGED CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO THE BOTTOM OF THE COLUMN.
3. EXPOSED CONCRETE FOOTINGS (BENTS 59 TO 84) EXHIBITED ABRASION UP TO 1/2 INCH DEEP, FROM THE TOP OF THE FOOTING TO THE CHANNEL BOTTOM.
4. SUBMERGED CONCRETE SEALS (BENTS 59 TO 84) TYPICALLY EXHIBITED MEDIUM TO SOFT CONCRETE HARDNESS.
5. CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED VOIDS AT THE FOOTING–SEAL INTERFACE, UP TO 3 INCH VERTICAL WITH UP TO 6 INCH PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR DETAILED LIST OF COLUMN DEFECTS.
6. CONCRETE COLUMNS EXHIBITED VOIDS AT THE FOOTING–SEAL INTERFACE, UP TO 6 INCH VERTICAL WITH UP TO 1.5 FEET PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR A DETAILED LIST OF COLUMN DEFECTS.
7. CONCRETE COLUMNS HAD VARIOUS VOIDS AND SPALLS; SEE TABLE A.4 FOR A DETAILED LIST OF COLUMN DEFECTS.
8. EXPOSED STEEL H–PILE OBSERVED AT COLUMN 76–1 AT WEST CORNER UNDER SILL WITH APPROXIMATELY 0.5 FEET OF EXPOSURE. WHEN CURRENT SOUNDING ELEVATIONS ARE COMPARED TO ORIGINAL HISTORIC ELEVATIONS, NO SIGNIFICANT GENERAL AND ONLY MINOR LOCAL SCOUR WAS OBSERVED. EXPOSURE OF BEARING PILE AT COLUMN 76–1 SHOULD BE MONITORED DURING FUTURE INSPECTIONS. THE EXPOSED H–PILE WAS NOT ACCESSIBLE FOR DETAILED INSPECTION OF THICKNESS MEASUREMENTS.

GENERAL NOTES:

I. MARINE GROWTH CONSISTED OF UP TO 1/2–INCH–THICK ALGAE COVERING 100 PERCENT OF THE SUBMERGED CONCRETE SURFACES FROM THE CHANNEL BOTTOM TO THE WATERLINE.

II. ALL CHANNEL EMBANKMENTS WERE STABLE AT THE TIME OF THE INSPECTION, WITH ALL CHANNEL EMBANKMENTS (SHORELINES) BEING WELL VEGETATED. NO SIGNIFICANT SIGNS OF CHANNEL MIGRATION WERE EVIDENT. THE EMBANKMENTS AROUND BOTH ABUTMENTS WERE STABLE AT THE TIME OF INSPECTION, WITH ALL THE EMBANKMENTS BEING WELL VEGETATED AND ARMORED WITH 2–FOOT–DIAMETER RIPRAP. NO SIGNIFICANT EROSION WAS OBSERVED.

III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH DIAMETER ROCK, AND SILT WITH UP TO 1 INCH PENETRATION.

LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 WEST FASCIA	——	CUT–OFF TIMBER PILE	
2021 EAST FASCIA	——	CONCRETE PILE–ENCASEMENT, SQUARE	
2016 WEST FASCIA	– – –	CONCRETE PILE–ENCASEMENT, ROUND	
2016 EAST FASCIA	– – –	STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021 / 2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	7	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	182.5
SCOUR		BATTERED DIRECTION	
FLOODPLAINS			

NOTE:
1. DRAWING NOT TO SCALE AND INTENDED FOR ILLUSTRATIVE PURPOSES ONLY. SHORELINE PROTECTION, DEBRIS, AND ANCILLARY FEATURES SHOWN ARE APPROXIMATE.
2. AS THE INTENTION OF THIS DRAWING IS TO SHOW THE CHANNEL AND ADJACENT BENTS IN ORDER TO MAP THE HISTORICAL MOVEMENT OF THE WATERWAY, THE ENTIRE BRIDGE MAY NOT BE SHOWN DUE TO SPACE CONSTRAINTS. THE ENTIRE CHANNEL, OBSERVED AT THE TIME OF INSPECTION, IS SHOWN

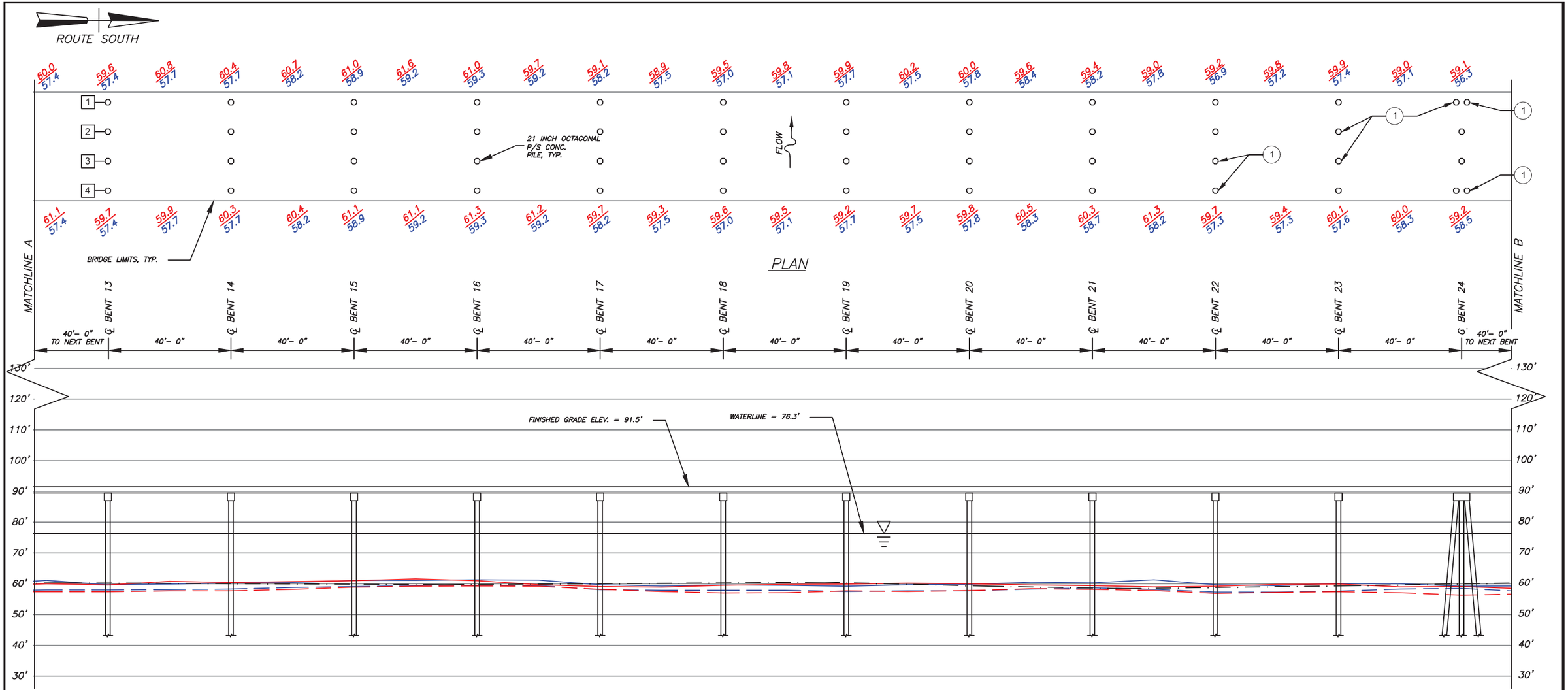
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5249
I–95 NB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 1–12

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 1



ELEVATION

INSPECTION NOTES:

1. SUBMERGED CONCRETE PILES (BENTS 3 TO 58) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO 1 FOOT BELOW THE WATERLINE AND UP TO 3/16 INCH DEEP, FROM 1 FOOT BELOW THE WATERLINE TO THE CHANNEL BOTTOM. CRACKS SIZED UP TO 1/4 INCHES WIDE WERE TYPICALLY OBSERVED AT THE WATERLINE RANGING FROM UP TO 3 FEET ABOVE THE WATERLINE TO 2 FEET BELOW THE WATERLINE. SEE TABLE A.2 IN APPENDIX A FOR DETAILED CRACK LOCATIONS, SIZES, AND QUANTITIES. CONCRETE PILES TYPICALLY EXHIBITED (UNRAVELLING) ROUNDED CORNERS UP TO 3 INCH VERTICAL BY 1 INCH WIDE BY 1/2 INCH PENETRATION AT ISOLATED LOCATIONS.
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4. SUBMERGED CONCRETE SEALS (BENTS 59 TO 84) TYPICALLY EXHIBITED MEDIUM TO SOFT CONCRETE HARDNESS.
5. CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED VOIDS AT THE FOOTING–SEAL INTERFACE, UP TO 3 INCH VERTICAL WITH UP TO 6 INCH PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR DETAILED LIST OF COLUMN DEFECTS.
6. CONCRETE COLUMNS EXHIBITED VOIDS AT THE FOOTING–SEAL INTERFACE, UP TO 6 INCH VERTICAL WITH UP TO 1.5 FEET PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR A DETAILED LIST OF COLUMN DEFECTS.
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LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
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ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	(7)	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	• 182.5
SCOUR		BATTERED DIRECTION	←
FLOODPLAINS			

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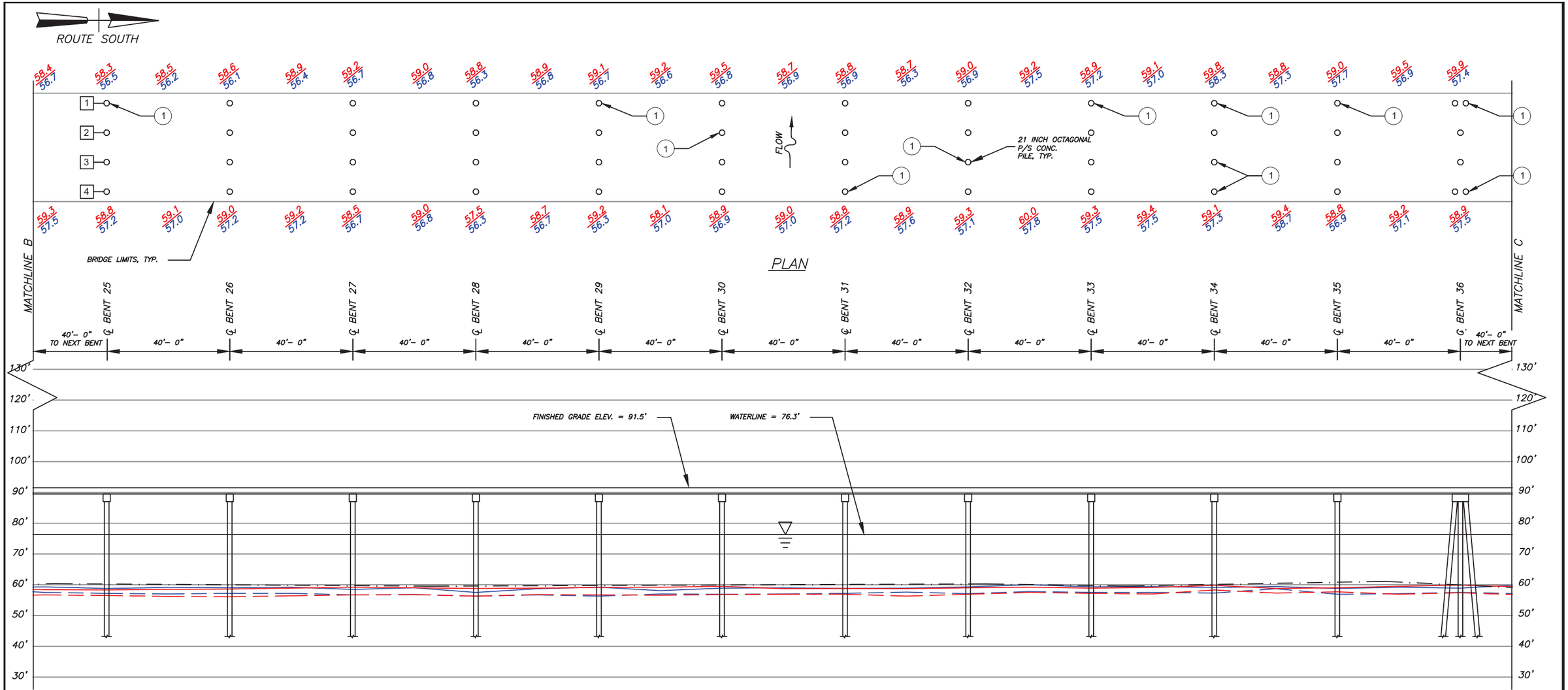
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5249
I–95 NB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 13–24

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 2



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LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
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2021 EAST FASCIA	——	CONCRETE PILE–ENCASEMENT, SQUARE	
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ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	(7)	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	• 182.5
SCOUR		BATTERED DIRECTION	←
FLOODPLAINS			

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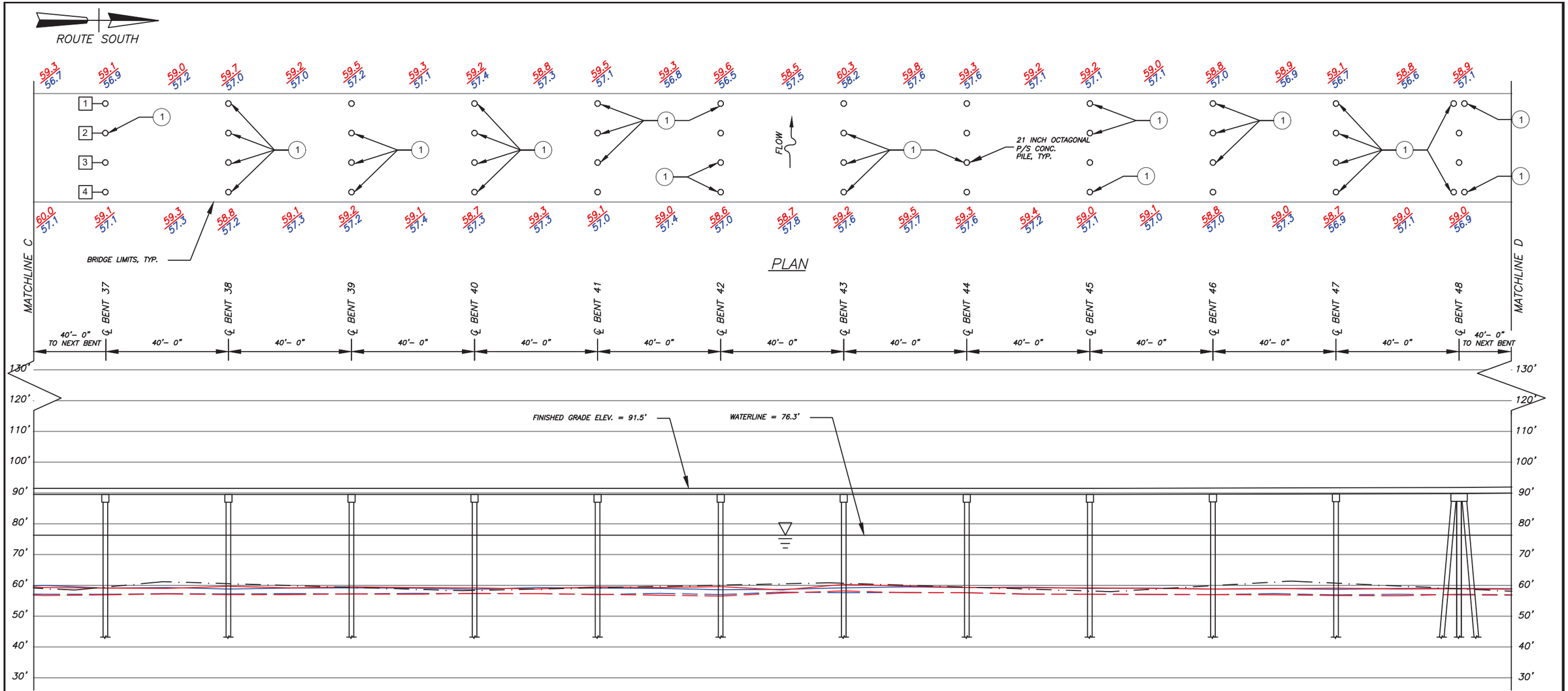
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5249
I–95 NB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 25–36

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 3



INSPECTION NOTES:

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LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 WEST FASCIA	———	CUT–OFF TIMBER PILE	
2021 EAST FASCIA	———	CONCRETE PILE–ENCASEMENT, SQUARE	
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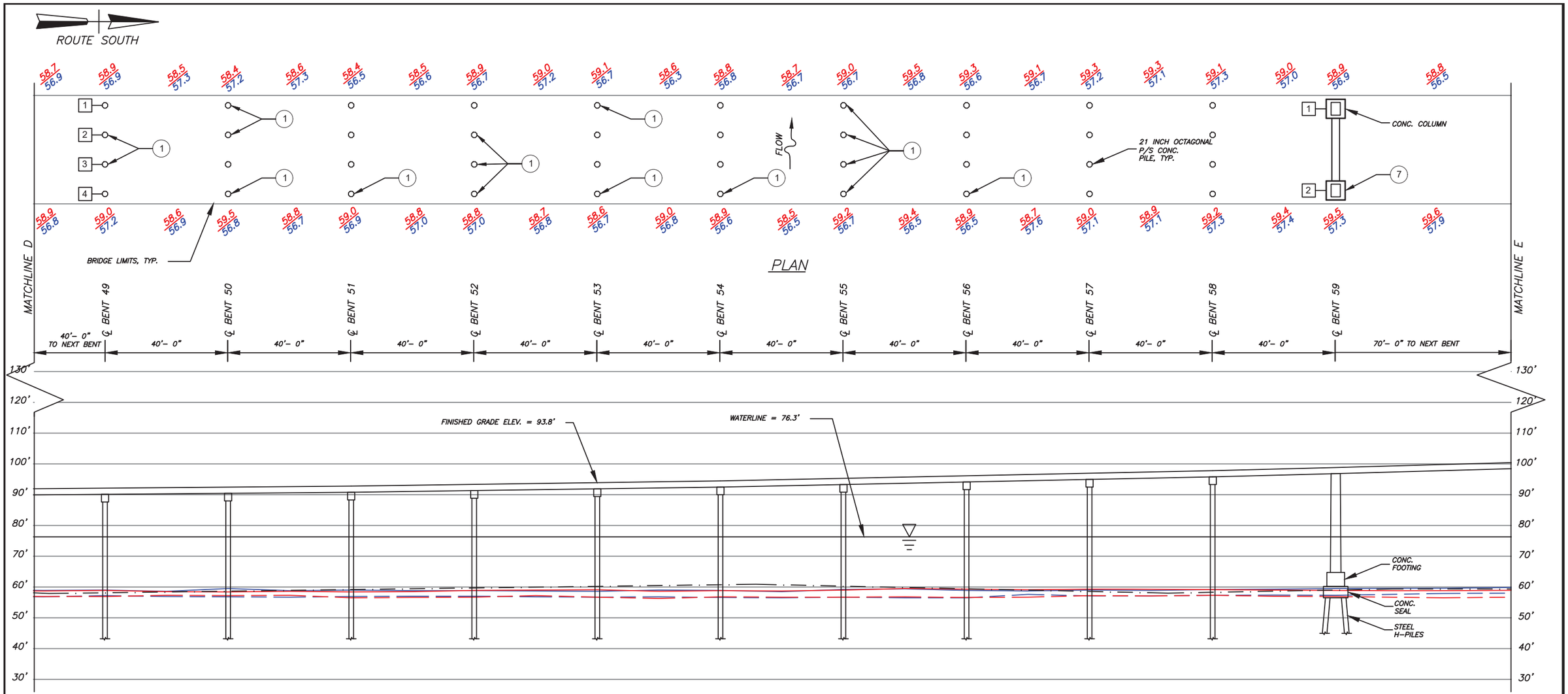
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5249
I–95 NB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 37–48

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 4



ELEVATION

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6. CONCRETE COLUMNS EXHIBITED VOIDS AT THE FOOTING–SEAL INTERFACE, UP TO 6 INCH VERTICAL WITH UP TO 1.5 FEET PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR A DETAILED LIST OF COLUMN DEFECTS.
7. CONCRETE COLUMNS HAD VARIOUS VOIDS AND SPALLS; SEE TABLE A.4 FOR A DETAILED LIST OF COLUMN DEFECTS.
8. EXPOSED STEEL H–PILE OBSERVED AT COLUMN 76–1 AT WEST CORNER UNDER SILL WITH APPROXIMATELY 0.5 FEET OF EXPOSURE. WHEN CURRENT SOUNDING ELEVATIONS ARE COMPARED TO ORIGINAL HISTORIC ELEVATIONS, NO SIGNIFICANT GENERAL AND ONLY MINOR LOCAL SCOUR WAS OBSERVED. EXPOSURE OF BEARING PILE AT COLUMN 76–1 SHOULD BE MONITORED DURING FUTURE INSPECTIONS. THE EXPOSED H–PILE WAS NOT ACCESSIBLE FOR DETAILED INSPECTION OF THICKNESS MEASUREMENTS.

GENERAL NOTES:

I. MARINE GROWTH CONSISTED OF UP TO 1/2–INCH–THICK ALGAE COVERING 100 PERCENT OF THE SUBMERGED CONCRETE SURFACES FROM THE CHANNEL BOTTOM TO THE WATERLINE.

II. ALL CHANNEL EMBANKMENTS WERE STABLE AT THE TIME OF THE INSPECTION, WITH ALL CHANNEL EMBANKMENTS (SHORELINES) BEING WELL VEGETATED. NO SIGNIFICANT SIGNS OF CHANNEL MIGRATION WERE EVIDENT. THE EMBANKMENTS AROUND BOTH ABUTMENTS WERE STABLE AT THE TIME OF INSPECTION, WITH ALL THE EMBANKMENTS BEING WELL VEGETATED AND ARMORED WITH 2–FOOT–DIAMETER RIPRAP. NO SIGNIFICANT EROSION WAS OBSERVED.

III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH DIAMETER ROCK, AND SILT WITH UP TO 1 INCH PENETRATION.

LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 WEST FASCIA	——	CUT–OFF TIMBER PILE	
2021 EAST FASCIA	——	CONCRETE PILE–ENCASEMENT, SQUARE	
2016 WEST FASCIA	– – –	CONCRETE PILE–ENCASEMENT, ROUND	
2016 EAST FASCIA	– – –	STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021 / 2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	7	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	● 182.5
SCOUR		BATTERED DIRECTION	←
FLOODPLAINS			

NOTE:
1. DRAWING NOT TO SCALE AND INTENDED FOR ILLUSTRATIVE PURPOSES ONLY. SHORELINE PROTECTION, DEBRIS, AND ANCILLARY FEATURES SHOWN ARE APPROXIMATE.
2. AS THE INTENTION OF THIS DRAWING IS TO SHOW THE CHANNEL AND ADJACENT BENTS IN ORDER TO MAP THE HISTORICAL MOVEMENT OF THE WATERWAY, THE ENTIRE BRIDGE MAY NOT BE SHOWN DUE TO SPACE CONSTRAINTS. THE ENTIRE CHANNEL, OBSERVED AT THE TIME OF INSPECTION, IS SHOWN

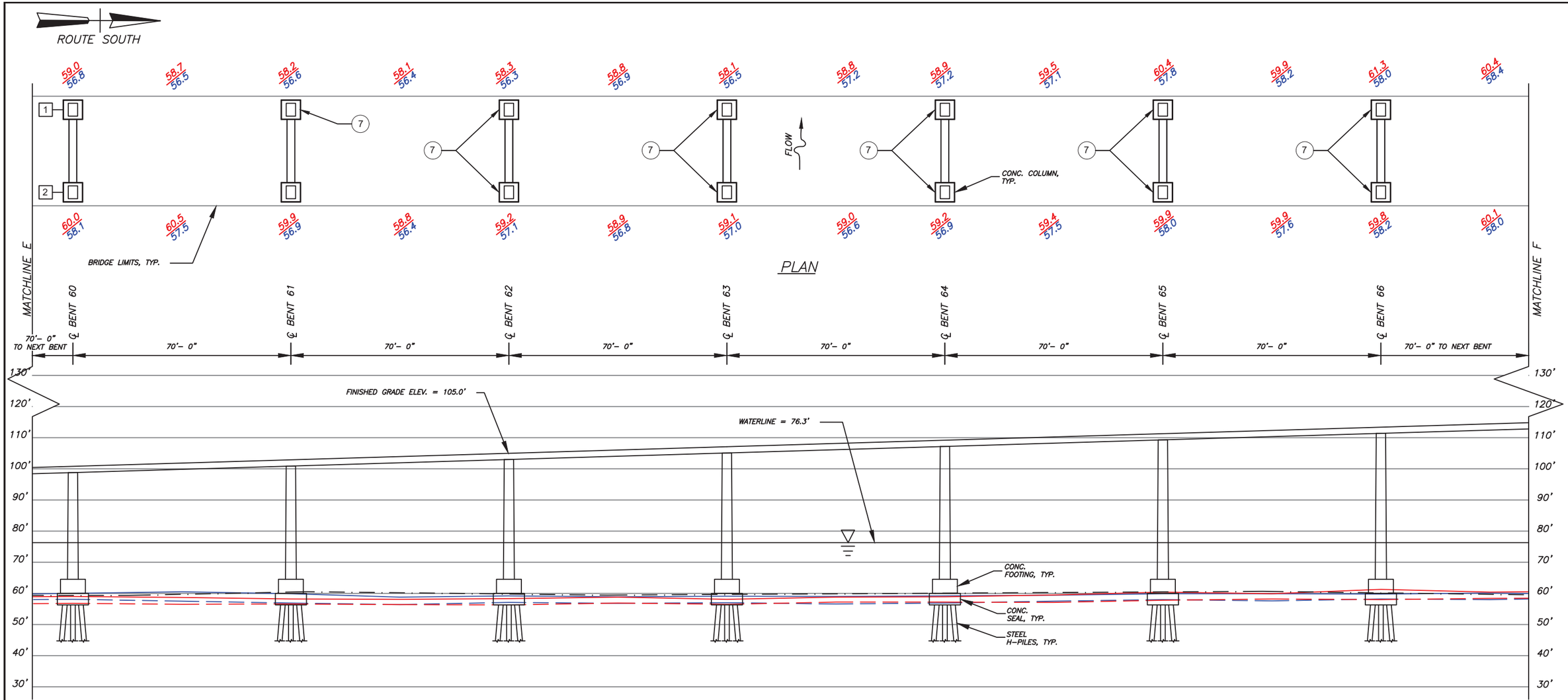
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5249
I–95 NB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 49–59

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 5



ELEVATION

INSPECTION NOTES:

1. SUBMERGED CONCRETE PILES (BENTS 3 TO 58) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO 1 FOOT BELOW THE WATERLINE AND UP TO 3/16 INCH DEEP, FROM 1 FOOT BELOW THE WATERLINE TO THE CHANNEL BOTTOM. CRACKS SIZED UP TO 1/4 INCHES WIDE WERE TYPICALLY OBSERVED AT THE WATERLINE RANGING FROM UP TO 3 FEET ABOVE THE WATERLINE TO 2 FEET BELOW THE WATERLINE. SEE TABLE A.2 IN APPENDIX A FOR DETAILED CRACK LOCATIONS, SIZES, AND QUANTITIES. CONCRETE PILES TYPICALLY EXHIBITED (UNRAVELLING) ROUNDED CORNERS UP TO 3 INCH VERTICAL BY 1 INCH WIDE BY 1/2 INCH PENETRATION AT ISOLATED LOCATIONS.
2. SUBMERGED CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO THE BOTTOM OF THE COLUMN.
3. EXPOSED CONCRETE FOOTINGS (BENTS 59 TO 84) EXHIBITED ABRASION UP TO 1/2 INCH DEEP, FROM THE TOP OF THE FOOTING TO THE CHANNEL BOTTOM.
4. SUBMERGED CONCRETE SEALS (BENTS 59 TO 84) TYPICALLY EXHIBITED MEDIUM TO SOFT CONCRETE HARDNESS.
5. CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED VOIDS AT THE FOOTING–SEAL INTERFACE, UP TO 3 INCH VERTICAL WITH UP TO 6 INCH PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR DETAILED LIST OF COLUMN DEFECTS.
6. CONCRETE COLUMNS EXHIBITED VOIDS AT THE FOOTING–SEAL INTERFACE, UP TO 6 INCH VERTICAL WITH UP TO 1.5 FEET PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR A DETAILED LIST OF COLUMN DEFECTS.
7. CONCRETE COLUMNS HAD VARIOUS VOIDS AND SPALLS; SEE TABLE A.4 FOR A DETAILED LIST OF COLUMN DEFECTS.
8. EXPOSED STEEL H–PILE OBSERVED AT COLUMN 76–1 AT WEST CORNER UNDER SILL WITH APPROXIMATELY 0.5 FEET OF EXPOSURE. WHEN CURRENT SOUNDING ELEVATIONS ARE COMPARED TO ORIGINAL HISTORIC ELEVATIONS, NO SIGNIFICANT GENERAL AND ONLY MINOR LOCAL SCOUR WAS OBSERVED. EXPOSURE OF BEARING PILE AT COLUMN 76–1 SHOULD BE MONITORED DURING FUTURE INSPECTIONS. THE EXPOSED H–PILE WAS NOT ACCESSIBLE FOR DETAILED INSPECTION OF THICKNESS MEASUREMENTS.

GENERAL NOTES:

I. MARINE GROWTH CONSISTED OF UP TO 1/2–INCH–THICK ALGAE COVERING 100 PERCENT OF THE SUBMERGED CONCRETE SURFACES FROM THE CHANNEL BOTTOM TO THE WATERLINE.

II. ALL CHANNEL EMBANKMENTS WERE STABLE AT THE TIME OF THE INSPECTION, WITH ALL CHANNEL EMBANKMENTS (SHORELINES) BEING WELL VEGETATED. NO SIGNIFICANT SIGNS OF CHANNEL MIGRATION WERE EVIDENT. THE EMBANKMENTS AROUND BOTH ABUTMENTS WERE STABLE AT THE TIME OF INSPECTION, WITH ALL THE EMBANKMENTS BEING WELL VEGETATED AND ARMORED WITH 2–FOOT–DIAMETER RIPRAP. NO SIGNIFICANT EROSION WAS OBSERVED.

III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH DIAMETER ROCK, AND SILT WITH UP TO 1 INCH PENETRATION.

LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 WEST FASCIA	——	CUT–OFF TIMBER PILE	
2021 EAST FASCIA	——	CONCRETE PILE–ENCASEMENT, SQUARE	
2016 WEST FASCIA	– – –	CONCRETE PILE–ENCASEMENT, ROUND	
2016 EAST FASCIA	– – –	STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021 / 2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	7	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	● 182.5
SCOUR		BATTERED DIRECTION	←
FLOODPLAINS			

NOTE:
1. DRAWING NOT TO SCALE AND INTENDED FOR ILLUSTRATIVE PURPOSES ONLY. SHORELINE PROTECTION, DEBRIS, AND ANCILLARY FEATURES SHOWN ARE APPROXIMATE.
2. AS THE INTENTION OF THIS DRAWING IS TO SHOW THE CHANNEL AND ADJACENT BENTS IN ORDER TO MAP THE HISTORICAL MOVEMENT OF THE WATERWAY, THE ENTIRE BRIDGE MAY NOT BE SHOWN DUE TO SPACE CONSTRAINTS. THE ENTIRE CHANNEL, OBSERVED AT THE TIME OF INSPECTION, IS SHOWN

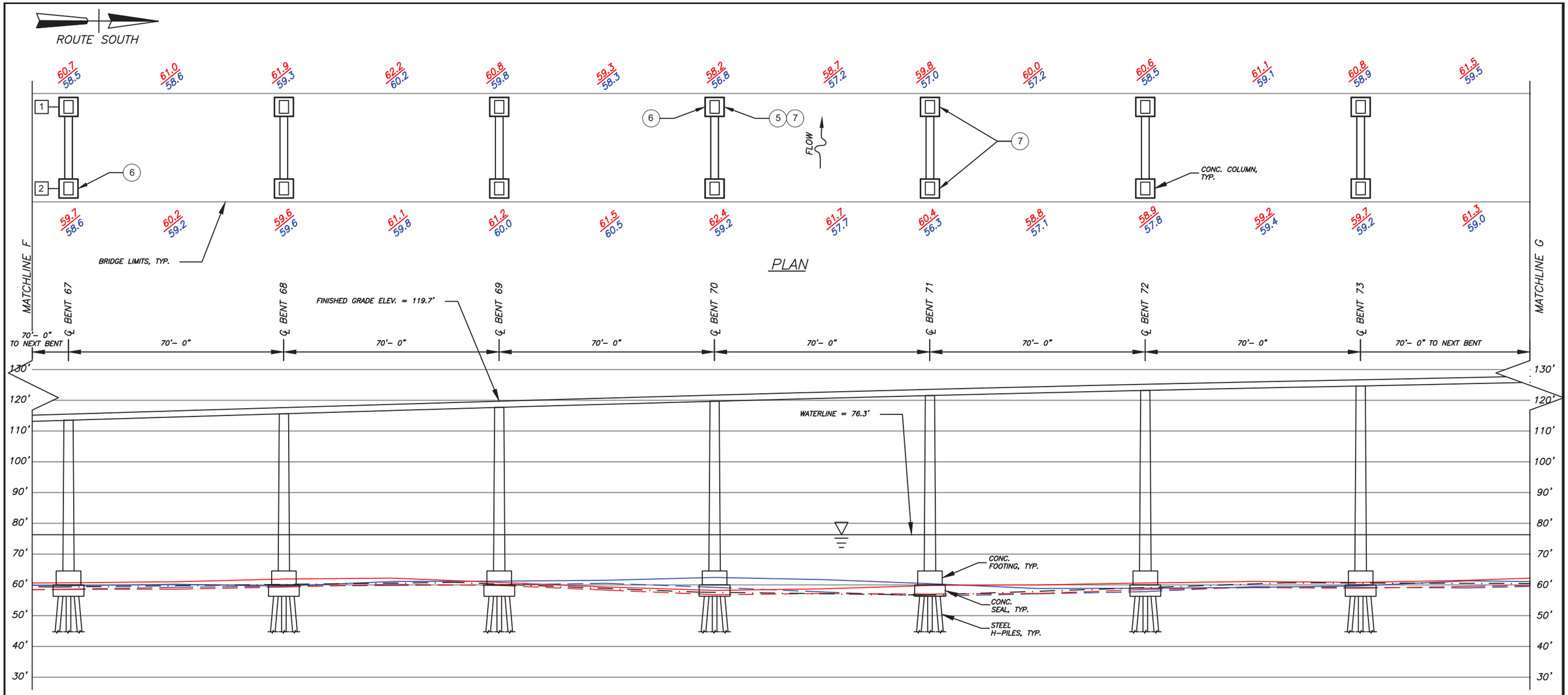
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5249
I–95 NB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 60–66

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 6



ELEVATION

INSPECTION NOTES:

1. SUBMERGED CONCRETE PILES (BENTS 3 TO 58) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO 1 FOOT BELOW THE WATERLINE AND UP TO 3/16 INCH DEEP, FROM 1 FOOT BELOW THE WATERLINE TO THE CHANNEL BOTTOM. CRACKS SIZED UP TO 1/4 INCHES WIDE WERE TYPICALLY OBSERVED AT THE WATERLINE RANGING FROM UP TO 3 FEET ABOVE THE WATERLINE TO 2 FEET BELOW THE WATERLINE. SEE TABLE A.2 IN APPENDIX A FOR DETAILED CRACK LOCATIONS, SIZES, AND QUANTITIES. CONCRETE PILES TYPICALLY EXHIBITED (UNRAVELLING) ROUNDED CORNERS UP TO 3 INCH VERTICAL BY 1 INCH WIDE BY 1/2 INCH PENETRATION AT ISOLATED LOCATIONS.
2. SUBMERGED CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO THE BOTTOM OF THE COLUMN.
3. EXPOSED CONCRETE FOOTINGS (BENTS 59 TO 84) EXHIBITED ABRASION UP TO 1/2 INCH DEEP, FROM THE TOP OF THE FOOTING TO THE CHANNEL BOTTOM.
4. SUBMERGED CONCRETE SEALS (BENTS 59 TO 84) TYPICALLY EXHIBITED MEDIUM TO SOFT CONCRETE HARDNESS.
5. CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED VOIDS AT THE FOOTING–SEAL INTERFACE, UP TO 3 INCH VERTICAL WITH UP TO 6 INCH PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR DETAILED LIST OF COLUMN DEFECTS.
6. CONCRETE COLUMNS EXHIBITED VOIDS AT THE FOOTING–SEAL INTERFACE, UP TO 6 INCH VERTICAL WITH UP TO 1.5 FEET PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR A DETAILED LIST OF COLUMN DEFECTS.
7. CONCRETE COLUMNS HAD VARIOUS VOIDS AND SPALLS; SEE TABLE A.4 FOR A DETAILED LIST OF COLUMN DEFECTS.
8. EXPOSED STEEL H–PILE OBSERVED AT COLUMN 76–1 AT WEST CORNER UNDER SILL WITH APPROXIMATELY 0.5 FEET OF EXPOSURE. WHEN CURRENT SOUNDING ELEVATIONS ARE COMPARED TO ORIGINAL HISTORIC ELEVATIONS, NO SIGNIFICANT GENERAL AND ONLY MINOR LOCAL SCOUR WAS OBSERVED. EXPOSURE OF BEARING PILE AT COLUMN 76–1 SHOULD BE MONITORED DURING FUTURE INSPECTIONS. THE EXPOSED H–PILE WAS NOT ACCESSIBLE FOR DETAILED INSPECTION OF THICKNESS MEASUREMENTS.

GENERAL NOTES:

I. MARINE GROWTH CONSISTED OF UP TO 1/2–INCH–THICK ALGAE COVERING 100 PERCENT OF THE SUBMERGED CONCRETE SURFACES FROM THE CHANNEL BOTTOM TO THE WATERLINE.

II. ALL CHANNEL EMBANKMENTS WERE STABLE AT THE TIME OF THE INSPECTION, WITH ALL CHANNEL EMBANKMENTS (SHORELINES) BEING WELL VEGETATED. NO SIGNIFICANT SIGNS OF CHANNEL MIGRATION WERE EVIDENT. THE EMBANKMENTS AROUND BOTH ABUTMENTS WERE STABLE AT THE TIME OF INSPECTION, WITH ALL THE EMBANKMENTS BEING WELL VEGETATED AND ARMORED WITH 2–FOOT–DIAMETER RIPRAP. NO SIGNIFICANT EROSION WAS OBSERVED.

III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH DIAMETER ROCK, AND SILT WITH UP TO 1 INCH PENETRATION.

LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 WEST FASCIA	——	CUT–OFF TIMBER PILE	
2021 EAST FASCIA	——	CONCRETE PILE–ENCASEMENT, SQUARE	
2016 WEST FASCIA	– – –	CONCRETE PILE–ENCASEMENT, ROUND	
2016 EAST FASCIA	– – –	STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021 / 2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	7	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	• 182.5
SCOUR		BATTERED DIRECTION	←
FLOODPLAINS			

NOTE:
1. DRAWING NOT TO SCALE AND INTENDED FOR ILLUSTRATIVE PURPOSES ONLY. SHORELINE PROTECTION, DEBRIS, AND ANCILLARY FEATURES SHOWN ARE APPROXIMATE.
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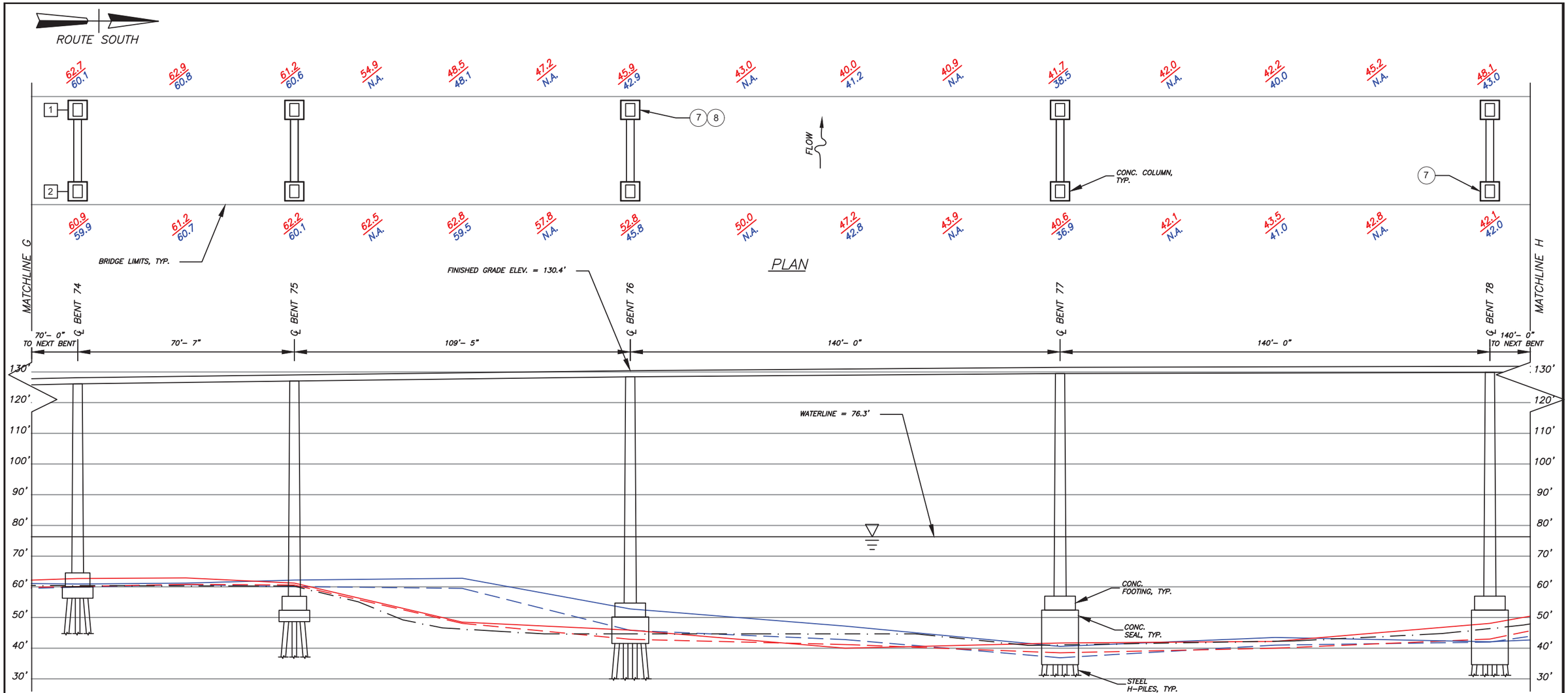
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5249
I–95 NB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 67–73

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 7



ELEVATION

INSPECTION NOTES:

1. SUBMERGED CONCRETE PILES (BENTS 3 TO 58) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO 1 FOOT BELOW THE WATERLINE AND UP TO 3/16 INCH DEEP, FROM 1 FOOT BELOW THE WATERLINE TO THE CHANNEL BOTTOM. CRACKS SIZED UP TO 1/4 INCHES WIDE WERE TYPICALLY OBSERVED AT THE WATERLINE RANGING FROM UP TO 3 FEET ABOVE THE WATERLINE TO 2 FEET BELOW THE WATERLINE. SEE TABLE A.2 IN APPENDIX A FOR DETAILED CRACK LOCATIONS, SIZES, AND QUANTITIES. CONCRETE PILES TYPICALLY EXHIBITED (UNRAVELLING) ROUNDED CORNERS UP TO 3 INCH VERTICAL BY 1 INCH WIDE BY 1/2 INCH PENETRATION AT ISOLATED LOCATIONS.
2. SUBMERGED CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO THE BOTTOM OF THE COLUMN.
3. EXPOSED CONCRETE FOOTINGS (BENTS 59 TO 84) EXHIBITED ABRASION UP TO 1/2 INCH DEEP, FROM THE TOP OF THE FOOTING TO THE CHANNEL BOTTOM.
4. SUBMERGED CONCRETE SEALS (BENTS 59 TO 84) TYPICALLY EXHIBITED MEDIUM TO SOFT CONCRETE HARDNESS.
5. CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED VOIDS AT THE FOOTING–SEAL INTERFACE, UP TO 3 INCH VERTICAL WITH UP TO 6 INCH PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR DETAILED LIST OF COLUMN DEFECTS.
6. CONCRETE COLUMNS EXHIBITED VOIDS AT THE FOOTING–SEAL INTERFACE, UP TO 6 INCH VERTICAL WITH UP TO 1.5 FEET PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR A DETAILED LIST OF COLUMN DEFECTS.
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GENERAL NOTES:

I. MARINE GROWTH CONSISTED OF UP TO 1/2–INCH–THICK ALGAE COVERING 100 PERCENT OF THE SUBMERGED CONCRETE SURFACES FROM THE CHANNEL BOTTOM TO THE WATERLINE.

II. ALL CHANNEL EMBANKMENTS WERE STABLE AT THE TIME OF THE INSPECTION, WITH ALL CHANNEL EMBANKMENTS (SHORELINES) BEING WELL VEGETATED. NO SIGNIFICANT SIGNS OF CHANNEL MIGRATION WERE EVIDENT. THE EMBANKMENTS AROUND BOTH ABUTMENTS WERE STABLE AT THE TIME OF INSPECTION, WITH ALL THE EMBANKMENTS BEING WELL VEGETATED AND ARMORED WITH 2–FOOT–DIAMETER RIPRAP. NO SIGNIFICANT EROSION WAS OBSERVED.

III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH DIAMETER ROCK, AND SILT WITH UP TO 1 INCH PENETRATION.

LEGEND

ORIGINAL CHANNEL		LEVEL II INSPECTION	
2021 WEST FASCIA		CUT–OFF TIMBER PILE	
2021 EAST FASCIA		CONCRETE PILE–ENCASEMENT, SQUARE	
2016 WEST FASCIA		CONCRETE PILE–ENCASEMENT, ROUND	
2016 EAST FASCIA		STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021 / 2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	7	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	182.5
SCOUR		BATTERED DIRECTION	
FLOODPLAINS			

NOTE:
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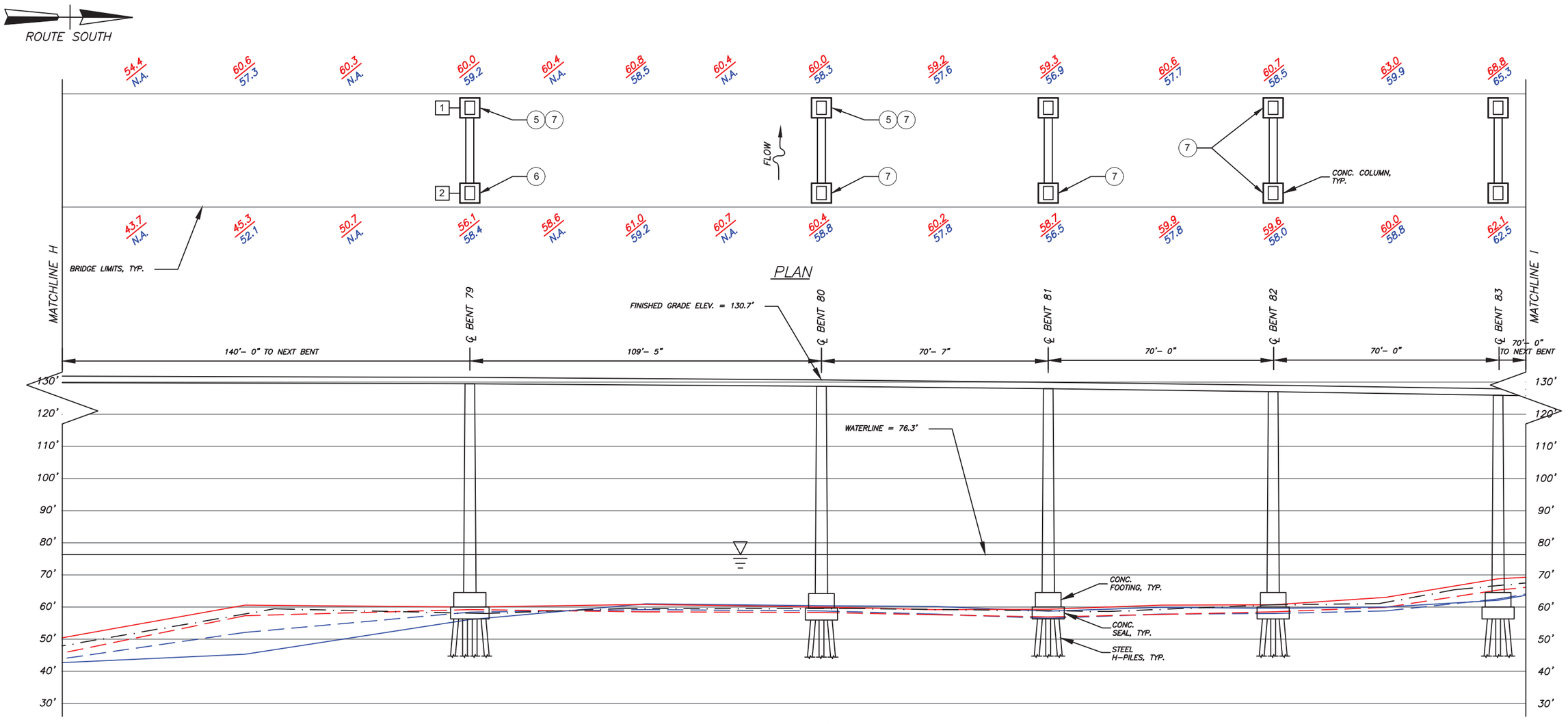
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5249
I–95 NB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 74–78

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 8



ELEVATION

INSPECTION NOTES:

1. SUBMERGED CONCRETE PILES (BENTS 3 TO 58) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO 1 FOOT BELOW THE WATERLINE AND UP TO 3/16 INCH DEEP, FROM 1 FOOT BELOW THE WATERLINE TO THE CHANNEL BOTTOM. CRACKS SIZED UP TO 1/4 INCHES WIDE WERE TYPICALLY OBSERVED AT THE WATERLINE RANGING FROM UP TO 3 FEET ABOVE THE WATERLINE TO 2 FEET BELOW THE WATERLINE. SEE TABLE A.2 IN APPENDIX A FOR DETAILED CRACK LOCATIONS, SIZES, AND QUANTITIES. CONCRETE PILES TYPICALLY EXHIBITED (UNRAVELLING) ROUNDED CORNERS UP TO 3 INCH VERTICAL BY 1 INCH WIDE BY 1/2 INCH PENETRATION AT ISOLATED LOCATIONS.
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GENERAL NOTES:

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III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH DIAMETER ROCK, AND SILT WITH UP TO 1 INCH PENETRATION.

LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 WEST FASCIA	——	CUT–OFF TIMBER PILE	
2021 EAST FASCIA	——	CONCRETE PILE–ENCASEMENT, SQUARE	
2016 WEST FASCIA	– –	CONCRETE PILE–ENCASEMENT, ROUND	
2016 EAST FASCIA	– –	STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021 / 2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	7	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	● 182.5
SCOUR		BATTERED DIRECTION	←
FLOODPLAINS			

NOTE:
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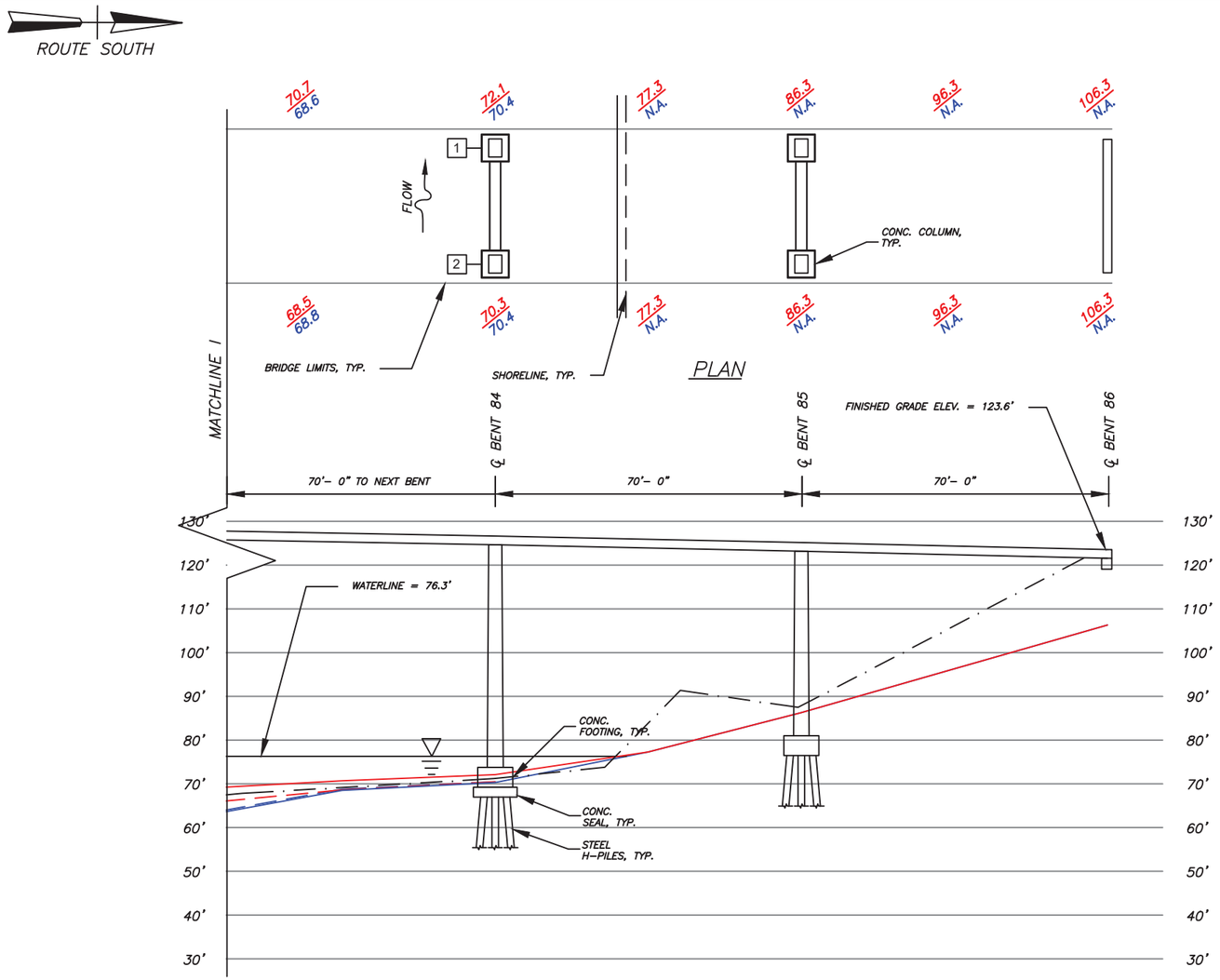
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5249
I–95 NB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 79–83

Drawn By: TAH	COLLINS ENGINEERS, INC.	Date: 02/25/2021
Checked By: BMR	5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Scale: NTS
		Figure No.: 9



INSPECTION NOTES:

1. SUBMERGED CONCRETE PILES (BENTS 3 TO 58) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO 1 FOOT BELOW THE WATERLINE AND UP TO 3/16 INCH DEEP, FROM 1 FOOT BELOW THE WATERLINE TO THE CHANNEL BOTTOM. CRACKS SIZED UP TO 1/4 INCHES WIDE WERE TYPICALLY OBSERVED AT THE WATERLINE RANGING FROM UP TO 3 FEET ABOVE THE WATERLINE TO 2 FEET BELOW THE WATERLINE. SEE TABLE A.2 IN APPENDIX A FOR DETAILED CRACK LOCATIONS, SIZES, AND QUANTITIES. CONCRETE PILES TYPICALLY EXHIBITED (UNRAVELLING) ROUNDED CORNERS UP TO 3 INCH VERTICAL BY 1 INCH WIDE BY 1/2 INCH PENETRATION AT ISOLATED LOCATIONS.
2. SUBMERGED CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO THE BOTTOM OF THE COLUMN.
3. EXPOSED CONCRETE FOOTINGS (BENTS 59 TO 84) EXHIBITED ABRASION UP TO 1/2 INCH DEEP, FROM THE TOP OF THE FOOTING TO THE CHANNEL BOTTOM.
4. SUBMERGED CONCRETE SEALS (BENTS 59 TO 84) TYPICALLY EXHIBITED MEDIUM TO SOFT CONCRETE HARDNESS.
5. CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED VOIDS AT THE FOOTING–SEAL INTERFACE, UP TO 3 INCH VERTICAL WITH UP TO 6 INCH PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR DETAILED LIST OF COLUMN DEFECTS.
6. CONCRETE COLUMNS EXHIBITED VOIDS AT THE FOOTING–SEAL INTERFACE, UP TO 6 INCH VERTICAL WITH UP TO 1.5 FEET PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR A DETAILED LIST OF COLUMN DEFECTS.
7. CONCRETE COLUMNS HAD VARIOUS VOIDS AND SPALLS; SEE TABLE A.4 FOR A DETAILED LIST OF COLUMN DEFECTS.
8. EXPOSED STEEL H–PILE OBSERVED AT COLUMN 76–1 AT WEST CORNER UNDER SILL WITH APPROXIMATELY 0.5 FEET OF EXPOSURE. WHEN CURRENT SOUNDING ELEVATIONS ARE COMPARED TO ORIGINAL HISTORIC ELEVATIONS, NO SIGNIFICANT GENERAL AND ONLY MINOR LOCAL SCOUR WAS OBSERVED. EXPOSURE OF BEARING PILE AT COLUMN 76–1 SHOULD BE MONITORED DURING FUTURE INSPECTIONS. THE EXPOSED H–PILE WAS NOT ACCESSIBLE FOR DETAILED INSPECTION OF THICKNESS MEASUREMENTS

GENERAL NOTES:

I. MARINE GROWTH CONSISTED OF UP TO 1/2–INCH–THICK ALGAE COVERING 100 PERCENT OF THE SUBMERGED CONCRETE SURFACES FROM THE CHANNEL BOTTOM TO THE WATERLINE.

II. ALL CHANNEL EMBANKMENTS WERE STABLE AT THE TIME OF THE INSPECTION, WITH ALL CHANNEL EMBANKMENTS (SHORELINES) BEING WELL VEGETATED. NO SIGNIFICANT SIGNS OF CHANNEL MIGRATION WERE EVIDENT. THE EMBANKMENTS AROUND BOTH ABUTMENTS WERE STABLE AT THE TIME OF INSPECTION, WITH ALL THE EMBANKMENTS BEING WELL VEGETATED AND ARMORED WITH 2–FOOT–DIAMETER RIPRAP. NO SIGNIFICANT EROSION WAS OBSERVED.

III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH DIAMETER ROCK, AND SILT WITH UP TO 1 INCH PENETRATION.

LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 WEST FASCIA	——	CUT–OFF TIMBER PILE	
2021 EAST FASCIA	——	CONCRETE PILE–ENCASEMENT, SQUARE	
2016 WEST FASCIA	– – –	CONCRETE PILE–ENCASEMENT, ROUND	
2016 EAST FASCIA	– – –	STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021 / 2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	(7)	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	● 182.5
SCOUR		BATTERED DIRECTION	←
FLOODPLAINS			

NOTE:
1. DRAWING NOT TO SCALE AND INTENDED FOR ILLUSTRATIVE PURPOSES ONLY. SHORELINE PROTECTION, DEBRIS, AND ANCILLARY FEATURES SHOWN ARE APPROXIMATE.
2. AS THE INTENTION OF THIS DRAWING IS TO SHOW THE CHANNEL AND ADJACENT BENTS IN ORDER TO MAP THE HISTORICAL MOVEMENT OF THE WATERWAY, THE ENTIRE BRIDGE MAY NOT BE SHOWN DUE TO SPACE CONSTRAINTS. THE ENTIRE CHANNEL, OBSERVED AT THE TIME OF INSPECTION, IS SHOWN

SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5249
I–95 NB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 84–86

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 10

SCDOT BRIDGE INSPECTION FORM

(008) BRIDGE ID:	1410009530100	(005) ROUTE:	CLARENDON I-95
(420) ASSET NO:	5258	(006) CROSSING:	LAKE MARION
(419) RAMP NO:		(009) LOCATION:	7MI S OF SUMMERTON
(026) FUNCTIONAL CLASS:	1	(016) LAT: 33d 30m 19.25s	(017) LON: 80d 27m 9.86s

GENERAL BRIDGE DATA

	EXISTING	REVISED		EXISTING	REVISED
(027) Year Built	1968		(042) Type Serv; On(A) Und(B)	1 5	
(106) Year Recon	0		(028) Lanes; On(A) Und(B)	2 0	
(031) Design Load	5		(107) Deck Struct	1	
(36A) Railings	1		(108) Wear Surf/Membrane/Prot	1 0 0	
(36B) Transitions	1			MAT-SUP-SUB	MAT-SUP-SUB
(36C) Appr Guard	1		(043) Main Original (A)	4 2 1	
(36D) Appr Guard End	1		Main Reconst (B)		
(037) History	5		(044) Appr Orginal (A)	1 04 5	
(319) Last Paint Date	07/2017		Appr Reconst (B)		

GEOMETRIC DATA

	EXISTING	REVISED		EXISTING		REVISED	
(032) Appr Rdway	38			FT	IN	FT	IN
(033) Bridge Median	0		(053) Vert Clr Above Deck	99	99		
(034) Skew	0		(54A) Vert Clear Ref	N			
(035) Flared	0		(54B) Vert Clear Right	0	0	0	0
(045) # Main Spans	5		(54C) Vert Clear Left	0	0	0	0
(046) # Appr Spans	80		(10A) Great Min Clr Over/Und	99	99		
(048) Max Span Lgth	140		(10B) Great Min Right	99	99		
(308) Appr Span Lgth	40		(10C) Great Min Left	99	99		
(049) Struct Length	4500						
(47A) Horz Clear Right	31		(55A) Lat Clear Ref	N			
(47B) Horz Clear Left	0		(55B) Lat Clear Right	0			
(47UA) Horz Clear Right	0	0	(056) Lat Clear Left	0			
(47UB) Horz Clear Left	0	0					
(50B) Sidewalk Right	0		(038) Navigation Cont	1		1	
(50A) Sidewalk Left	0		(039) Nav Vert Clear	50		50	
(051) Curb to Curb	31		(040) Nav Horz Clear	100		100	
(052) Deck Out-Out	35.20		(111) Nav Pier Port	4		4	

RATINGS DATA

	EXISTING	REVISED		EXISTING		REVISED	
(58) Deck	5		(041) Traffic Status	A			
(59) Super Str	6		(063) Rating Method	8		8	
(60) Sub Str	5		(064) Operating Method	1.06		1.10	
(061) Channel	8		(065) Rating Method	8		8	
(062) Culv Ret	N		(066) Inventory Rating	0.69		0.69	
(071) Water Adeq	6		(411) Date Rated	11/2022		10/2021	
(072) Appr Rdway	8		(418) Conditions During Rating	5 6 5		5 6 5	
(113) Scour Critical	9			Freq	Mth/Year	Freq	Mth/Year
(067) Structure	5		(091, 090) Routine Insp	24	10/2021	24	10/2021
(068) Deck Geom	4		(92A, 93A) Fracture Critical	N			
(069) Underclear	N		(92B, 93B) Underwater Insp	Y60	02/2021		
(070) Bridge Post	5		(92C, 93C) Special Insp	Y24	10/2021		

Inspection Leader:	CHARLES LAFFERTY, MBI	Reviewed By:	
Date:		Date:	

Bridge Element Group Textual Data

Bridge ID: 14-1-00095-3-01-00

20 Dec 2022

Abutments and/or Headwalls:

NO NOTEWORTHY DEFECTS AT THE TIME OF INSPECTION

Bents and/or Piers:

BENTS#59-85 HAVE 2)R/C COLUMNS W/ EITHER 1 OR 2 STRUTS; BENTS #2-58 HAVE 4 21" P/S CONC. PILES (BENTS #12,24,36, AND 48 HAVE 2 OUTSIDE PILES(SEISMIC)), ALL WITH R/C CAPS/
CAPS:
-HAIRLINE TO SMALL (~1/16) FLEXURE CRACKING THRU-OUT CAPS, USUALLY SPACED @ 1'-2';
-WIDE VERT. CRACKING IN CAP #47;
-SPALL ON CAP#57 B/W BEAMS 1-2 AND CAP#4 W/ EXPOSED R/S;
COLUMNS AND PILES:
-MOST COLUMNS HAVE CRACKING AND DELAM. AT TOP CONSTR. JOINTS;
-MODERATE TO HEAVY ABRASION (1/2-3/4") AT SPLASH ZONE ON ALL COLUMNS AND PILES;
-MULTIPLE PILES W/CRACKS UP TO 1/8" WIDE OBSERVED BELOW HIGH-WATER MARK. SEE UNDERWATER REPORT FOR LOCATION SPECIFIC NOTES.
-VEGETATION GROWTH AT BENT 85, PILE 2
-~75% OF PILES HAVE SMALL TO MODERATE VERT. CRACKS IN MOST PRESTR. PILES AT SPLASH ZONE WITH ~25 OF PILES HAVING WIDE CRACKING (WIDE CRACKS ARE MOSTLY ON FASCIA PILES);
-1'X3' PATCHED SPALL ON P4 ON BT#9;

FOR LOCATION SPECIFIC NOTES, SEE SKETCH SHEET

Bearings:

STEEL GIRDERS=16-EXPANSION ROCKER BEARINGS AND 8-FIXED SHOE BEARINGS:
-BEARINGS UNDER STEEL GIRDERS WERE PAINTED IN 7-2017 AND ARE IN GOOD CONDITION, ANGLES OF EXP. BEARINGS APPEAR TO BE WITHIN TOLERANCE;
-BEARINGS EXHIBIT MINOR TO MODERATE CORROSION WITH THE WORST CASES APPEARING AT THE END BEARINGS. BEARINGS WITH MORE SEVERE CORROSION ARE NOTED ON SKETCH SHEET.

PRESTR. BEAMS=220 STEEL ROCKER PLATES :
-MOVABLE/FIXED PLATES HAVE MINOR TO MOD. SURFACE RUST WITH COMPACTION; EVIDENCE OF FROZEN BEARINGS ON MOVABLE;

TEE BEAMS=FELT PADS:
-OVERALL, APPEARS NOT TO BE WORKING PROPERLY DUE TO NUMEROUS DELAM. AND SPALLS IN DIAPH'S;

FOR LOCATION SPECIFIC NOTES, SEE SKETCH SHEET

Girders/Floor Beams/Stringers and/or Beams:

6-SAT.: 58 SPANS OF 5-CONCRETE TEE BEAMS,/
FOUR 5'-3"H CONTINUOUS STEEL GIRDERS WITH 7'-9" HAUNCHES PER SPAN (SPANS #75-79):
-VERTICAL CRACKING, DELAMINATIONS AND SPALLING (W/ SOME EXPOSED REBAR) IN DIAPHRAGMS, WORSE BEING OVER BENT #75 B/W BEAMS 2-3;

FIVE P/S CONCRETE BEAMS PER SPAN (SPANS #80-85 + 59-74):
-SMALL SHALLOW SPALLS ON UNDERSIDE OF BEAMS WITH P/S EXPOSED ON SOME SPALLS (WORSE AREAS ARE IN SPAN #55 and 70;
-SMALL CRACKING, DELAMINATIONS, AND SPALLING AT BEARINGS AREA THRU-OUT MOST BEAM ENDS;

FIVE R/C TEE BEAMS PER SPAN (SPANS #1-58):
-HAIRLINE FLEXURE CRACKS THRU-OUT BEAMS, TYPICALLY SPACED @ ~1-2';
-ALL DIAPH'S HAVE SPALLS RANGING FROM SMALL TO SEVERAL SQ FEET THRU-OUT BRIDGE W/ SOME HAVING LARGE AREAS OF EXPOSED R/S (SOME OF THE WORSE AREAS ARE OVER BENT #36;

FOR LOCATION SPECIFIC NOTES, SEE SKETCH SHEET

Truss Members:

N/A

Expansion Joints:

2-STEEL OPEN FINGER JOINTS ON BENTS #75 AND 80; 80 POURABLE EXPANSION JOINTS ON ALL OTHERS/
-OPEN FINGER JOINTS HAVE ABOUT ~1/4" OF VERTICAL DIFFERENCE BUT STILL IN GOOD CONDITION; AND SPANS HAVE ABOUT A 1/4" OF MOVEMENT AT JOINTS;
-POURABLE JOINTS ARE IN SAT. CONDITION WITH OVERALL LEAKAGE ON ABOUT 18 JOINTS, OVER P/S BEAMS (EVIDENCE ON CAPS, BEARINGS, AND BEAMS) AND LOSS OF ADHESION THRU-OUT (~85');
-WORSE AREAS OF JOINT FAILURES ARE OVER BENT #70, MOST ON 67-69

Decks and/or Slabs:

6.5" R/C TOP FLANGE OVER TEE BEAM (58 AT @40'), 6.5" R/C DECK OVER P/S SPANS (22 AT 70'); 7.5" R/C DECK OVER STEEL GIRDERS (2 SPANS AT 110' AND 3 SPANS AT 140')/
OVERALL/GENERAL NOTES:
-HAIRLINE TO MOSTLY SMALL MAP CRACK THRU-OUT DECK;
-LIGHT SCALING WITH MORE WEARING;
-SMALL TO LARGE POP-OUTS THRU-OUT DECK;
-CURB HAS LIGHT ABRASION AT CURB AND DECK CORNER ("CURD AND GUTTER")FROM RAIN RUNOFF;
-WORSE AREAS OF CRACKING ARE OVER STEEL SPANS #76-80;
-NUMEROUS PATCHING FROM CONTRACTOR SINCE 2018 INSPECTION;

FOR LOCATION SPECIFIC NOTES SEE SKETCH SHEET

*****DAMAGE INSPECTION (SPECIAL INSP)*****
-SEE ATTACHED DAMAGE INSPECTION REPORT DATED 10-16-2021

Curbs:

6-SAT.: 18" CONCRETE SAFETY CURB;
-LIGHT ABRASION AT CURB AND DECK CORNER FROM RAIN RUNOFF;

Bridge Railing/Parapets and/or Median Barriers:

1-CONCRETE RAILING AND POSTS WITH METAL THRIEBEAM RAILING RETRO FITTED ACROSS BRIDGE;
1-METAL THRIEBEAM TRANSITIONS WITH METAL POST;
1-STANDARD "W" BEAM G.R. WITH TIMBER AND METAL POSTS ON THREE APPROACHES;
1-END TERMINAL OR CONTINUOUS G.R. ON ENDS;

-SOME MINOR INSIGNIFICANT DAMAGE THROUGHOUT THRIE-BEAM RAILING ACROSS BRIDGE;
-DAMAGE AT RAIL UP TO 7' LONG AT SPAN 76, RIGHT SIDE

*****DAMAGE INSPECTION (SPECIAL INSP)*****
-SEE ATTACHED DAMAGE INSPECTION REPORT DATED 10-16-2021

Paint Systems:

GIRDERS=EST. @ 45,000'SF OF PAINTED SURFACE:
-STEEL GIRDERS ARE IN GOOD CONDITION DUE TO BEING PAINTED BY CONTRACTOR IN SUMMER OF 2017;
STEEL ROCKER BEARINGS:
-BEARINGS UNDER PRESTRESSED BEAMS ARE IN FAIR TO MOSTLY POOR CONDITION, WILL NEED TO BE REHABILITATED IN THE NEAR FUTURE;

Waterway and Scour:

UNDERWATER INSPECTION PERFORMED 02/25/2021, SEE UNDERWATER BRIDGE INSPECTION REPORT

-LAKE ALIGNMENT WITH LOW FLOW CHANNEL;
-WELL VEGETATED BANKS;

Fender System:

N/A

Roadway Alignment:

-STRAIGHT HORIZONTAL ALIGNMENT AND SLIGHT VERTICAL CURVE AT BEGINNING, BUT NO SPEED REDUCTION IS NECESSARY;

Traffic Signs:

-BRIDGE END PANELS ON APPROACH ENDS ONLY;
-NAVIGATIONAL LIGHT (RED) ON BENT #78 ON UPSTREAM SIDE OF BRIDGE, POWER DISCONNECTED, DATE UNKNOWN;
-SPAN #57: "NO STOPPING ON BRIDGE" SIGNAGE;
-SPAN #51: “MILE 100” MILE MARKER SIGNAGE;

Encroachments:

NON-WORKING POWER LINE AND CONDUIT FOR NAVIGATIONAL LIGHTS;

Miscellaneous Notes:

BRIDGE ORIENTAITON: Labeling diagram orientation is opposite direction from the historic orientation of the bridge (N-S).

Bridge Asset ID is located on the southeast corner of the bridge.

Bridge Inspected on 10/12/2021. Sunny, 70 degrees.
BITL: Douglas McLendon, PE, Collins Engineers, Inc.
Assistants: Eric Beach, Zane Peterson, Mikayla Young

*****DAMAGE INSPECTION (SPECIAL INSP)*****
-SEE ATTACHED DAMAGE INSPECTION REPORT, DATED 10-16-2021.
-*AT NEXT ROUTINE INSPECTION THE BITL SHALL CANCEL OUT THE (92C,93C) SPECIAL INSP TO REVERT BACK TO ROUTINE ONLY, UNLESS ANOTHER SPECICAL INSP IS PERFORMED PRIOR TO 10/2023*

MBI updated load rating information 12/20/2022. No inspection performed

Bridge Element Level Data

20 Dec 2022

					Quantity in Each Condition State				
Element No	Element Name/Description	Units	Env	Defect	1	2	3	4	Total Qty
107	Steel Open Girder/Beam	feet	4	No	2556	0	0	0	2556
109	Prestressed Concrete Open Girder/Beam	feet	4	Yes					
109	Delamination/Spall/Patched Area	feet	4	1080	0	304	8	0	312
109	Exposed Rebar	feet	4	1090	0	8	0	0	8
109	Exposed Prestressing	feet	4	1100	0	34	0	0	34
109	Cracking (PSC)	feet	4	1110	0	220	0	0	220
109	Prestressed Concrete Open Girder/Beam	feet	4	Yes	7131	566	8	0	7705
110	Reinforced Concrete Open Girder/Beam	feet	4	Yes					
110	Cracking (RC and Other)	feet	4	1130	11600	0	0	0	11600
110	Reinforced Concrete Open Girder/Beam	feet	4	Yes	11600	0	0	0	11600
16	Reinforced Concrete Top Flange	sq feet	4	Yes					
16	Delamination/Spall/Patched Area	sq feet	4	1080	0	1135	25	0	1160
16	Exposed Rebar	sq feet	4	1090	0	7	0	0	7
16	Cracking (RC and Other)	sq feet	4	1130	127252	19840	181	0	147273
16	Abrasion/Wear (PSC/RC)	sq feet	4	1190	0	9000	60	0	9060
16	Reinforced Concrete Top Flange	sq feet	4	Yes	135105	29982	648	0	165735
205	Reinforced Concrete Column	each	1	Yes					
205	Abrasion/Wear (PSC/RC)	each	1	1190	0	54	0	0	54
205	Reinforced Concrete Column	each	1	Yes	0	54	0	0	54
215	Reinforced Concrete Abutment	feet	3	No	64	0	0	0	64
220	Reinforced Concrete Pile Cap/Footing	feet	3	Yes					
220	Delamination/Spall/Patched Area	feet	3	1080	0	26	0	0	26
220	Reinforced Concrete Pile Cap/Footing	feet	3	Yes	28	26	0	0	54
226	Prestressed Concrete Pile	each	1	Yes					
226	Cracking (PSC)	each	1	1110	0	0	105	0	105
226	Abrasion/Wear (PSC/RC)	each	1	1190	0	127	0	0	127
226	Prestressed Concrete Pile	each	1	Yes	0	127	105	0	232
234	Reinforced Concrete Pier Cap	feet	4	Yes					
234	Delamination/Spall/Patched Area	feet	4	1080	0	7	10	0	17
234	Exposed Rebar	feet	4	1090	0	1	0	0	1

234	Cracking (RC and Other)	feet	4	1130	2116	424	1	0	2541
234	Abrasion/Wear (PSC/RC)	feet	4	1190	0	93	0	0	93
234	Reinforced Concrete Pier Cap	feet	4	Yes	2184	525	11	0	2720
301	Pourable Joint Seal	feet	3	Yes					
301	Leakage	feet	3	2310	0	630	0	0	630
301	Seal Adhesion	feet	3	2320	0	85	0	0	85
301	Seal Damage	feet	3	2330	0	0	112	0	112
301	Pourable Joint Seal	feet	3	Yes	1973	715	112	0	2800
304	Open Expansion Joint	feet	3	No	62	0	0	0	62
311	Movable Bearing	each	2	Yes					
311	Corrosion	each	2	1000	0	0	105	0	105
311	Connection	each	2	1020	0	0	5	0	5
311	Movable Bearing	each	2	Yes	16	0	110	0	126
313	Fixed Bearing	each	2	Yes					
313	Corrosion	each	2	1000	0	110	0	0	110
313	Fixed Bearing	each	2	Yes	8	110	0	0	118
330	Metal Bridge Railing	feet	1	Yes					
330	Damage	feet	1	7000	0	24	90	0	114
330	Metal Bridge Railing	feet	1	Yes	8886	24	90	0	9000
515	Steel Protective Coating	sq feet	1	No	43878	0	0	0	43878

Photograph Form

Asset ID Number:	5258	Bridge Inspection Date:	10/12/2021

1 Top of Deck from Downstation Approach (Looking Upstation)

2 Top of Deck from Upstation Approach (Looking Downstation)

3 North Approach Roadway

4 South Approach Roadway

5 Intersecting Feature Looking East

6 Intersecting Feature Looking West

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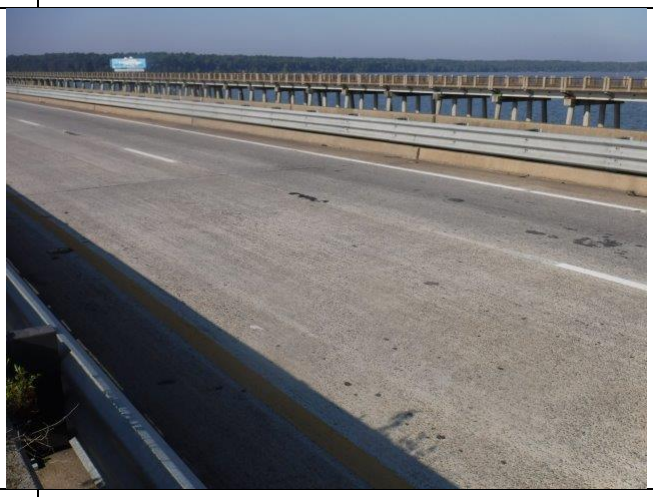
Consultant: For Repair Rec.? ☐

Photograph Form

Asset ID Number:	5258	Bridge Inspection Date:	10/12/2021

7 East Elevation

8 West Elevation



9 Deck Condition Photograph

10 Bridge Joint Condition Photograph

11 Bridge Finger Joint Condition Photograph

12 Superstructure Condition Photograph (Reinforced Concrete)

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Consultant: For Repair Rec.? ☐

Photograph Form

Asset ID Number:	5258	Bridge Inspection Date:	10/12/2021

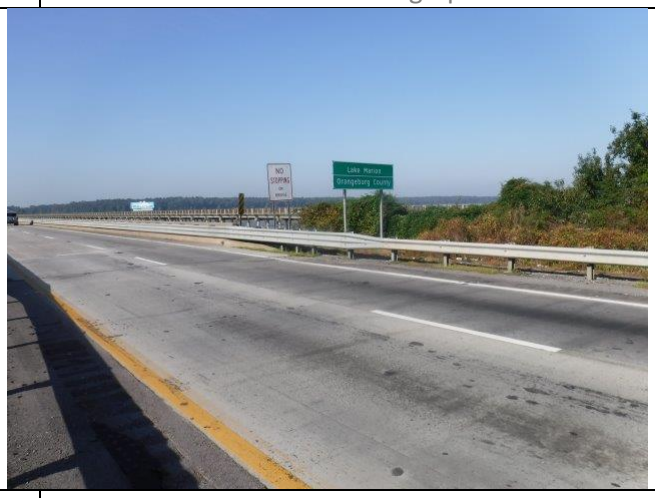
13 Superstructure Condition Photograph (Steel)

14 Superstructure Condition Photograph (Prestressed Concrete)

15 Substructure Condition Photograph

16 Substructure Condition Photograph

17 Bridge Barrier/Railing



18 Rail Transitions

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Consultant: For Repair Rec.? ☐

Photograph Form

Asset ID Number:	5258	Bridge Inspection Date:	10/12/2021

19	Approach Guardrail

20	End Guardrail Treatment

#	Choose an item.

#	Choose an item.

#	Choose an item.

#	Choose an item.

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Consultant: For Repair Rec.? ☐

1 UNDERWATER INSPECTION EXECUTIVE SUMMARY

INSPECTION SUMMARY				
ASSET ID:	5258		UW INSP. DATE:	02/25/2021
DISTRICT:	7		MAX WATER DEPTH:	37.8 FEET
COUNTY:	CLARENDON COUNTY		MAX WATER VELOCITY	0.3 FPS
ROUTE:	I-95 SB		WATER TEMP.:	60°F
WATERWAY:	LAKE MARION		UW VISABILITY:	2.0 FEET
INVENTORY DIRECTION:	NORTH TO SOUTH		SUBSTRUCT. TYPE	P/S CONC. OCTAGONAL PILE AND REIN. CONC. COLUMN
SSU INSPECTED:	BENTS 3 THROUGH 84		SUBSTRUCT. SIZE:	21 INCH AND VARIOUS SIZE SQUARE
TEAM LEADER:	BRIAN RHETT, P.E.		BRIDGE INSPECTION ACCESS:	BOAT
DIVE INSPECTORS:	B. RHETT; W. GWALTNEY; W. MOORE		BOAT LAUNCH: SANTEE STATE PARK	
TENDERS:	W. GWALTNEY; W. MOORE; J. DAVIS		LATITUDE (DD):	N33.512745
ADDITIONAL TEAM MEMBER(S):	NA		LONGITUDE (DD):	W80.475084

CRITICAL FINDINGS: No critical findings were made during this inspection.
REPAIRS RECOMMENDED: There are no repair recommendations at this time.
SCOUR CRITICAL: No significant signs of scour observed.
LOAD RATING: No load rating recommended.

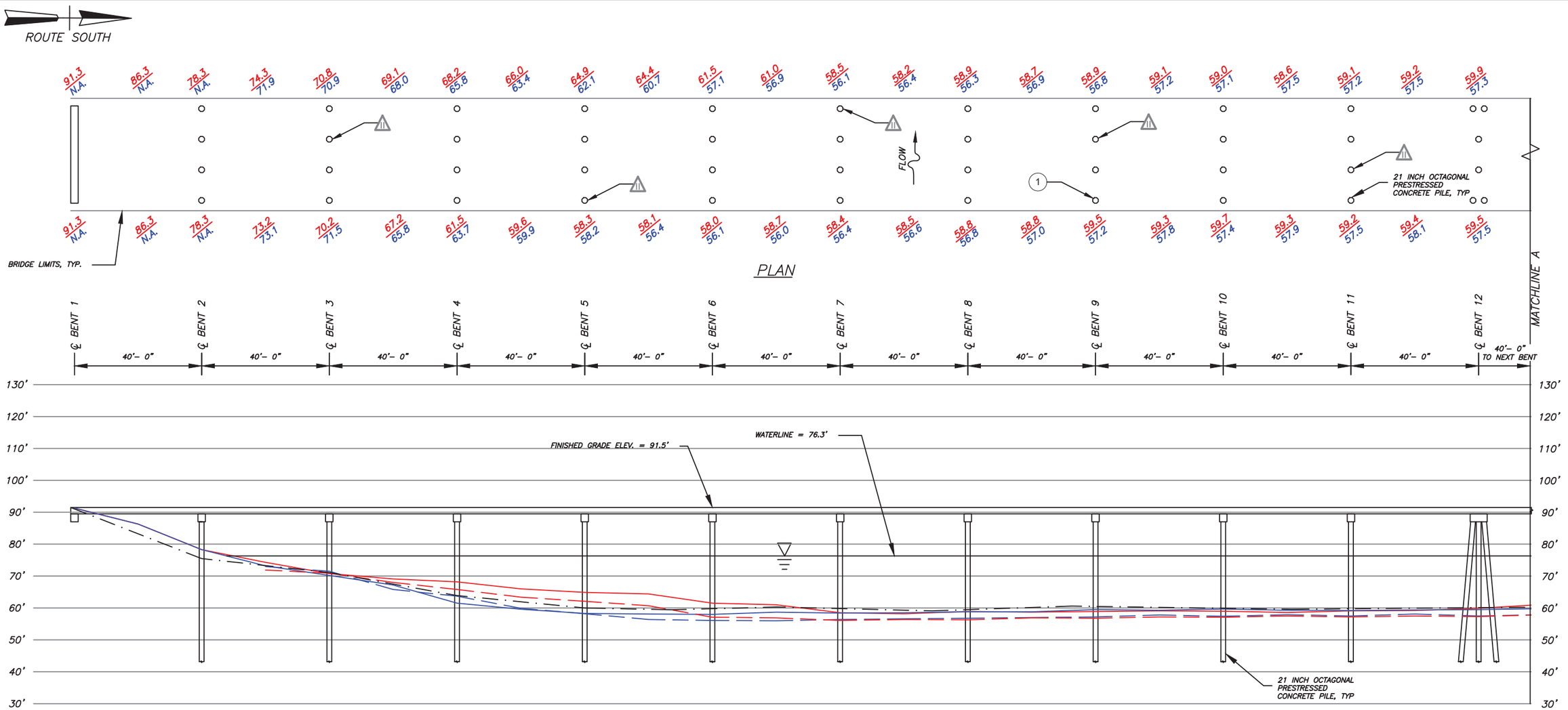
Element and Condition State Ratings of inspected elements can be found in the Bridge Inspection Online Application (BIO).

2 INTRODUCTION

2.1 Purpose and Scope

SCDOT Bridge Asset ID 5258 carries I-95 SB over Lake Marion in Clarendon County, South Carolina. On 02/25/2021, Collins Engineers, Inc. performed a routine underwater inspection at the bridge to evaluate the condition of all applicable submerged substructure units (SSUs). This report includes a general description of the investigation method, a detailed description of the conditions observed, photographs of typical conditions and deficiencies, and bridge and channel drawings.

The scope of the investigation included a visual and/or tactile inspection of all accessible SSUs located in the water from the high-water mark to the channel bottom. Depth soundings and channel velocity measurements were taken along the bridge's upstream and downstream fascias to assist



INSPECTION NOTES:

1. BENT 9, PILE 4: POOR CONSOLIDATION MEASURING UP TO 3 FEET HIGH BY 8 INCH WIDE BY 2 INCH OF PENETRATION WAS OBSERVED 2 FEET ABOVE THE WATERLINE ON THE NORTH FACE OF THE PILE.

GENERAL NOTES:

I. MARINE GROWTH CONSISTED OF UP TO 1/2–INCH–THICK ALGAE COVERING 100 PERCENT OF THE SUBMERGED CONCRETE SURFACES FROM THE CHANNEL BOTTOM TO THE WATERLINE.

II. ALL CHANNEL EMBANKMENTS WERE STABLE AT THE TIME OF THE INSPECTION, WITH ALL CHANNEL EMBANKMENTS (SHORELINES) BEING WELL VEGETATED. NO SIGNIFICANT SIGNS OF CHANNEL MIGRATION WERE EVIDENT. THE EMBANKMENTS AROUND BOTH ABUTMENTS WERE STABLE AT THE TIME OF INSPECTION, WITH ALL THE EMBANKMENTS BEING WELL VEGETATED AND ARMORED WITH 2–FOOT–DIAMETER RIPRAP.

III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH–DIAMETER ROCK, AND SILT WITH UP TO 1–INCH PENETRATION.

IV. SUBMERGED CONCRETE PILES (BENTS 3 TO 58) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO 1 FOOT BELOW THE WATERLINE AND UP TO 3/16 INCH DEEP, FROM 1 FOOT BELOW THE WATERLINE TO THE CHANNEL BOTTOM. VERTICAL CRACKS SIZED UP TO 1/4 INCH WIDE WERE TYPICALLY OBSERVED AT THE WATERLINE RANGING FROM UP TO 3 FEET ABOVE THE WATERLINE TO 2 FEET BELOW THE WATERLINE. SEE TABLE A.2 IN APPENDIX A FOR DETAILED CRACK LOCATIONS, SIZES, AND QUANTITIES. CONCRETE PILES TYPICALLY EXHIBITED ROUNDED CORNERS (UNRAVELLING) UP TO 3 INCH VERTICAL BY 1 INCH WIDE BY 1/2 INCH PENETRATION AT ISOLATED LOCATIONS.

V. SUBMERGED CONCRETE COLUMNS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO THE BOTTOM OF THE COLUMN.

VI. EXPOSED CONCRETE FOOTINGS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/2 INCH DEEP, FROM THE TOP OF THE FOOTING TO THE CHANNEL BOTTOM. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

VII. EXPOSED CONCRETE SEALS (BENTS 59 TO 84) TYPICALLY EXHIBITED MEDIUM TO SOFT CONCRETE. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 EAST FASCIA	——	CUT–OFF TIMBER PILE	
2021 WEST FASCIA	——	CONCRETE PILE–ENCASEMENT, SQUARE	
2016 EAST FASCIA	– –	CONCRETE PILE–ENCASEMENT, ROUND	
2016 WEST FASCIA	– –	STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021 / 2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	7	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	● 182.5
SCOUR		BATTERED DIRECTION	←
FLOODPLAINS			

NOTE:
1. DRAWING NOT TO SCALE AND INTENDED FOR ILLUSTRATIVE PURPOSES ONLY. SHORELINE PROTECTION, DEBRIS, AND ANCILLARY FEATURES SHOWN ARE APPROXIMATE.
2. AS THE INTENTION OF THIS DRAWING IS TO SHOW THE CHANNEL AND ADJACENT BENTS IN ORDER TO MAP THE HISTORICAL MOVEMENT OF THE WATERWAY, THE ENTIRE BRIDGE MAY NOT BE SHOWN DUE TO SPACE CONSTRAINTS. THE ENTIRE CHANNEL, OBSERVED AT THE TIME OF INSPECTION, IS SHOWN

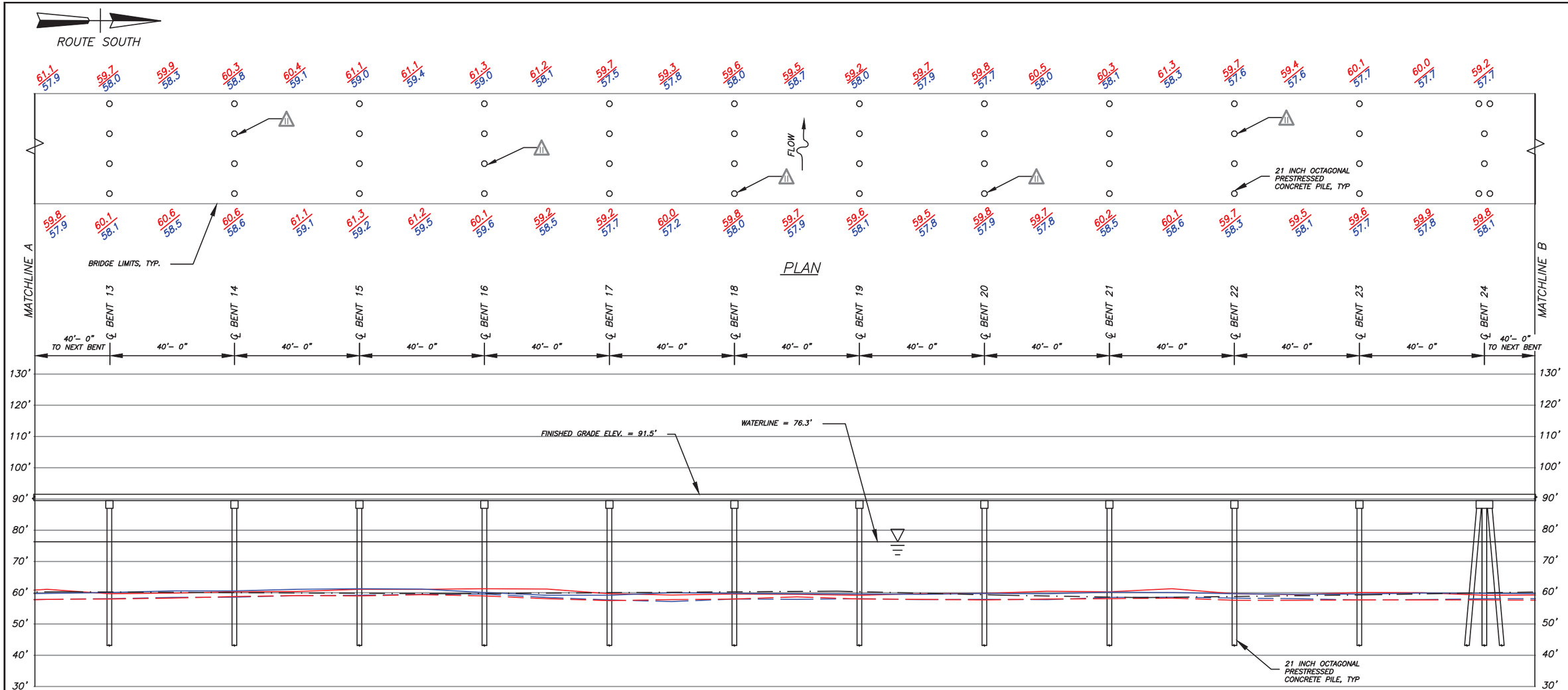
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5258
I–95 SB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 1–12

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 1



INSPECTION NOTES:

*NO SPECIFIC INSPECTION NOTES OBSERVED

GENERAL NOTES:

I. MARINE GROWTH CONSISTED OF UP TO 1/2–INCH–THICK ALGAE COVERING 100 PERCENT OF THE SUBMERGED CONCRETE SURFACES FROM THE CHANNEL BOTTOM TO THE WATERLINE.

II. ALL CHANNEL EMBANKMENTS WERE STABLE AT THE TIME OF THE INSPECTION, WITH ALL CHANNEL EMBANKMENTS (SHORELINES) BEING WELL VEGETATED. NO SIGNIFICANT SIGNS OF CHANNEL MIGRATION WERE EVIDENT. THE EMBANKMENTS AROUND BOTH ABUTMENTS WERE STABLE AT THE TIME OF INSPECTION, WITH ALL THE EMBANKMENTS BEING WELL VEGETATED AND ARMORED WITH 2–FOOT–DIAMETER RIPRAP.

III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH–DIAMETER ROCK, AND SILT WITH UP TO 1–INCH PENETRATION.

IV. SUBMERGED CONCRETE PILES (BENTS 3 TO 58) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO 1 FOOT BELOW THE WATERLINE AND UP TO 3/16 INCH DEEP, FROM 1 FOOT BELOW THE WATERLINE TO THE CHANNEL BOTTOM. VERTICAL CRACKS SIZED UP TO 1/4 INCH WIDE WERE TYPICALLY OBSERVED AT THE WATERLINE RANGING FROM UP TO 3 FEET ABOVE THE WATERLINE TO 2 FEET BELOW THE WATERLINE. SEE TABLE A.2 IN APPENDIX A FOR DETAILED CRACK LOCATIONS, SIZES, AND QUANTITIES. CONCRETE PILES TYPICALLY EXHIBITED ROUNDED CORNERS (UNRAVELLING) UP TO 3 INCH VERTICAL BY 1 INCH WIDE BY 1/2 INCH PENETRATION AT ISOLATED LOCATIONS.

V. SUBMERGED CONCRETE COLUMNS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO THE BOTTOM OF THE COLUMN.

VI. EXPOSED CONCRETE FOOTINGS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/2 INCH DEEP, FROM THE TOP OF THE FOOTING TO THE CHANNEL BOTTOM. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

VII. EXPOSED CONCRETE SEALS (BENTS 59 TO 84) TYPICALLY EXHIBITED MEDIUM TO SOFT CONCRETE. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 EAST FASCIA	———	CUT–OFF TIMBER PILE	
2021 WEST FASCIA	———	CONCRETE PILE–ENCASEMENT, SQUARE	
2016 EAST FASCIA	– – –	CONCRETE PILE–ENCASEMENT, ROUND	
2016 WEST FASCIA	– – –	STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021 / 2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	7	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	182.5
SCOUR		BATTERED DIRECTION	
FLOODPLAINS			

NOTE:
1. DRAWING NOT TO SCALE AND INTENDED FOR ILLUSTRATIVE PURPOSES ONLY. SHORELINE PROTECTION, DEBRIS, AND ANCILLARY FEATURES SHOWN ARE APPROXIMATE.
2. AS THE INTENTION OF THIS DRAWING IS TO SHOW THE CHANNEL AND ADJACENT BENTS IN ORDER TO MAP THE HISTORICAL MOVEMENT OF THE WATERWAY, THE ENTIRE BRIDGE MAY NOT BE SHOWN DUE TO SPACE CONSTRAINTS. THE ENTIRE CHANNEL, OBSERVED AT THE TIME OF INSPECTION, IS SHOWN

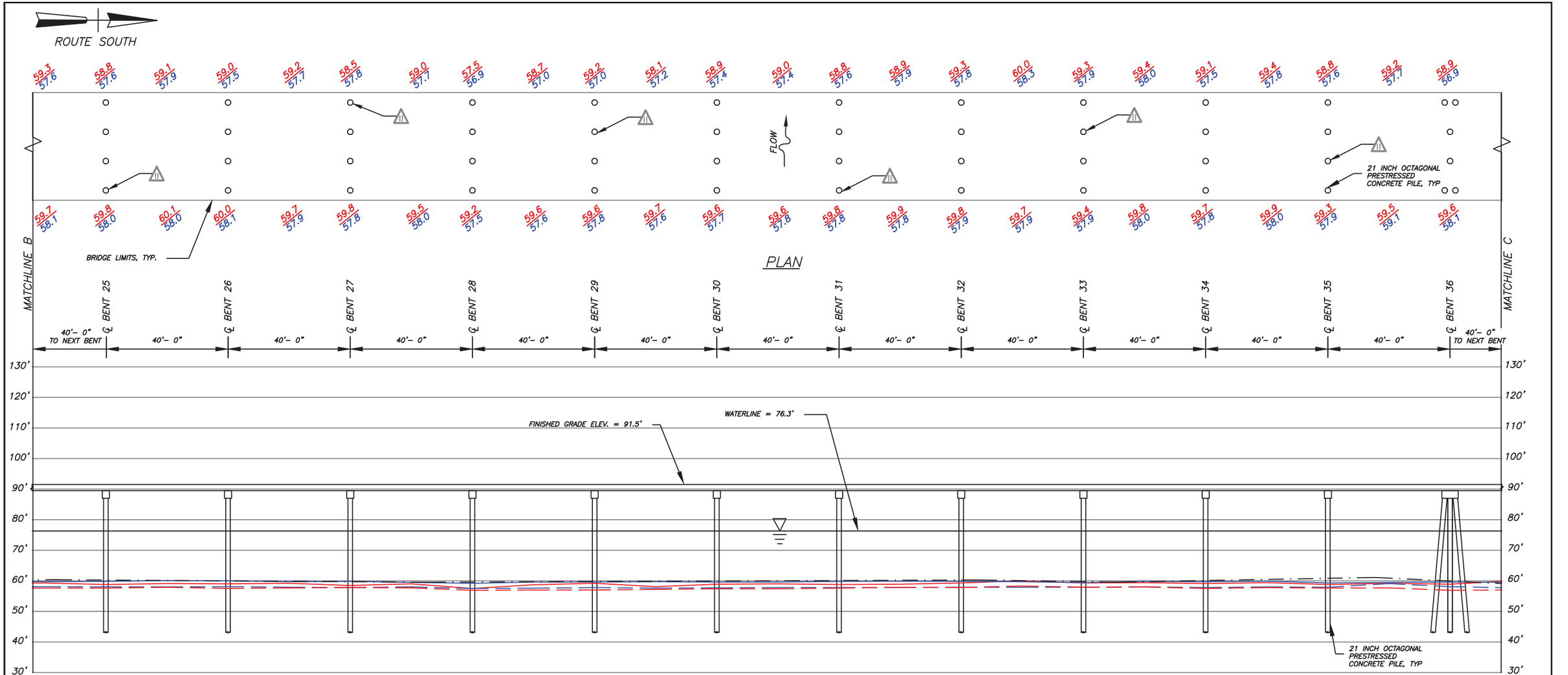
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5258
I–95 SB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 13–24

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 2



ELEVATION

INSPECTION NOTES:

*NO SPECIFIC INSPECTION NOTES OBSERVED

GENERAL NOTES:

I. MARINE GROWTH CONSISTED OF UP TO 1/2–INCH–THICK ALGAE COVERING 100 PERCENT OF THE SUBMERGED CONCRETE SURFACES FROM THE CHANNEL BOTTOM TO THE WATERLINE.

II. ALL CHANNEL EMBANKMENTS WERE STABLE AT THE TIME OF THE INSPECTION, WITH ALL CHANNEL EMBANKMENTS (SHORELINES) BEING WELL VEGETATED. NO SIGNIFICANT SIGNS OF CHANNEL MIGRATION WERE EVIDENT. THE EMBANKMENTS AROUND BOTH ABUTMENTS WERE STABLE AT THE TIME OF INSPECTION, WITH ALL THE EMBANKMENTS BEING WELL VEGETATED AND ARMORED WITH 2–FOOT–DIAMETER RIPRAP.

III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH–DIAMETER ROCK, AND SILT WITH UP TO 1–INCH PENETRATION.

IV. SUBMERGED CONCRETE PILES (BENTS 3 TO 58) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO 1 FOOT BELOW THE WATERLINE AND UP TO 3/16 INCH DEEP, FROM 1 FOOT BELOW THE WATERLINE TO THE CHANNEL BOTTOM. VERTICAL CRACKS SIZED UP TO 1/4 INCH WIDE WERE TYPICALLY OBSERVED AT THE WATERLINE RANGING FROM UP TO 3 FEET ABOVE THE WATERLINE TO 2 FEET BELOW THE WATERLINE. SEE TABLE A.2 IN APPENDIX A FOR DETAILED CRACK LOCATIONS, SIZES, AND QUANTITIES. CONCRETE PILES TYPICALLY EXHIBITED ROUNDED CORNERS (UNRAVELLING) UP TO 3 INCH VERTICAL BY 1 INCH WIDE BY 1/2 INCH PENETRATION AT ISOLATED LOCATIONS.

V. SUBMERGED CONCRETE COLUMNS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO THE BOTTOM OF THE COLUMN.

VI. EXPOSED CONCRETE FOOTINGS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/2 INCH DEEP, FROM THE TOP OF THE FOOTING TO THE CHANNEL BOTTOM. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

VII. EXPOSED CONCRETE SEALS (BENTS 59 TO 84) TYPICALLY EXHIBITED MEDIUM TO SOFT CONCRETE. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 EAST FASCIA	——	CUT–OFF TIMBER PILE	
2021 WEST FASCIA	——	CONCRETE PILE–ENCASEMENT, SQUARE	
2016 EAST FASCIA	– – –	CONCRETE PILE–ENCASEMENT, ROUND	
2016 WEST FASCIA	– – –	STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021 / 2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	7	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	182.5
SCOUR		BATTERED DIRECTION	
FLOODPLAINS			

NOTE:
1. DRAWING NOT TO SCALE AND INTENDED FOR ILLUSTRATIVE PURPOSES ONLY. SHORELINE PROTECTION, DEBRIS, AND ANCILLARY FEATURES SHOWN ARE APPROXIMATE.
2. AS THE INTENTION OF THIS DRAWING IS TO SHOW THE CHANNEL AND ADJACENT BENTS IN ORDER TO MAP THE HISTORICAL MOVEMENT OF THE WATERWAY, THE ENTIRE BRIDGE MAY NOT BE SHOWN DUE TO SPACE CONSTRAINTS. THE ENTIRE CHANNEL, OBSERVED AT THE TIME OF INSPECTION, IS SHOWN

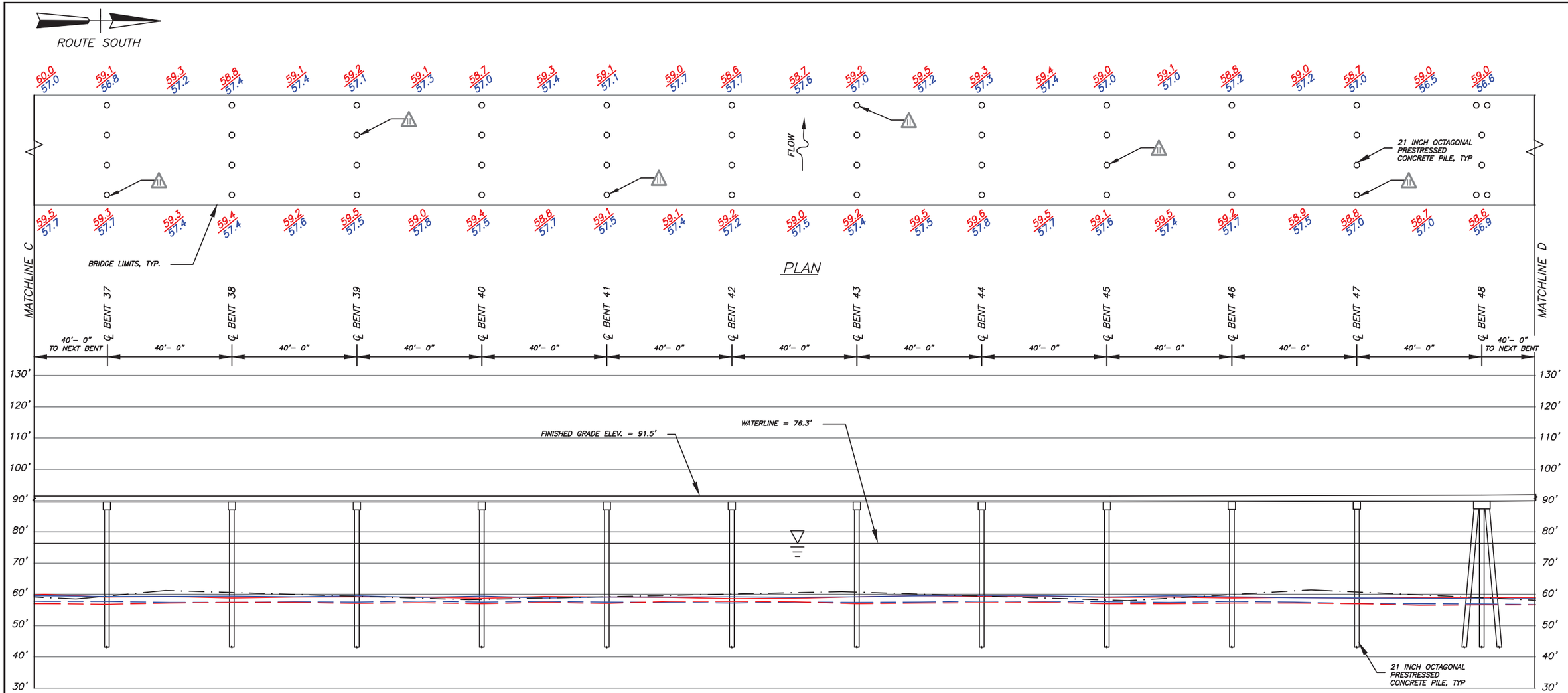
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5258
I–95 SB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 25–36

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 3



ELEVATION

INSPECTION NOTES:

*NO SPECIFIC INSPECTION NOTES OBSERVED

GENERAL NOTES:

I. MARINE GROWTH CONSISTED OF UP TO 1/2–INCH–THICK ALGAE COVERING 100 PERCENT OF THE SUBMERGED CONCRETE SURFACES FROM THE CHANNEL BOTTOM TO THE WATERLINE.

II. ALL CHANNEL EMBANKMENTS WERE STABLE AT THE TIME OF THE INSPECTION, WITH ALL CHANNEL EMBANKMENTS (SHORELINES) BEING WELL VEGETATED. NO SIGNIFICANT SIGNS OF CHANNEL MIGRATION WERE EVIDENT. THE EMBANKMENTS AROUND BOTH ABUTMENTS WERE STABLE AT THE TIME OF INSPECTION, WITH ALL THE EMBANKMENTS BEING WELL VEGETATED AND ARMORED WITH 2–FOOT–DIAMETER RIPRAP.

III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH–DIAMETER ROCK, AND SILT WITH UP TO 1–INCH PENETRATION.

IV. SUBMERGED CONCRETE PILES (BENTS 3 TO 58) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO 1 FOOT BELOW THE WATERLINE AND UP TO 3/16 INCH DEEP, FROM 1 FOOT BELOW THE WATERLINE TO THE CHANNEL BOTTOM. VERTICAL CRACKS SIZED UP TO 1/4 INCH WIDE WERE TYPICALLY OBSERVED AT THE WATERLINE RANGING FROM UP TO 3 FEET ABOVE THE WATERLINE TO 2 FEET BELOW THE WATERLINE. SEE TABLE A.2 IN APPENDIX A FOR DETAILED CRACK LOCATIONS, SIZES, AND QUANTITIES. CONCRETE PILES TYPICALLY EXHIBITED ROUNDED CORNERS (UNRAVELLING) UP TO 3 INCH VERTICAL BY 1 INCH WIDE BY 1/2 INCH PENETRATION AT ISOLATED LOCATIONS.

V. SUBMERGED CONCRETE COLUMNS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO THE BOTTOM OF THE COLUMN.

VI. EXPOSED CONCRETE FOOTINGS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/2 INCH DEEP, FROM THE TOP OF THE FOOTING TO THE CHANNEL BOTTOM. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

VII. EXPOSED CONCRETE SEALS (BENTS 59 TO 84) TYPICALLY EXHIBITED MEDIUM TO SOFT CONCRETE. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 EAST FASCIA	———	CUT–OFF TIMBER PILE	
2021 WEST FASCIA	———	CONCRETE PILE–ENCASEMENT, SQUARE	
2016 EAST FASCIA	– – –	CONCRETE PILE–ENCASEMENT, ROUND	
2016 WEST FASCIA	– – –	STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021 / 2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	7	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	182.5
SCOUR		BATTERED DIRECTION	
FLOODPLAINS			

NOTE:
1. DRAWING NOT TO SCALE AND INTENDED FOR ILLUSTRATIVE PURPOSES ONLY. SHORELINE PROTECTION, DEBRIS, AND ANCILLARY FEATURES SHOWN ARE APPROXIMATE.
2. AS THE INTENTION OF THIS DRAWING IS TO SHOW THE CHANNEL AND ADJACENT BENTS IN ORDER TO MAP THE HISTORICAL MOVEMENT OF THE WATERWAY, THE ENTIRE BRIDGE MAY NOT BE SHOWN DUE TO SPACE CONSTRAINTS. THE ENTIRE CHANNEL, OBSERVED AT THE TIME OF INSPECTION, IS SHOWN

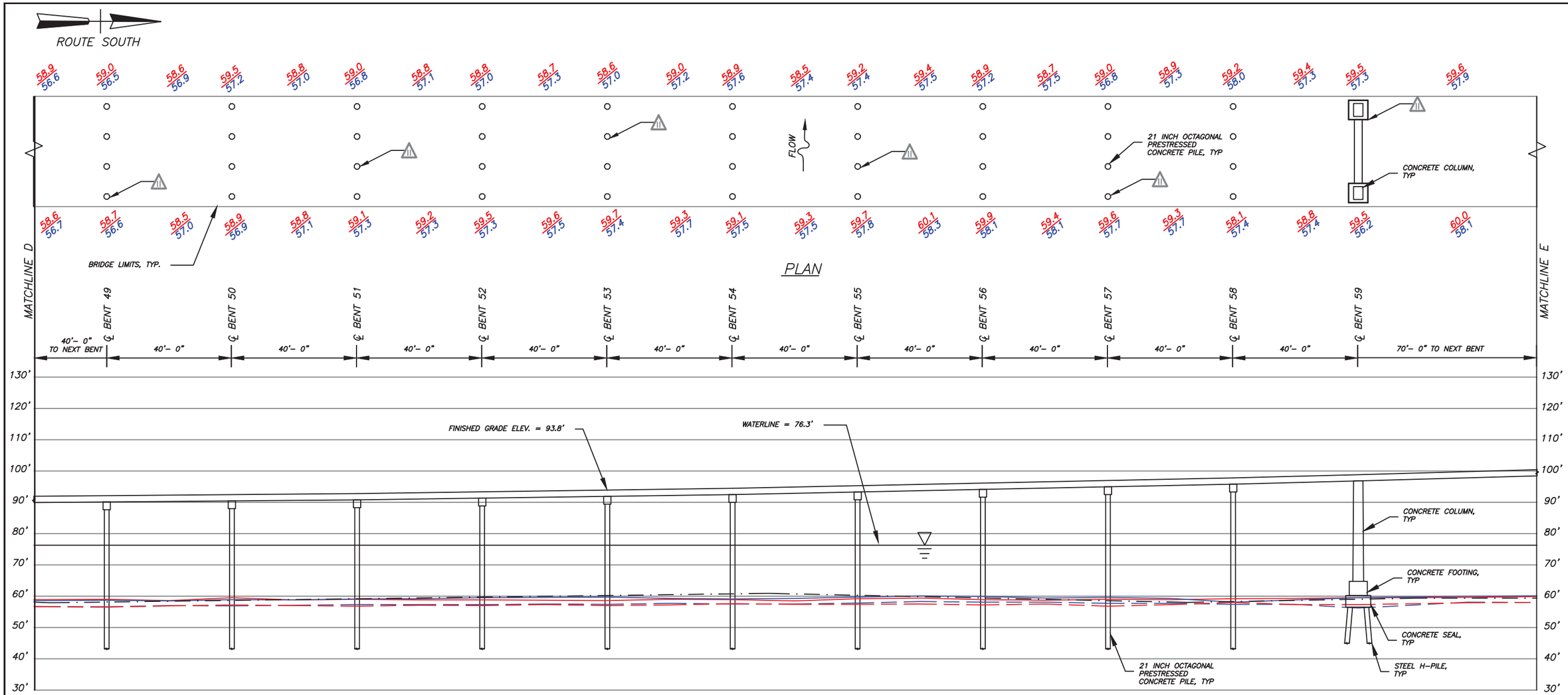
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5258
I–95 SB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 37–48

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 4



INSPECTION NOTES:

*NO SPECIFIC INSPECTION NOTES OBSERVED

GENERAL NOTES:

I. MARINE GROWTH CONSISTED OF UP TO 1/2–INCH–THICK ALGAE COVERING 100 PERCENT OF THE SUBMERGED CONCRETE SURFACES FROM THE CHANNEL BOTTOM TO THE WATERLINE.

II. ALL CHANNEL EMBANKMENTS WERE STABLE AT THE TIME OF THE INSPECTION, WITH ALL CHANNEL EMBANKMENTS (SHORELINES) BEING WELL VEGETATED. NO SIGNIFICANT SIGNS OF CHANNEL MIGRATION WERE EVIDENT. THE EMBANKMENTS AROUND BOTH ABUTMENTS WERE STABLE AT THE TIME OF INSPECTION, WITH ALL THE EMBANKMENTS BEING WELL VEGETATED AND ARMORED WITH 2–FOOT–DIAMETER RIPRAP.

III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH–DIAMETER ROCK, AND SILT WITH UP TO 1–INCH PENETRATION.

IV. SUBMERGED CONCRETE PILES (BENTS 3 TO 58) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO 1 FOOT BELOW THE WATERLINE AND UP TO 3/16 INCH DEEP, FROM 1 FOOT BELOW THE WATERLINE TO THE CHANNEL BOTTOM. VERTICAL CRACKS SIZED UP TO 1/4 INCH WIDE WERE TYPICALLY OBSERVED AT THE WATERLINE RANGING FROM UP TO 3 FEET ABOVE THE WATERLINE TO 2 FEET BELOW THE WATERLINE. SEE TABLE A.2 IN APPENDIX A FOR DETAILED CRACK LOCATIONS, SIZES, AND QUANTITIES. CONCRETE PILES TYPICALLY EXHIBITED ROUNDED CORNERS (UNRAVELLING) UP TO 3 INCH VERTICAL BY 1 INCH WIDE BY 1/2 INCH PENETRATION AT ISOLATED LOCATIONS.

V. SUBMERGED CONCRETE COLUMNS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO THE BOTTOM OF THE COLUMN.

VI. EXPOSED CONCRETE FOOTINGS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/2 INCH DEEP, FROM THE TOP OF THE FOOTING TO THE CHANNEL BOTTOM. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

VII. EXPOSED CONCRETE SEALS (BENTS 59 TO 84) TYPICALLY EXHIBITED MEDIUM TO SOFT CONCRETE. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 EAST FASCIA	——	CUT–OFF TIMBER PILE	
2021 WEST FASCIA	——	CONCRETE PILE–ENCASEMENT, SQUARE	
2016 EAST FASCIA	– – –	CONCRETE PILE–ENCASEMENT, ROUND	
2016 WEST FASCIA	– – –	STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021/2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	(7)	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	● 182.5
SCOUR		BATTERED DIRECTION	←
FLOODPLAINS			

NOTE:
1. DRAWING NOT TO SCALE AND INTENDED FOR ILLUSTRATIVE PURPOSES ONLY. SHORELINE PROTECTION, DEBRIS, AND ANCILLARY FEATURES SHOWN ARE APPROXIMATE.
2. AS THE INTENTION OF THIS DRAWING IS TO SHOW THE CHANNEL AND ADJACENT BENTS IN ORDER TO MAP THE HISTORICAL MOVEMENT OF THE WATERWAY, THE ENTIRE BRIDGE MAY NOT BE SHOWN DUE TO SPACE CONSTRAINTS. THE ENTIRE CHANNEL, OBSERVED AT THE TIME OF INSPECTION, IS SHOWN

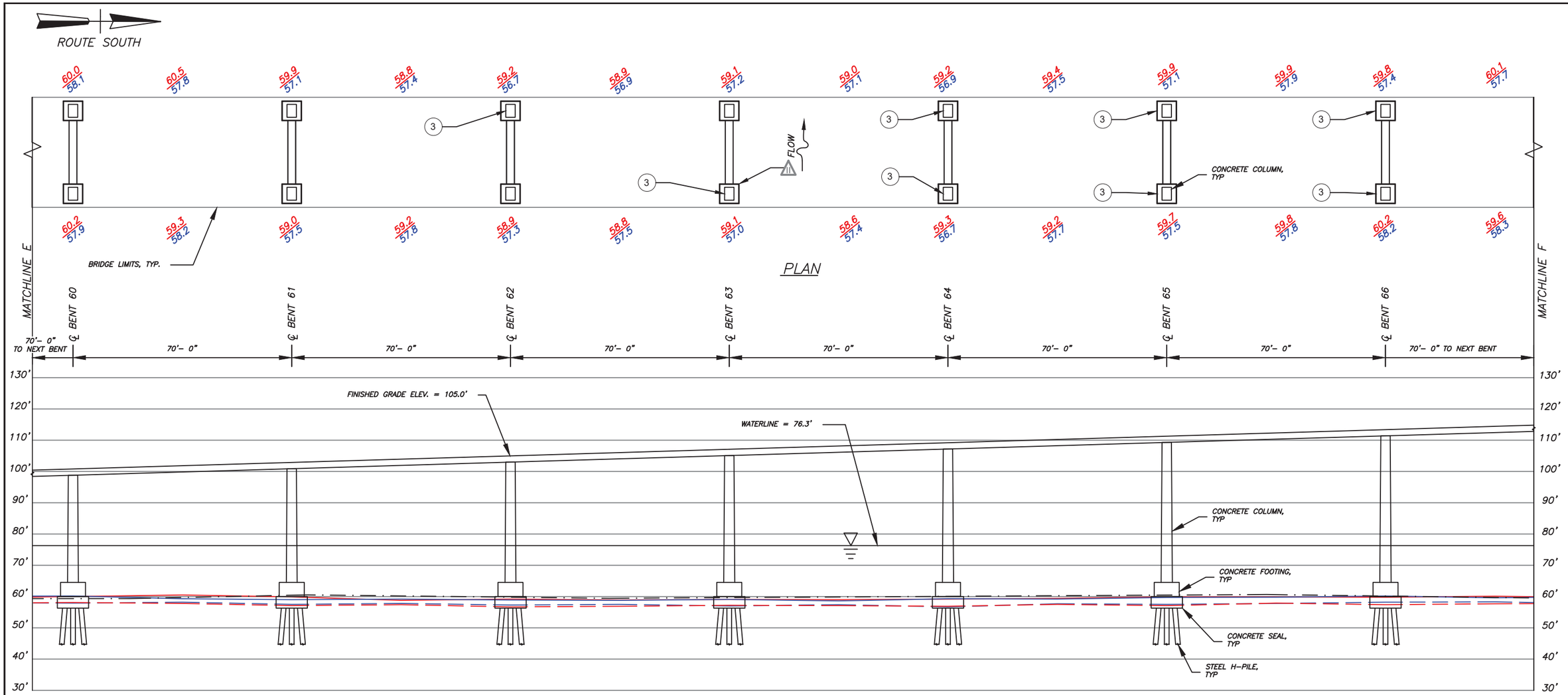
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5258
I–95 SB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 49–59

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 5



ELEVATION

INSPECTION NOTES:

1. CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED VOIDS IN THE FOOTING–TO–SEAL INTERFACE UP TO 3 INCH VERTICAL BY 6 INCH PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR DETAILED LIST OF COLUMN DEFECTS.
2. CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED VOIDS IN THE FOOTING–TO–SEAL INTERFACE UP TO 6 INCH VERTICAL BY 18 INCH PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR DETAILED LIST OF COLUMN DEFECTS.
3. CONCRETE COLUMNS (BENTS 59 TO 84) HAD VARIOUS VOIDS AND SPALLS; SEE TABLE A.4 FOR DETAILED LIST OF COLUMN DEFECTS.

GENERAL NOTES:

I. MARINE GROWTH CONSISTED OF UP TO 1/2–INCH–THICK ALGAE COVERING 100 PERCENT OF THE SUBMERGED CONCRETE SURFACES FROM THE CHANNEL BOTTOM TO THE WATERLINE.

II. ALL CHANNEL EMBANKMENTS WERE STABLE AT THE TIME OF THE INSPECTION, WITH ALL CHANNEL EMBANKMENTS (SHORELINES) BEING WELL VEGETATED. NO SIGNIFICANT SIGNS OF CHANNEL MIGRATION WERE EVIDENT. THE EMBANKMENTS AROUND BOTH ABUTMENTS WERE STABLE AT THE TIME OF INSPECTION, WITH ALL THE EMBANKMENTS BEING WELL VEGETATED AND ARMORED WITH 2–FOOT–DIAMETER RIPRAP.

III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH–DIAMETER ROCK, AND SILT WITH UP TO 1–INCH PENETRATION.

IV. SUBMERGED CONCRETE PILES (BENTS 3 TO 58) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO 1 FOOT BELOW THE WATERLINE AND UP TO 3/16 INCH DEEP, FROM 1 FOOT BELOW THE WATERLINE TO THE CHANNEL BOTTOM. VERTICAL CRACKS SIZED UP TO 1/4 INCH WIDE WERE TYPICALLY OBSERVED AT THE WATERLINE RANGING FROM UP TO 3 FEET ABOVE THE WATERLINE TO 2 FEET BELOW THE WATERLINE. SEE TABLE A.2 IN APPENDIX A FOR DETAILED CRACK LOCATIONS, SIZES, AND QUANTITIES. CONCRETE PILES TYPICALLY EXHIBITED ROUNDED CORNERS (UNRAVELLING) UP TO 3 INCH VERTICAL BY 1 INCH WIDE BY 1/2 INCH PENETRATION AT ISOLATED LOCATIONS.

V. SUBMERGED CONCRETE COLUMNS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO THE BOTTOM OF THE COLUMN.

VI. EXPOSED CONCRETE FOOTINGS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/2 INCH DEEP, FROM THE TOP OF THE FOOTING TO THE CHANNEL BOTTOM. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

VII. EXPOSED CONCRETE SEALS (BENTS 59 TO 84) TYPICALLY EXHIBITED MEDIUM TO SOFT CONCRETE. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 EAST FASCIA	——	CUT–OFF TIMBER PILE	
2021 WEST FASCIA	——	CONCRETE PILE–ENCASEMENT, SQUARE	
2016 EAST FASCIA	– – –	CONCRETE PILE–ENCASEMENT, ROUND	
2016 WEST FASCIA	– – –	STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021 / 2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	7	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	● 182.5
SCOUR		BATTERED DIRECTION	←
FLOODPLAINS			

NOTE:
1. DRAWING NOT TO SCALE AND INTENDED FOR ILLUSTRATIVE PURPOSES ONLY. SHORELINE PROTECTION, DEBRIS, AND ANCILLARY FEATURES SHOWN ARE APPROXIMATE.
2. AS THE INTENTION OF THIS DRAWING IS TO SHOW THE CHANNEL AND ADJACENT BENTS IN ORDER TO MAP THE HISTORICAL MOVEMENT OF THE WATERWAY, THE ENTIRE BRIDGE MAY NOT BE SHOWN DUE TO SPACE CONSTRAINTS. THE ENTIRE CHANNEL, OBSERVED AT THE TIME OF INSPECTION, IS SHOWN

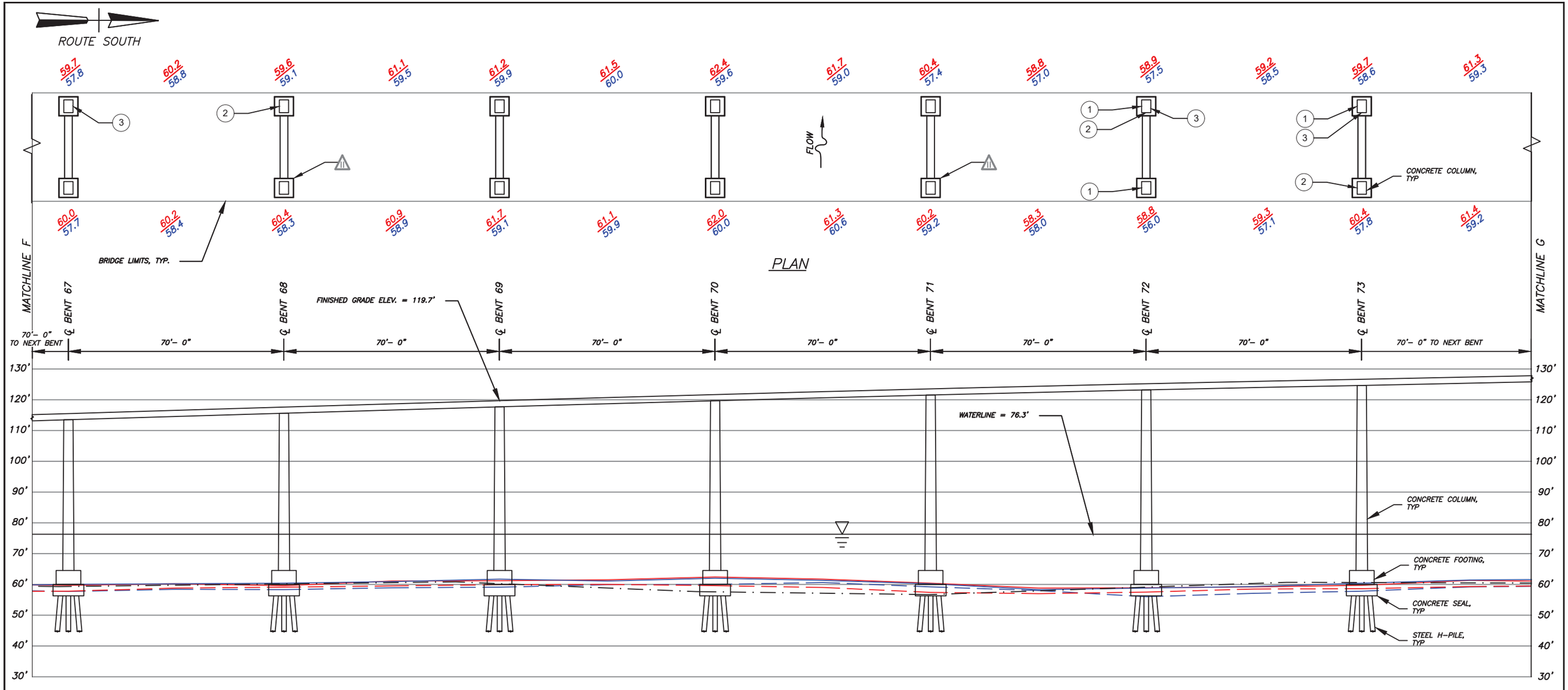
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5258
I–95 SB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 60–66

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 6



ELEVATION

INSPECTION NOTES:

1. CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED VOIDS IN THE FOOTING–TO–SEAL INTERFACE UP TO 3 INCH VERTICAL BY 6 INCH PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR DETAILED LIST OF COLUMN DEFECTS.
2. CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED VOIDS IN THE FOOTING–TO–SEAL INTERFACE UP TO 6 INCH VERTICAL BY 18 INCH PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR DETAILED LIST OF COLUMN DEFECTS.
3. CONCRETE COLUMNS (BENTS 59 TO 84) HAD VARIOUS VOIDS AND SPALLS; SEE TABLE A.4 FOR DETAILED LIST OF COLUMN DEFECTS.

GENERAL NOTES:

I. MARINE GROWTH CONSISTED OF UP TO 1/2–INCH–THICK ALGAE COVERING 100 PERCENT OF THE SUBMERGED CONCRETE SURFACES FROM THE CHANNEL BOTTOM TO THE WATERLINE.
II. ALL CHANNEL EMBANKMENTS WERE STABLE AT THE TIME OF THE INSPECTION, WITH ALL CHANNEL EMBANKMENTS (SHORELINES) BEING WELL VEGETATED. NO SIGNIFICANT SIGNS OF CHANNEL MIGRATION WERE EVIDENT. THE EMBANKMENTS AROUND BOTH ABUTMENTS WERE STABLE AT THE TIME OF INSPECTION, WITH ALL THE EMBANKMENTS BEING WELL VEGETATED AND ARMORED WITH 2–FOOT–DIAMETER RIPRAP.
III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH–DIAMETER ROCK, AND SILT WITH UP TO 1–INCH PENETRATION.
IV. SUBMERGED CONCRETE PILES (BENTS 3 TO 58) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO 1 FOOT BELOW THE WATERLINE AND UP TO 3/16 INCH DEEP, FROM 1 FOOT BELOW THE WATERLINE TO THE CHANNEL BOTTOM. VERTICAL CRACKS SIZED UP TO 1/4 INCH WIDE WERE TYPICALLY OBSERVED AT THE WATERLINE RANGING FROM UP TO 3 FEET ABOVE THE WATERLINE TO 2 FEET BELOW THE WATERLINE. SEE TABLE A.2 IN APPENDIX A FOR DETAILED CRACK LOCATIONS, SIZES, AND QUANTITIES. CONCRETE PILES TYPICALLY EXHIBITED ROUNDED CORNERS (UNRAVELLING) UP TO 3 INCH VERTICAL BY 1 INCH WIDE BY 1/2 INCH PENETRATION AT ISOLATED LOCATIONS.
V. SUBMERGED CONCRETE COLUMNS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO THE BOTTOM OF THE COLUMN.
VI. EXPOSED CONCRETE FOOTINGS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/2 INCH DEEP, FROM THE TOP OF THE FOOTING TO THE CHANNEL BOTTOM. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.
VII. EXPOSED CONCRETE SEALS (BENTS 59 TO 84) TYPICALLY EXHIBITED MEDIUM TO SOFT CONCRETE. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 EAST FASCIA	——	CUT–OFF TIMBER PILE	
2021 WEST FASCIA	——	CONCRETE PILE–ENCASEMENT, SQUARE	
2016 EAST FASCIA	– –	CONCRETE PILE–ENCASEMENT, ROUND	
2016 WEST FASCIA	– –	STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021 / 2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	7	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	182.5
SCOUR		BATTERED DIRECTION	
FLOODPLAINS			

NOTE:
1. DRAWING NOT TO SCALE AND INTENDED FOR ILLUSTRATIVE PURPOSES ONLY. SHORELINE PROTECTION, DEBRIS, AND ANCILLARY FEATURES SHOWN ARE APPROXIMATE.
2. AS THE INTENTION OF THIS DRAWING IS TO SHOW THE CHANNEL AND ADJACENT BENTS IN ORDER TO MAP THE HISTORICAL MOVEMENT OF THE WATERWAY, THE ENTIRE BRIDGE MAY NOT BE SHOWN DUE TO SPACE CONSTRAINTS. THE ENTIRE CHANNEL, OBSERVED AT THE TIME OF INSPECTION, IS SHOWN

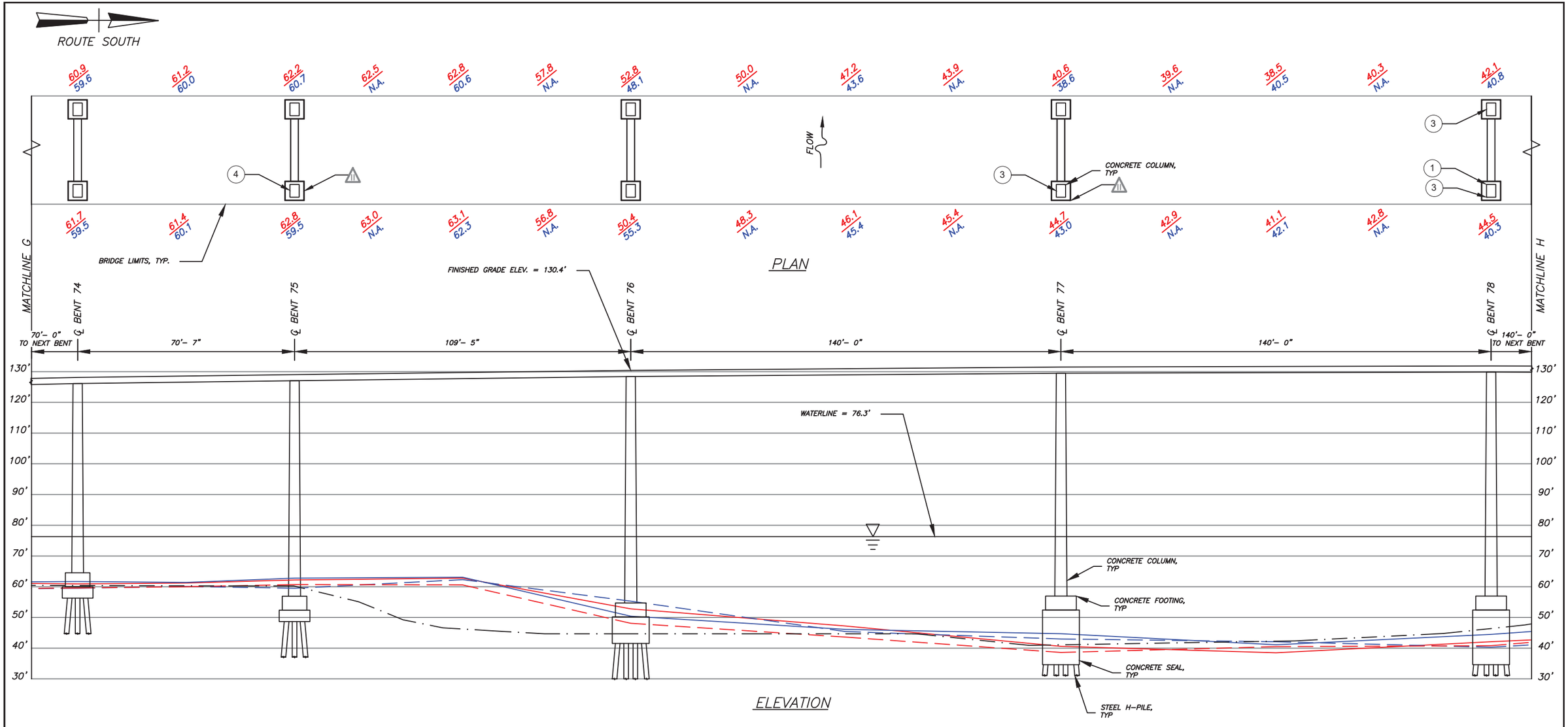
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5258
I–95 SB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 67–73

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 7



INSPECTION NOTES:

1. CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED VOIDS IN THE FOOTING–TO–SEAL INTERFACE UP TO 3 INCH VERTICAL BY 6 INCH PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR DETAILED LIST OF COLUMN DEFECTS.
2. CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED VOIDS IN THE FOOTING–TO–SEAL INTERFACE UP TO 6 INCH VERTICAL BY 18 INCH PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR DETAILED LIST OF COLUMN DEFECTS.
3. CONCRETE COLUMNS (BENTS 59 TO 84) HAD VARIOUS VOIDS AND SPALLS; SEE TABLE A.4 FOR DETAILED LIST OF COLUMN DEFECTS.
4. BENT 75, COLUMN 2: THE CONCRETE FOOTING IS NOT CENTERED AND WAS OBSERVED TO BE CLOSER TO THE SOUTH EDGE OF THE SEAL.

GENERAL NOTES:

I. MARINE GROWTH CONSISTED OF UP TO 1/2–INCH–THICK ALGAE COVERING 100 PERCENT OF THE SUBMERGED CONCRETE SURFACES FROM THE CHANNEL BOTTOM TO THE WATERLINE.

II. ALL CHANNEL EMBANKMENTS WERE STABLE AT THE TIME OF THE INSPECTION, WITH ALL CHANNEL EMBANKMENTS (SHORELINES) BEING WELL VEGETATED. NO SIGNIFICANT SIGNS OF CHANNEL MIGRATION WERE EVIDENT. THE EMBANKMENTS AROUND BOTH ABUTMENTS WERE STABLE AT THE TIME OF INSPECTION, WITH ALL THE EMBANKMENTS BEING WELL VEGETATED AND ARMORED WITH 2–FOOT–DIAMETER RIPRAP.

III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH–DIAMETER ROCK, AND SILT WITH UP TO 1–INCH PENETRATION.

IV. SUBMERGED CONCRETE PILES (BENTS 3 TO 58) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO 1 FOOT BELOW THE WATERLINE AND UP TO 3/16 INCH DEEP, FROM 1 FOOT BELOW THE WATERLINE TO THE CHANNEL BOTTOM. VERTICAL CRACKS SIZED UP TO 1/4 INCH WIDE WERE TYPICALLY OBSERVED AT THE WATERLINE RANGING FROM UP TO 3 FEET ABOVE THE WATERLINE TO 2 FEET BELOW THE WATERLINE. SEE TABLE A.2 IN APPENDIX A FOR DETAILED CRACK LOCATIONS, SIZES, AND QUANTITIES. CONCRETE PILES TYPICALLY EXHIBITED ROUNDED CORNERS (UNRAVELLING) UP TO 3 INCH VERTICAL BY 1 INCH WIDE BY 1/2 INCH PENETRATION AT ISOLATED LOCATIONS.

V. SUBMERGED CONCRETE COLUMNS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO THE BOTTOM OF THE COLUMN.

VI. EXPOSED CONCRETE FOOTINGS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/2 INCH DEEP, FROM THE TOP OF THE FOOTING TO THE CHANNEL BOTTOM. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

VII. EXPOSED CONCRETE SEALS (BENTS 59 TO 84) TYPICALLY EXHIBITED MEDIUM TO SOFT CONCRETE. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 EAST FASCIA	——	CUT–OFF TIMBER PILE	
2021 WEST FASCIA	——	CONCRETE PILE–ENCASEMENT, SQUARE	
2016 EAST FASCIA	– –	CONCRETE PILE–ENCASEMENT, ROUND	
2016 WEST FASCIA	– –	STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021 / 2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	7	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	● 182.5
SCOUR		BATTERED DIRECTION	←
FLOODPLAINS			

NOTE:
1. DRAWING NOT TO SCALE AND INTENDED FOR ILLUSTRATIVE PURPOSES ONLY. SHORELINE PROTECTION, DEBRIS, AND ANCILLARY FEATURES SHOWN ARE APPROXIMATE.
2. AS THE INTENTION OF THIS DRAWING IS TO SHOW THE CHANNEL AND ADJACENT BENTS IN ORDER TO MAP THE HISTORICAL MOVEMENT OF THE WATERWAY, THE ENTIRE BRIDGE MAY NOT BE SHOWN DUE TO SPACE CONSTRAINTS. THE ENTIRE CHANNEL, OBSERVED AT THE TIME OF INSPECTION, IS SHOWN

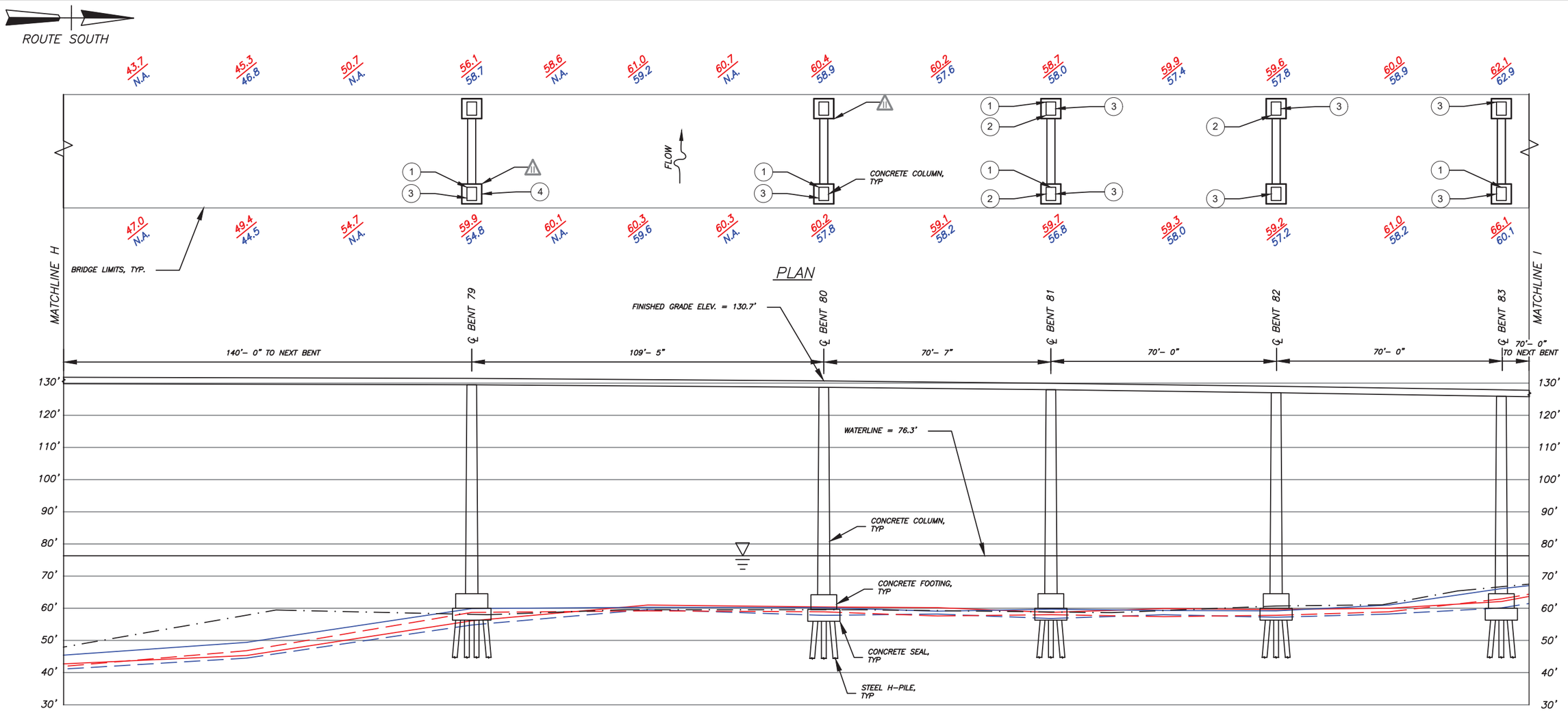
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5258
I–95 SB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 74–78

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 8



ELEVATION

INSPECTION NOTES:

1. CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED VOIDS IN THE FOOTING–TO–SEAL INTERFACE UP TO 3 INCH VERTICAL BY 6 INCH PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR DETAILED LIST OF COLUMN DEFECTS.
2. CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED VOIDS IN THE FOOTING–TO–SEAL INTERFACE UP TO 6 INCH VERTICAL BY 18 INCH PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR DETAILED LIST OF COLUMN DEFECTS.
3. CONCRETE COLUMNS (BENTS 59 TO 84) HAD VARIOUS VOIDS AND SPALLS; SEE TABLE A.4 FOR DETAILED LIST OF COLUMN DEFECTS.
4. EXPOSED STEEL H–PILE OBSERVED AT COLUMN 79–2 AT THE NORTH FACE UNDER SEAL WITH APPROXIMATELY 0.5 FEET OF EXPOSURE. WHEN CURRENT SOUNDING ELEVATIONS ARE COMPARED TO ORIGINAL HISTORIC ELEVATIONS, NO SIGNIFICANT GENERAL AND ONLY MINOR LOCAL SCOUR WAS OBSERVED. EXPOSURE OF BEARING PILE AT 79–2 SHOULD BE MONITORED DURING FUTURE INSPECTIONS; HOWEVER, BASED ON THE PREVIOUS 2016 INSPECTION, THE UNDERMINING HAS NOT CHANGED APPRECIABLY. THE EXPOSED H–PILE WAS NOT ACCESSIBLE FOR DETAILED INSPECTION OF THICKNESS MEASUREMENTS.

GENERAL NOTES:

I. MARINE GROWTH CONSISTED OF UP TO 1/2–INCH–THICK ALGAE COVERING 100 PERCENT OF THE SUBMERGED CONCRETE SURFACES FROM THE CHANNEL BOTTOM TO THE WATERLINE.

II. ALL CHANNEL EMBANKMENTS WERE STABLE AT THE TIME OF THE INSPECTION, WITH ALL CHANNEL EMBANKMENTS (SHORELINES) BEING WELL VEGETATED. NO SIGNIFICANT SIGNS OF CHANNEL MIGRATION WERE EVIDENT. THE EMBANKMENTS AROUND BOTH ABUTMENTS WERE STABLE AT THE TIME OF INSPECTION, WITH ALL THE EMBANKMENTS BEING WELL VEGETATED AND ARMORED WITH 2–FOOT–DIAMETER RIPRAP.

III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH–DIAMETER ROCK, AND SILT WITH UP TO 1–INCH PENETRATION.

IV. SUBMERGED CONCRETE PILES (BENTS 3 TO 58) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO 1 FOOT BELOW THE WATERLINE AND UP TO 3/16 INCH DEEP, FROM 1 FOOT BELOW THE WATERLINE TO THE CHANNEL BOTTOM. VERTICAL CRACKS SIZED UP TO 1/4 INCH WIDE WERE TYPICALLY OBSERVED AT THE WATERLINE RANGING FROM UP TO 3 FEET ABOVE THE WATERLINE TO 2 FEET BELOW THE WATERLINE. SEE TABLE A.2 IN APPENDIX A FOR DETAILED CRACK LOCATIONS, SIZES, AND QUANTITIES. CONCRETE PILES TYPICALLY EXHIBITED ROUNDED CORNERS (UNRAVELLING) UP TO 3 INCH VERTICAL BY 1 INCH WIDE BY 1/2 INCH PENETRATION AT ISOLATED LOCATIONS.

V. SUBMERGED CONCRETE COLUMNS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO THE BOTTOM OF THE COLUMN.

VI. EXPOSED CONCRETE FOOTINGS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/2 INCH DEEP, FROM THE TOP OF THE FOOTING TO THE CHANNEL BOTTOM. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

VII. EXPOSED CONCRETE SEALS (BENTS 59 TO 84) TYPICALLY EXHIBITED MEDIUM TO SOFT CONCRETE. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 EAST FASCIA	——	CUT–OFF TIMBER PILE	
2021 WEST FASCIA	——	CONCRETE PILE–ENCASEMENT, SQUARE	
2016 EAST FASCIA	– – –	CONCRETE PILE–ENCASEMENT, ROUND	
2016 WEST FASCIA	– – –	STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021 / 2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	(7)	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	• 182.5
SCOUR		BATTERED DIRECTION	←
FLOODPLAINS			

NOTE:
1. DRAWING NOT TO SCALE AND INTENDED FOR ILLUSTRATIVE PURPOSES ONLY. SHORELINE PROTECTION, DEBRIS, AND ANCILLARY FEATURES SHOWN ARE APPROXIMATE.
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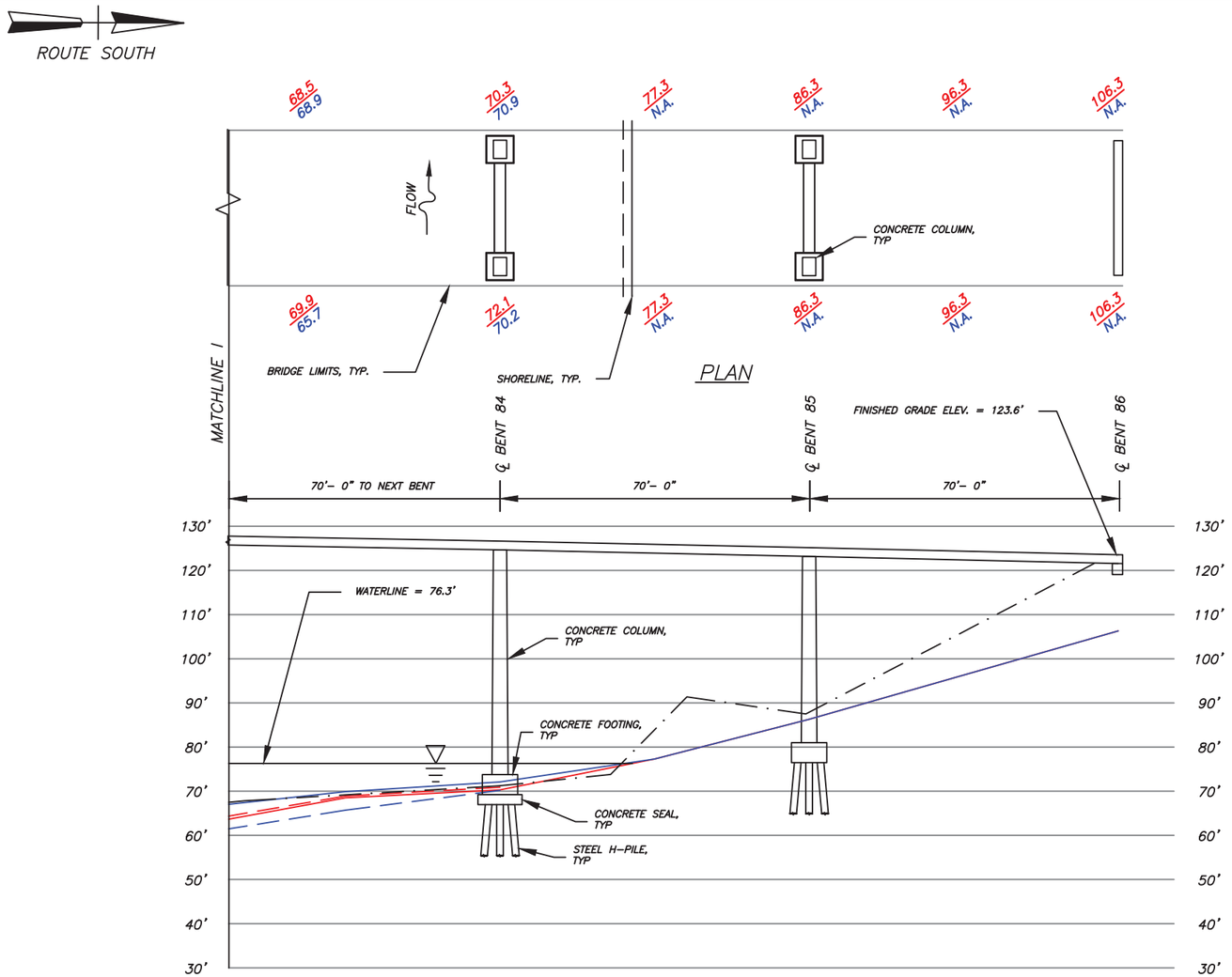
SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5258
I–95 SB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 79–83

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 9



INSPECTION NOTES:

1. CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED VOIDS IN THE FOOTING–TO–SEAL INTERFACE UP TO 3 INCH VERTICAL BY 6 INCH PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR DETAILED LIST OF COLUMN DEFECTS.
2. CONCRETE COLUMNS (BENTS 59 TO 84) EXHIBITED VOIDS IN THE FOOTING–TO–SEAL INTERFACE UP TO 6 INCH VERTICAL BY 18 INCH PENETRATION AT VARIOUS LOCATIONS; SEE TABLE A.4 IN APPENDIX A FOR DETAILED LIST OF COLUMN DEFECTS.
3. CONCRETE COLUMNS (BENTS 59 TO 84) HAD VARIOUS VOIDS AND SPALLS; SEE TABLE A.4 FOR DETAILED LIST OF COLUMN DEFECTS.

GENERAL NOTES:

I. MARINE GROWTH CONSISTED OF UP TO 1/2–INCH–THICK ALGAE COVERING 100 PERCENT OF THE SUBMERGED CONCRETE SURFACES FROM THE CHANNEL BOTTOM TO THE WATERLINE.

II. ALL CHANNEL EMBANKMENTS WERE STABLE AT THE TIME OF THE INSPECTION, WITH ALL CHANNEL EMBANKMENTS (SHORELINES) BEING WELL VEGETATED. NO SIGNIFICANT SIGNS OF CHANNEL MIGRATION WERE EVIDENT. THE EMBANKMENTS AROUND BOTH ABUTMENTS WERE STABLE AT THE TIME OF INSPECTION, WITH ALL THE EMBANKMENTS BEING WELL VEGETATED AND ARMORED WITH 2–FOOT–DIAMETER RIPRAP.

III. THE CHANNEL BOTTOM PREDOMINANTLY CONSISTED OF MUSSELS, 2–TO–3–INCH–DIAMETER ROCK, AND SILT WITH UP TO 1–INCH PENETRATION.

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V. SUBMERGED CONCRETE COLUMNS (BENTS 59 TO 84) TYPICALLY EXHIBITED ABRASION UP TO 1/4 INCH DEEP, FROM THE HIGH–WATER MARK TO THE BOTTOM OF THE COLUMN.

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VII. EXPOSED CONCRETE SEALS (BENTS 59 TO 84) TYPICALLY EXHIBITED MEDIUM TO SOFT CONCRETE. SEE TABLE A.3 FOR FOOTING AND SEAL EXPOSURE AND THEIR LOCATIONS.

LEGEND

ORIGINAL CHANNEL	—·—	LEVEL II INSPECTION	
2021 EAST FASCIA	——	CUT–OFF TIMBER PILE	
2021 WEST FASCIA	——	CONCRETE PILE–ENCASEMENT, SQUARE	
2016 EAST FASCIA	– – –	CONCRETE PILE–ENCASEMENT, ROUND	
2016 WEST FASCIA	– – –	STEEL H–PILE	
CHANNEL BOTTOM ELEVATION	2021 / 2016	SQUARE CONCRETE PILE/COLUMN	
ACCUMULATED DEBRIS		ROUND CONCRETE PILE/COLUMN	
INSPECTION NOTE	7	TIMBER PILE	
SHORELINE PROTECTION		ADDITIONAL SOUNDING	182.5
SCOUR		BATTERED DIRECTION	
FLOODPLAINS			

NOTE:
1. DRAWING NOT TO SCALE AND INTENDED FOR ILLUSTRATIVE PURPOSES ONLY. SHORELINE PROTECTION, DEBRIS, AND ANCILLARY FEATURES SHOWN ARE APPROXIMATE.
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SCDOT South Carolina Department of Transportation

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

ASSET ID 5258
I–95 SB OVER LAKE MARION
CLARENDON COUNTY

PLAN AND ELEVATION BENTS 84–86

Drawn By: TAH	COLLINS ENGINEERS, INC. 5955 CORE ROAD, STE. 522 NORTH CHARLESTON, S.C. 29406 (843)884–2027	Date: 02/25/2021
Checked By: BMR		Scale: NTS
		Figure No.: 10

SCDOT BRIDGE INSPECTION FORM

(008) BRIDGE ID:	1410009510200	(005) ROUTE:	CLARENDON I-95
(420) ASSET NO:	5250	(006) CROSSING:	LAKE MARION RELIEF
(419) RAMP NO:		(009) LOCATION:	7MI S OF SUMMERTON
(026) FUNCTIONAL CLASS:	1	(016) LAT: 33d 31m 5.28s	(017) LON: 80d 26m 8s

GENERAL BRIDGE DATA

	EXISTING	REVISED		EXISTING	REVISED
(027) Year Built	1968		(042) Type Serv; On(A) Und(B)	1 5	
(106) Year Recon	0		(028) Lanes; On(A) Und(B)	2 0	
(031) Design Load	5		(107) Deck Struct	1	
(36A) Railings	0		(108) Wear Surf/Membrane/Prot	1 8 8	
(36B) Transitions	1			MAT-SUP-SUB	MAT-SUP-SUB
(36C) Appr Guard	1		(043) Main Original (A)	1 4 5	
(36D) Appr Guard End	1		Main Reconst (B)		
(037) History	5		(044) Appr Orginal (A)	0 00 0	
(319) Last Paint Date			Appr Reconst (B)		

GEOMETRIC DATA

	EXISTING	REVISED		EXISTING		REVISED	
				FT	IN	FT	IN
(032) Appr Rdway	38						
(033) Bridge Median	0		(053) Vert Clr Above Deck	99	99		
(034) Skew	0		(54A) Vert Clear Ref	N			
(035) Flared	0		(54B) Vert Clear Right	0	0	0	0
(045) # Main Spans	9		(54C) Vert Clear Left	0	0	0	0
(046) # Appr Spans	0		(10A) Great Min Clr Over/Und	99	99		
(048) Max Span Lgth	40		(10B) Great Min Right	99	99		
(308) Appr Span Lgth	0		(10C) Great Min Left	99	99		
(049) Struct Length	360						
(47A) Horz Clear Right	31		(55A) Lat Clear Ref	N			
(47B) Horz Clear Left	0		(55B) Lat Clear Right	0			
(47UA) Horz Clear Right	0	0	(056) Lat Clear Left	0			
(47UB) Horz Clear Left	0	0					
(50B) Sidewalk Right	0		(038) Navigation Cont	0			
(50A) Sidewalk Left	0		(039) Nav Vert Clear	0			
(051) Curb to Curb	31		(040) Nav Horz Clear	0			
(052) Deck Out-Out	35		(111) Nav Pier Port				

RATINGS DATA

	EXISTING	REVISED		EXISTING	REVISED
(58) Deck	6		(041) Traffic Status	A	
(59) Super Str	6		(063) Rating Method	8	8
(60) Sub Str	6		(064) Operating Method	1.86	1.86
(061) Channel	7		(065) Rating Method	7	8
(062) Culv Ret	N		(066) Inventory Rating	1.43	1.43
(071) Water Adeq	6		(411) Date Rated	10/2021	10/2021
(072) Appr Rdway	8		(418) Conditions During Rating	5 7 7	5 7 7
(113) Scour Critical	5			Freq Mth/Year	Freq Mth/Year
(067) Structure	7		(091, 090) Routine Insp	24 10/2021	24 10/2021
(068) Deck Geom	4		(92A, 93A) Fracture Critical	N	N
(069) Underclear	N		(92B, 93B) Underwater Insp	Y60 02/2021	Y60 02/2021
(070) Bridge Post	5		(92C, 93C) Special Insp	N	N

Inspection Leader:	CHARLES LAFFERTY, MBI	Reviewed By:	
Date:		Date:	

Bridge Element Group Textual Data

Bridge ID: 14-1-00095-1-02-00

01 Mar 2022

Abutments and/or Headwalls:

- End Bent 1 backwall in Bay 1, spall [20" x 12" x 3" Deep] (photo 1).
- Along End Bent 1 backwall, vertical cracking [FH x 0.02"] with efflorescence.
- End Bent 1 cap, through cracking [FH x FW x 0.03"]. (unable to verify at the time of this inspection)
- End Bent 10 cap under Bay 4, [2] spalls [8" x 6" x 1" Deep] with exposed rusted rebar [no section loss] (photos 2 and 3).

Bents and/or Piers:

Bents 2 thru 4 and 7 thru 9 [4] PS piles and Bents 5 and 6 [6] PS piles with RC cap.

- Along all piles of interior bents at waterline, scaling [4' High x up to 1/4" Deep].
- Bent 2 Pile 3 at waterline, vertical cracking [up to 3' x 0.05" W].
- Bent 3 Pile 3 at waterline, vertical cracking [up to 3' x 0.05" W].
- Bent 4 Piles 2 to 4 at waterline, vertical cracking [up to 3' x 0.05" W] (photo 4).
- Bent 5 Piles 1 and 3 at waterline, vertical cracking [up to 3' x 0.05" W].
- Bent 6 Piles 1, 2, 3, and 5 at waterline, vertical cracking [up to 3' x 0.05" W].
- Bent 7 Piles 1, 3, and 4 at waterline, vertical cracking [up to 3' x 0.05" W].
- Bent 8 Pile 2, spall [30" High x 18" x 2" Deep] (photo 5).
- Bent 8 Pile 4, spall [26" H x 12" W x 1-1/2" Deep] (photo 6).
- Bent 9 Piles 1, 3, and 4 at groundline, vertical cracking [30" x 0.04" W] (photo 7).

Bearings:

Felt pads.

- No defects noted at the time of this inspection.

Girders/Floor Beams/Stringers and/or Beams:

[5] RC T-beams per span with RC diaphragms.

- Throughout all end diaphragms, multiple spalls [up to 12" Diameter x 1" Deep] and vertical cracks [up to FH x 0.02"] some with efflorescence and exposed rusted rebar [no section loss].
- Spans 1 and 9 all beams near midspan, vertical cracking [FH x HL].
- Span 1 underside of Beams 1, 2, and 3, spalling [up to 8" x 1" x 1/2" Deep] (photo 8).
- Span 2 underside of Beams 2, 3, and 5, spalling [up to 8" x 1" x 1/2" Deep] with exposed rusted rebar [no section loss] (photo 9).
- Span 3 Beam 1 over Bent 4, spall with exposed rebar (3').
- Span 5 underside of Beams 1, 3, 4, and 5, spalling [up to 8" x 2" x 1/2"] with exposed rusted rebar [13' x 13' with no section loss].
- Span 6 underside of Beams 1 and 5, spalling [8" x 3" x 1/2"] with exposed rusted rebar [no section loss].
- Span 8 Beam 1 over Bent 9, spall [3" Diameter x 1" Deep] with exposed rusted rebar [no section loss]. (unable to verify at the time of this inspection)
- Span 8 underside of Beams 1, 2, 3, and 5 at Bent 9, spalling [8" x 2" x 1/2"] with exposed rusted rebar [no section loss] (photo 10).
- Span 9 Beam 1 over Bent 9, spall [9" x 3" x 1" Deep] with exposed rusted rebar [10% section loss] (photo 11).

Truss Members:

N/A

Expansion Joints:

Pourable silicone.

- Along all joints, seals missing or loss of adhesion [up to 7' per joint] (photo 12).
- Along joint over Bent 1, edge spalling [up to 6" x 3" Deep] (photo 13).
- Along joints over Bents 3 and 4, torn joint material [up to 4' per joint] (photo 14).

Decks and/or Slabs:

6.5" RC deck, [9] spans at 40'.

- Throughout deck surface, moderate abrasion.
- Throughout deck surface in travel lanes, hairline map cracking.
- Deck surface along both sides of joints over Bents 2 through 8, transverse cracking [FW x 0.04" W] (photo 15).
- Deck surface in Spans 3 and 4, exposed shallow rebar (16') (photo 16).
- All spans along bridge rails, debris accumulation [FL x 24" x 6" Deep] (photos 17 and 18).
- Throughout deck underside in all spans, exposed rusted rebar chairs [200SF per span].

Curbs:

RC curbs on both sides.

- No defects noted at the time of this inspection.

Bridge Railing/Parapets and/or Median Barriers:

RC rails and posts with steel thriebeam.

- Along both bridge rails, minor impact damage [up to 28'].
- All spans along outer face of both concrete bridge rails at random locations, spalling [up to 4" Diameter] with exposed rusted rebar [no section loss].

Paint Systems:

N/A

Waterway and Scour:

- Rip rap in place at waterline.

*Underwater Inspection Performed 02/23/2021, See Underwater Bridge Inspection Report.

Fender System:

N/A

Roadway Alignment:

Straight no reduction of speed required.

Traffic Signs:

[2] Delineators in place on approach end.

Encroachments:

N/A

Miscellaneous Notes:

- Throughout South approach adjacent to joint over End Bent 1, [4] spalls [up to 36" x 6" x 4"] (photo 19).

BRIDGE ORIENTATION: Labeling diagram orientation is the same direction as the historic orientation of the bridge, South to North.

Asset ID plaque is not provided at this bridge.
Bridge ID plaque is located on exterior of East curb at South end.

Bridge inspected on October 21, 2021. Weather: Partly cloudy, 72°F.
BITL: Todd Powell, Volkert, Inc. for Collins Engineers, Inc.
Assistant: Tim Earp

*Underwater Inspection Performed 02/23/2021, See Underwater Bridge Inspection Report; Weather: 55°F, Sunny

MBI corrected load rating data on 3/1/2022. No inspection performed.

Bridge Element Level Data

01 Mar 2022

					Quantity in Each Condition State				
Element No	Element Name/Description	Units	Env	Defect	1	2	3	4	Total Qty
110	Reinforced Concrete Open Girder/Beam	feet	4	Yes					
110	Delamination/Spall/Patched Area	feet	4	1080	0	0	6	0	6
110	Exposed Rebar	feet	4	1090	0	35	0	0	35
110	Cracking (RC and Other)	feet	4	1130	10	3	0	0	13
110	Reinforced Concrete Open Girder/Beam	feet	4	Yes	1746	38	6	0	1790
12	Reinforced Concrete Deck	sq feet	4	Yes					
12	Delamination/Spall/Patched Area	sq feet	4	1080	0	52	0	0	52
12	Exposed Rebar	sq feet	4	1090	0	16	0	0	16
12	Cracking (RC and Other)	sq feet	4	1130	0	360	0	0	360
12	Abrasion/Wear (PSC/RC)	sq feet	4	1190	0	10080	0	0	10080
12	Reinforced Concrete Deck	sq feet	4	Yes	2092	10508	0	0	12600
226	Prestressed Concrete Pile	each	4	Yes					
226	Delamination/Spall/Patched Area	each	4	1080	0	0	2	0	2
226	Cracking (PSC)	each	4	1110	0	3	13	0	16
226	Abrasion/Wear (PSC/RC)	each	4	1190	0	22	0	0	22
226	Prestressed Concrete Pile	each	4	Yes	0	25	15	0	40
234	Reinforced Concrete Pier Cap	feet	4	Yes					
234	Delamination/Spall/Patched Area	feet	4	1080	0	0	1	0	1
234	Reinforced Concrete Pier Cap	feet	4	Yes	349	0	1	0	350
301	Pourable Joint Seal	feet	3	Yes					
301	Seal Adhesion	feet	3	2320	0	0	50	0	50
301	Seal Damage	feet	3	2330	0	0	8	0	8
301	Pourable Joint Seal	feet	3	Yes	292	0	58	0	350
331	Reinforced Concrete Bridge Railing	feet	2	Yes					
331	Delamination/Spall/Patched Area	feet	2	1080	0	50	0	0	50
331	Damage	feet	2	7000	0	28	0	0	28
331	Reinforced Concrete Bridge Railing	feet	2	Yes	642	78	0	0	720

Inventory Photographs

Asset ID Number:	5250	Bridge Inspection Date:	10/21/2021

Asset ID Not Provided

1 Asset ID (Not Provided)

2 Bridge ID (Exterior East Curb South End)

3 South Approach Looking North

4 South Approach Looking South

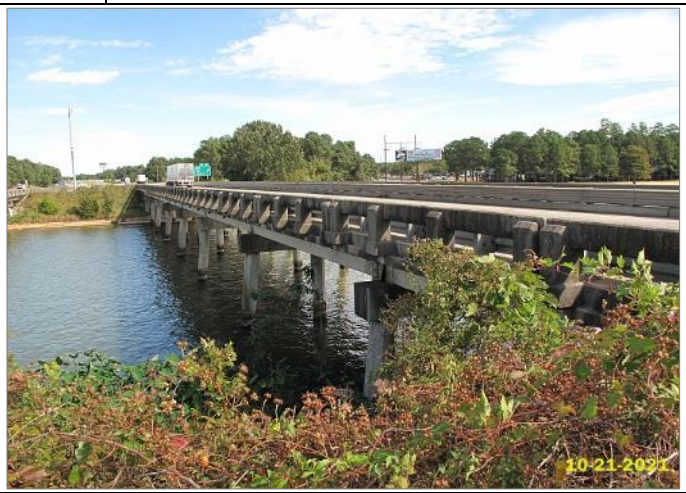
5 North Approach Looking South

6 North Approach Looking North

Consultant: For Repair Rec.? ☐

Inventory Photographs

Asset ID Number:	5250	Bridge Inspection Date:	10/21/2021



7 West Profile Looking East

8 East Profile Looking West

9 Upstream Looking West

10 Downstream Looking East

11 Typical Bridge Rail (West Bridge Rail Shown)

12 Top of Deck (Span 9 Shown)

Consultant: For Repair Rec.? ☐

Inventory Photographs

Asset ID Number:	5250	Bridge Inspection Date:	10/21/2021

13	Typical Superstructure Framing/Underside (Span 2 Shown)

14	Typical Interior Bent (Bent 2 Shown)

15	Typical End Bent and Slope Protection (End Bent 1 Shown)

Consultant: For Repair Rec.? ☐

SCDOT BRIDGE INSPECTION FORM

(008) BRIDGE ID:	1410009530200	(005) ROUTE:	CLARENDON I-95
(420) ASSET NO:	5259	(006) CROSSING:	LAKE MARION RELIEF
(419) RAMP NO:		(009) LOCATION:	7MI S OF SUMMERTON
(026) FUNCTIONAL CLASS:	1	(016) LAT:	33d 31m 5.97s (017) LON: 80d 26m 8.80s

GENERAL BRIDGE DATA

	EXISTING	REVISED		EXISTING	REVISED
(027) Year Built	1968		(042) Type Serv; On(A) Und(B)	1 5	
(106) Year Recon	0		(028) Lanes; On(A) Und(B)	2 0	
(031) Design Load	5		(107) Deck Struct	1	
(36A) Railings	0	1	(108) Wear Surf/Membrane/Prot	1 8 8	
(36B) Transitions	1	1		MAT-SUP-SUB	MAT-SUP-SUB
(36C) Appr Guard	1	1	(043) Main Original (A)	1 4 5	
(36D) Appr Guard End	1	1	Main Reconst (B)		
(037) History	5		(044) Appr Orginal (A)	0 00 0	
(319) Last Paint Date			Appr Reconst (B)		

GEOMETRIC DATA

	EXISTING	REVISED		EXISTING		REVISED	
				FT	IN	FT	IN
(032) Appr Rdway	38						
(033) Bridge Median	0		(053) Vert Clr Above Deck	99	99		
(034) Skew	0		(54A) Vert Clear Ref	N			
(035) Flared	0		(54B) Vert Clear Right	0	0	0	0
(045) # Main Spans	9		(54C) Vert Clear Left	0	0	0	0
(046) # Appr Spans	0		(10A) Great Min Clr Over/Und	99	99		
(048) Max Span Lgth	40		(10B) Great Min Right	99	99		
(308) Appr Span Lgth	0		(10C) Great Min Left	99	99		
(049) Struct Length	360						
(47A) Horz Clear Right	31		(55A) Lat Clear Ref	N			
(47B) Horz Clear Left	0		(55B) Lat Clear Right	0			
(47UA) Horz Clear Right	0	0	(056) Lat Clear Left	0			
(47UB) Horz Clear Left	0	0					
(50B) Sidewalk Right	0		(038) Navigation Cont	0			
(50A) Sidewalk Left	0		(039) Nav Vert Clear	0			
(051) Curb to Curb	31		(040) Nav Horz Clear	0			
(052) Deck Out-Out	35		(111) Nav Pier Port				

RATINGS DATA

	EXISTING	REVISED		EXISTING	REVISED
(58) Deck	6	6	(041) Traffic Status	A	
(59) Super Str	7	6	(063) Rating Method	8	8
(60) Sub Str	7	6	(064) Operating Method	1.38	1.86
(061) Channel	7	7	(065) Rating Method	8	8
(062) Culv Ret	N		(066) Inventory Rating	1.06	1.43
(071) Water Adeq	8	8	(411) Date Rated	05/2021	10/2021
(072) Appr Rdway	8	8	(418) Conditions During Rating	6 7 7	
(113) Scour Critical	5			Freq Mth/Year	Freq Mth/Year
(067) Structure	7		(091, 090) Routine Insp	24 10/2020	24 10/2021
(068) Deck Geom	4		(92A, 93A) Fracture Critical	N	
(069) Underclear	N		(92B, 93B) Underwater Insp	Y60 02/2021	
(070) Bridge Post	5		(92C, 93C) Special Insp	N	

Inspection Leader:	TODD POWELL, VOLKERT	Reviewed By:	AARON IMMEL, VOLKERT
Date:		Date:	12/28/2021

Bridge Element Group Textual Data

Bridge ID: 14-1-00095-3-02-00

28 Dec 2021

Abutments and/or Headwalls:

- End Bent 1 backwall, horizontal crack [FL x 0.03"] with efflorescence (photo 1).

Bents and/or Piers:

Bents 2 through 4 and 7 through 9 [4] PS piles, Bents 5 and 6 [6] PS piles with RC cap.

- Throughout Bents 3 to 8 all piles in normal water zone, scaling with exposed aggregate [4' High x up to 1/4" Deep] (photo 2).
- Bent 3 Piles 1 through 4 in normal water zone, vertical cracking [up to 36" x up to 0.10"]
- Along Bents 4 and 6 caps, through-cracking [FH x 0.03"] (photo 3).
- Bent 5 Piles 4 and 6 in normal water zone, vertical cracking [up to 36" x up to 0.10"]
- Bent 7 Pile 1 in normal water zone, vertical crack [up to 36" x up to 0.10"]
- Bent 8 Pile 2 in normal water zone, vertical crack [up to 36" x up to 0.10"] (photo 4).
- Bent 8 North face of cap under Beam 2, vertical and horizontal cracking [1' High x 1' Wide x 0.02"].
- Bent 9 Pile 3 at groundline, spall [14" x 14"x 1" Deep] with vertical crack [20" x 0.03"] (photo 5).

Bearings:

Felt pads.

- No defects noted at the time of this inspection.

Girders/Floor Beams/Stringers and/or Beams:

[5] RC T-beams per span with RC diaphragms.

- Throughout all end diaphragms, spalling [up to 12" diameter x 1" Deep] and vertical cracking [up to FH x 0.03"] some with efflorescence and some with exposed rebar (photo 6).
- Span 2 underside of Beams 2 through 4, exposed shallow rusted rebar [up to 6"] [no section loss] (2LF total) (photo 7).
- Span 3 Beam 1 at midspan, vertical cracking [FH x 0.03"].
- Span 3 underside of Beams 1 through 4 and Span 4 Beam 5, spalling [up to 8" x up to 4" x 1/2" Deep] with exposed rusted rebar [no section loss] (8LF total of exposed rebar) (photo 8).
- Span 7 underside of Beam 5 over Bent 7, spall [8" x 2" x 1/2"] with exposed rusted rebar [no section loss].
- Span 9 underside of Beam 5 over Bent 9, spall [FW x 16" x 1" Deep] with exposed rusted rebar [minor section loss] (photo 9).

Truss Members:

N/A

Expansion Joints:

Pourable silicone.

- Along all joints, loss of seal adhesion [3' per joint].
- Joint over Bent 1 in left travel lane, missing seal.

Decks and/or Slabs:

6.5" RC deck, [9] spans at 40'.

- Throughout deck surface, minor abrasion.
- Throughout travel lanes, hairline map cracking.
- Throughout deck surface, transverse cracking [up to 8' x 0.03"] (photo 10).
- Spans 1 through 4 throughout deck surface, exposed shallow rebar (photos 11 and 12).
- Throughout underside of overhangs in all spans, exposed rusted rebar chairs [75SF per span].

Curbs:

RC curbs on both sides.

- Along left curb at random locations, spalls/delaminations [up to 6" Diameter].

Bridge Railing/Parapets and/or Median Barriers:

RC rails and posts with steel thriebeam.

- Along both rails, minor impact damage [up to 52'].

Paint Systems:

N/A

Waterway and Scour:

- Rip rap in place at waterline.

*Underwater Inspection Performed 02/23/2021, See Underwater Bridge Inspection Report.

Fender System:

N/A

Roadway Alignment:

Straight no reduction of speed required.

Traffic Signs:

[2] Delineators in place on approach end.

Encroachments:

N/A

Miscellaneous Notes:

- South approach in left and right lane adjacent to joint over End Bent 1, spalling [up to 4' x 6' x 3"] (photo 13).

BRIDGE ORIENTATION: Labeling diagram orientation is the same direction as the historic orientation of the bridge, South to North.

Asset ID plaque not provided on this bridge.
Bridge ID plaque is located on the exterior of East curb at South end.

Inspected on October 21, 2021. Weather: Sunny, 72°F.
BITL: Todd Powell, Volkert, Inc. for Collins Engineers, Inc.
Assistant: Tim Earp

*Underwater Inspection Performed 02/23/2021, See Underwater Bridge Inspection Report. Weather: 53°F, Sunny.

Bridge Element Level Data

28 Dec 2021

					Quantity in Each Condition State				
Element No	**Element Name/Description**	**Units**	**Env**	**Defect**	**1**	**2**	**3**	**4**	**Total Qty**
110	Reinforced Concrete Open Girder/Beam	feet	4	Yes					
110	Delamination/Spall/Patched Area	feet	4	1080	0	0	13	0	13
110	Exposed Rebar	feet	4	1090	0	5	1	0	6
110	Cracking (RC and Other)	feet	4	1130	0	5	0	0	5
110	Reinforced Concrete Open Girder/Beam	feet	4	Yes	1776	10	14	0	1800
12	Reinforced Concrete Deck	sq feet	4	Yes					
12	Delamination/Spall/Patched Area	sq feet	4	1080	0	0	8	0	8
12	Cracking (RC and Other)	sq feet	4	1130	0	280	0	0	280
12	Abrasion/Wear (PSC/RC)	sq feet	4	1190	0	3430	0	0	3430
12	Reinforced Concrete Deck	sq feet	4	Yes	8882	3710	8	0	12600
226	Prestressed Concrete Pile	each	4	Yes					
226	Delamination/Spall/Patched Area	each	4	1080	0	0	1	0	1
226	Cracking (PSC)	each	4	1110	0	2	6	0	8
226	Abrasion/Wear (PSC/RC)	each	4	1190	0	27	0	0	27
226	Prestressed Concrete Pile	each	4	Yes	0	29	7	0	36
234	Reinforced Concrete Pier Cap	feet	4	Yes					
234	Efflorescence/Rust Staining	feet	4	1120	0	1	0	0	1
234	Cracking (RC and Other)	feet	4	1130	0	8	0	0	8
234	Reinforced Concrete Pier Cap	feet	4	Yes	371	9	0	0	380
301	Pourable Joint Seal	feet	3	Yes					
301	Seal Adhesion	feet	3	2320	0	30	0	12	42
301	Pourable Joint Seal	feet	3	Yes	308	30	0	12	350
330	Metal Bridge Railing	feet	1	Yes					
330	Damage	feet	1	7000	0	52	0	0	52
330	Metal Bridge Railing	feet	1	Yes	668	52	0	0	720
331	Reinforced Concrete Bridge Railing	feet	2	Yes					
331	Delamination/Spall/Patched Area	feet	2	1080	0	18	0	0	18
331	Reinforced Concrete Bridge Railing	feet	2	Yes	702	18	0	0	720

Inventory Photographs

Asset ID Number:	5259	Bridge Inspection Date:	10/21/2021

Asset ID Not Provided

1 Asset ID

2 Bridge ID (Exterior East Curb South End)

3 South Approach Looking North

4 South Approach Looking South

5 North Approach Looking South

6 North Approach Looking North

Consultant: For Repair Rec.? ☐

Inventory Photographs

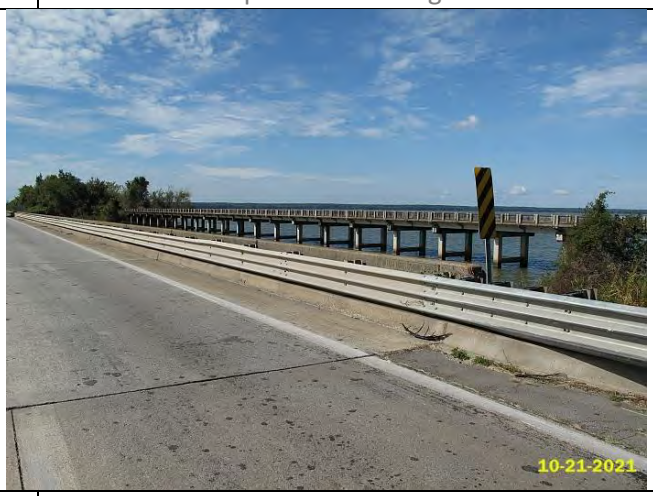
Asset ID Number:	5259	Bridge Inspection Date:	10/21/2021

7 West Profile Looking East

8 East Profile Looking West

9 Upstream Looking West

10 Downstream Looking East



11 Typical Bridge Rail (West Bridge Rail Shown)

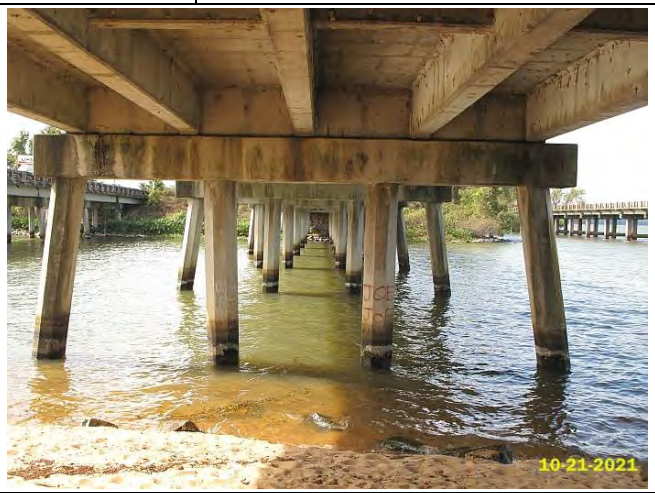
12 Top of Deck (Span 1 Shown)

Consultant: For Repair Rec.? ☐

Inventory Photographs

Asset ID Number:	5259	Bridge Inspection Date:	10/21/2021

13 Typical Superstructure Framing/Underside (Span 2 Shown)



14 Typical Interior Bent (Bent 8 Shown)

15 Typical End Bent and Slope Protection (End Bent 2 Shown)

16 Typical Beam Ends at Bearing Seats (Bent 9 Beam 5 Shown)

Consultant: For Repair Rec.? ☐

Existing Bridge Plans

TRANSYSTEMS

FED. ROAD DIV. NO.	STATE	COUNTY	FILE NO.	F. A. PROJ. NO.	ROUTE	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON ORANGEBURG	1438.315.1		I-95	1	77

INDEX OF SHEETS

SHEET NO. 1. TITLE SHEET
2. GUARDRAIL ATTACHMENT TO END POST
3. FLARED CURB AND GUTTER
4A. 8 IN. PIPE SLOPE DRAINS
4B. WELDING STANDARD
5. STANDARD NOTES
6. STANDARD DETAILS
7&8. ROAD PLAN AND PROFILE SHEETS
9. BRIDGE PLAN AND PROFILE SHEET
10. PRESTRESSED CONCRETE BEAMS
11. 70FT. SPAN
12. DETAILS OF 70FT. SPAN
13. 638FT. SPAN LAYOUT
14. 638FT. GIRDER DETAILS
15. 638FT. SPAN DETAILS
16. 638FT. SPAN DECK DETAILS
17. DETAILS OF EXPANSION DAM

SOUTH CAROLINA
STATE HIGHWAY DEPARTMENT
COLUMBIA

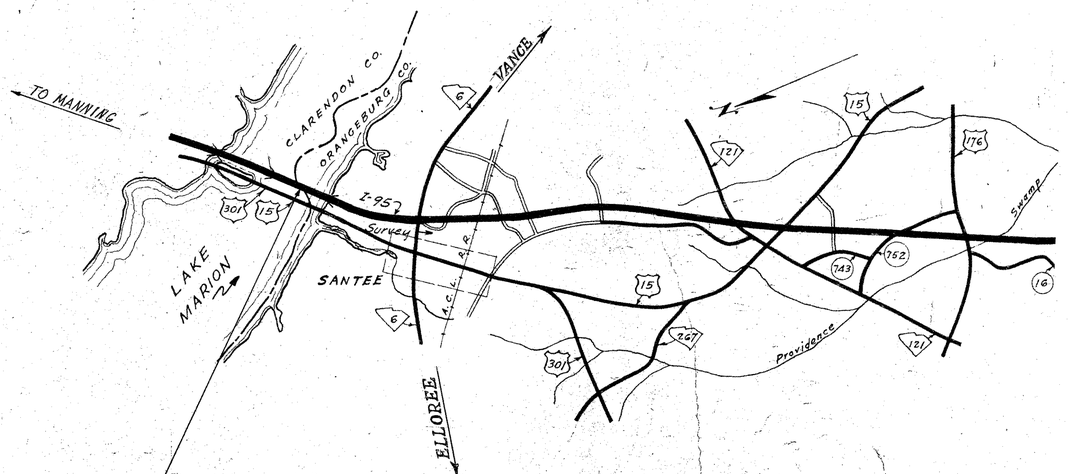
PLAN AND PROFILE OF PROPOSED STATE HIGHWAY

F. A. PROJECT NO. I-95-2(12)
FILE NO. 1438.315.1
CLARENDON & ORANGEBURG CO., S. C.
ROUTE I-95
TWIN BRIDGES OVER LAKE MARION
70FT. AND 638FT. SPAN SUPERSTRUCTURES
BRIDGE NO. 2

SUMMARY OF ESTIMATED QUANTITIES

CONCRETE - CLASS "A"	4600.6 C.Y.
REINFORCING STEEL	1,441,374 LBS.
STEEL SUPERSTRUCTURES	*NECESSARY L.S.
8 IN. PIPE SLOPE DRAINS	250 L.F.
INTAKE SPILLWAY ASSEMBLY	4 EACH
70 FT. PRESTRESSED CONCRETE BEAMS (3'-9" DEPTH)	220 EACH
NAVIGATION LIGHTING SYSTEM	NECESSARY L.S.

*APPROX. 1,563,800 LBS.



Construct 2180'-0" Superstructure Consisting of 22-70 ft. R.C. (Prestressed) Spans and 1-638 ft. R.C. & S.S. Continuous Span from Sta. 5246+79.00 to Sta. 5268+59.00 on N.B. Lane and on S.B. Lane of Rt. I-95. (Entire Substructure Constructed under Separate Contract.)

Note: All Structural Steel for Main Girders shall comply with the latest A.S.T.M. Spec. A-36. Structural Steel for Bearing Assemblies and Exp. Dams may be A-36 or A-373 Steel. All Cross Frames, Laterals and other secondary members and connections may be A-36 or A-373 Steel.

CONVENTIONAL SIGNS

State Line		Trolley Poles	
County Line		Power Poles	
City or Town Limits		Telephone or Telegraph Poles	
Property Line		Marsh	
Fence	x x	Trees	
Retaining Wall		Brush	
Existing Road		Stumps	
℄ and R.O.W. Lines of		Buildings	
Proposed Road		Bridge	
Railroad		Concrete Box Culvert	
Levee or Embankment		Pipe Culvert	
Guard Rail		Drop Inlet and Culvert	
Point of Intersection (P.I.)	△	Hub on Center Line	

LEGEND

PROPOSED PROJECT
OTHER ROADS — PAV. — ER.

Net Length of Roadway	0.000	Miles
Net Length of Bridges	0.000	Miles
Net Length of Project	0.000	Miles
Length of Exceptions	0.000	Miles
Gross Length of Project	0.000	Miles

Equalities in Stationing

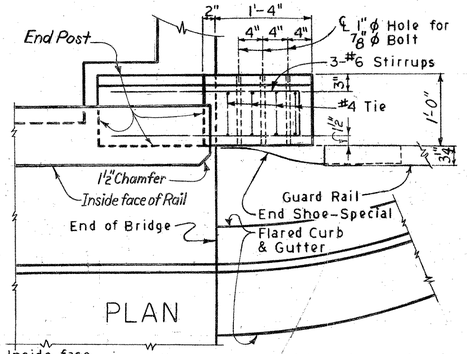
Note: All workmanship and material on this project to conform with South Carolina State Highway Department Standard Specifications for Highway Construction, Edition of 1964.

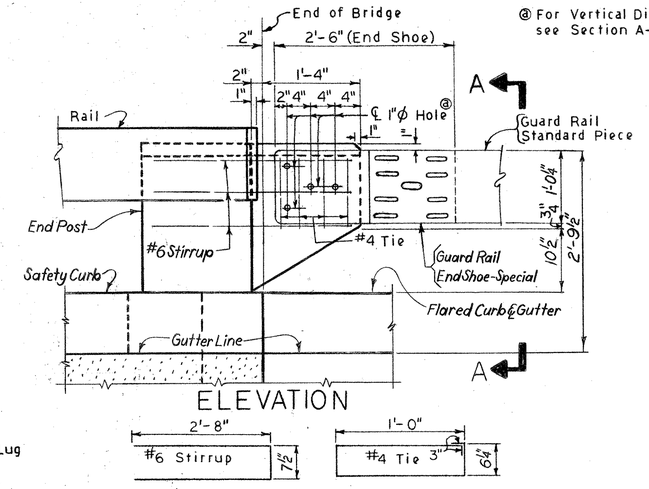
APPROVED: [signature] 9/3/68
STATE HIGHWAY ENGINEER — DATE

DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS
APPROVED: [redacted]
DISTRICT ENGINEER — DATE
[redacted] DATE

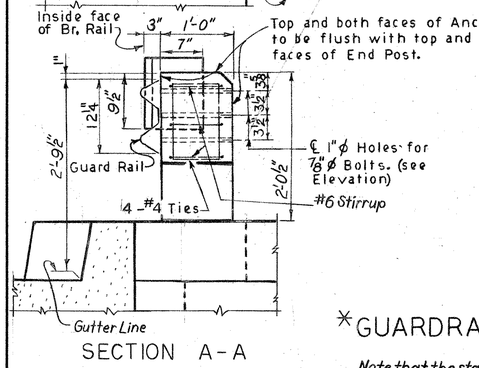
E. S. GILLOTT CO. KOK. PA. BIDDER A-57027

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON-ORANGEBURG	1438,315,1	I-95	2	17





③ For Vertical Dimensions see Section A-A.



SECTION A-A

NOTES:

Guardrail Anchor Lug to be cast monolithic with End Post.

Form 1"ϕ holes with 1"ϕ Standard Weight Pipe. Cost of pipe to be included in prices bid for Class "A" Concrete and Reinforcing Steel. Pipe to remain in place.

Special End Shoe and Guard Rail Standard Piece furnished by others.

1"ϕ Pipe to remain in place after casting Lug.

QUANTITIES ONE LUG	
Class "A" Concrete	0.09 C.Y.
Reinforcing Steel	37 Lbs.

*GUARDRAIL ANCHOR LUG DETAILS

SCALE: 1"= 1'-0"

Note that the standard mounting height of 2'-3" to top of rail on roadway approaches must be gradually increased to 2'-9½" at Anchor Lug.

** Guardrail Lug & Connection shown in these details is for Bridge along S.B. Lane only. Guardrail on Bridge along N.B. Lane shall be blocked out to face of curb by Guardrail Contractor.*

NOTE:

Guardrail Anchor Lugs are required for all 70Ft. End Span End Posts at End of Bridges.

REV.				
REV.				
REV.				
REV.	WDS	WGP	4-69	From Foil No. 190d

REVIEWED

	IN CHARGE		
QUAN.	K H M	ATM	11-68
TR.			
DR.	K H M	ATM	11-68
DES.			
	BY	CHK'D	DATE

S. C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA S. C.

STANDARD DETAILS
STANDARD CONNECTION OF GUARD RAIL TO END POST

FILE NO.	COUNTY	ROUTE NO.	DATE
1438,315,1	CLARENDON-ORANGEBURG	I-95	4-69

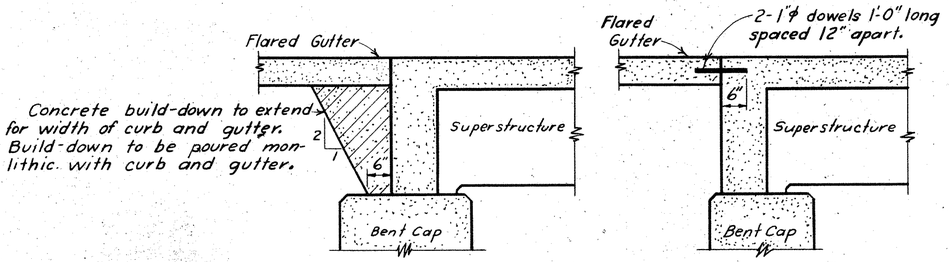
APPROVED BY J. M. Sease ASS'T BRIDGE DESIGN & PLANS ENGINEER

APPROVED BY DESIGN C. B. Crum BRIDGE ENGINEER

190 d

K&E ALBANENE® TRACING PAPER 74328

FED. ROAD DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON-ORANGEBURG	1438315.1	I-95	3	17



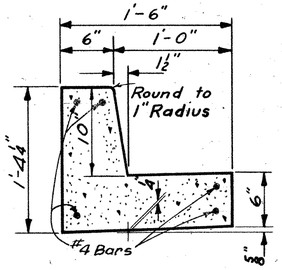
METHOD "A" METHOD "B"

NOTE: Ends of curb and gutter adjacent to bridge to be supported by one of the methods shown above. Use method "A" when there is sufficient width and length of bent cap to support concrete build-down. Otherwise use Method "B".

The quantity of concrete or reinforcing steel involved shall be computed by the Engineer and added to the quantities shown on this sheet.

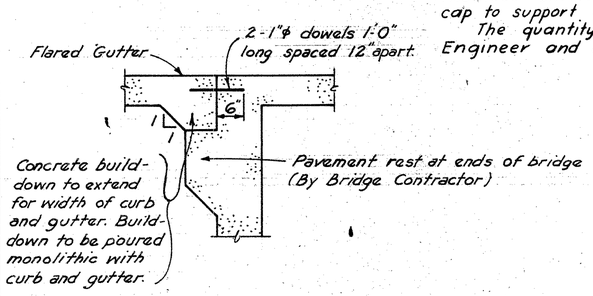
CURB AND GUTTER SUPPORT

SCALE $\frac{3}{4}$"=1'-0"



SECTION A—A

SCALE 1½"=1'-0"

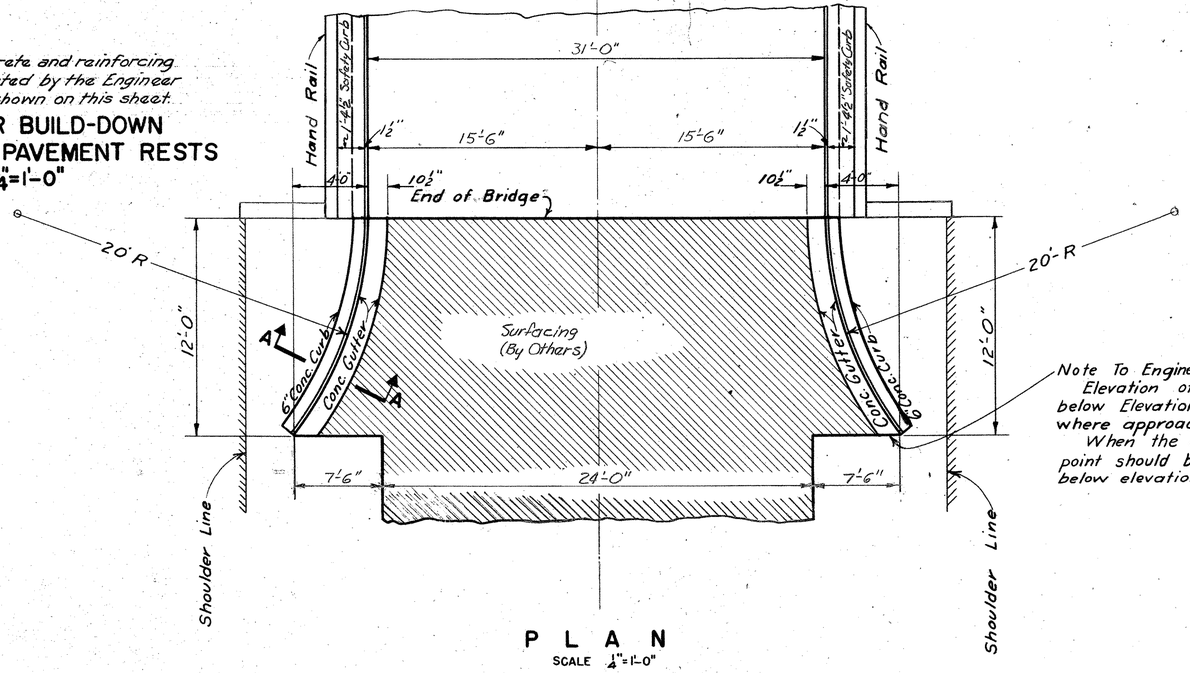


Note: The quantities of concrete and reinforcing steel involved shall be computed by the Engineer and added to the quantities shown on this sheet.

DETAIL OF GUTTER BUILD-DOWN FOR BRIDGES WITH PAVEMENT RESTS

SCALE: $\frac{3}{4}$"=1'-0"

All costs of constructing the concrete curb and gutter at the ends of the bridge will be included in payment for the concrete and steel in place at the Unit Price Bid for those items.



Note To Engineer:
Elevation of this point to be set 3" below Elevation of gutter at end of Bridge where approach is on 0.0% grade.
When the approach is on a grade this point should be set (3"± % of grade x 12') below elevation of gutter at end of bridge.

PLAN

SCALE $\frac{1}{4}$"=1'-0"

*QUANTITIES	
ONE END OF BRIDGE	
Class "A" Concrete	1.2 C.Y.
# Reinf. Steel	79 LBS.

*Does not include quantities for Curb & Gutter Support. (See note above)
#Reinf. consists of 10 #4 Bars, 11'-9" long.

REV.	WGP	EAS	11-65
	FROM FOIL 72		
Rev.	JRC	JWB	4-65
	Gutter Build-down		
Rev.	W.J.B.	G.K.B.	6
	~~For Det.~~ for Reinf.		
REV.	T.M.	EMQ.	2-51
	Traced		
	BY	C'KD	DATE

S. C. STATE HIGHWAY DEPARTMENT
COLUMBIA

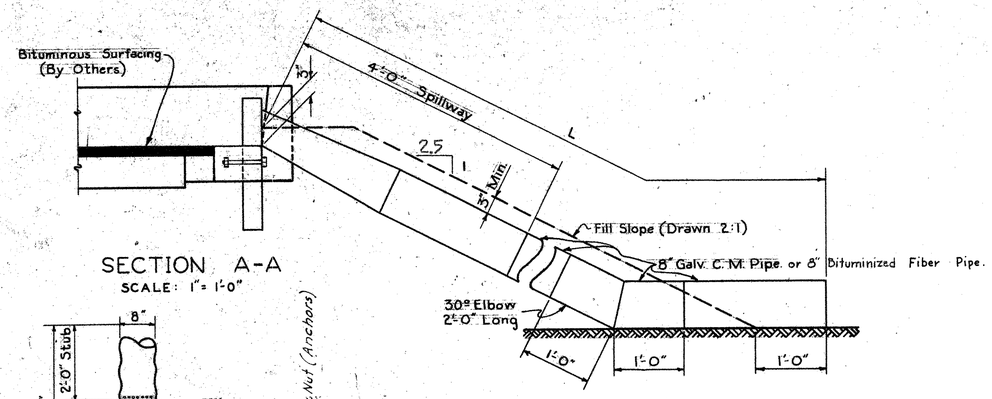
DETAILS OF FLARED CURB AND GUTTER AT ENDS OF BRIDGE

FILE NO. 1438.315.1 ROUTE NO. I-95

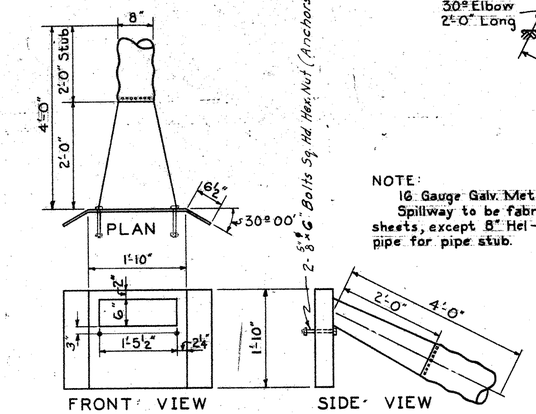
COUNTY: CLARENDON-ORANGEBURG DATE 11-65

SCALE AS NOTED

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON-ORANGEBURG	1438.315.1	I-95	4A	17



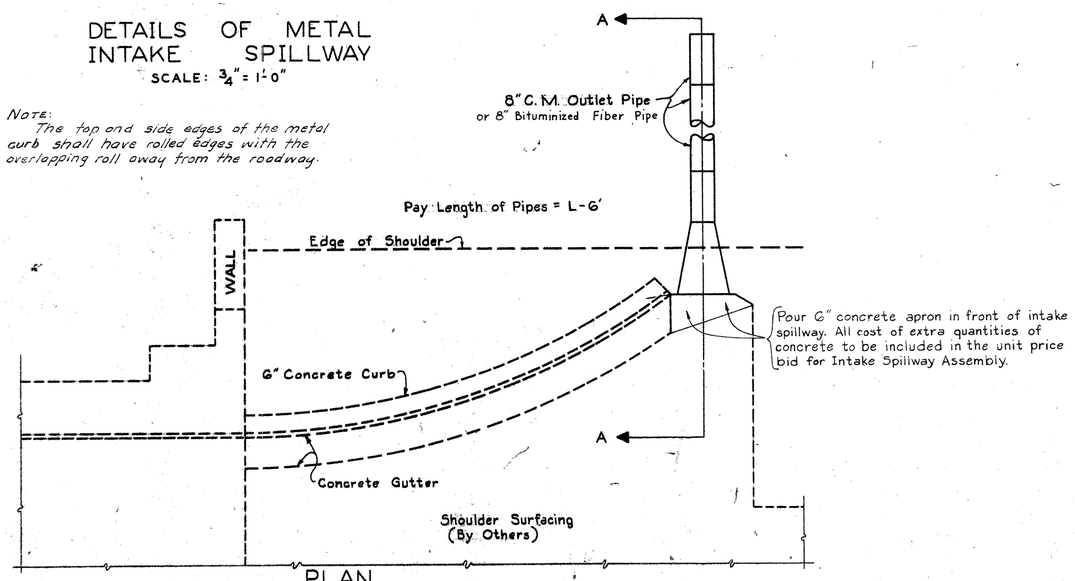
SECTION A-A
SCALE: 1" = 1'-0"



NOTE:
16 Gauge Galv. Metal to be used thruout.
Spillway to be fabricated from flat smooth sheets, except 8" Hel-Cor or equal non-perforated pipe for pipe stub.

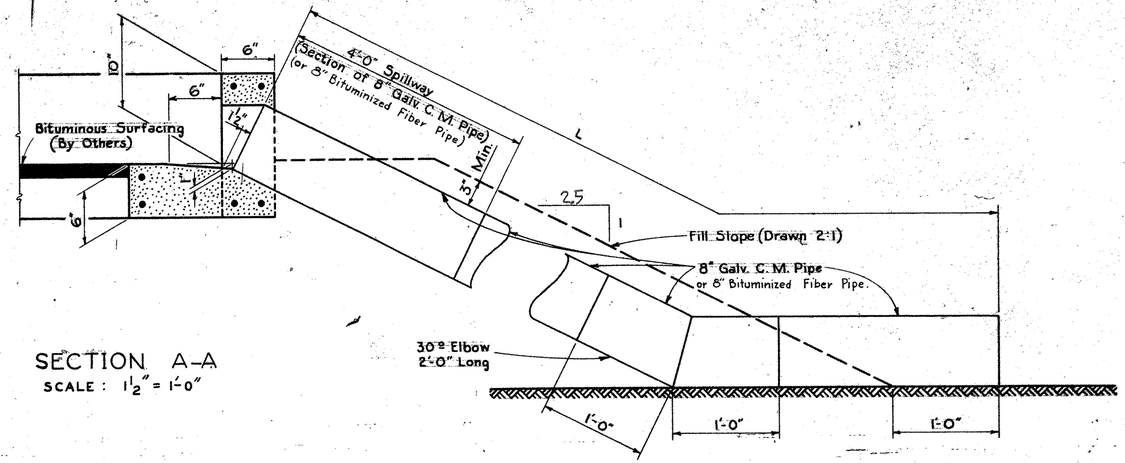
DETAILS OF METAL INTAKE SPILLWAY
SCALE: ¾" = 1'-0"

NOTE:
The top and side edges of the metal curb shall have rolled edges with the overlapping roll away from the roadway.

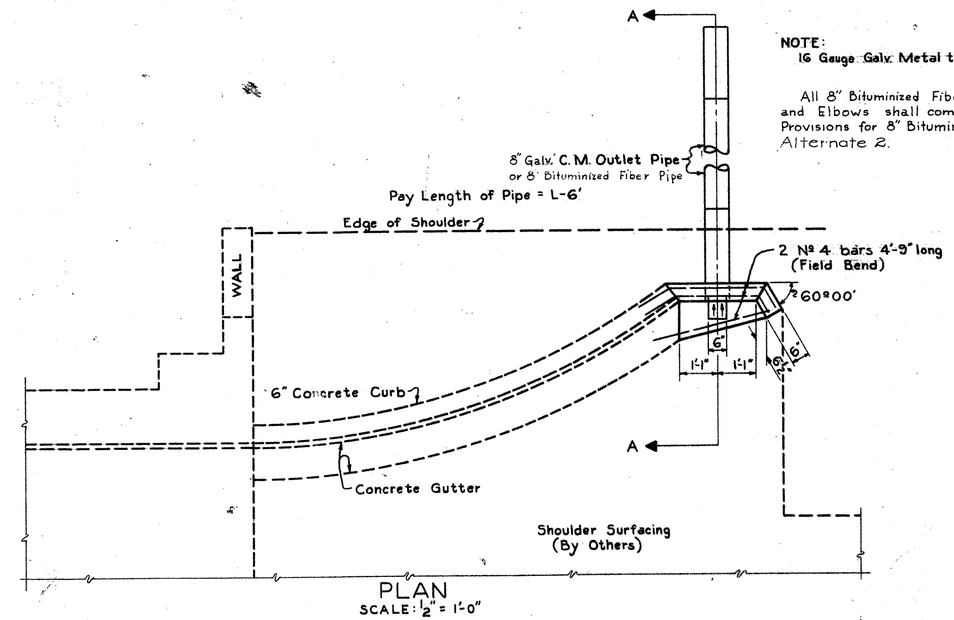


PLAN
SCALE: ½" = 1'-0"

METAL INTAKE OPTION



SECTION A-A
SCALE: 1½" = 1'-0"



NOTE:
16 Gauge Galv. Metal to be used thruout.

All 8" Bituminized Fiber Pipe, Couplings and Elbows shall comply with the Special Provisions for 8" Bituminized Fiber Pipe, Alternate 2.

PLAN
SCALE: ½" = 1'-0"

CONCRETE INTAKE OPTION

BID ITEMS	
Intake Spillway Assembly	4 Each
8" Galv. C. M. Pipe Slope Drain - Alternate 1	250 L.F.
8" Bituminized Fiber Pipe Slope Drain - Alternate 2	250 L.F.

REV.			
REV.	W.G.P.	E.A.S.	11-65
	FROM FOIL 259		
REV.	WFL	LEW	11-62
	Anchor Bolts added		
REV.	W.A.E.	WFL	7/62
	Apron Added		
REVIEWED	SAS		
	IN CHARGE		
QUAN.			
TR.			
DR.	W.A.E.	WFL	12/60
DES.			
	BY	CK'D	DATE

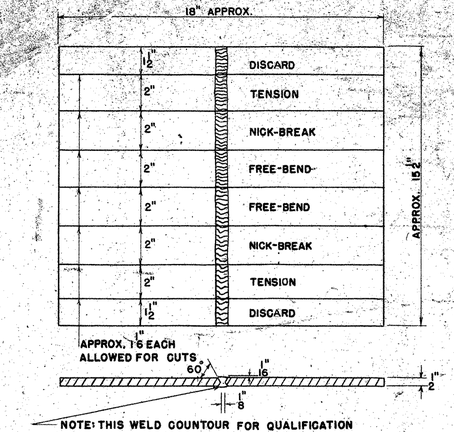
S. C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA, S.C.

DETAILS OF METAL PIPE SLOPE DRAINS

FILE NO.	COUNTY	ROUTE NO.	DATE
1438.315.1	CLARENDON-ORANGEBURG	I-95	11-65

APPROVED BY W. E. Caum — BR. DESIGN & PLANS ENGR.
APPROVED BY W. H. Harding — BRIDGE ENGINEER

FED. ROAD DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	CLARENDON ORANGEBURG	1438.315	I-95	48	17

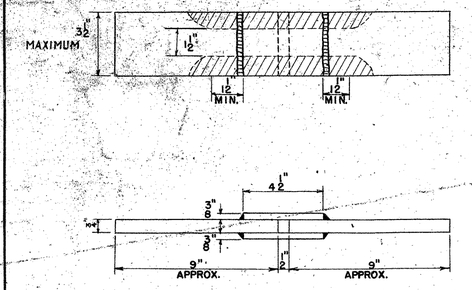


NOTE: THIS WELD COUNTOUR FOR QUALIFICATION TESTS. FOR FIELD TESTS WELD CONTOUR SHOULD BE SIMILAR TO ACTUAL WORK.

NOTE: WELD TO BE MADE HORIZONTALLY WITH PLATES IN VERTICAL POSITION. TACK WELD THE TWO PLATES TOGETHER AT EACH SIDE IN THE DISCARD AREA, THEN FIX IN VERTICAL PLANE WITH THE JOINT HORIZONTAL.

FIGURE II
BUTT WELD SPECIMEN

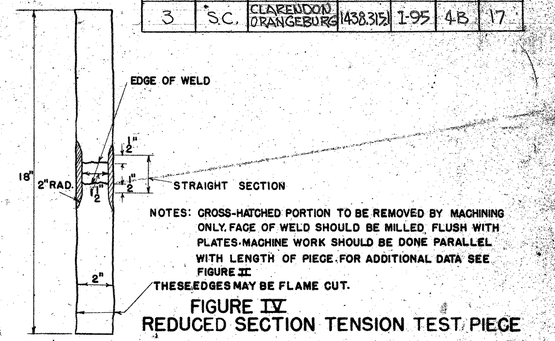
SPECIMEN TO BE CUT AS SHOWN AND SUBMITTED TO S.C.H.D. TESTING LAB.



NOTES: WELDS TO BE ¼" FILLET. CROSSHATCHED PORTION TO BE REMOVED FOR TESTS. FINAL CUT TO BE MADE BY MACHINE. WELD TO BE GAGED BEFORE TESTING.

FIGURE III
TRANSVERSE FILLET WELD TEST SPECIMEN

SPECIMEN AS SHOWN (UNCUT) TO BE SUBMITTED TO S.C.H.D. TESTING LAB.



NOTES: CROSS-HATCHED PORTION TO BE REMOVED BY MACHINING ONLY. FACE OF WELD SHOULD BE MILLED FLUSH WITH PLATES. MACHINE WORK SHOULD BE DONE PARALLEL WITH LENGTH OF PIECE. FOR ADDITIONAL DATA SEE FIGURE II.

THESE EDGES MAY BE FLAME CUT.

FIGURE IV
REDUCED SECTION TENSION TEST PIECE

WELDING SYMBOLS

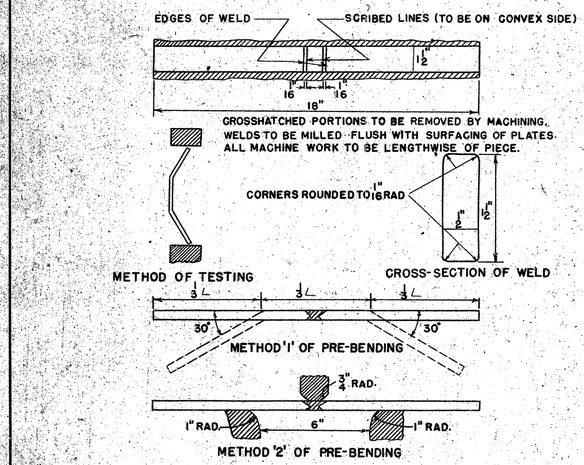
TYPE OF WELD

BEAD	FILLET	GROOVE: SQUARE	GROOVE: V	GROOVE: BEVEL	GROOVE: U	GROOVE: J	PLUG & SLOT	FIELD WELD	WELD ALL AROUND	FLUSH
⌒	◺	|	V	⟋	Y	⟋	▱	●	○	—

LOCATION OF WELDS

ARROWS (OR NEAR) SIDE OF JOINT	OTHER (OR FAR) SIDE OF JOINT	BOTH SIDES OF JOINT
FIELD WELD SIZE, SEE NOTE 5, FLUSH, ROOT OPENING	INCLUDED ANGLE, SIZE, ROOT OPENING, SEE NOTE 5	SIZE, INCREMENT LENGTH, WELD ALL AROUND, PITCH, OFFSET IF STAGGERED, NO. OF INCREMENTS

1 THE SIDE OF THE JOINT TO WHICH THE ARROW POINTS IS THE ARROW (OR NEAR) SIDE.
2 BOTH SIDES WELDS OF SAME TYPE ARE OF SAME SIZE UNLESS OTHERWISE SHOWN.
3 SYMBOLS APPLY BETWEEN ABRUPT CHANGES IN DIRECTION OF JOINT OR AS DIMENSIONED (EXCEPT WHERE ALL AROUND SYMBOL IS USED).
4 ALL WELDS ARE CONTINUOUS AND OF USER'S STANDARD PROPORTIONS, UNLESS OTHERWISE SHOWN.
5 TAIL OF ARROW USED FOR SPECIFICATION REFERENCE (TAIL MAY BE OMITTED WHEN REFERENCE NOT USED).
6 DIMENSIONS OF WELD SIZES, INCREMENTS, LENGTHS AND SPACINGS, IN INCHES.



SHOWING DIE FOR PREFORMING TEST PIECE TO BE BENT 90° IN DIE. REMAINDER OF BEND TO BE MADE FREE.

FIGURE V
FREE BEND TEST PIECE

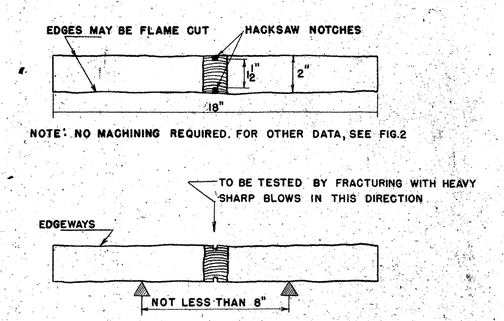
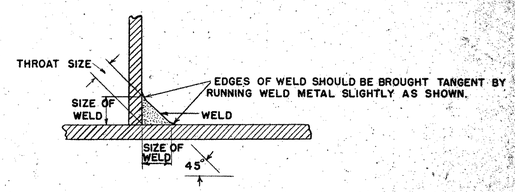


DIAGRAM SHOWING METHOD OF TESTING

FIGURE VI
NICK-BREAK TEST PIECE

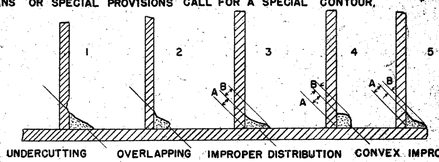
NOTE:

The Nick-break Test may be used as a preliminary requirement. If the Nick-break Test is passed, the remaining Operator Qualification Procedure will be performed in accordance with the latest A.W.S. specifications. All test specimens shall be made from A-36 Steel.



DESIRABLE FILLET WELD CONTOUR

NOTE:
THE DESIRABLE FILLET WELD CONTOUR SHOWN SHALL BE CONSTRUCTED UNLESS THE PLANS OR SPECIAL PROVISIONS CALL FOR A SPECIAL CONTOUR.



UNDESIRABLE FILLET WELD CONTOUR

1 AND 2 ARE NOT PERMITTED. 3, 4 AND 5 PERMITTED IF RATIO $\frac{A}{B}$ IS NOT OVER 40% (CONVEXITY RATIO) AND DIMENSIONS ARE WITHIN TOLERANCES ALLOWED.

FIGURE VIII

S. C. STATE HIGHWAY DEPARTMENT
COLUMBIA

WELD SYMBOLS AND TEST SPECIMENS

W.A.D.	L.S.	10-12-55
Retraced		
BY	CHECKED	Date

FILE NO. 1438.315.1 ROUTE NO. I-95
COUNTY: CLARENDON ORANGEBURG DATE: SEPT. 1968

FED.RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	CLARENDON — ORANGEBURG	1438.315.1	I-95	5	17

WIDENING EXISTING CONCRETE STRUCTURES

Existing structure is indicated on the plans by light lines, new structure by heavy lines.

All dimensions of new construction are subject to existing conditions.

Connecting surfaces of the old concrete shall be thoroughly roughened, cleaned of loose material, wetted and flushed with 1:2 cement mortar immediately before pouring new concrete, except as noted on other sheets of these plans.

All reinforcing steel protruding beyond surface after chipping shall be left in place and imbedded in new concrete if feasible. Reinforcing steel which can not be imbedded in new concrete shall be cut off flush with surface of concrete where asphalt surfacing will cover. Where exposed the old reinforcing shall be cut off 1" below the exposed concrete surface and the hole patched with dry 1:3 mortar to the satisfaction of the Engineer.

The Contractor shall repair or replace at his own expense, and in a manner satisfactory to the Engineer, any portion of the existing structure damaged as a result of his carelessness or negligence.

The entire cost of the above work including all drilling and chipping, and removing and disposing of portions of old structure necessary to construct new structure, shall be included in the unit price bid for Class "A" Concrete.

If expansion anchor bolts are called for they shall be similar and equal to Powl's Multi-Talk Anchor "F" American Exp. Bolt and shall be installed in accordance with the manufacturer's directions.

Expansion anchor bolts will be paid for at unit price bid for reinforcing steel.

Unless otherwise specified in these plans or Special Provisions the Contractor shall provide necessary temporary supports for utilities attached to the bridge to maintain service during construction.

The owner will make all necessary changes in alignment and elevation of the utility and furnish permanent supports which shall be placed in the concrete by the Contractor.

All costs of the work to be performed by the Contractor shall be included in the unit price bid for Class "A" Concrete.

Any necessary repairs to the existing structure in the opinion of the Engineer are to be paid for as extra work.

EXCAVATION FOR PILE TYPE END BENT

All cost of excavation necessary to remove material under superstructure to an elevation 1'0" below tops of end bent caps shall be included in the unit price bid for Class "A" Concrete.

EXCAVATION FOR CONCRETE FTG. END BENT

If a concrete footing is used for the end bent, the excavation below that included for the cap and bent is the above paragraph will be paid for at the unit price bid for excavation. Excavation above this shall be included in the unit price bid for Class "A" Concrete.

HAMMER FOR CONCRETE PILES

Concrete Piles shall be driven with steam, or air single-acting hammer or Diesel hammer of suitable size. The drop hammer allowed in Parag. 1010.5 of the Standard Specifications may not be used.

ALLOWANCE FOR DEAD LOAD DEFLECTION AND SETTLEMENT

Bridges shall be built on the grade or vertical curve shown on plans. Handrails, slabs and curbs shall conform to the grade or curve.

In setting forms for structural steel or prestressed concrete beam bridges, an allowance shall be made for dead load deflections in addition to the elevations shown.

In setting falsework and forms for reinforced concrete spans an allowance shall be made for dead load deflections, settlement of falsework, and permanent camber which shall be provided for in addition to the elevations shown. After removal of the falsework, the finished structure shall conform to the elevations shown plus the allowance for permanent camber specified by the Engineer.

SPECIAL NOTE

Generally, in case of discrepancy, this standard sheet of notes shall govern over the Specifications, but the remainder of the plans shall govern over notes hereon, and Special Provisions shall govern over all. See Standard Specifications paragraph 504.

BRONZE EXPANSION PLATES

Bronze PL's to be self-lubricating Exp. PL's manufactured from rolled bronze alloy complying with A.S.T.M. B100 - Alloy I, or A.S.T.M. B22 - Gr. B casting, and to have special inserts consisting of graphite and metallic substances with a lubricating binder in top & bot. faces. Installation of PL's to be in accord. with manufacturer's directions. The Coeff. of friction shall not exceed 0.1. The Bronze PL's shall be similar to those manufactured by Merrimam Bros., Inc., 183 Amory St, Boston 30, Mass., or Whiteley Bearing Corporation Chicago, Ill., or an approved equal.

STRUCTURAL STEEL

Beams shall be cambered for vertical curve and dead load deflection either in mill or shop.

Layout dimensions and standard lengths of beams shown are horizontal dimensions and must have the additional lengths added for lengths along grade.

All rivets shall be 7/8" ϕ unless noted.

All high-tensile-strength bolts shall be 7/8" ϕ unless noted.

All holes shall be 15/16" ϕ unless noted.

Holes in all main member splices shall be sub-punched, the connecting members shop assembled in their proper positions, and the holes reamed to full size while assembled.

Bearing plates, rocker plates and welded bearing assemblies to be rolled steel.

Shims shall be placed between beam flange and rocker plate where required and shall be adjusted to bring top of beam to theoretical grade.

Nuts on Anchor Bolts at Exp. Ends of 70 Ft. Spans to be tightened 1/8 clear to allow for movement.

Anchor bolt assemblies furnished and placed by others. All exposed portions shall be thoroughly cleaned and painted with 2 coats of red lead paint before bearings are installed by the Superstructure Contractor.

Mill and shop inspection of the structural steel will be performed by Froehling & Robertson, Inc., 814 West Cary St., Richmond, Virginia. The contractor shall notify that company of the name and address of the fabricator of the structural steel as soon as the fabricator has been given the contract to fabricate so that the inspection procedure can be set up. The contractor shall also stipulate in his order to the fabricator that Froehling & Robertson, Inc., will perform the mill and shop inspection of the structural steel. Exposed machine-finished surfaces of bearing assemblies shall not be shop painted until after inspection.

COMPOSITE BEAMS

A 5 day interval shall be allowed between time of pouring slab and sidewalk.

Tops of beam flanges shall not be painted.

All equipment, materials and workmanship for electric arc welded stud shear connectors shall be in accordance with the recommendations of the manufacturer and Special Provisions.

Alternate for welded studs: an approved alternate method of securing composite action between beams and slab may be used at no additional cost to the Dept. Details must be submitted for approval in advance of making the change.

7/8 ϕ studs may be substituted for 3/4 ϕ studs. The 7/8 ϕ studs shall be placed with the same number in each transverse row as the 3/4" ϕ studs. The pitch of the 7/8 ϕ studs shall be equal to 1.36 times the pitch of the 3/4" ϕ studs. The 7/8 ϕ studs must be welded within the recommended area of an approved arc stabilizer cart.

PRESTRESSED BEAMS

Tops of beams shall be rough floated. At the approximate time of initial set, entire top of beam shall be scrubbed with a coarse wire brush to remove all laitance, and to produce a roughened surface for bonding slab.

Membrane curing compound shall not be used on tops or ends of beams.

Concrete in prestressed beams shall be class "X" as described in the Standard Specifications.

The prestressing strands, wire or bars, must be thoroughly cleaned of any loose rust, dirt, grease, form lubricant, or other deleterious substances, to the satisfaction of the Engineer, before the concrete is placed.

Beams shall not be transported to the bridge site until concrete has cured for at least 6 days.

Beam lengths given are based on horizontal span only. These lengths shall be increased to correct for concrete shrinkage, concrete shortening when the strands are cut, and for beams being on a grade.

CONCRETE

All concrete shall be Class "A" except Prestressed Concrete Bms.

Payment for Concrete in slab will be based on theoretical plan quantity.

Any necessary adjustment for Camber shall be at the Contractor's expense.

All exposed edges shall be chamfered 3/4" unless otherwise noted.

For simple spans over 70 Ft. in length, the center portion (approximately 1/3 of the length) of the slab shall be poured first and allowed to cure for not less than 4 days before the remaining end sections are poured. However, when the temperature permits (in the opinion of the engineer) the entire slab may be poured provided a suitable retarding agent is used in such amounts that the slab concrete shall not have had its initial set prior to the completion of the casting of the slab concrete.

BEARINGS

For concrete beams bearing on concrete, the top of caps, or tops of build-ups, under bearing areas of beams shall receive a steel trowel finish to insure a smooth and level bearing surface. See Standard Specifications paragraph 710.14.

DESIGN DATA

SPECIFICATIONS: A.A.S.H.O. 1965 with rev. thru 1968 and the 1966 Edition of the Specifications of the American Welding Society for Welded Highway and Railway Bridges with revisions and additions as set forth in the Special Provisions. Operator Qualification Procedure will be performed in accordance with the aforementioned Welding Specifications.

LIVE LOAD: HS20-44, Includes provision for alternate loading of 2 axles 4' apart with each axle weighing 75% of rear loading for spans under 40'.

UNIT STRESSES

REINFORCING STEEL:
fs (reinf.) = 20,000 psi
CLASS "A" CONCRETE:
fc=1200 psi; n=10; v=225 psi; u=300 psi
STRUCTURAL STEEL:
fs=20,000 psi. (For A-36 Steel)
fs=18,000 psi. (For A-373 Steel)
PRESTRESSED CONCRETE:
fc=5,000 psi; fci=4,000 psi; fc=2,000 psi
PRESTRESSING STEEL:
fs=250,000 psi; fsi=175,000 psi

MATERIAL AND WORKMANSHIP

Except as may otherwise be specified on plans or in the Special Provisions, all material and workmanship shall be in accordance with the South Carolina Highway Department Standard Specifications for Highway Construction, Edition of 1964.

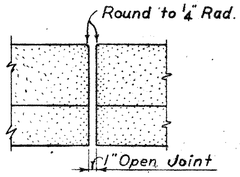
REV.			
REV.			
REV.	W.G.P.	EAS	10-65
	FROM FILE (721-307.1)		
REV.	WRS	W.G.P.	8-65
	From Fail 189		
REVIEWED:		IN CHARGE	

S.C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA, S. C.

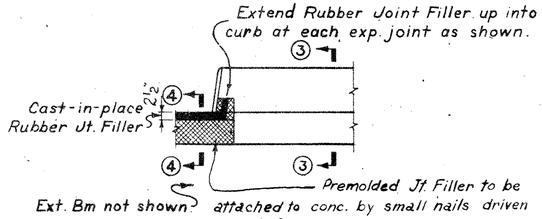
STANDARD NOTES

QUAN.				FILE NO.	COUNTY	ROUTE NO.	DATE
TR.	A.P.D.	R.W.H.	4-61	1438.315.1	CLARENDON-ORANGEBURG	I-95	10-65
DR.	A.P.D.	R.W.H.	4-61	APPROVED BY:		APPROVED BY:	
DES.							
	BY	CHK.	DATE	BRIDGE DESIGN & PLANS ENGR.		BRIDGE ENGINEER	

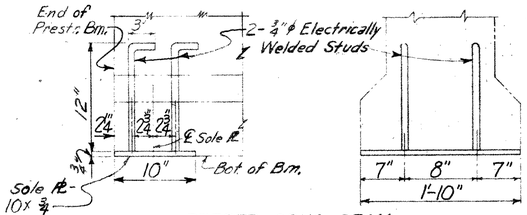
FED. RD DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	CLARENDON-ORANGEBURG	14.38.315.1	I-95	6	17



SECTION ③-③
SCALE: 1"=1'-0"

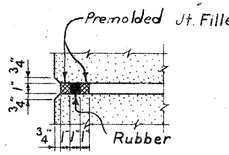


SECTION ALONG EXP. JT.
SCALE: ¾"=1'-0"

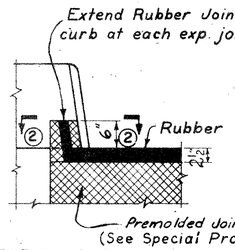


PRESTR. CONC. BEAM
SIDE ELEVATION END ELEVATION

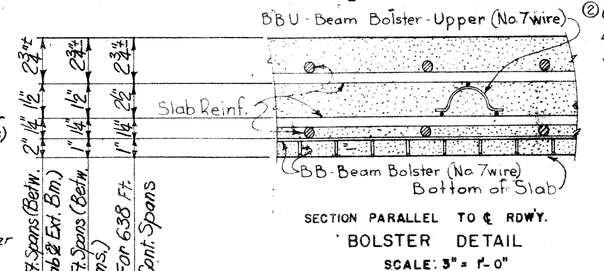
BEARING DETAILS
ELECTRICALLY WELDED STUD ALTERNATE
SCALE: 1½" = 1'-0"



SECTION ②-②
SCALE: 1½"=1'-0"



SECTION ALONG EXP. JT.
SCALE: 1½"=1'-0"



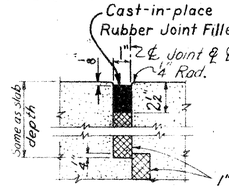
SECTION PARALLEL TO ℄ RDWY.

BOLSTER DETAIL
SCALE: 3" = 1'-0"

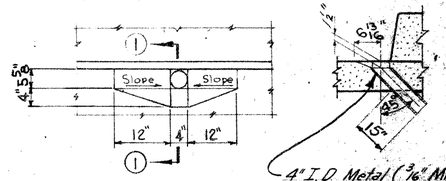
Note:
Bolsters shall be spaced so that they provide adequate support for the slab reinforcing steel. The BBU bolsters shall be spaced at approx 3'-0" ctrs. The BB bolsters shall be placed with one row near each edge of slab & with a max. spacing of approx. 3'-0" between.

Bolsters shall be equal to beam bolsters BB and BBU as Mfg'd by Meadow Steel Co., or Richmond Screw Anchor Co.

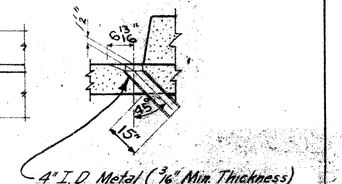
The lengths of bolsters shown in reinforcing steel schedules are approximate. Weights are included in the reinforcing steel quantities and payment will be made at the unit price bid for Reinforcing Steel.



SECTION ④-④
SCALE: 3"=1'-0"

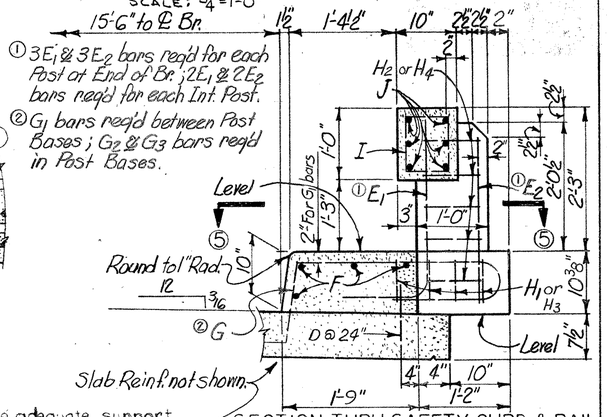


PLAN



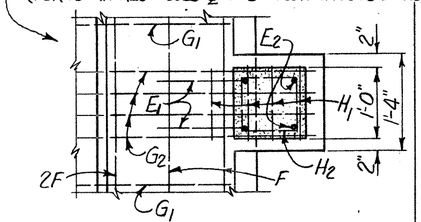
SECTION ①-①

DRAIN DETAILS
(FOR 70 FT. PRESTRESSED SPANS)
SCALE: ¾"=1'-0"



Slab Reinf. not shown.

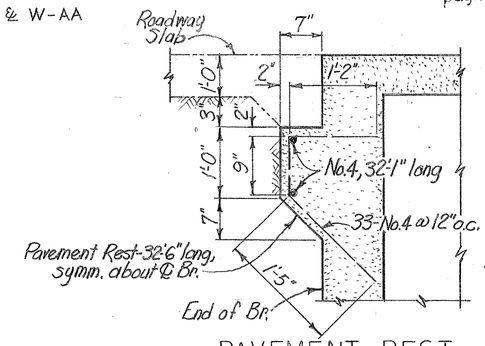
SECTION THRU SAFETY CURB & RAIL
(FOR 70 FT. PRESTRESSED & 638 FT. CONTINUOUS SPANS)



SECTION ⑤-⑤
(FOR SINGLE INTERIOR POST)

Note: For arrangement of E_1, E_2, G_2, H_1 & H_2 bars for Posts at Ends of Spans and Double Int. Posts see Shs. No. 11 & 16.

JOINT DETAILS
FOR EXP. JTS. AT PRS. A-P & W-AA



PAVEMENT REST

QUANTITIES
(ONE PAVEMENT REST)

Concrete-Class "A" ___ 0.9 C.Y.
Reinf. Steel ___ ___ 116 Lbs.

REV.			
	W.G.P.	E.A.S.	10-65
	FROM FILE 1721.307.1		
REV.	E.A.S.	W.G.P.	8-65
	FROM FOIL 190a		
REV.	B.A.M.	R.W.H.	1-65
	Pavement Rest		
REV.	C.D.K.	E.A.S.	4-62
	Jt. Details & New Foil		
REV.	C.D.K.	M.D.S.	4-60
	Exp. Anchor Detail		

REV			
	A.M.Z.	H.D.L.	4-59
	Bearing Detail		
REV	W.C.B.	M.D.S.	12-58
	Drain Detail		
REV	A.M.Z.	R.W.H.	1-58
	Build-down Det. 1		
REV	R.W.H.	V.A.E.H.	7-57
	Add Dowel Detail		

REVIEWED
IN CHARGE

QUAN.				
TR.	W.C.F.	E.A.S.	12-56	
DR.	J.C.W.	E.A.S.	12-56	
DES.				
BY.		CHK.	DATE	

S.C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA, S.C.

STANDARD DETAILS

SCALE: 1"=1'-0"; OR AS NOTED

FILE NO.	COUNTY	ROUTE NO.	DATE
14.38.315.1	CLARENDON-ORANGEBURG	I-95	10-65

APPROVED BY: W. E. Crum — BRIDGE DESIGN & PLANS ENG.
APPROVED BY: [signature] — BRIDGE ENGINEER

FED. ROAD DIV. NO.	STATE	COUNTY	FILE NO.	PROJECT NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	CLARENDON & ORANGEBURG	1438.315.1		I-95	7	17

275' R/W

275' R/W

5240

5245

5250

5255

② S.C. PUBLIC SERVICE AUTHORITY
By: GEN. MGR.
D. 2. 15. 65

WATER

← CONTROLLED ACCESS LINE

To Manning

℄ Br.

48'

48'

℄ Survey, Rt. I-95

S 50° 09' W

48'-0"

48'-0"

℄ Br.

CONTROLLED ACCESS LINE →

WATER

WATER

← CONTROLLED ACCESS LINE

228'

② (SEE ABOVE)

228'-0"

Present R/W

Present R/W

PRESENT U.S. ROUTE 301

PLAN

B.M. No. 102: "X" Mark on End of Exist. Bridge on Lt. Side going South, 276' Rt. Sta. 5172+00. El. 92.80.

This portion of Bridges under Separate Contract

218'-0" ℄ Jt. at P.I. A to End Br.
(Superstructure under this Contract; Substructure under Separate Contract)

620' V.C.

Begin File No. 1438.315.1:
℄ Jt. (P.I. A) - Sta. 5246+79.00
F.G.El. 98.819

P.T. Sta. 5247+49.00
F.G.El. 100.600

P.C. Sta. 5253+79.00
F.G.El. 119.700

FINISHED GRADE

+3.00%

1620' V.C.

0.00%

P.C. Sta. 5241+29.00
F.G.El. 91.500

P.I. - 5244+39.00
El. 91.500 (For Fin. Gr.)

Max. Lake Level, El. 76.8

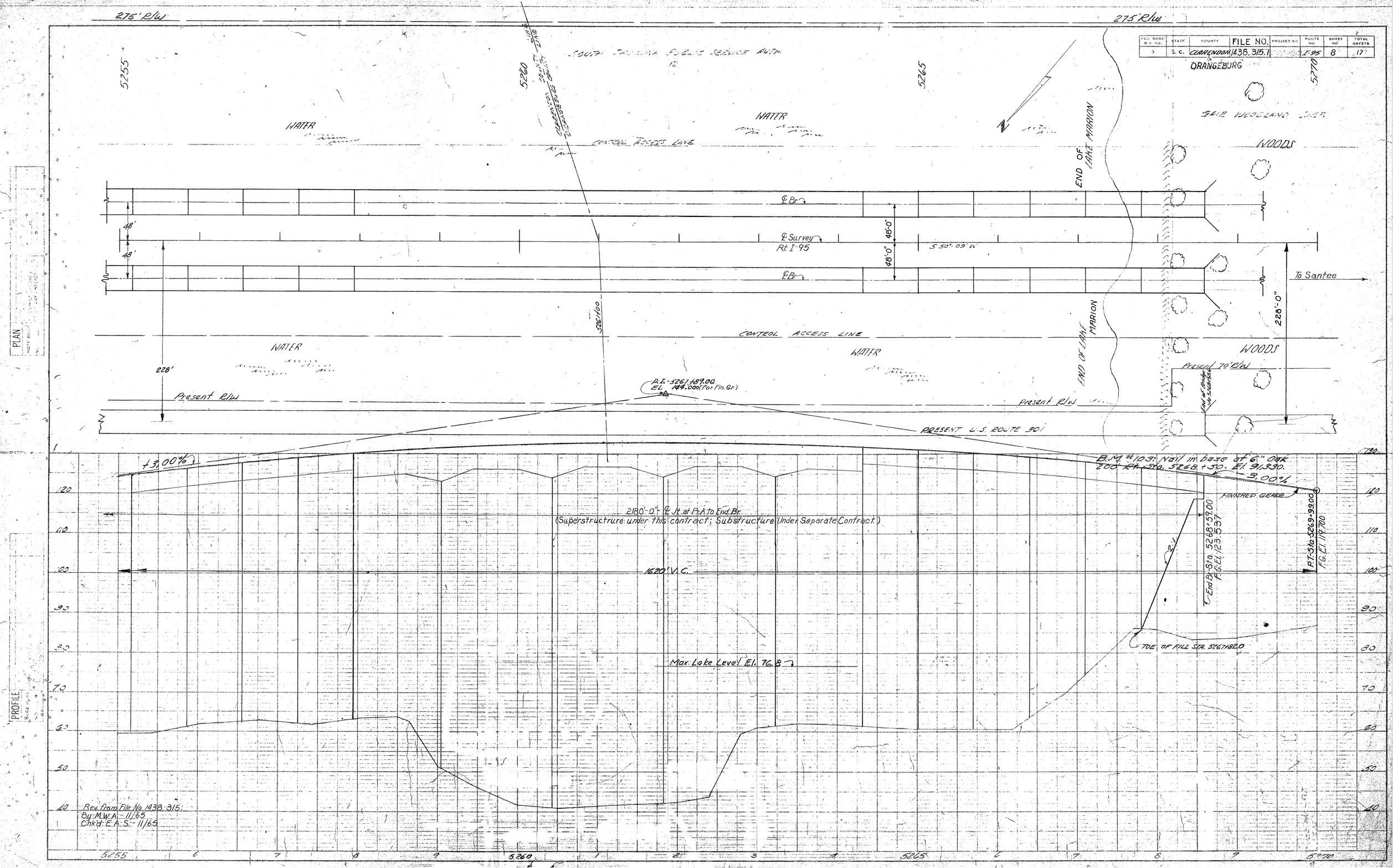
PROFILE

Rev. from File No. 1438.315:
By: M.W.A. 11/65
Chk'd: E.A.S. 11/65

130 120 110 100 90 80 70 60

30 20 110 100 90 80 70 60

5240 1 2 3 4 5245 6 7 8 9 5250 1 2 3 4 5255



FILE NO. 1438.315.1
S.C. CLARENDON
I-95
8
17
ORANGEBURG
275' R/W
275' R/W
SOUTH CAROLINA PUBLIC SERVICE AUTH.
WATER
WATER
WOODS
CONTROL ACCESS LINE
END OF LAKE MARION
℄ Br.
℄ Survey Rt. I-95
48'
48'
48'-0"
48'-0"
S 50°-09' W
To Santee
228'-0"
228'
Present R/W
Present R/W
Present 70' R/W
P.I.-5261+89.00
EL. 144.000 (For Fin. Gr.)
PRESENT U.S. ROUTE 301
+3.00%
-3.00%
B.M. #103: Nail in base of 6" Oak 200' Rt. Sta. 5268+50. El. 91.330.
FINISHED GRADE
2180'-0" - ℄ Jt. at Pr. A to End Br.
(Superstructrure under this contract; Substructure Under Separate Contract.)
1620' V.C.
End Br. Sta. 5268+59.00 F.G. El. 123.537
P.T. Sta. 5269+99.00 F.G. El. 119.700
TOE OF FILL STA. 5267+82.0
Max. Lake Level El. 76.8
Rev. from File No. 1438.315:
By: M.W.A. - 11/65
Chk'd: E.A.S. - 11/65
PLAN
PROFILE

SUMMARY OF QUANTITIES - BOTH BRIDGES

ITEM	NO	CONCRETE CLASS 'A' C.Y.	REINF. STEEL LBS.	STRUCTURAL STEEL LBS.	RIP-RAP SLOPE DRAINS L.F.	INTAKE SPILLWAY ASSEMBLIES EACH	70 FT. PRESTRESSED CONC. BMS. EACH
70ft. End Spans	2	1558	① 97,536	—	—	—	10
70ft. Int. Spans	42	3091.2	985,194	—	—	—	210
63.871 Cont Girder Spans	2	1351.2	408,486	1,563,820	—	—	—
Flared Curb & Gutters	8	1.4	136		250	4	—
Totals		4602.6	1491,374	1,563,820	250	4	220

① Includes 0.4 C.Y. for Guardrail Connections on End Posts.
② Includes 948 Lbs. for Guardrail Connections on End Posts.

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	Clarendon & Orangeburg	1458.515	I-95	9	17

PLAN

LAKE MARION

FLOW

To Manning

℄ Survey S 50°-08' W
Route I-95

℄ Survey S 50°-09' W
Route I-95

℄ Bridge

Exp. Jt.

End of Slab

Exp. Jt.

℄ Bridge

To Santee

℄ Survey S 50°-08' W
Route I-95

℄ Bridge

Equit.

Equit.

46'-0"

46'-0"

46'-0"

46'-0"

96'-0"

2.5% Grade

3.00% Grade

EL. 94.500 (Per Fin. Grade)

EL. 94.500 (Per Fin. Grade)

EL. 94.500 (Per Fin. Grade)

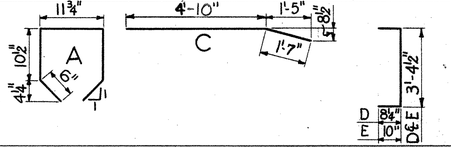
FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON ORANGEBURG	1438.315.1	I-95	10	17

HS 20-44 L.L.
f'_c = 250,000 psi.
f'_{ci} = 175,000 psi.
f_{ps} = 270,000 psi.
f_{pi} = 202,500 psi.
f_c = 4000 psi.
f_{ci} = 2800 psi.

REINFORCING STEEL SCHEDULE — I-BEAM

MARK	SIZE NO.	D	70 FT. SPAN NO. REQ'D.	70 FT. SPAN LENGTH
A	5	B	68	3'-9"
B	6	S	4	35'-7"
C	4	B	20	6'-5"
D	4	B	88	4'-9"
E	4	B	24	5'-1"

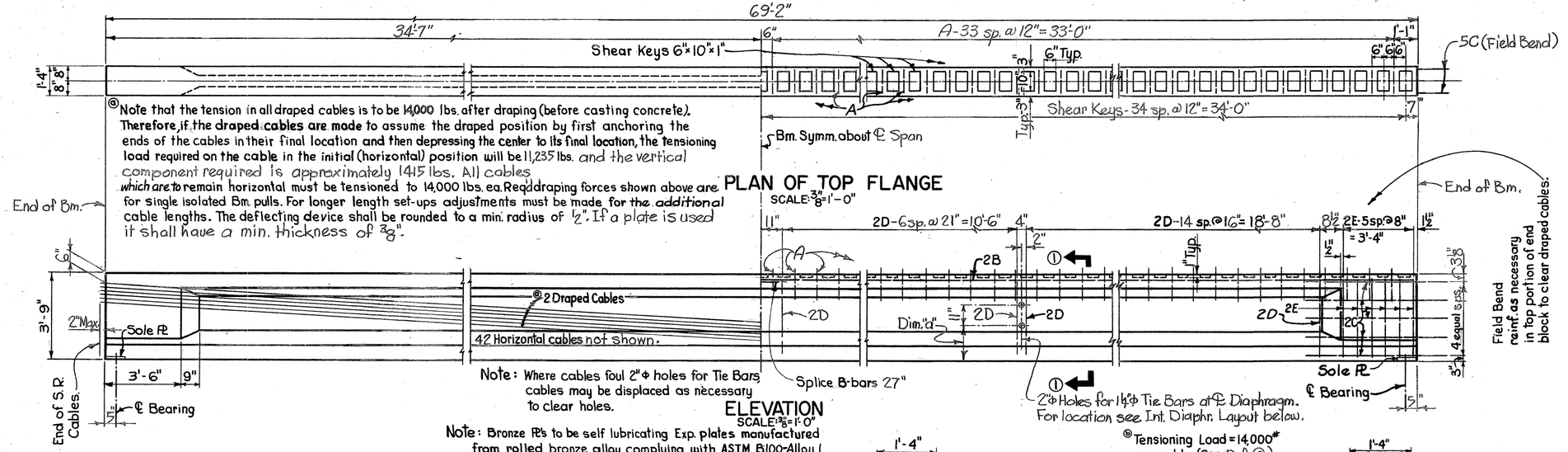
BENDING DETAILS



QUANTITIES — ONE BEAM

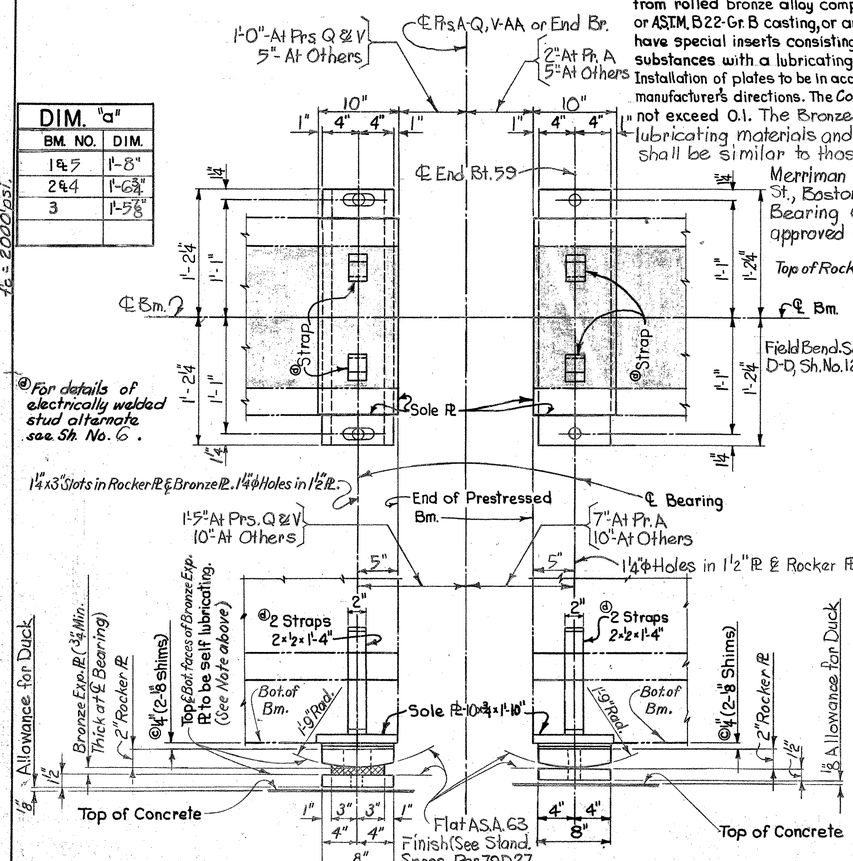
		70' SPAN
CONCRETE - CLASS "X",	C.Y.	10.4
REINFORCING STEEL,	LBS.	926
PRESTR. ST. (3/8" Ø S.R. CABLES),	L.F.	3753
STRUCTURAL STEEL ①	LBS.	569

① Includes Sole Plate Assemblies & Bearing Assemblies. Does not Include Bronze Exp. Pl's.



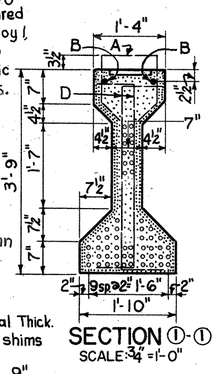
Note: Bronze Pl's to be self lubricating Exp. plates manufactured from rolled bronze alloy complying with A.S.T.M. B100-Alloy I, or A.S.T.M. B22-Gr. B casting, or an approved equal, and to have special inserts consisting of graphite and metallic substances with a lubricating binder in top & bot. faces. Installation of plates to be in accordance with the manufacturer's directions. The Coefficient of friction shall not exceed 0.1. The Bronze Pl's, with respect to lubricating materials and spacing of recesses, shall be similar to those manufactured by Merriman Bros., Inc., 183 Amory St., Boston-30, Mass. or, Whitely Bearing Corp., Chicago, Ill., or an approved equal.

DIM. "a"	
BM. NO.	DIM.
1&5	1'-8"
2&4	1'-6¾"
3	1'-5⅞"

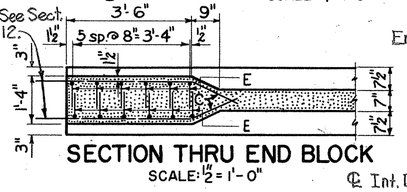


Ⓓ Adjust to bring top of Beams to theoretical grade.

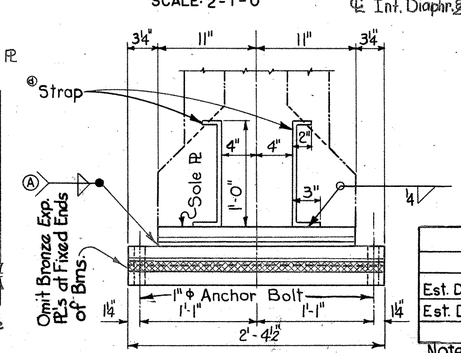
BEARING DETAILS
SCALE: 1½" = 1'-0"



SECTION ①-①
SCALE: 3/4" = 1'-0"



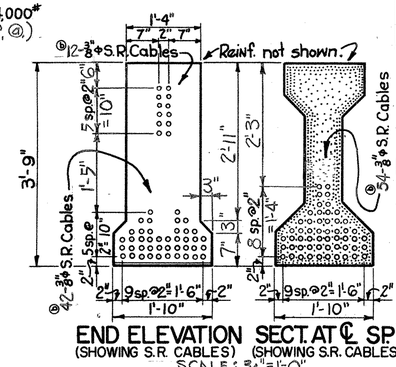
SECTION THRU END BLOCK
SCALE: 1½" = 1'-0"



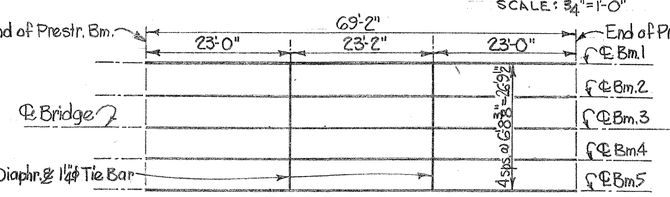
ELEVATION - END OF BEAM

Note: The top surface of beams for all spans, except first 70 Ft. Int. Span, to be finished off level.

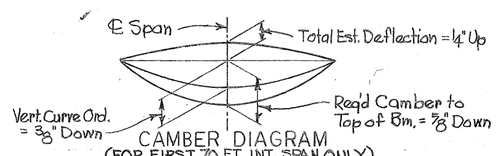
Theoretical slab thickness to be retained by lowering bottom of slab below top of beam or by building down from bottom of slab to top of beam, if necessary.



END ELEVATION (SHOWING S.R. CABLES)
SECT. AT ℄ SP. (SHOWING S.R. CABLES)
SCALE: 3/4" = 1'-0"



INT. DIAPHRAGM LAYOUT
NO SCALE



CAMBER DIAGRAM
(FOR FIRST 70 FT. INT. SPAN ONLY)

BEAM DEFLECTION AND CAMBER

	70' Span
Est. Deflection of top surface of bm. when cables are released	⅞" up
Est. Deflection of top surface of bm. due to wt. of slab when poured	⅝" down
Total Est. Deflection (Due to Prestress & D.L.)	¼" up

NOTE: For Standard Notes see Sh. No. 5.
For Standard Details see Sh. No. 6.

The Price Bid for Prestressed Concrete Beams shall include S.R. Cables, Sole Pl. Assemblies, Bearing Assemblies (including Shims, Booster Pl's & Bronze Exp. Pl's.), Reinf. Steel, Lifting Devices, and all other material (except Anchor Bolt Assemblies) complete in place.

Partial Payment for Prestressed Conc. Bms.:

When prestressed concrete beams are delivered to the bridge site the Engineer will enter 80% of the Contract Unit Price on the current estimate, and after erection, 100% of the Contract Unit Price. Such percentages shall be subject to the usual 10% retainage.

The Prestressed Bms. must always be maintained in an upright position. When beams are handled they shall be lifted by devices provided at ends of beams. A suggested type lifting device may utilize a 2" diameter pipe with a ½" diameter mild steel pin thru the end block located approximately ⅓ to ⅜ the depth of the beam below the top. Other types of lifting devices may be used provided they meet with the approval of the Engineer. Pick-up points must be within the extent of the end blocks. When being stored, care must be taken to eliminate interior supports which cause negative moments.

Bronze Exp. Plates shall not be painted. The steel surfaces in contact with the top and bottom faces of the bronze plate shall be left unpainted but coated with a graphite material.

THIS SHEET TO ACCOMPANY SHS. NO. 11 & 12.

REV.				
REV.				
REV.				
REV.				
REVIEWED: EHS		IN CHARGE		
QUAN.	WGP	EAS	11-65	
TR.	J.C.C.	WNW	5-60	
DR.	Tech.	WNW	5-60	
DES.	FROM	FILE	1/21/3011	
	BY	CHK	DATE	

S. C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA, S.C.

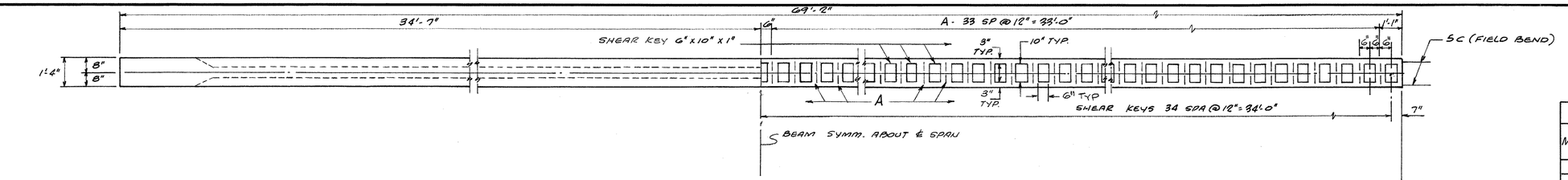
PRE-TENSIONED CONC. BEAMS
FOR TWIN BRIDGES OVER
LAKE MARION

SCALE AS NOTED

FILE NO.	COUNTY	ROUTE NO.	DATE
1438.315.1	CLARENDON-ORANGEBURG	I-95	11-65

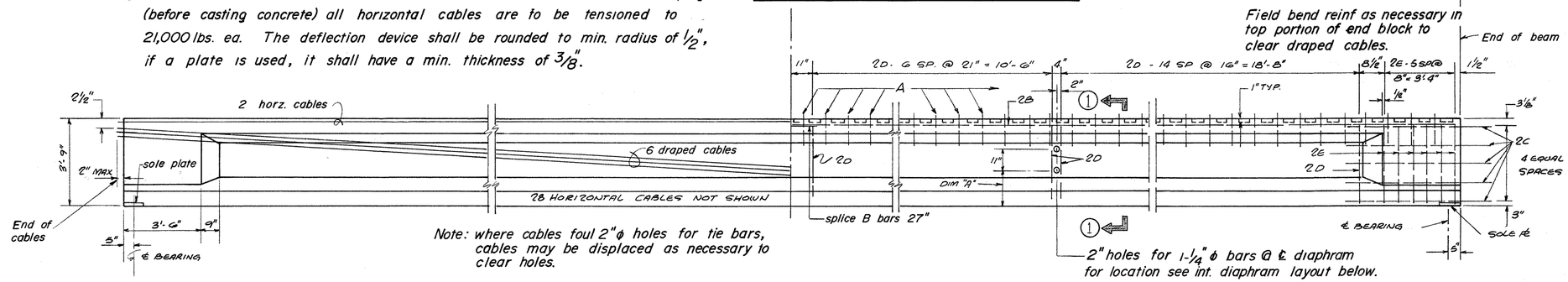
APPROVED BY: W. E. Crum — BRIDGE DESIGN & PLANS ENGR.
APPROVED BY: [illegible] — BRIDGE ENGINEER

FED. RD DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SH NO.	TOTAL SHEET
3	S. C.	CLARENDON ORANGEBURG	1438315.1	I-95	10A	17



PLAN OF TOP FLANGE

ⓐ note that the tension in all draped cables is to be 21,700 lbs. after draping (before casting concrete) all horizontal cables are to be tensioned to 21,000 lbs. ea. The deflection device shall be rounded to min. radius of 1/2", if a plate is used, it shall have a min. thickness of 3/8".

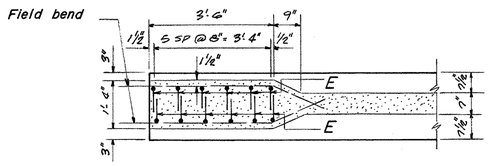


Note: where cables foul 2" ϕ holes for tie bars, cables may be displaced as necessary to clear holes.

ⓑ tension load = 21,700 # per cable. (see Ref ⓐ)

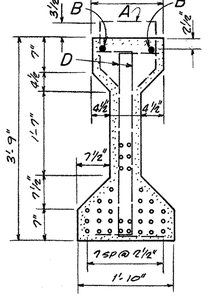
ELEVATION

DIM "d"	
BM. NO.	DIM.
1 & 5	1'-8"
2 & 4	1'-6¾"
3	1'-5⅞"



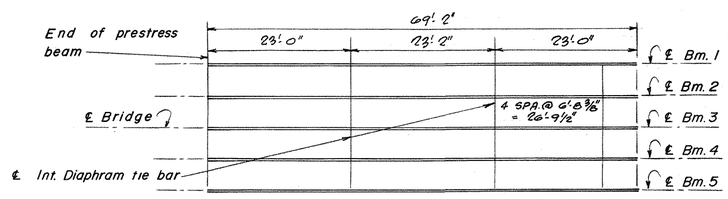
SECTION THRU END BLOCK

SCALE ½ = 1'-0"



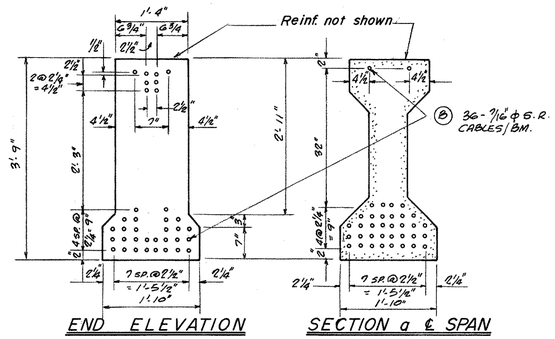
SECTION ①-①

SCALE ¾ = 1'-0"



INT. DIAPHRAM LAYOUT

NO SCALE



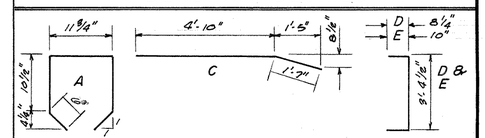
END ELEVATION — SECTION a ℄ SPAN

SCALE: ¾" = 1'-0"

REINFORCING STEEL SCHEDULE - I BEAM

Mark	Size no.	D	70ft. Span No. Reqd.	Length
A	5	B	68	3'-9"
B	6	S	4	35'-7"
C	4	B	20	6'-5"
D	4	B	88	4'-9"
E	4	B	24	5'-1"

BENDING DETAILS



QUANTITES - ONE BEAM

	70' Span	
Concrete - Class "X" C.Y.	10.4	
Reinforcing Steel lbs.	926	
Prestress Steel (7/16 ϕ H.S.) L.F.	2502	
Structural Steel ① lbs.	569	

① Includes sole plate assemblies & bearing assemblies. Does not include bronze expansion plates.

NOTE:

The prestressed beams must always be maintained in an upright position. When beams are handled they shall be lifted by devices provided at ends of beams. Pickup points must be within the extent of the end blocks. When being stored, care must be taken to eliminate interior supports which cause negative moments.

The concrete finish for outside faces of exterior beams shall be class "A" in accordance with the Special Provisions.

REV. 8-20-69 G. K.

S & G PRESTRESS CO

WILMINGTON, N. C.

DRAWN	D.A., WJB
CHECK	G. K.
JOB NO.	344
DATE	8-14-69

PRETENSIONED CONCRETE BEAMS FOR TWIN BRIDGES OVER LAKE MARION

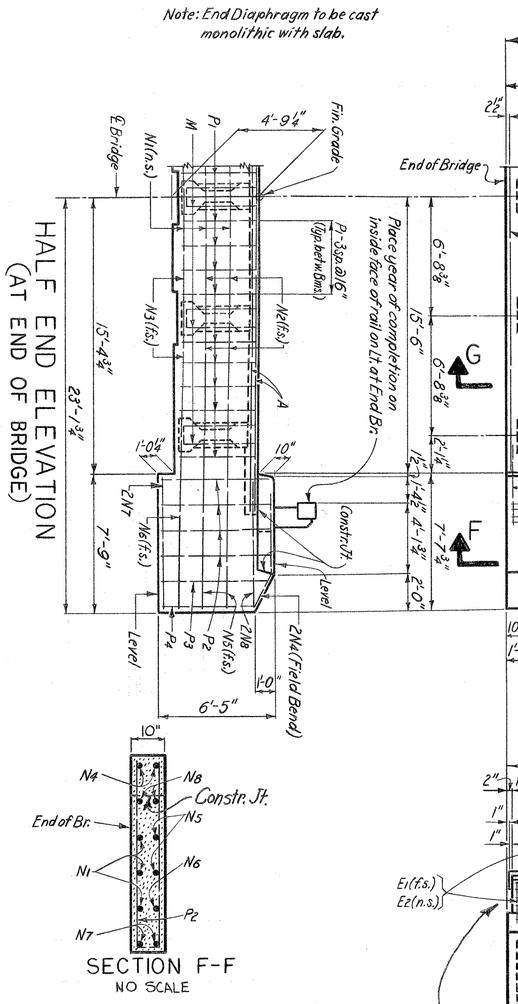
SHEET 1 OF 1

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON-ORANGEBURG	1438.315.1	I-95	11	17

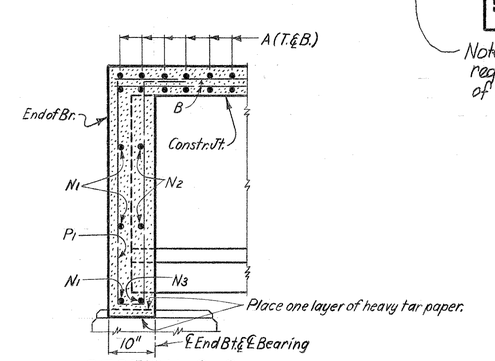
LiveLoad:HS20-44
fs(Reinf.)=20,000psi.
fc=1200psi.
n=10
v=225psi.
u=300 psi.

Note: Pavement Rest, not shown above, to be poured integral with End Diaphragm if deemed necessary by the Engineer. In this event, the additional Concrete and Reinf. Quantities involved shall be added to the Final Estimate. For Pavement Rest Detail and Quantities see Sh. No. 6.

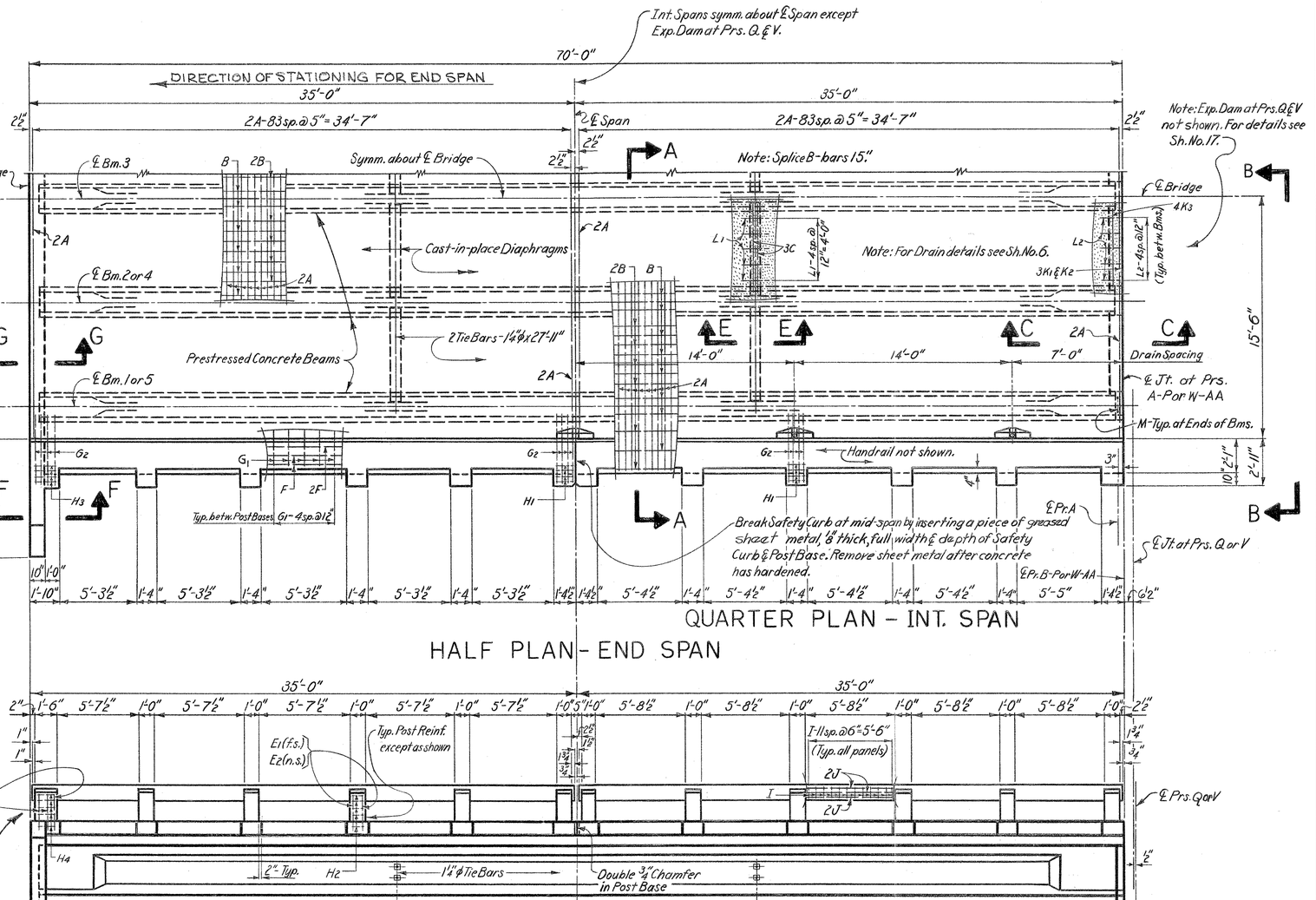
HALF END ELEVATION (AT END OF BRIDGE)



SECTION F-F
NO SCALE

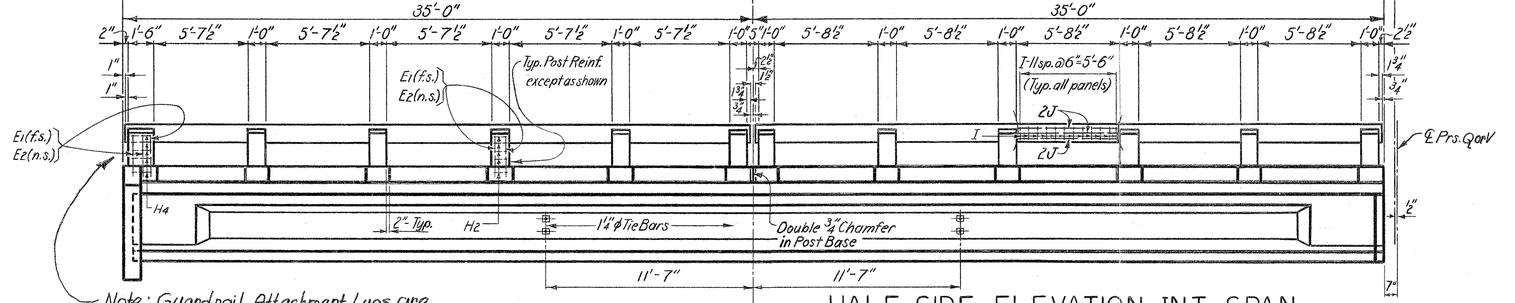


SECTION G-G
Scale: ¾"=1'-0"



QUARTER PLAN - INT. SPAN

HALF PLAN - END SPAN



Note: Guardrail Attachment Lugs are req'd on both sides of roadways at end of each bridge. For details see Sh. No. 2.

HALF SIDE ELEVATION-INT. SPAN

FULL SIDE ELEVATION-END SPAN

NOTES:

For Standard Notes see Sh. No. 5.
For Standard Details see Sh. No. 6.
See Sh. No. 12 for additional notes and the following:
Half Section A-A
Half Elevation B-B
Section C-C
Section E-E.
End diaphragms to be cast monolithically with slab.

THIS SHEET TO ACCOMPANY SHS. NO. 10 & 12.

REV.			
REV.			
REV.			
REV.			
REVIEWED		IN CHARGE	
QUAN.	W.D.S.	W.G.P.	11-65
TR.			
DR.	W.D.S.	W.G.P.	11-65
DES.	E.H.S.	W.G.P.	8-65
	BY	CHK'D	DATE

S. C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA S. C.

70FT. SPAN FOR TWIN BRIDGES OVER LAKE MARION

SCALE: ¼"=1'-0"; or as noted

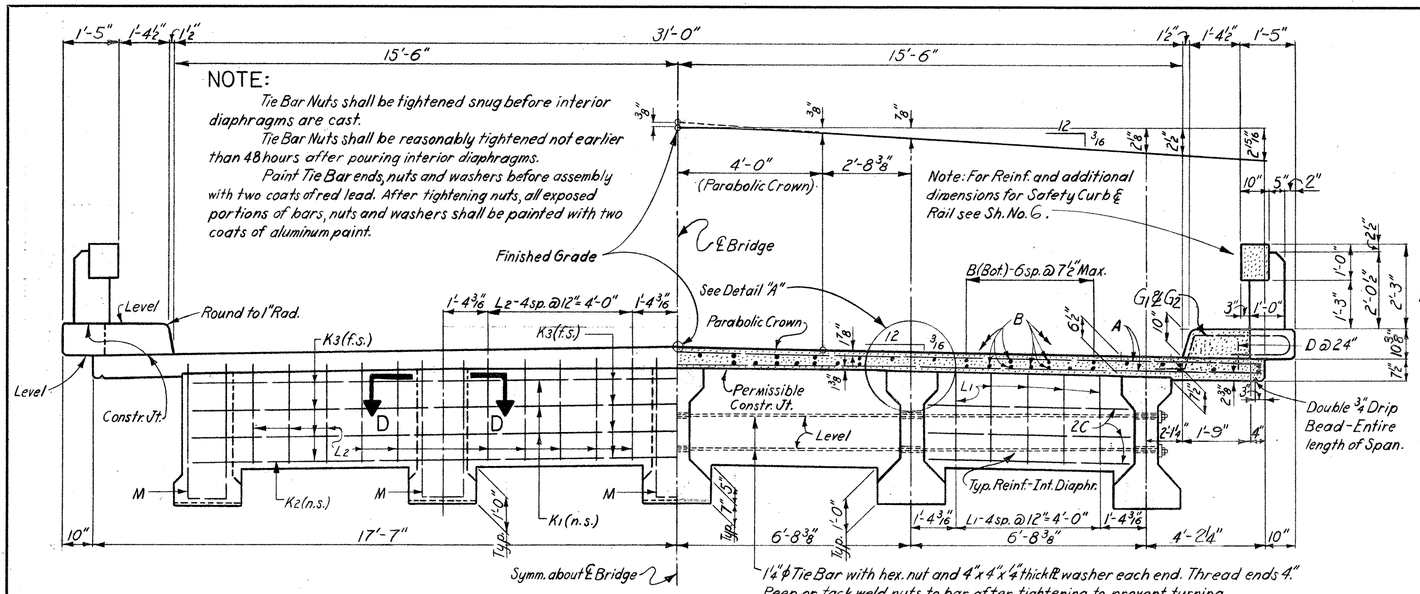
FILE NO.	COUNTY	ROUTE NO.	DATE
1438.315.1	CLARENDON-ORANGEBURG	I-95	11-65

APPROVED BY: E. B. Cram — BRIDGE DESIGN & PLANS ENGINEER
APPROVED BY: C. H. Armstrong — BRIDGE ENGINEER

K&E ALBANENE TRACING PAPER 72428

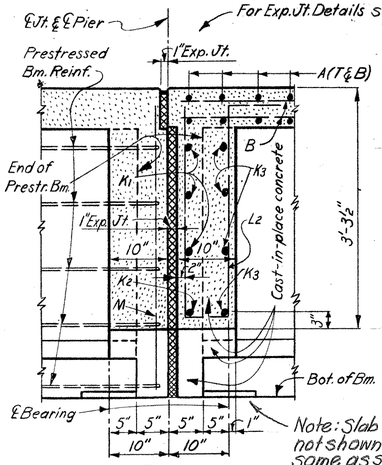
FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	CLARENDON-ORANGEBURG	1438.315.1	I-95	12	17

Live Load: HS20-44
fs (Reinf.) = 20,000 psi.
fc = 1200 psi.
n = 10
v = 225 psi.
u = 300 psi.

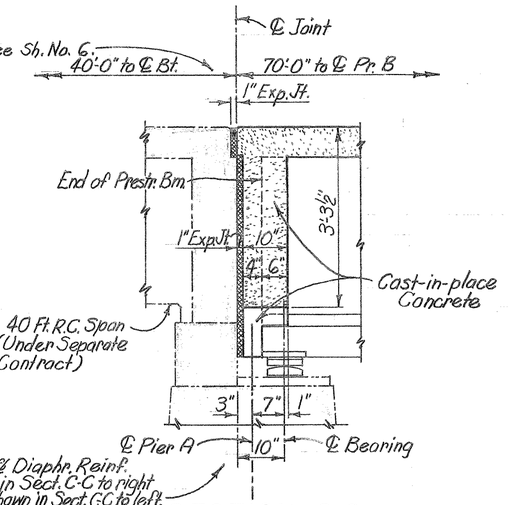


HALF ELEVATION B-B NO SCALE HALF SECTION A-A

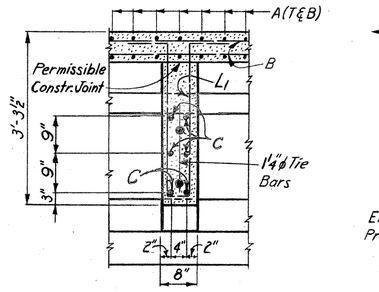
Note: Expansion Dam at Piers Q and V not shown in Half Elevation B-B above.



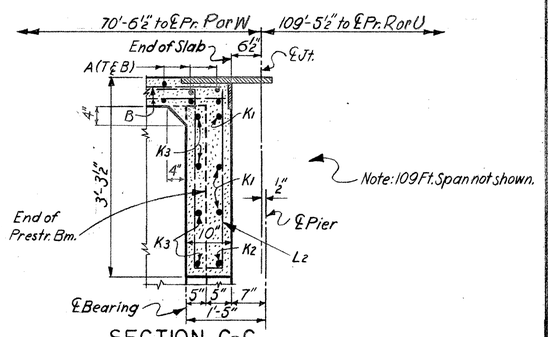
SECTION C-C
(AT PIERS B THRU P & W THRU AA)
Scale: 1" = 1'-0"



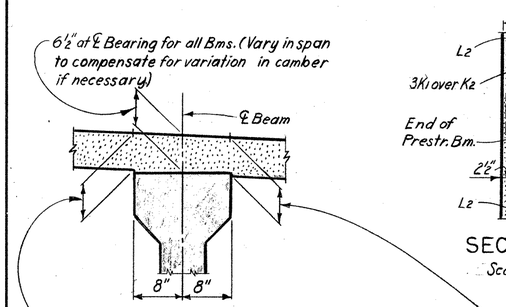
SECTION C-C
(AT PIER A)
SCALE: 3/4" = 1'-0"



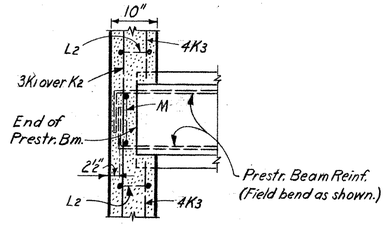
SECTION E-E
Scale: 3/4" = 1'-0"



SECTION C-C
(AT PIERS Q & V)
Scale: 3/4" = 1'-0"



DETAIL "A"
Scale: 1" = 1'-0"



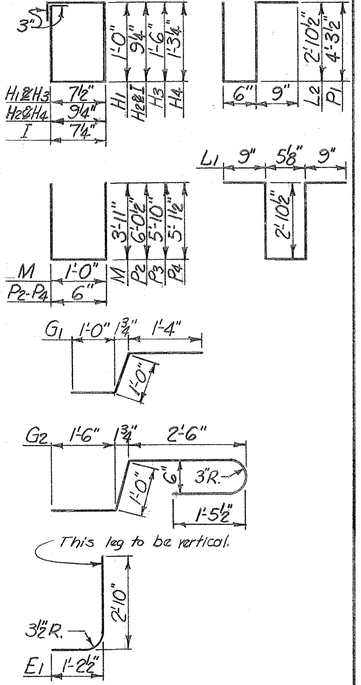
SECTION D-D
Scale: 3/4" = 1'-0"

REINFORCING STEEL SCHEDULE (1-SPAN)

MARK	SIZE NO.	D	END SPAN NO. REQ'D	END SPAN LENGTH	INTERIOR SPAN NO. REQ'D	INTERIOR SPAN LENGTH
A	5	S	336	34'-10"	336	34'-10"
B	5	S	128	35'-5"	128	35'-5"
C	4	S	48	6'-0"	48	6'-0"
D	5	S	70	0'-10"	70	0'-10"
E1	7	B	50	3'-11"	48	3'-11"
E2	7	S	50	2'-6"	48	2'-6"
F	4	S	16	34'-8"	16	34'-8"
G1	4	B	100	3'-4"	100	3'-4"
G2	7	B	96	6'-9"	96	6'-9"
H1	4	B	88	3'-9"	96	3'-9"
H2	3	B	110	3'-7"	120	3'-7"
H3	4	B	8	4'-9"	—	—
H4	3	B	10	4'-7"	—	—
I	3	B	240	3'-3"	240	3'-3"
J	6	S	24	34'-7"	24	34'-7"
K1	4	S	3	27'-9"	6	27'-9"
K2	6	S	1	27'-9"	2	27'-9"
K3	4	S	16	5'-3"	32	5'-3"
L1	4	B	40	7'-8"	40	7'-8"
L2	4	B	20	7'-0"	40	7'-0"
M	4	B	10	8'-10"	10	8'-10"
N1	4	S	3	45'-11"	—	—
N2	4	S	8	5'-3"	—	—
N3	4	S	4	4'-2"	—	—
N4	4	S	4	6'-0"	—	—
N5	4	S	4	8'-10"	—	—
N6	4	S	2	8'-3"	—	—
N7	4	S	4	7'-5"	—	—
N8	5	S	4	7'-6"	—	—
P1	4	B	18	9'-10"	—	—
P2	4	B	8	12'-7"	—	—
P3	4	B	2	12'-2"	—	—
P4	4	B	2	10'-9"	—	—
BB	1" Ht.	—	—	700'-0"	—	700'-0"
BB	2" Ht.	—	—	140'-0"	—	140'-0"
BBU	1½ Ht.	—	—	840'-0"	—	840'-0"
① 1¼"ø Tie Bar Assemblies	—	—	4	27'-11"	4	27'-11"

① Includes Hex. Nuts & ℄ Washers.

BENDING DETAILS



QUANTITIES (1-SPAN)

ITEM		END SPAN	INTERIOR SPAN
CONCRETE-CLASS "A",	C.Y.	77.7	73.6
REINFORCING STEEL,	LBS.	② 23,694	② 23,457
③ 70' PRESTRESSED CONCRETE BEAMS,	EA.	5	5

② Includes 543 Lbs. for Bolsters & 478 Lbs. for Tie Bar Assemblies.
③ All costs of furnishing and placing bearing assemblies (except Anchor Bolts) shall be included in the Price Bid for Prestressed Concrete Beams.

NOTES:

For Standard Notes see Sheet No. 5.
For Standard Details including Bolster Detail, Hook Details, Drain Details, Details of Safety Curb and Rail and 1" Expansion Joint Details see Sheet No. 6.
For Pre-tensioned Concrete Bms. see Sheet No. 10.
The quantities for concrete and reinforcing steel shown on this sheet are exclusive of the prestressed beam quantities for which see Sheet No. 10.
All concrete for 70 Ft. Spans, except prestressed beams, shall be Class "A".
Diaphragms between beams shall be cast at least 7 days before the slab if cast separately. Int. Diaphragms may be poured monolithic with slab provided the prestressed beams are temporarily strutted apart at bottom flange and top flange and tie bars are tightened snug during the slab and diaphragm pouring.
Allow a 5 day waiting period after pouring slab before pouring safety curb.

THIS SHEET TO ACCOMPANY SH'S. NO. 10 & 11.

REV.				
REV.				
REV.				
REV.	E.A.S.	W.G.P.	11-65	
	FROM FILE 721.3071			
REVIEWED			IN CHARGE	
QUAN.	W.D.S.	E.A.S.	8-65	
TR.				
DR.	W.D.S.	E.A.S.	8-65	
DES.	E.A.S.	W.G.P.	8-65	
	BY	CHK'D	DATE	

S.C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA S.C.

DETAILS OF 70 FT. SPAN FOR TWIN BRIDGES OVER LAKE MARION

SCALE AS NOTED

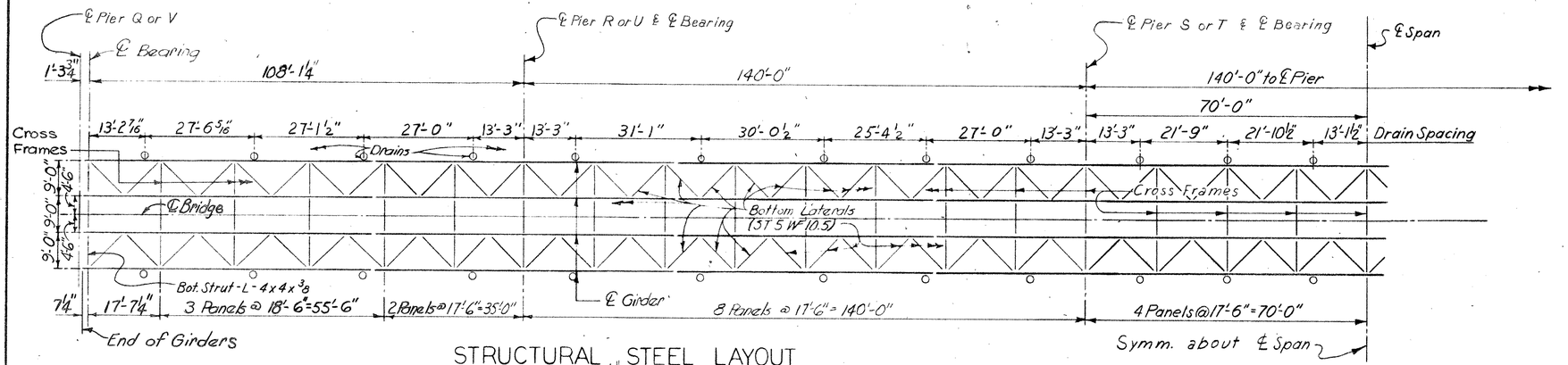
FILE NO.	COUNTY	ROUTE NO.	DATE
1438.315.1	CLARENDON-ORANGEBURG	I-95	11-65

APPROVED BY: W. E. Adams — BRIDGE DESIGN & PLANS ENGINEER
APPROVED BY: [illegible] — BRIDGE ENGINEER

ALBANENE® TRACING PAPER 72-629

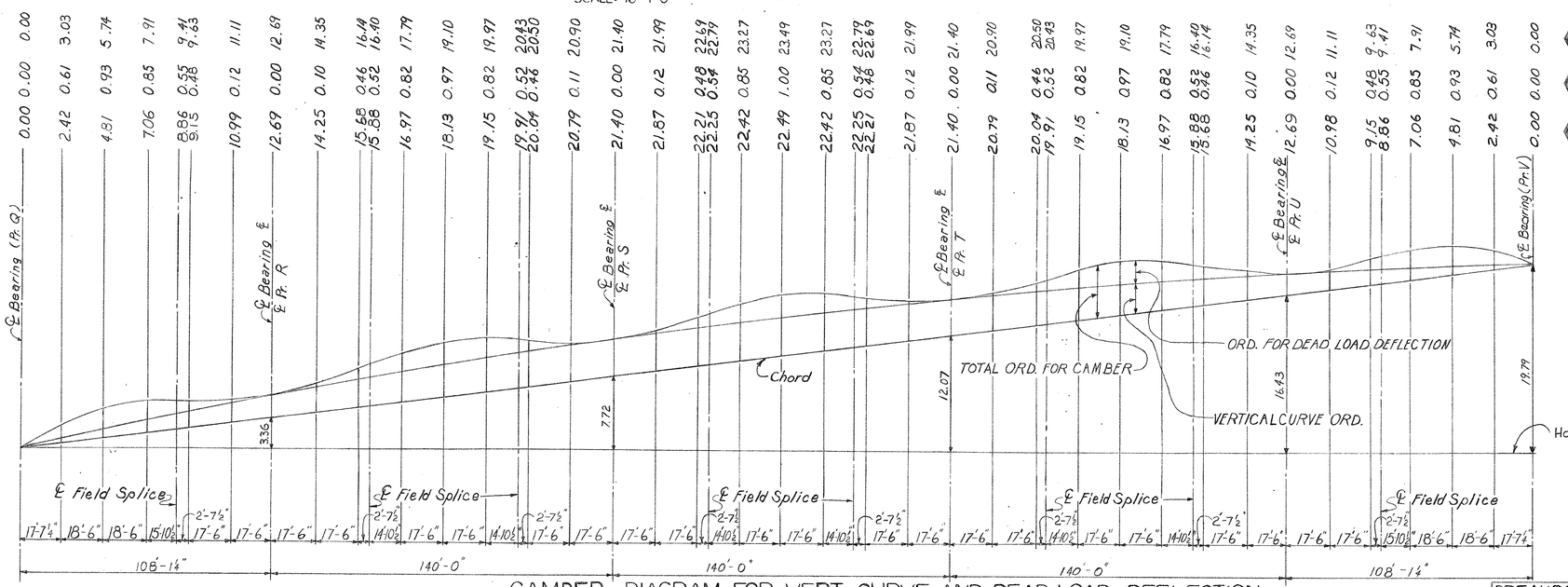
FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	CLARENDON-ORANGEBURG	1438.315.1	I-95	13	17

Live Load: HS20-44
f_s (Struct.) = 20,000 psi. - For A-36 Steel



STRUCTURAL STEEL LAYOUT

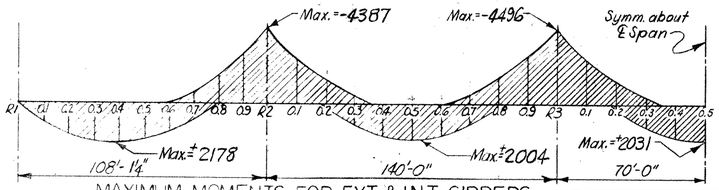
SCALE: 1/16" = 1'-0"



CAMBER DIAGRAM FOR VERT. CURVE AND DEAD LOAD DEFLECTION

IN INCHES
NO SCALE

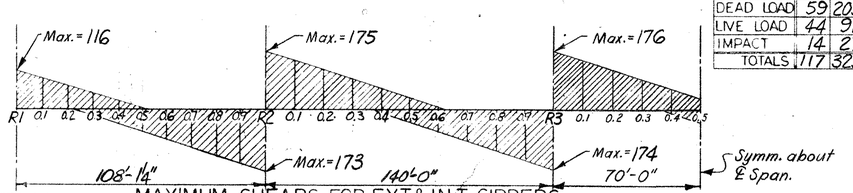
Note: Camber to be same for Ext. and Int. Girders.



MAXIMUM MOMENTS FOR EXT. & INT. GIRDERS*
(IN FT-KIPS)
NO SCALE

* Dead loads used in computing D.L. Deflections shown on this sheet to right.

DEAD LOAD (LBS. PER FT.)	ONE EXT. GIRDER	ONE INT. GIRDER
STRUCT. STEEL	287	287
SLAB	848	875
SAFETY CURB	91	75
RAIL	57	46
TOTAL	1283	1283



MAXIMUM SHEARS FOR EXT. & INT. GIRDERS
(IN KIPS)
NO SCALE

BREAKDOWN OF REACTIONS (IN KIPS)	ONE EXT. GIRDER			ONE INT. GIRDER		
	R1	R2	R3	R1	R2	R3
DEAD LOAD	59	205	202	46	185	181
LIVE LOAD	44	91	94	55	106	110
IMPACT	14	27	28	16	32	33
TOTALS	117	323	324	117	323	324

NOTES:

For Standard Notes see Sh. No 5.
For Standard Details see Sh. No. 6.
Design Spec's. (For Girder Span): A.A.S.H.O. 1965 with revisions thru 1968 and the 1966 Edition of the Standard Specifications of the American Welding Society for Welded Highway and Railway Bridges with revisions and additions set forth in the Special Provisions.
Live Load: HS 20-44 (including provision for alternate loading of 2 axles 4 ft. apart with each axle weighing 75% of rear loading for spans under 40 ft.).
All Structural Steel for main girders shall comply with the latest A.S.T.M. Spec. A-36. Structural Steel for bearing assemblies may be A-36 or A-373 steel. All cross frames, laterals, and other secondary members and connections may be A-36 or A-373 Steel.
No deck concrete to be poured until Superstructure falsework has been struck.
All costs of welding and of furnishing and placing shoes, rockers, expansion assemblies and drain pipes to be included in the Lump Sum Bid for Steel Superstructures.
Field connections shall be Rivets or High-Tensile-Strength Bolts except where welded or other connections are otherwise shown in these plans.
All Rivets or High-Tensile Bolts shall be ⅞" ϕ and holes shall be 15/16" ϕ unless noted.
Materials and installation for High-Tensile-Strength bolts, nuts and washers shall meet all the requirements of S.C. Standard Specifications, Edition of 1964.
Holes in all main member field splices shall be Sub-Punched, the connecting members shop assembled in their proper position, and the holes reamed to full size while assembled.
End stiffeners shall be vertical; all others normal to grade. All stiffeners over supports shall be milled to bear on flange plates and welded as shown. All interior stiffeners shall be fitted tight against tension flange and then welded as shown to web and compression flange.
For welding, the top flange shall be considered the tension flange for the length over Int. Supports between field splices, and the bottom flange shall be considered the tension flange from ends of girders to first field splices and for center portion of Int. Spans between field splices.
The following welding sequence to be followed in fabricating girder sections in shop:
1. Butt weld flange and web splices.
2. Weld flanges to web. The welding of flanges to webs shall proceed on both sides from the middle of the section being welded toward each end.
3. Weld transverse stiffeners to girder.
4. Weld longitudinal stiffeners and connection plates to girder.

This sheet to accompany Sh's, No. 14 thru 16.

REV.			
REV.	M.W.A.	W.G.P.	10-65
	FROM FILE 172.3021		
REV.	E.A.S.	W.D.S.	8-65
	From Dkt. 3.320.2		
REV.	R.R.C.	E.A.S.	4-63
	FROM DKT. 4.5063		
REVIEWED:		IN CHARGE	
QUAN.	W.D.S.	E.A.S.	8-65
TR.			
DR.	R.R.C.	E.A.S.	2-61
DES.	E.A.S.	W.N.W.	2-61
	BY	CHKD.	DATE

S.C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA, S.C.

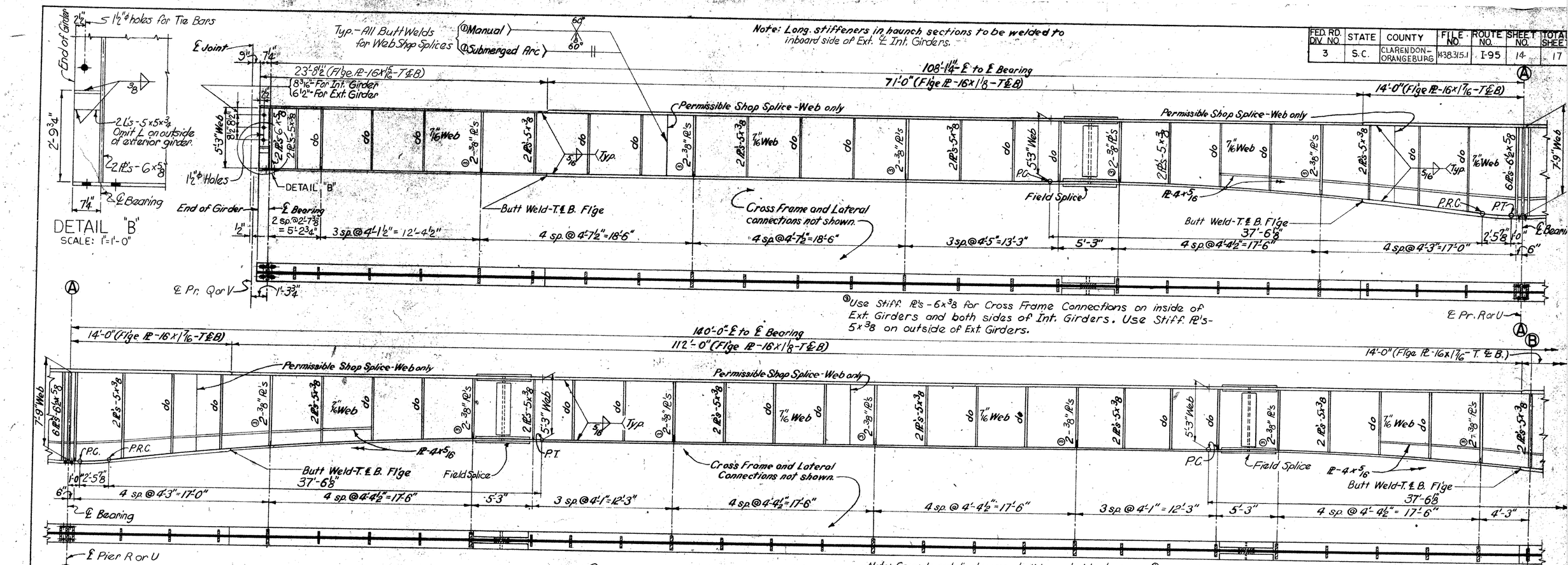
638 FT. SPAN LAYOUT FOR TWIN BRIDGES OVER LAKE MARION

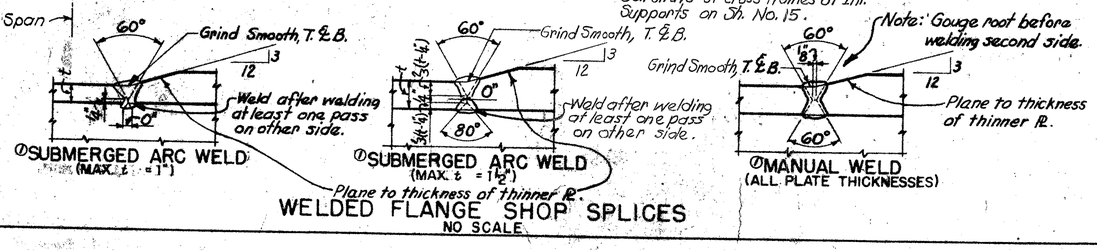
SCALE AS NOTED

FILE NO.	COUNTY	ROUTE NO.	DATE
1438.315.1	CLARENDON-ORANGEBURG	I-95	10-65

APPROVED BY: _____ BRIDGE DESIGN & PLANS ENGR.
APPROVED BY: _____ BRIDGE ENGINEER.

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEET
3	S.C.	CLARENDON-ORANGEBURG	1438.315.1	I-95	14	17





NOTES:
For Standard Notes see Sh. No. 5.
For Standard Details see Sh. No. 6.

THIS SHEET TO ACCOMPANY SH'S. NO. 13, 15 & 16.

S.C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA, S.C.

638 FT. GIRDER DETAILS FOR TWIN BRIDGES OVER LAKE MARION

SCALE: ¼"=1'-0"; OR AS NOTED

REV.			
REV.	W.G.P.	E.A.S.	10-65
	FROM FILE 172.1301		
REV.	W.G.P.	E.A.S.	8-65
	FROM DKT. 3.320.2		
REV.	R.R.C.	E.A.S.	8-63
	FOR DKT. 3.320.2		
REVIEWED:	SOC		
IN CHARGE			
QUAN.	WDS	E.A.S.	8-65
TR.	APP. R.R.C.	E.A.S.	5-63
DR.	R.R.C.	E.A.S.	5-63
DES.	E.A.S.	W.G.P.	5-63
	BY	CHK'D	DATE

FILE NO.	COUNTY	ROUTE NO.	DATE
1438.315.1	CLARENDON-ORANGEBURG	I-95	10-65

APPROVED BY: [signature] BRIDGE DESIGN & PLANS ENGR.
APPROVED BY: [signature] BRIDGE ENGINEER

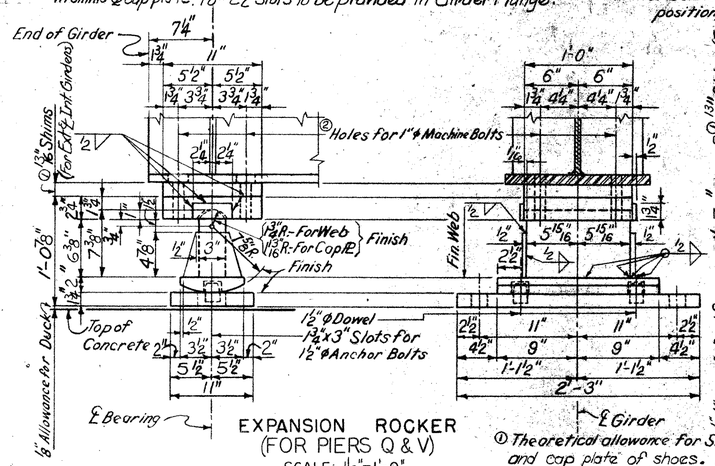
Live Load: HS 20-44
fs (Struct) = 20,000 psi. — For A-36 Steel

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	CLARENDON-ORANGEBURG	1438.315.1	I-95	15	17

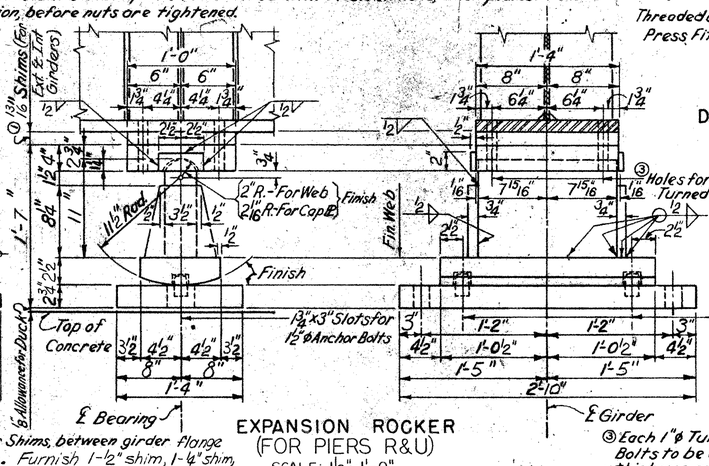
Live Load: HS 20-44
fs (Struct.) = 20,000 psi - For A-36 Steel

② Each 1" ϕ Machine Bolt to have Hex. H. & N. and one 2"x4"x1/2" PL Washer against Girder Flange. Bolts to be of 1 length 3 to accomodate shims from 0 to 1 1/2" total thickness. 1 1/16" ϕ holes to be provided in shims & cap plate. 1 1/8" x 2 1/2" slots to be provided in Girder Flange.

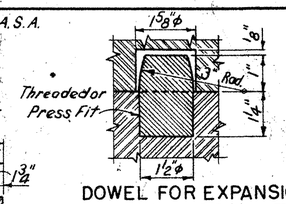
Note: Finish for all Surfaces where indicated on rockers and fixed shoes to be Flat Class 63 A.S.A. See Standard Specs. Par. 79D21, for method of Finishing and inspection. Rockers and fixed shoes to be fabricated from rolled steel. Rockers to be set vertical at 70° F. Anchor bolt slots in bottom plate to be filled with moulten lead when plates are in position, before nuts are tightened.



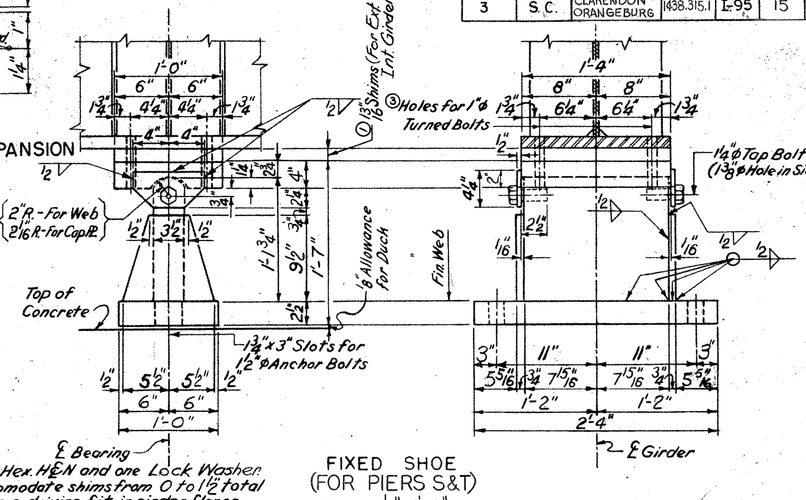
EXPANSION ROCKER
(FOR PIERS Q & V)
SCALE: 1 1/2" = 1'-0"



EXPANSION ROCKER
(FOR PIERS R&U)
SCALE: 1 1/2" = 1'-0"



DOWEL FOR EXPANSION ROCKERS
HALF SCALE

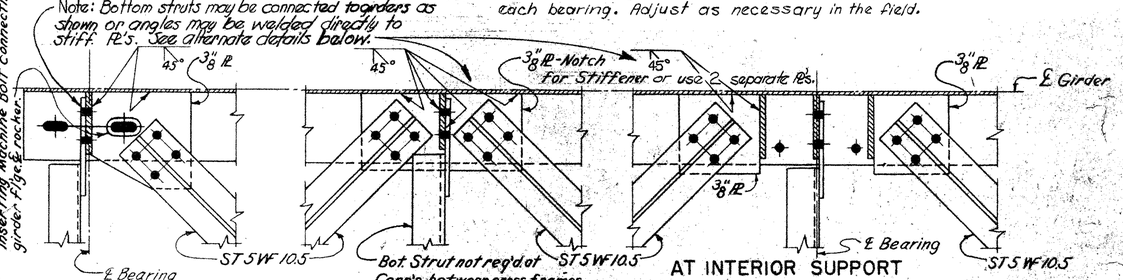


FIXED SHOE
(FOR PIERS S&T)
SCALE: 1 1/2" = 1'-0"

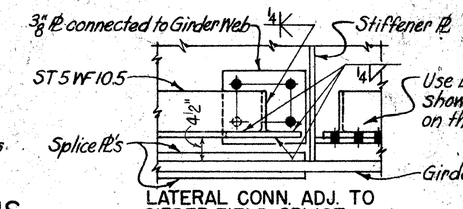
① Theoretical allowance for Shims, between girder flange and cap plate of shoes. Furnish 1-1/2" shim, 1-1/4" shim, 1-3/16" shim & 1-1/8" shim to make a total of 1 1/16" at each bearing. Adjust as necessary in the field.

③ Each 1" ϕ Turned Bolt to have Hex. H&N and one Lock Washer. Bolts to be of lengths to accomodate shims from 0 to 1 1/2" total thickness and to be turned to a driving fit in girder flange. 1 1/8" ϕ holes to be provided in Shims and Cap Plate.

Note: Bottom struts may be connected to girders as shown or angles may be welded directly to stiff. PL's. See alternate details below:

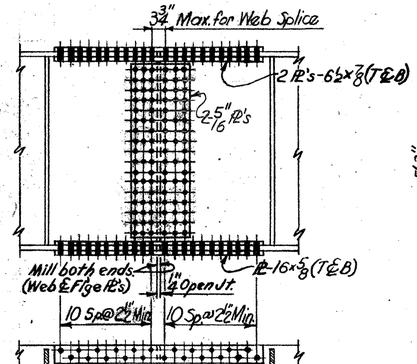


Note: Bolted or riveted field connections are shown above & to rt. for laterals. If desired by the Contractor, 5/16" all around fillet welds may be substituted for bolts or rivets as detailed.

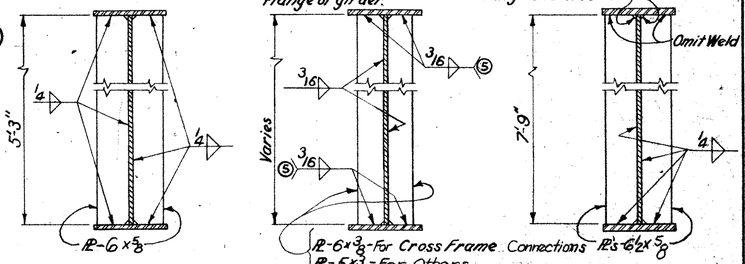


LATERAL CONN. ADJ. TO GIRDER FIELD SPLICE

ALTERNATE LATERAL CONNECTIONS
SCALE: 1 1/2" = 1'-0"



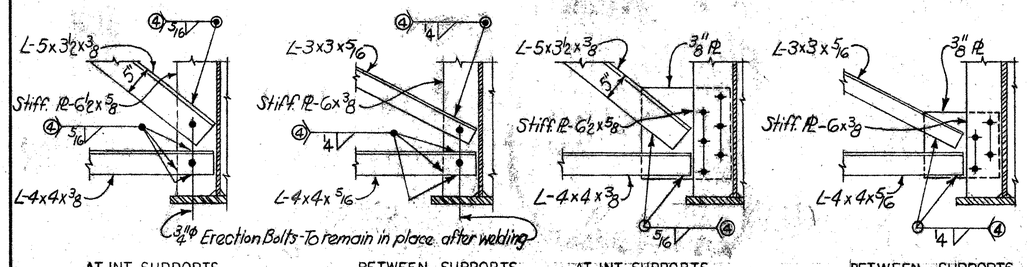
FIELD SPLICE DETAIL
SCALE: 1 1/2" = 1'-0"



Note: Cross Frame & Lateral Conn's. and Long. Stiffeners not shown.

TRANSVERSE STIFFENER DETAILS
SCALE: 3/4" = 1'-0"

Note: If desired by the Contractor a 1/4" all around fillet weld & 3/4" ϕ Erection Bolts may be substituted for the bolted or riveted field connections shown below.

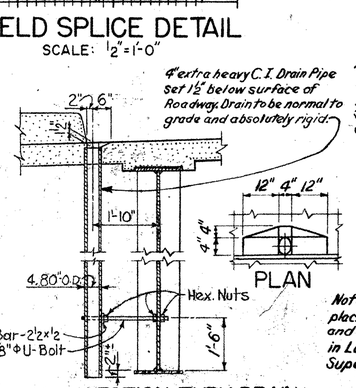


WELDED FIELD CONNECTIONS
BOLTED OR RIVETED FIELD CONNECTIONS

ALTERNATE CROSS FRAME CONNECTIONS
SCALE: 1" = 1'-0"

NOTE: FIELD CONNECTIONS FOR LATERALS & CROSS FRAMES MAY BE BOLTED, RIVETED OR WELDED IN ACCORDANCE WITH ALTERNATE DETAILS SHOWN ON THIS SHEET AND SH. NO. 16.

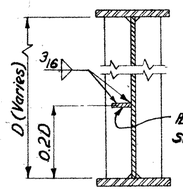
④ Provide min. total length of fillet weld at ends of diagonals & struts as follows:
L-3x3x5/16 - 10"
L-4x4x5/16 - 12"
L-4x4x3/8 - 14"
L-5x3 1/2x3/8 - 22"



SECTION THRU DRAIN

Note: All costs of furnishing, placing, and painting drains and U-bolts to be included in Lump Sum Bid for Steel Superstructure.

DRAIN DETAIL
SCALE: 1" = 1'-0"



LONG STIFFENER DETAIL
SCALE: 3/4" = 1'-0"
Note: For location of long. stiffeners see Sh. No. 14.

NOTES:
For Standard Notes see Sh. No. 5.
For Standard Details see Sh. No. 6.

THIS SHEET TO ACCOMPANY SHEETS NO. 13, 14 & 16.

REV.			
REV.	W.G.P.	E.A.S.	10-65
	FROM FILE 172(30).1		
REV.	W.G.P.	E.A.S.	9-65
	FROM DKT. 33202		
REV.	R.R.C.	E.A.S.	14-63
	FROM DKT. 4505.3		
REVIEWED:			
IN CHARGE			
QUAN.	W.G.P.	E.A.S.	2-61
TR.	A.P.D.	E.A.S.	2-61
DR.	A.P.D.	W.N.W.	2-61
DES.	E.A.S.	W.N.W.	2-61
BY	CHKD.	DATE	

S.C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA, S.C.

638 FT. SPAN DETAILS
FOR TWIN BRIDGES OVER
LAKE MARION
SCALE AS NOTED

FILE NO.	COUNTY	ROUTE NO.	DATE
1438.315.1	CLARENDON-ORANGEBURG	I-95	10-65

APPROVED BY: _____ BRIDGE DESIGN & PLANS ENGR.
APPROVED BY: _____ BRIDGE ENGINEER

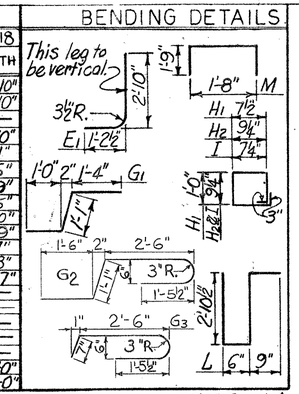
Live Load : HS 20-44
fs (Reinf.) = 20,000 psi.
For Class "A" Concrete : fc = 1200 psi. ; n = 10 ; v = 225 psi. ; u = 300 psi.

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	CLARENDON-ORANGEBURG	1438.315.1	I-95	16	17

REINFORCING STEEL SCHEDULE

PANEL NO. →			1 OR 2		3,4 OR 5		6,9 OR 10		①7 OR 8		11,12,15 OR 16		13,14,17 OR 18	
MARK	SIZE NO.	D	NO. REQ'D	LENGTH	NO. REQ'D	LENGTH	NO. REQ'D	LENGTH	NO. REQ'D	LENGTH	NO. REQ'D	LENGTH	NO. REQ'D	LENGTH
A	5	S	178	34'-10"	168	34'-10"	168	34'-10"	175	34'-10"	168	34'-10"	168	34'-10"
B	5	S	64	39'-8"	64	37'-8"	64	36'-3"	64	36'-8"	64	36'-3"	64	34'-10"
C	4	S	—	—	—	—	—	—	—	—	14	15'-0"	—	—
D	5	S	38	0'-10"	36	0'-10"	36	0'-10"	38	0'-10"	36	0'-10"	36	0'-10"
E1	7	B	24	3'-11"	24	3'-11"	24	3'-11"	24	3'-11"	24	3'-11"	24	3'-11"
E2	7	S	24	2'-6"	24	2'-6"	24	2'-6"	24	2'-6"	24	2'-6"	24	2'-6"
F	4	S	8	36'-9"	8	34'-9"	8	34'-9"	8	37'-5"	8	34'-9"	8	34'-9"
G1	4	B	60	3'-5"	50	3'-5"	50	3'-5"	60	3'-5"	50	3'-5"	50	3'-5"
G2	7	B	48	6'-10"	48	6'-10"	48	6'-10"	44	6'-10"	48	6'-10"	48	6'-10"
H1	4	B	48	3'-9"	48	3'-9"	48	3'-9"	48	3'-9"	48	3'-9"	48	3'-9"
H2	3	B	60	3'-7"	60	3'-7"	60	3'-7"	60	3'-7"	60	3'-7"	60	3'-7"
I	3	B	120	3'-3"	110	3'-3"	110	3'-3"	120	3'-3"	110	3'-3"	110	3'-3"
J	6	S	12	36'-7"	12	34'-7"	12	34'-7"	12	37'-5"	12	34'-7"	12	34'-7"
K1	4	S							3	26'-9"				
G3	7	B							4	41'-10"				
K2	4	S							3	8'-9"				
L	4	B							24	7'-0"				
M	4	B							4	5'-2"				
BB 1"HH				430'-0"		455'-0"		455'-0"		430'-0"		455'-0"		455'-0"
BBD 2"HH				460'-0"		425'-0"		425'-0"		460'-0"		425'-0"		425'-0"

BENDING DETAILS



BREAK-DOWN OF QUANTITIES

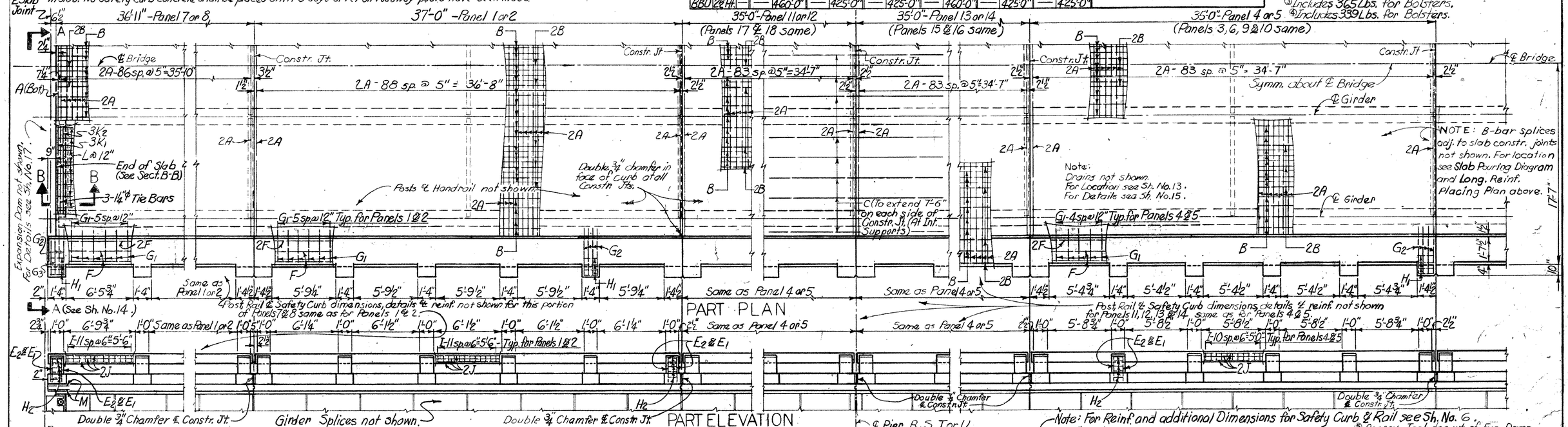
PANEL NO.	CONCRETE-CLASS "A" (C.Y. PER PANEL)				REINF. STEEL (LBS. PER PANEL)
	SLAB & DIAPHR.	SAFETY CURB	HAND-RAIL	TOTAL	TOTAL
1 or 2	31.4	4.5	3.0	38.9	③ 11,838
3,4 or 5	29.7	4.3	2.8	36.8	④ 11,232
6,9 or 10	29.7	4.3	2.8	36.8	④ 11,137
7 or 8	33.7	4.6	3.0	41.3	② 12,092
11,12,15 or 16	29.7	4.3	2.8	36.8	④ 11,277
13,14,17 or 18	29.7	4.3	2.8	36.8	④ 11,042

SLAB POURING DIAGRAM & LONG. REINF. PLACING PLAN
NO SCALE

NOTE:
Slabs to be poured in order shown.
A 36 hour interval will be required between pours except as follows:
No interval required between pouring Panels 1 and 2.
No interval required between pouring Panels 7 and 8.
No interval required between pouring Panels 11 and 12.
No interval required between pouring Panels 13 and 14.
No prescribed order for Safety Curb and Handrail pourings but joints shall be opposite those in slab. No Safety Curb concrete shall be placed until 5 days after all roadway pours have been made.

① Reinf. Steel for Panels 7 or 8 includes 3-1¼"φ x 27'-6" Tie Bar Assemblies with 2 Hex. Nuts and 2 Washers per Assembly.

② Includes 365 Lbs. for Bolsters & 363 Lbs. for Tie Bar Assemblies.
③ Includes 365 Lbs. for Bolsters.
④ Includes 339 Lbs. for Bolsters.



NOTES:
For Standard Notes see Sh. No. 5.
For Standard Details, including Bolster Detail, see Sh. No. 6.
For Details of Exp. Dam see Sh. No. 17.
All concrete to be Class "A".
For additional details of alternate cross frame & lateral connections see Sh. No. 15.
⑥ Field weld req'd for welded type cross frame connections.

TOTAL QUANTITIES (ONE 638 FT. SPAN)

CONCRETE - CLASS "A"	675.6 C.Y.
REINFORCING STEEL	204,243 LBS
STRUCTURAL STEEL	⑥ 781,900 LBS

This sheet to accompany Shs. No. 13, 14 & 15.

REV.			
REV.	W.G.P.	E.A.S.	10-65
	FROM FILE 1721.307-1		
REV.	EAS	WGP	8-65
	FROM DKT. 3320.2		
REV.	R.R.C.	E.A.S.	12-63
	FROM DKT. 4505.3		
REVIEWED			
IN CHARGE			

QUAN	WGP	E.A.S.	2-61
TR.			
DR.	WGP	E.A.S.	2-61
DES.	E.A.S.	WNW	2-61
	BY	CHKD	DATE

S.C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA, S.C.

638 FT. SPAN DECK DETAILS FOR TWIN BRIDGES OVER LAKE MARION

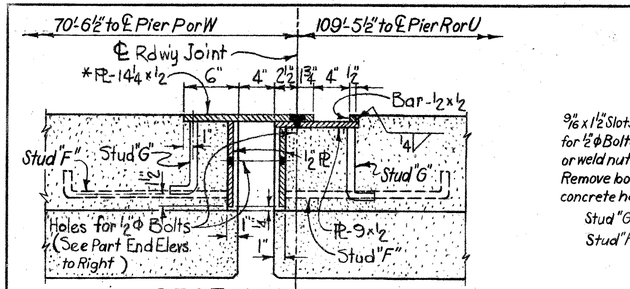
SCALE: ¼" = 1'-0" OR AS NOTED.

FILE NO.	COUNTY	ROUTE NO.	DATE
1438.315.1	CLARENDON-ORANGEBURG	I-95	10-65

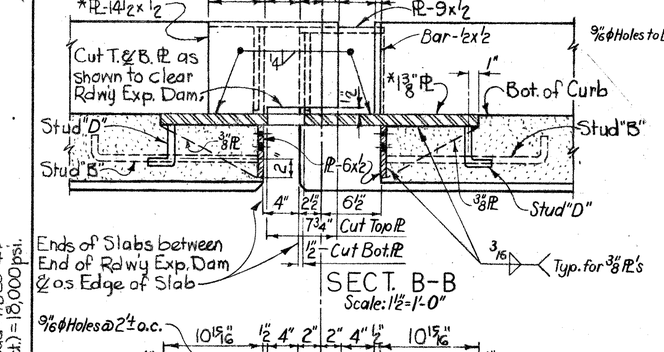
APPROVED BY: ℄ Bridge Design & Plans Engr. — APPROVED BY: Bridge Engineer

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON-ORANGEBURG	1438,315,1	I-95	17	17

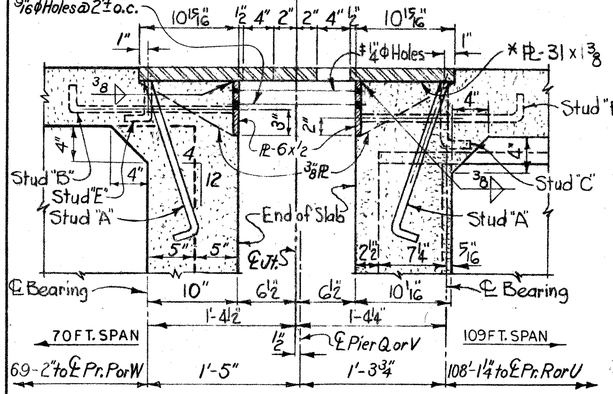
Live Load: HS 20-44
fs (Struct.) = 18,000 psi.



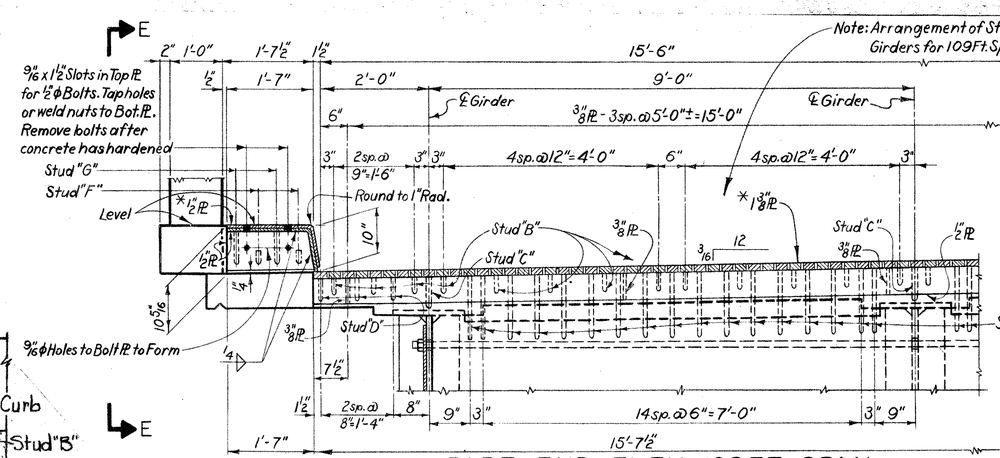
SECT. A-A
Scale: 1½"=1'-0"



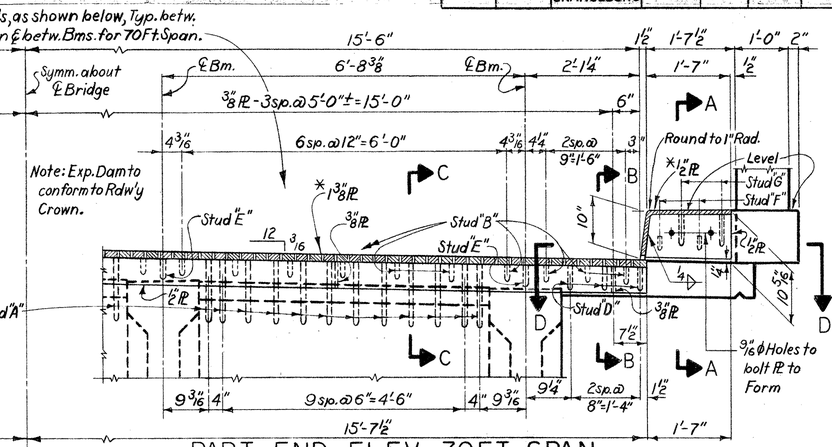
SECT. B-B
Scale: 1½"=1'-0"



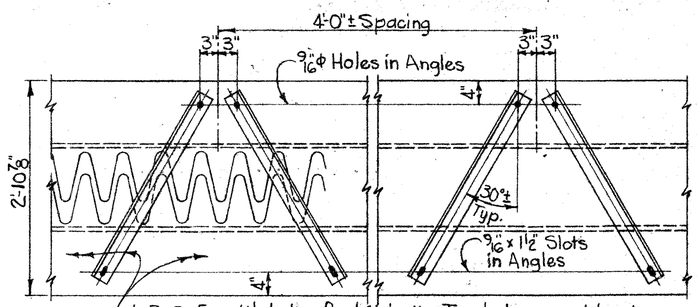
SECT. C-C
Scale: 1½"=1'-0"



PART END ELEV.-109 FT. SPAN

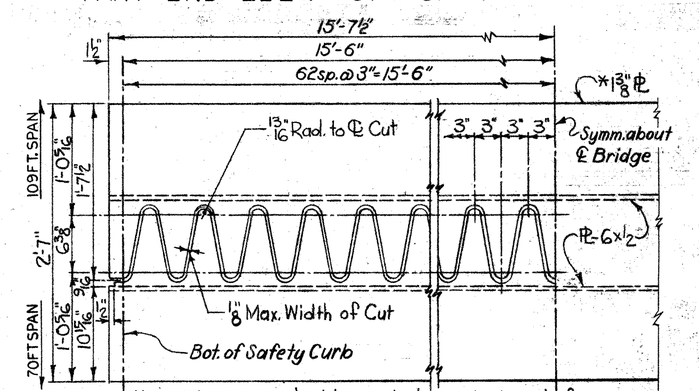


PART END ELEV.-70 FT. SPAN



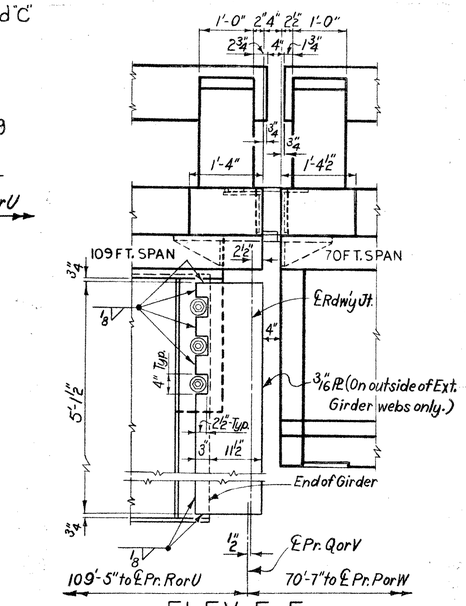
L-3x3x5/16 with holes for ½" ϕ bolts. Tap holes or weld nuts to bot. of PL's. Remove bolts after concrete has hardened.

PART PLAN - ROADWAY EXP. DAM
(Showing L Braces for holding alignment during construction)
SCALE: 1" = 1'-0"

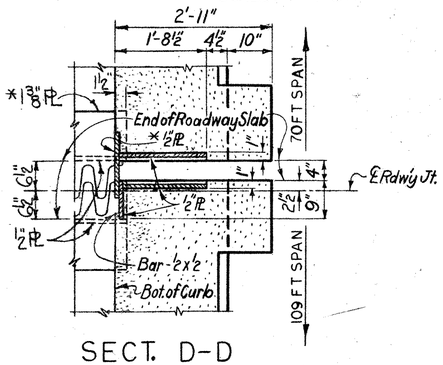


Note: The Scroll shall be made by a single cut of a machine guided torch. Grind off burns on the Roadway side of cut.

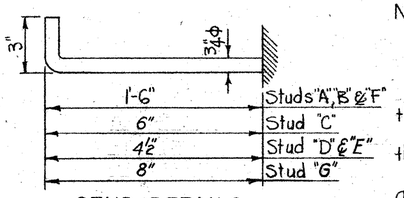
DETAIL OF SCROLL
SCALE: 1½" = 1'-0"



ELEV. E-E



SECT. D-D



STUD DETAILS
NO SCALE

NOTES:

For Standard Notes see Sh. No. 5 .
For Standard Details see Sh. No. 6 .
Structural Steel for Exp. Dams may be A-36 or A-373.
Exp. Dams to be set to dimensions shown on this sheet adjusted for a normal temperature of 70°F.
¾"ϕ Studs to be electrically welded to plates in the shop.
Care shall be taken to provide dense concrete around steel expansion plates and stud anchors.

*1 3/8" PL for Roadway Expansion Dam and Top ½" PL for Safety Curb Expansion Dam to be raised pattern, either manufactured or fabricated from plain plate with welded checkers.

‡Provide ¼"ϕ Holes @ 2'± o.c. in ½" PL to allow concrete flow into corner of dam. See Sect. C-C to left.

REV.			
REV.			
REV.			
REV.			
REVIEWED			
IN CHARGE			

S. C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA S. C.

DETAILS OF EXPANSION DAM AT PIERS Q & V FOR TWIN BRIDGES OVER LAKE MARION

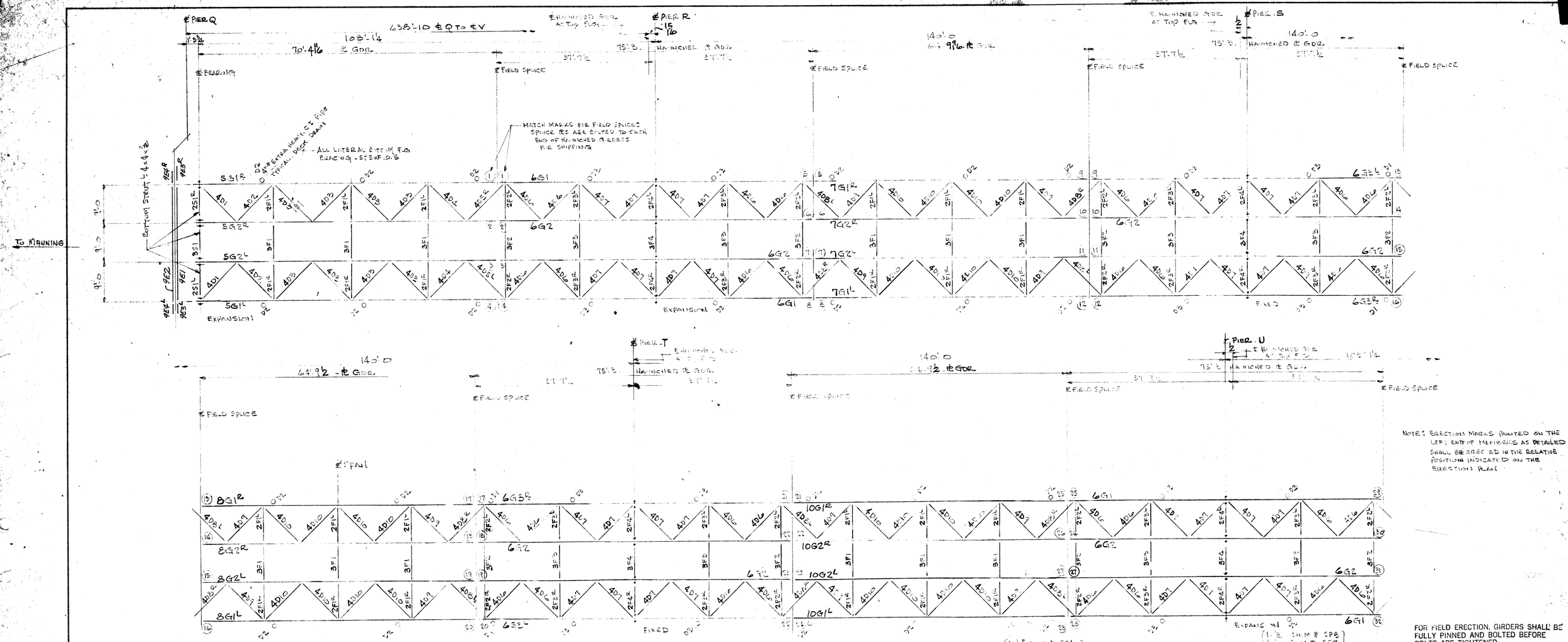
SCALE: ¾"=1'-0"; or as noted

QUAN.	WDS	EJM	4-69
TR.			
DR.	WDS	WGP	4-69
DES.	EAS	WGP	4-69
	BY	CHK'D	DATE

FILE NO.	COUNTY	ROUTE NO.	DATE
1438,315,1	CLARENDON-ORANGEBURG	I-95	4-69

APPROVED BY: T. M. Love ASS'T BRIDGE DESIGN & PLANS ENGINEER

APPROVED BY DESIGN: W. E. Crum BRIDGE ENGINEER



NOTES:

MATERIAL SPEC'S: S.C.H.D. & LATEST A.S.T.M.
WORKMANSHIP SPEC'S: S.C.H.D.
ALL WELDING, INCLUDING RADIOGRAPHIC & MAGNETIC PARTICLE INSPECTION, SHALL BE IN ACCORDANCE WITH THE 1966 EDITION OF THE A.W.S. SPEC'S FOR WELDED HIGHWAY & RAILWAY BRIDGES WITH REVISIONS & ADDITIONS SET FORTH IN THE SPECIAL PROVISIONS.
WELDING SEQUENCE FOR SHOP FABRICATION OF SECTIONS: (1) BUTT WELD FLANGE & WEB [illegible] FLANGES [illegible] BOTH SIDES FROM MIDDLE OF SECTION [illegible] ENDS. (2) WELD TRANSVERSE STIFFENERS. (4) WELD LONG. STIFFENERS, CONN. [illegible] TO GIRDER

SEE DWG. HE2 FOR BRIDGE CAMBER DIAGRAM

GENERAL NOTES
DESIGN BY
HOLES
RIVETS
SHOP PAINT
FIELD CONNS. 7/8" ⌀ H.S. BOLTS
ERECTION BY
INSPECTION BY F & 2
FABRICATED BY

REVISIONS			
DATE	NO.	BY	CHANGE
	R1		
	R2		
	R3		
	R4		

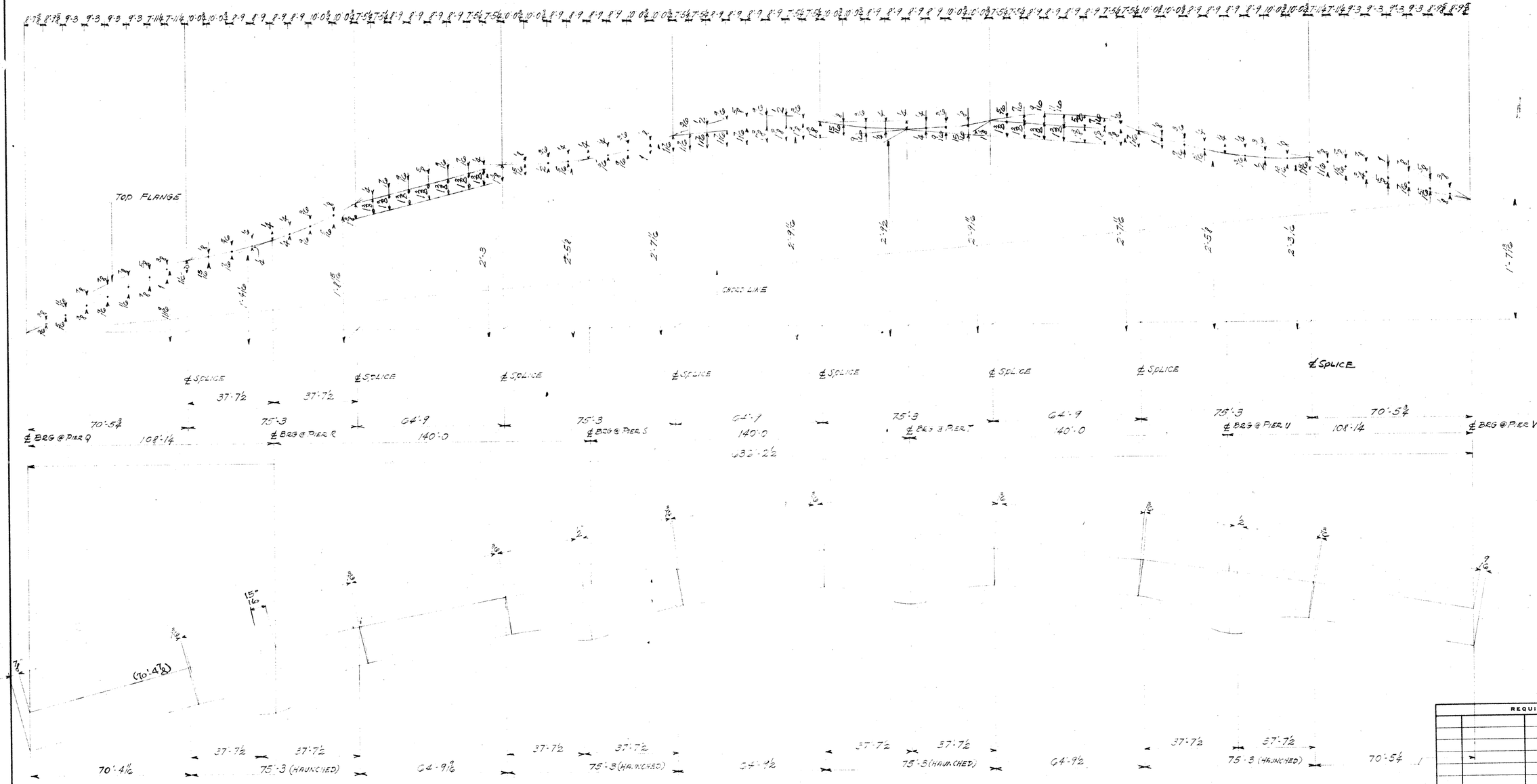
REQUIRED

S.C. FILE 1438.315.1
FAP # I-95-2(12)
CLARENDON-ORANGEBURG COUNTIES
STATION 5246+79.00 TO
STATION 5268+59.00
NORTH BOUND LANE

ORDER NO. 69-940H50
DETAILS OF ERECTION PLAN.
N.B.L. I-95 OVER
FOR LAKE MARION NO. 2
CUSTOMER WANNAMAKER & WELLS, INC.
AT CLARENDON-ORANGEBURG COUNTIES S.C.

CAROLINA STEEL CORPORATION
GREENSBORO, N. C.

MADE BY N. Fong
TRACED BY
CHECKED BY
SCALE 27 JUNE 69
SHOP BILL NO.
SHEET HE1



CAMBER DIAGRAM

NOTE: GRIDER SECTIONS TO BE BLOCKED AT ALL SPLICES AND AT ALL SUPPORTS WHEN SHOP ASSEMBLYING FOR REAMING FIELD SPLICES.

GENERAL NOTES

DESIGN BY
HOLES
RIVETS
SHOP PAINT
FIELD CONNS.
ERECTION BY
INSPECTION BY F&R
FABRICATED BY

REVISIONS			
DATE	NO.	BY	CHANGE
	R1		
	R2		
	R3		
	R4		

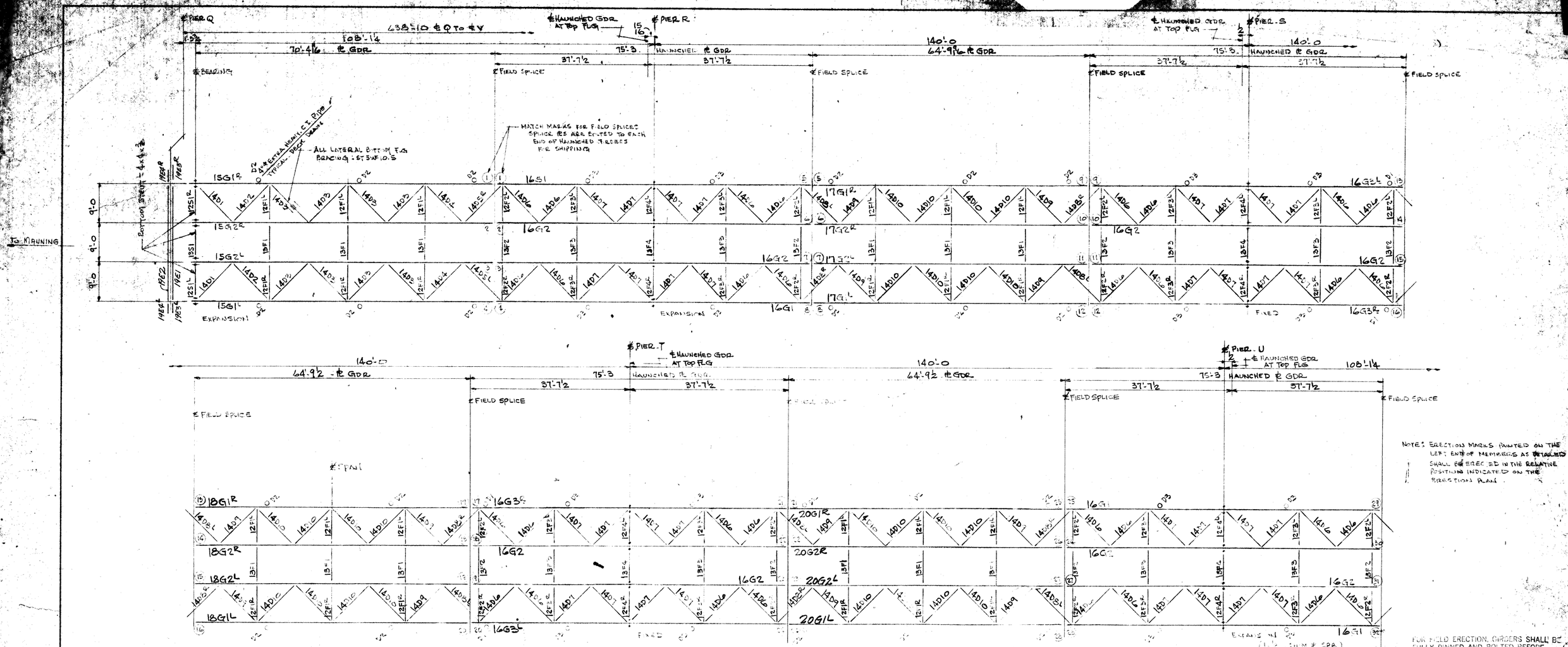
REQUIRED

S.C. FILE 1433.315.1
FAP # I-95-2 (12)
STATION 5246+79.00 TO
STATION 5268+59.00
CLARENDON - ORANGEBURG COUNTIES

ORDER NO. 69-940H50
DETAILS OF CAMBER DIAGRAM
NBL
FOR BRIDGE OVER LAKE MARION NO. 2
CUSTOMER WANAMAKER & WELLS, INC.
AT CLARENDON - ORANGEBURG COUNTIES, S.C.

CAROLINA STEEL
CORPORATION
GREENSBORO, N. C.

MADE BY Nifong
TRACED BY
CHECKED BY
SCALE 2" = 1 FT.
JUNE 69
SHOP BILL NO.
SHEET HE2 OF



NOTES: ERECTION MARKS PAINTED ON THE LEFT END OF MEMBERS AS DETAILED SHALL BE ERECTED IN THE RELATIVE POSITION INDICATED ON THE ERECTION PLAN.

FOR FIELD ERECTION, GIRDERS SHALL BE FULLY PINNED AND BOLTED BEFORE BOLTS ARE TIGHTENED.

NOTES:

MATERIAL SPEC'S: S.C.H.D. & LATEST A.S.T.M.
WORKMANSHIP SPEC'S S.C.H.D.
ALL WELDING, INCLUDING RADIOGRAPHIC & MAGNETIC PARTICLE INSPECTION, SHALL BE IN ACCORDANCE WITH THE 1966 EDITION OF THE A.W.S. SPEC'S FOR VISUAL HIGHWAY & RAILWAY BRIDGES.
REVISIONS & ADDITIONS SET FORTH IN THE SPECIAL PROVISIONS.
WELDING SEE NOTE FOR SHOP FABRICATION OF GIRDER SECTIONS: (1) BUTT WELD FLANGE & WEB SPLICES (2) WELD FLANGES TO WEB INTERMITTENT ON BOTH SIDES FROM MIDDLE OF SECTION TOWARD ENDS. (3) WELD TRANSVERSE STIFFENERS (4) WELD LONG STIFFENERS, CONN. PLS ETC. TO GIRDER.

SEE DWG HE4 FOR BRIDGE CAMBER DIAGRAM

GENERAL NOTES
DESIGN BY
HOLES
RIVETS
SHOP PAINT
FIELD CONNS. ⅞" ϕ H.S. BOLTS
ERECTION BY
INSPECTION BY F & R
FABRICATED BY

REVISIONS			
DATE	NO.	BY	CHANGE
	R1		
	R2		
	R3		
	R4		

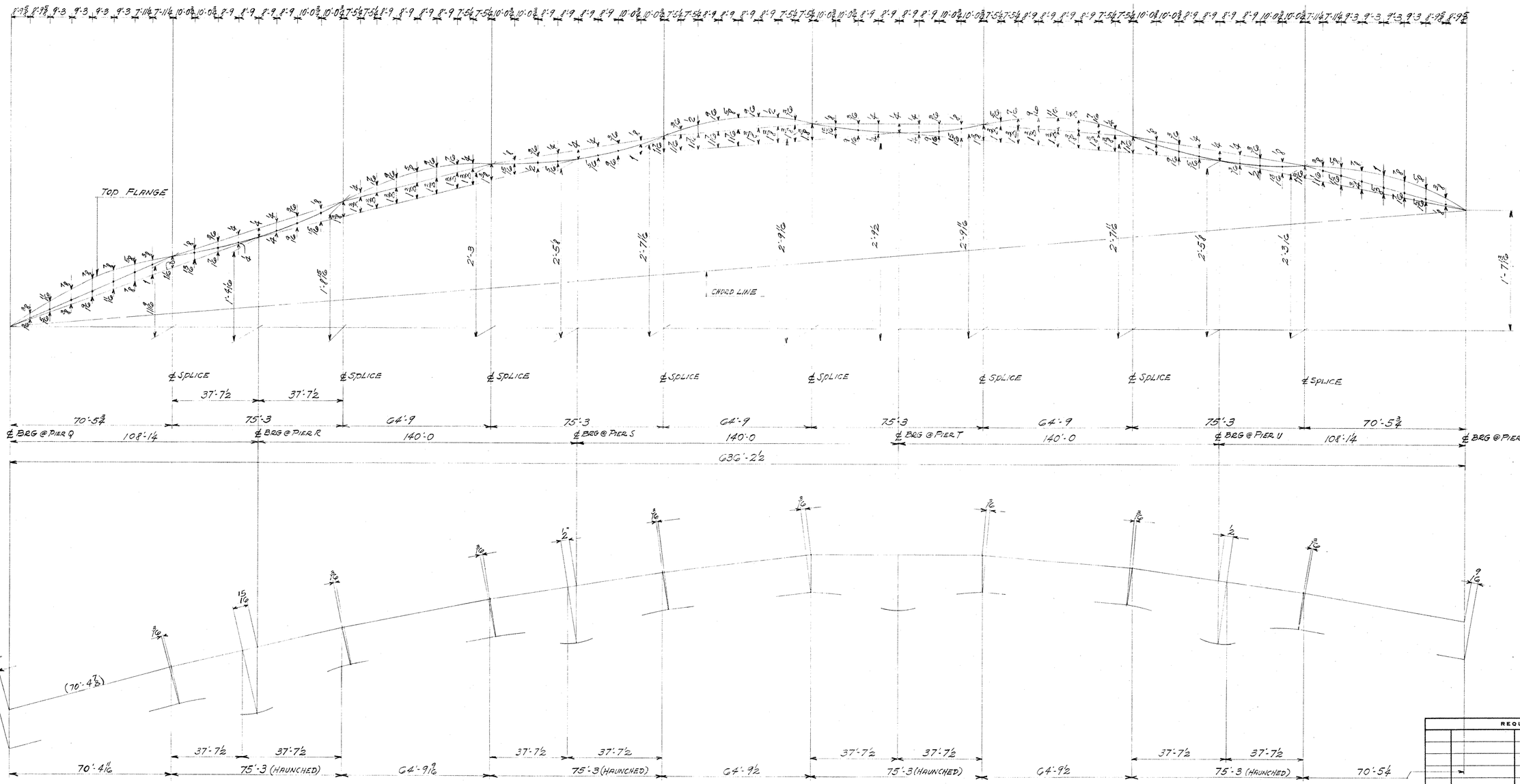
REQUIRED

S.C. FILE 1438.315.1
FAP # I-95-2(12)
CLARENDON-ORANGEBURG COUNTIES
STATION 5246+79.00 TO
STATION 5268+59.00
SOUTH BOUND LANE

ORDER NO. 69-940H60
DETAILS OF ERECTION PLAN
S.B.L. I-95
FOR LAKE MARION NO. 2
CUSTOMER WANNAMAKER & WELLS, INC.
AT CLARENDON-ORANGEBURG COUNTIES S.C.

CAROLINA STEEL CORPORATION
GREENSBORO, N. C.

MADE BY N. Fong
TRACED BY
CHECKED BY
SCALE 27 JUNE 69 1 FT.
SHOP BILL NO.
SHEET HE3 OF



CAMBER DIAGRAM

NOTE: GRIDER SECTIONS TO BE BLOCKED AT ALL SPLICES AND AT ALL SUPPORTS WHEN SHOP ASSEMBLYING FOR REAMING FIELD SPLICES

GENERAL NOTES
DESIGN BY
HOLES
RIVETS
SHOP PAINT
FIELD CONNS.
ERECTION BY
INSPECTION BY F & R
FABRICATED BY

REVISIONS			
DATE	NO.	BY	CHANGE
	R1		
	R2		
	R3		
	R4		

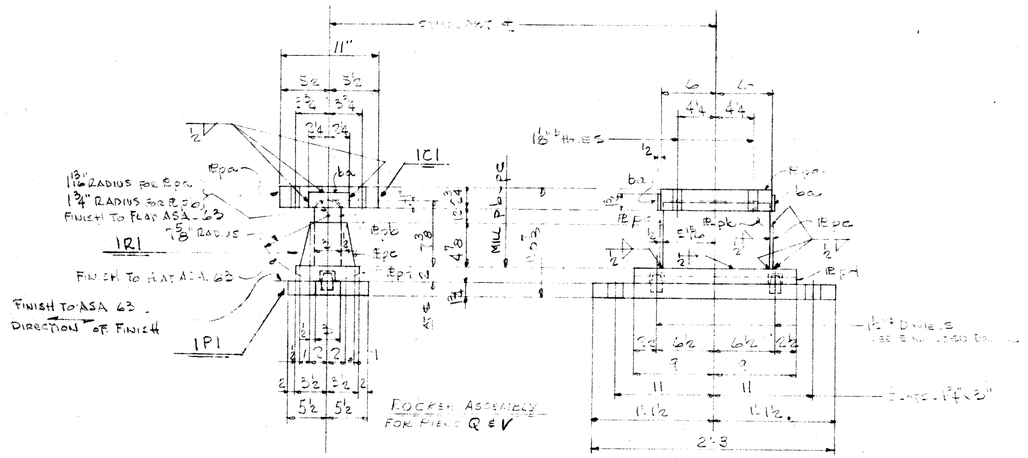
REQUIRED
S.C. FILE 1438.315.1
FAP # I-95-2 (V2)
STATION 5246+79.00 TO
STATION 5268+59.00
CLARENDON - ORANGEBURG COUNTIES

ORDER NO. 69-940H60
DETAILS OF CAMBER DIAGRAM
SBL
FOR BRIDGE OVER LAKE MARION NO. 2
CUSTOMER WANNAMAKER & WELLS, INC.
AT CLARENDON - ORANGEBURG COUNTIES, S.C.

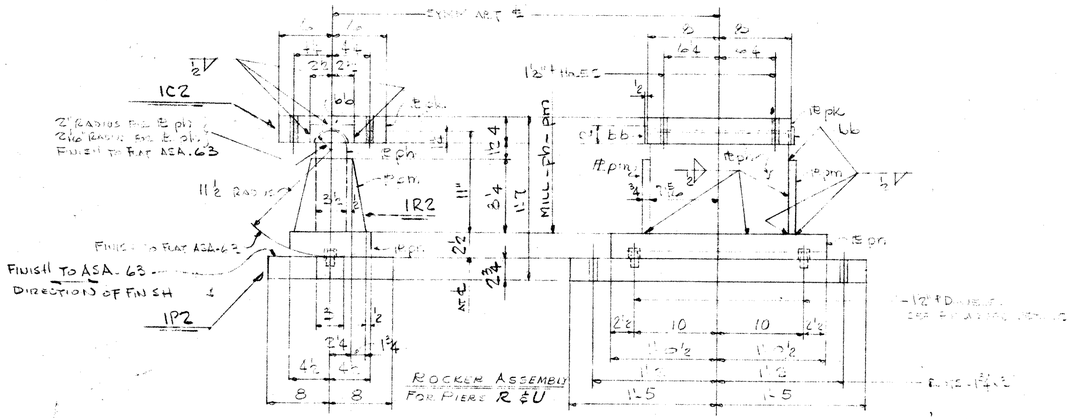
CAROLINA STEEL CORPORATION
GREENSBORO, N. C.

MADE BY Nifong
TRACED BY
CHECKED BY
SCALE 27 JUNE 69 1 FT.
SHOP BILL NO.
SHEET HE4 OF

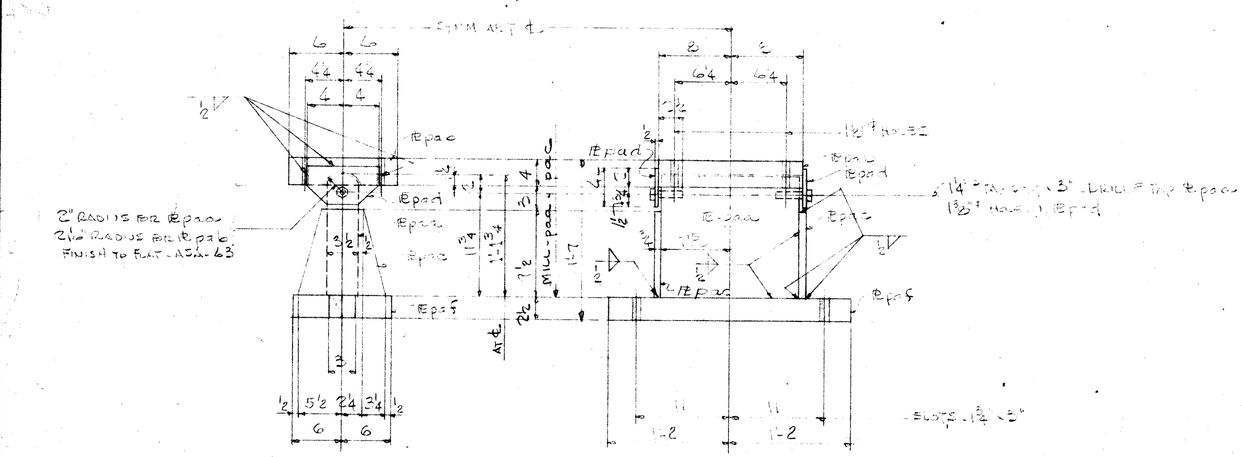
GLENNON & KERN, INC., CHICAGO



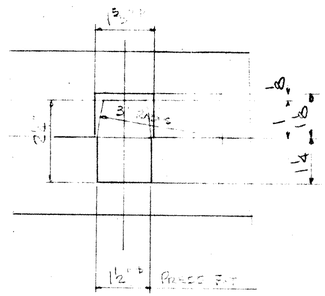
ROCKER ASSEMBLY FOR PIERS Q & V



ROCKER ASSEMBLY FOR PIERS R & U



FIXED SHOE ASSEMBLY - 1FS1
FOR PIERS S & T



DETAIL OF DOWEL

NOTE:
ALL BEARING ASSEMBLIES TO BE FABRICATED FROM ROLLED STEEL. BEARING ASSEMBLIES TO BE CHECKED IN SHOP BY FROEHLING & ROBERTSON INC. FOR PROPER FINISHING & ALL OTHER REQUIREMENTS BEFORE PAINTING.

SHOP BILL

SHIPPING LIST NO. PIECES	SHIPPING LIST MARK	MATERIAL ORDER NO.	ORDERED NO.	ORDERED FEET	ORDERED INS.	NO. PIECES	DESCRIPTION	LENGTH FEET	LENGTH INS.	REMARKS	WEIGHT
8	1C1	SHN				8	PL 11 x 2 3/4	1	0	pa. FIN	A36
		SOC				16	BARS 1 3/4 x 1/2	0	4 1/2	ba	
8	1R1	SHN				8	PL 7 7/8 x 3		11 7/8	pb (F-2-ENDS)	
		SOC				16	PL 4 7/8 x 1/2	0	6	pf (TEMP.)	
						8	PL 7 x 2	1	6	pd (FIN.)	
8	1P1	SHN-USE-2"				8	PL 11 x 1 7/8	2	3	(PLANE TO 1 3/4)	
		SOC				16	1 1/2" ϕ	0	2 1/4	DOWELS	
8	1C2	SHN				8	PL 12 x 4	1	4	pk - FIN	A36
		SHN				16	BARS 2 x 1/2	0	5	bb	
8	1R2	SHN				8	PL 11 x 3 1/2	1	3 7/8	ph (F-2-ENDS)	
		SHN				16	PL 8 x 3/4	0	8 1/4	pm (TEMP.)	
		SHN				8	PL 9 x 2 1/2	2	1	pn (FIN.)	
8	1P2	SHN-USE 3"				8	PL 16 x 2 7/8	2	10	(PLANE TO 2 3/4)	
		SOC				16	1 1/2" ϕ		2 1/4	DOWELS	
8	1FS1	SHN				8	PL 13 3/4 x 3 1/2	1	3 7/8	paa - FINISH-2 EDGES	A36
		SHN				8	PL 12 x 4	1	4	pab - FINISH	
		SHN				16	PL 9 1/2 x 3/4	0	11	pac - TEMP.	
		SHN				8	PL 12 x 2 1/2	2	4	paf	
		SHN				16	PL 4 1/4 x 1/2		8	pad - TEMP	
						16	1 1/4" ϕ TAP BOLTS x 3			HEX HD.	

SC FILE 1438.315.1
FAP # I-95-2 (12)
STA. 5246+79.00 TO
STA. 5268+59.00

TAB DEPT.

TOTAL WEIGHT

GENERAL NOTES
DESIGN BY
HOLES NOTED
RIVETS
SHOP PAINT RED LEAD (S.C. HWY SPECS)
FIELD CONNS.
ERECTION BY
INSPECTION BY F & R

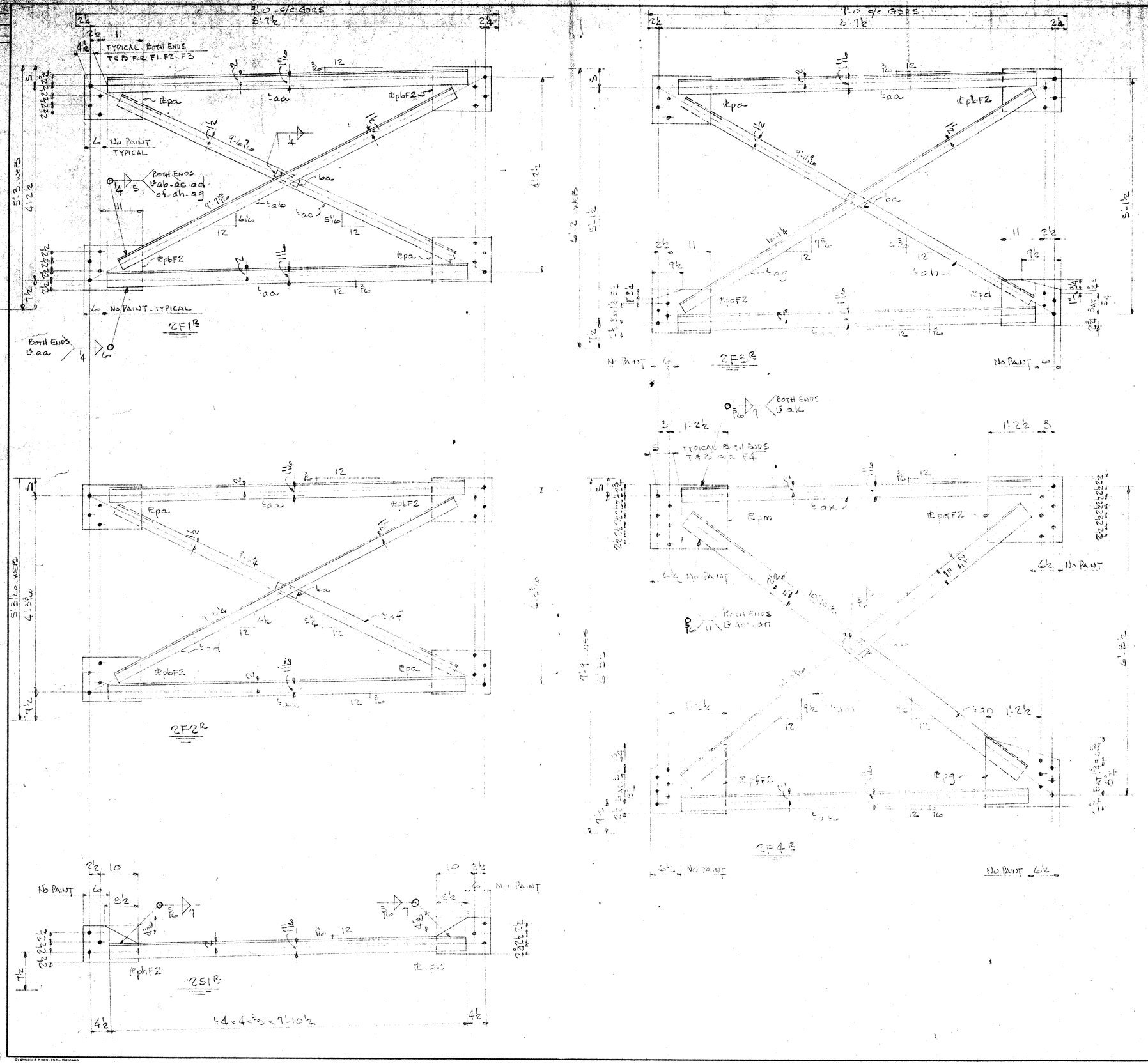
REVISIONS

DATE	NO.	BY	CHANGE
	R1		
	R2		
	R3		
	R4		

ORDER NO. 69-9401464
DETAILS OF BRG ASSEMBLIES & NBL
FOR BRIDGE OVER LAKE MARION NO. 2
CUSTOMER WANNAMAKER & NELLIS, INC.
AT CLARENDON & ORANGEBURG COUNTIES, S.C.

CAROLINA STEEL CORPORATION
GREENSBORO, N.C.

MADE BY N. Fong
TRACED BY
CHECKED BY
SCALE 1" = 1'-0" DATE 27 JUNE 69
SHOP BILL NO.



SHOP BILL

Shipping List No. Pieces	Shipping List Mark	Material Order No.	Ordered No.	Ordered Feet	Ordered Inc.	No. Pieces	Description	Length Feet	Length Inc.	Remarks
			(ALL MATERIAL A36, A373)							
30	2F1R	CB-0670 MR	47	3	60	L	4x4x5/16	7	10½	aa
			35	0	30	L	3x3x5/16	8	2½	ab
			49	3	30	L	3x3x5/16	8	1¼	ac
		SHN			60	PL	11¾x3/8	1	3	pa
					60	PL	11½x3/8	1	3	pbF2
		Soc			30	BARS	2½x3/8		7	ba
16	2F2R	CB-0670 MR	47	3	32	L				aa
			33	2	16	L	3x3x5/16	8	2¾	ad
			33	0	16	L	3x3x5/16	8	1½	af
		SHN			32	PL				pa
					32	PL				pbF2
		Soc			16	BARS				ba
16	2F3R	CB-0670 MR	47	3	32	L				aa
			35	8	16	L	3x3x5/16	8	10¼	ag
			35	0	16	L	3x3x5/16	8	8	ah
		SHN			16	PL				pa
					16	PL				pbF2
					16	PL	12x3/8	1	3	pcF2 TEMP
					16	PL	12¼x3/8	1	3	pd TEMP
		Soc			16	BARS				ba
8	2F4R	Soc			16	L	4x4x3/8	7	9½	ak
		Soc			8	L	5x3½x3/8	9	5¼	am
		Soc			8	L	5x3½x3/8	9	3¼	an
		SHN			8	PL	16¾x3/8	1	7	pm
					8	PL	16½x3/8	1	7	pdF2
					8	PL	18x3/8	1	7	pfF2 TEMP
					8	PL	18¼x3/8	1	7	pg TEMP
		Soc			8	BARS	4x3/8		8	bb
4	2S1R	Soc			4	L	4x4x3/8	7	10½	
		SHN			4	PL	9x3/8	1	2	pbF2 TEMP
					4	PL	9¼x3/8	1	2	pk TEMP

SC FILE 1438.315.1
FAP # I-95-2(12)
STA. 5246 + 79.00
STA. 5268 + 59.00

TOTAL WEIGHT

GENERAL NOTES
DESIGN BY
HOLES 15/16" ⌀
RIVETS
SHOP PAINT RED LEAD, UNLESS NOTED
FIELD CONNS S.C. HWY. SPECS.
ERECTION BY
INSPECTION BY F&R

REVISIONS

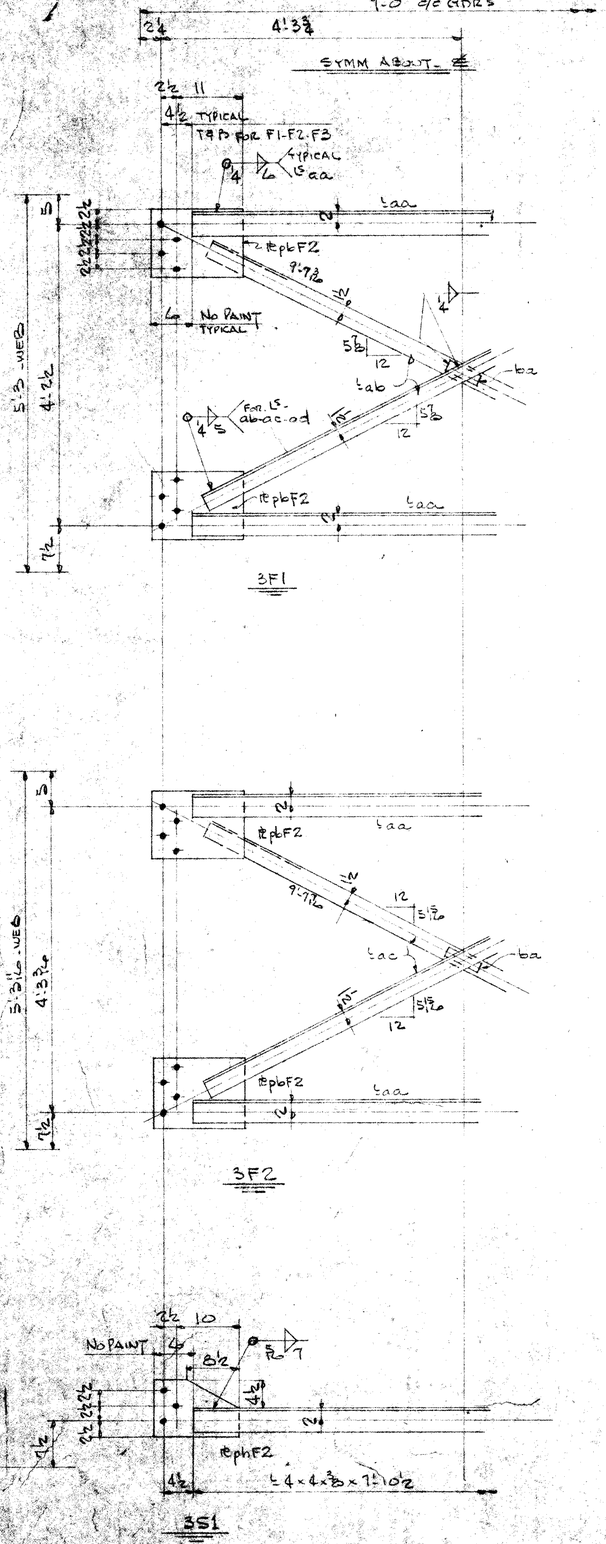
DATE	NO.	BY	CHANGE
	R1		
	R2		
	R3		
	R4		

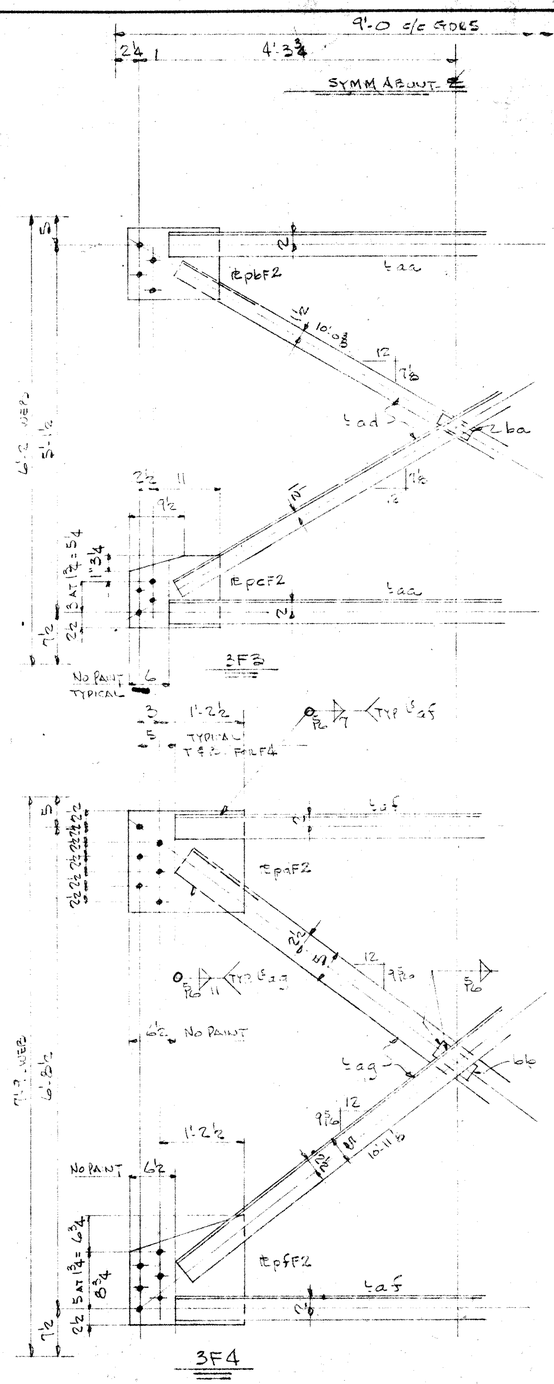
ORDER NO. 69-920H55
DETAILS OF CROSSFRAMES NBL
FOR BRIDGE OVER LAKE MARION NO. 2
CUSTOMER WHITEMAKER & WELLS, INC.
AT CLARENDON & ORANGEBURG COUNTIES, S.C.

CAROLINA STEEL CORPORATION
GREENSBORO, N.C.

MADE BY Wifong
TRACED BY
CHECKED BY
SCALE 27 JAN 69
SHOP BILL NO.
SHEET 1 OF 2

GLENNON & KERN, INC., CHICAGO





SHOP BILL

SHIPPING LIST NO. PIECES	SHIPPING LIST MARK	MATERIAL ORDER NO.	ORDERED NO.	ORDERED PCS	ORDERED INCS.	NO. GRADE	DESCRIPTION	LENGTH FEET	LENGTH INCHES	REMARKS	WEIGHT
			(ALL MATERIAL A36 or A572)								
15	3F1	CB-0670 PHL	99	3	20	L	4x4x5/16	7	10½	aa	
		↓	99	3	20	L	3x3x5/16	8	1⅜	ac	
		SHN			60	PL	11⅜x⅜	1	3	pbF2	
		Soc			15	BARS	2½x⅜		7	ba	
8	3F2	CB-0670 PHL	99	3	16	L				aa	
		↓	33	2	16	L	3x3x5/16	8	2¼	ac	
		SHN			32	PL				pbF2	
		Soc			8	BARS				ba	
8	3F3	CB-0670 PHL	99	3	16	L				aa	
		↓	35	8	16	L	3x3x5/16	8	9½	ad	
		SHN			16	PL				pbF2	
		↓			16	PL	12x⅜	1	3	pcF2 temp	
		Soc			8	BARS				ba	
4	3F4	Soc			8	L	4x4x⅜	7	9½	af	
		Soc			8	L	5x3½x⅜	9	6¼	ag	
		SHN			8	PL	16½x⅜	1	7	pdF2	
		↓			8	PL	13x⅜	1	7	peF2	
		Soc			4	BARS	4x⅜		8	bb	
2	3S1	Soc			2	L	4x4x⅜	9	10½		
		SHN			4	PL	9x⅜	1	2	phF2 temp	

TOTAL WEIGHT

SC FILE 1638.315.1
FAP # F-95-2(16)
STA. 5246+70.00 TO
STA. 5268+58.00

GENERAL NOTES

DESIGN BY

HOLES 15 to 11

RIVETS

SHOP PAINT RED LEAD UNLESS NOTED S.C. HWY. SPECS.

FIELD CONNS

ERECTION BY

INSPECTION BY FER

DATE	NO.	BY:	REVISIONS CHANGE
	R1		
	R2		
	R3		
	R4		

ORDER NO. G92 9474 55

DETAILS OF GDRS, FRMS, ETC. NOV.

FOR BRIDGE OVER Long Main Rd &

CUSTOMER Mowbray & Hewitt Inc.

AT Cleveland & Greenville Counties, SC

CAROLINA STEEL CORPORATION

MADE IN GREENSBORO, N. C.

MARKED BY

CHECKED BY

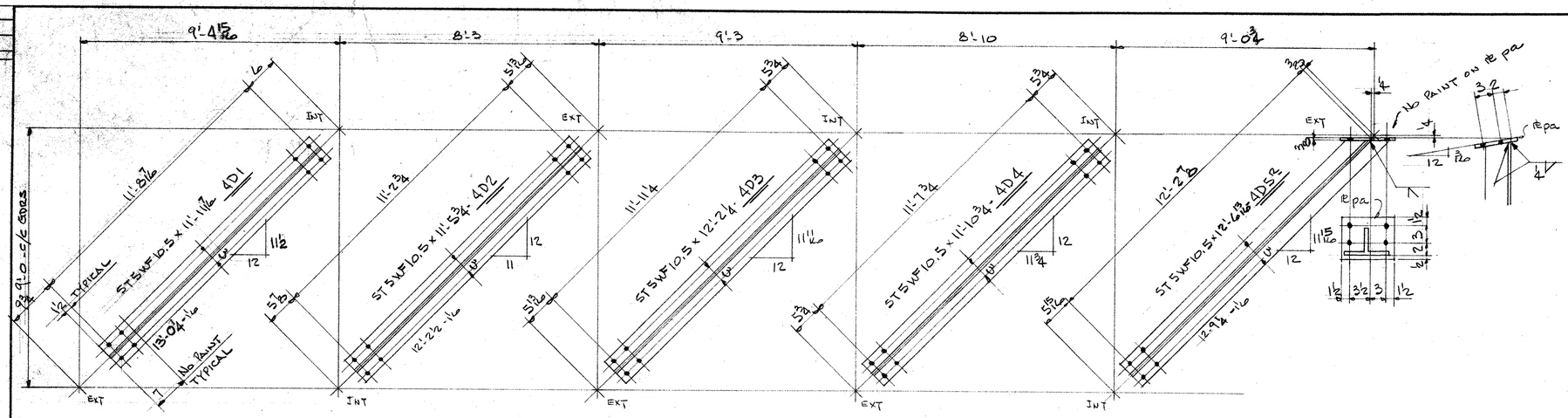
DATE 4-17-96

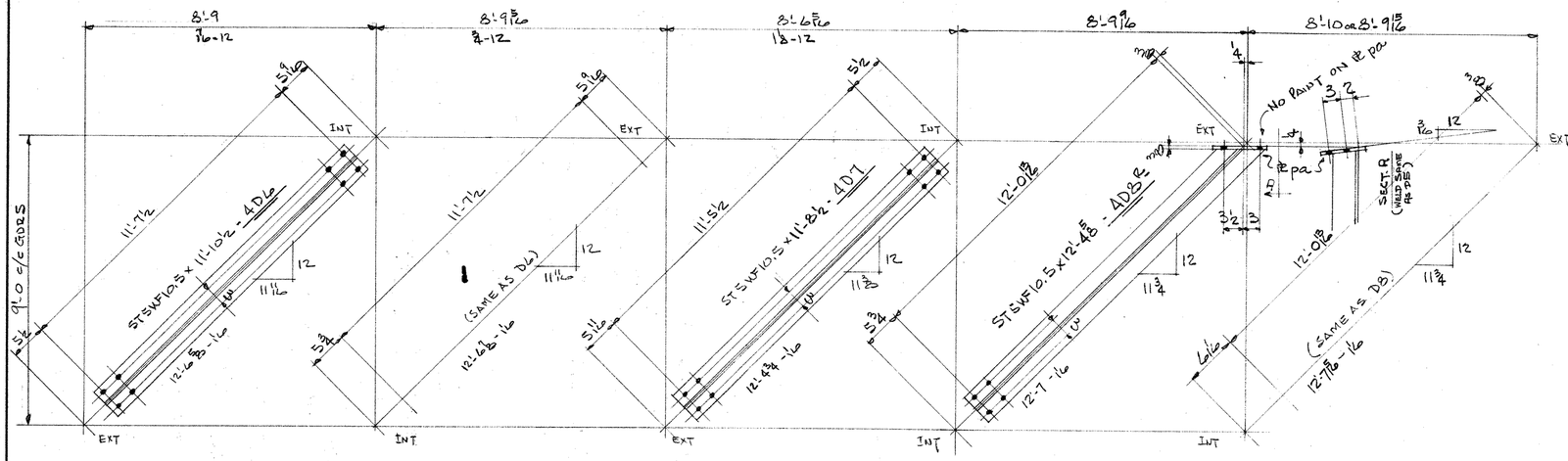
SHIPPED VIA

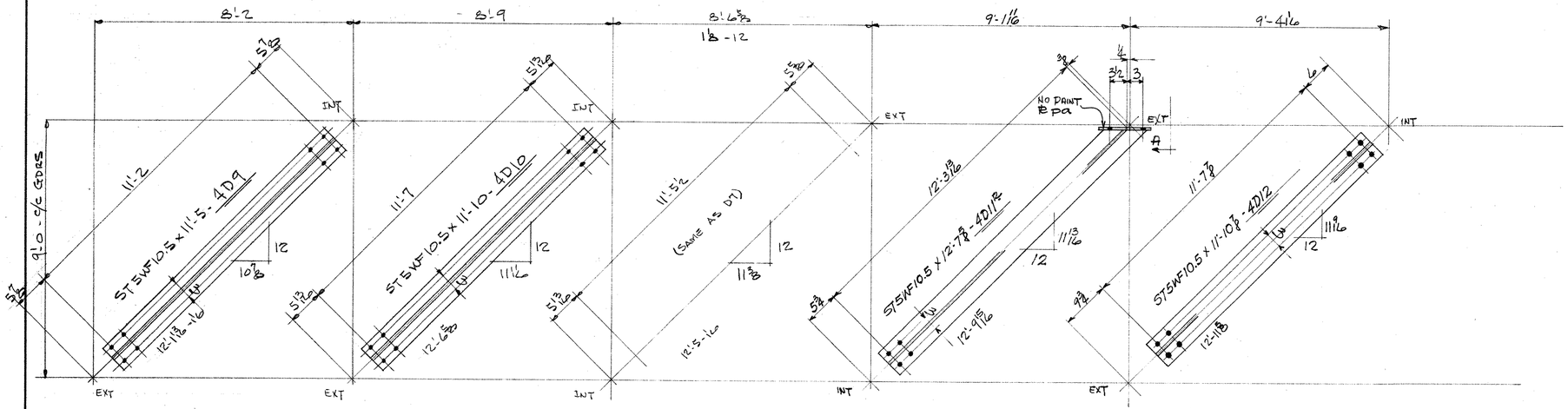
Prints for 1st Approval

Prints for 2nd Approval

Shop Prints







SHOP BILL

SHIPPING LIST NO. PIECES	SHIPPING LIST MARK	MATERIAL ORDER NO.	ORDERED NO.	ORDERED FEET	ORDERED INS.	NO. PIECES	DESCRIPTION	LENGTH FEET	LENGTH INS.	REMARKS	WEIGHT
			(ALL MATERIAL - A36, A373)								
2	4D1	CB-0670 MR	12	0	2	ST5WF10.5	11	11 7/16		
4	4D2		11	7	4	ST5WF10.5	11	5 3/4		
16	4D3		12	3 1/2	16	ST5WF10.5	12	2 1/4		
4	4D4		12	0	4	ST5WF10.5	11	10 3/4		
2	4D5E		12	8 1/2	2	ST5WF10.5	12	6 15/16	BEV-1-E	
	Sec				2	℄ 7x3/8		9 1/2	pa	
32	4D6	CB-0670 MR	12	0	32	ST5WF10.5	11	10 1/2		
32	4D7		12	0	32	ST5WF10.5	11	8 1/2		
12	4D8E		12	8 1/2	12	ST5WF10.5	12	4 5/8	BEV-1-E	
	Sec				12	℄			pa	
12	4D9	CB-0670 MR	11	7	12	ST5WF10.5	11	5		
24	4D10		11	10	24	ST5WF10.5	11	10		
2	4D11E		12	8 1/2	2	ST5WF10.5	12	7 7/8	BEV-1-E	
					2	℄			pa	
2	4D12		12	0	2	ST5WF10.5	11	10 3/8		

SC FILE 1439.315.1
FAD # I-95-2(12)
STA. 5220 + 79.00 TO
STA. 5268 + 57.00

TOTAL WEIGHT

GENERAL NOTES SPACING NOT GIVEN IS 3"

DESIGN BY

HOLES 15/16 ℄

RIVETS

SHOP PAINT RED LEAD - UNLESS NOTED

FIELD CONNS S.C. HWY. SPECS.

ERECTION BY

INSPECTION BY F&R

REVISIONS			
DATE	NO.	BY	CHANGE
	R1		
	R2		
	R3		
	R4		

ORDER NO. 69-940H55

DETAILS OF LATERAL BRACING NBL

FOR BRIDGE OVER LAKE MARION NO. 2

CUSTOMER WAINWRIGHT & WELLS, INC.

AT CLARENDON & ORANGEBURG COUNTIES, SC

CAROLINA STEEL CORPORATION
GREENSBORO, N. C.

MADE BY N.I. SONG

TRACED BY

CHECKED BY DATE

SCALE 27 JUNE 69 1 FT.

SHOP BILL NO.

SHEET #F4 OF

GLENNON & KERN, INC., CHICAGO

71'-0 — OUT TO OUT TOP FLG

Top Flg PL 16 x 1 5/16 x 23'-8 1/2

Top Flg PL 16 x 1 1/8 x 47'-3 1/2

8 AT 4'-7 1/2 = 37'-0

5 AT 4'-5 = 13'-3

10 AT 2 1/2 = 2'-1 1/2

SHOPSPLICE - FLG WELD TO AWS SPECS

GRIND WELD SMOOTH - T&B

SUBMERGED ARC WELD T & B FLGS

SUBMERGED ARC

12 TYPICAL

NO PAINT - WEB

1-PL 8 x 5/8 x 5'-3 FOR G1
2-PL 8 x 5/8 x 5'-3 FOR G2

1-PL 8 x 5/8 x 5'-3 - FOR G1
1-PL 8 x 1/2 - NS - FOR G1
2-PL 8 x 1/2 - FOR G2

WT. 9. TONS

HOLES FOR G1

1-PL 8 x 5/8 x 5'-3 - FS FOR G1
1-PL 8 x 1/2 x 5'-3 NS FOR G1
2-PL 8 x 1/2 x 5'-3 FOR G2

1-PL 8 x 5/8 x 5'-3 - FS FOR G1
1-PL 8 x 1/2 x 5'-3 NS FOR G1
2-PL 8 x 1/2 x 5'-3 FOR G2

1-PL 8 x 5/8 x 5'-3 - FS FOR G1
1-PL 8 x 1/2 x 5'-3 NS FOR G1
2-PL 8 x 1/2 x 5'-3 FOR G2

1-PL 8 x 5/8 x 5'-3 - FS FOR G1
1-PL 8 x 1/2 x 5'-3 NS FOR G1
2-PL 8 x 1/2 x 5'-3 FOR G2

1-L 4 x 3 1/2 x 5/16 x 6'-8
2-L 4 x 3 1/2 x 5/16 x 6'-8
4 x 5 x 5/16 x 21'-9 3/4

1/2" ø HOLES

5 PL CONT

5 PL CONT

5'-3 WEB

5'-3 WEB

16 AT 3 1/2 = 4'-6

5'-3 1/4 WEB

2-PL 8 x 5/8 x 5'-3 FS

5G1 PL ~ 5G2 PL

SHOP NOTE: BEVEL EDGE OF PL AT STIFF FOR REQD LENGTH

TYP. UNLESS NOTED

TYPICAL - ALL LATERAL CONN PLS

SLOT - 2 x 3 1/2 FOR PL pa a

SLOTS - 1 6 x 2 1/2 FOR PL FLG

PL 8 3/4 x 3/8 x 8 3/4 - pa a R FOR G2

PL 8 3/4 x 3/8 x 8 3/4 - pa b R FOR G2

PL 8 3/4 x 3/8 x 8 3/4 - pa c R FOR G2

PL 8 3/4 x 3/8 x 8 3/4 - pa d R FOR G1

PL 8 3/4 x 3/8 x 8 3/4 - pa f R FOR G1

PL 11 1/2 x 3/8 x 0'-11 1/2 - pa a R FOR G1

CLIP CORNER 1" x 1" TYPICAL ALL LATERAL CONN PLS

NO PAINT ON ALL LATERAL CONN. PLS

SHOP NOTE: DEVELOPED VIEW OF ALL LATERAL CONN PLS

SHOPSPLICE WEB WELD TO ANS SPECS

PL pa g R FOR G2

PL pa f R FOR G2

PL 8 3/4 x 3/8 x 8 3/4 pa g R FOR G1

PL pa f R FOR G1

SECTION - D

TYP. FOR ALL LATERAL CONN PLS

PL pa g R FOR G2

PL pa f R FOR G2

PL pa m R FOR G1

PL 8 3/4 x 3/8 x 8 3/4 pa n R FOR G1

PL 8 3/4 x 3/8 x 8 3/4 - pa k R FOR G2

PL pa k R FOR G2

NO PAINT - T&B FLGS

10 AT 2 1/2 = 2'-1

FOR LATERAL BRACING

9'-4 15/16 | 8'-3 | 9'-3 | 9'-3 | 9'-3 | 9'-3 | 8'-10 | 6'-11 7/16 | 9'-0 3/4 | 2'-1 15/16

WEB PL 63 x 7/16 x 34'-5

WEB PL 63 1/4 x 7/16 x 36'-7 7/8

BOTTOM FLG PL 16 x 1 5/16 x 23'-8 1/2

BOTTOM FLG PL 16 x 1 1/8 x 47'-4 7/16

71'-0 11/16 - OUT TO OUT BOTTOM FLG

FINISH END OF GDR

FC

3'-4 3/8

2'-6

2'-6 13/16

2'-1 1/2 RADIUS

CLIP CORNERS 3/4" x 3/4" T&B. TYPICAL

PL 6 x 5/8 x 5'-3 - pd - FOR G2
PL 6 x 5/8 x 5'-3 - pa - FOR G1

PL 6 x 5/8 x 5'-3 - pd

MILL TO BEAR

HOLES FOR G2

3 AT 2 1/2 = 7 1/2

PL 5 x 3/8 x 5'-3 pbF5 - G1

PL 6 x 5/8 x 5'-3 pc F5 FOR G2

NO PAINT ON pc F5

PL pc F5

NO WELD TIGHT FIT

PL pb F5

PL pb F5

NO WELD TIGHT FIT

SECTION - A

SECTION - B

SECTION - C

Top of Web

8'-9 15/16 | 26'-9 15/16 | 45'-3 15/16 | 62'-5 15/16

17'-6 11/16 | 35'-0 11/16 | 54'-6 11/16 | 70'-8 3/4

PL BRG

CAMBER DIAGRAM

SHOP NOTE:
#53 - FIELD SPLICES - INCLUDING DRILLING, FITTING, & REAMING

(R) RADIOGRAPH INSPECTION REQUIRED

GENERAL NOTES

DESIGN BY

HOLES 15/16 ø - UNLESS NOTED

RIVETS

SHOP PAINT RED LEAD - UNLESS NOTED

FIELD CONNS. S.C. HWY. SPECS.

ERECTION BY

INSPECTION BY F & R

FABRICATED BY

NOTE: GIRDERS TO BE SHOP ASSEMBLED IN CAMBERED POSITION. HOLES FOR FIELD SPLICES TO BE SUBPUNCHED & REAMED TO SIZE OR DRILLED FROM THE SOLID AND MATCH MARKED WITH SPLICE MATERIAL ASSEMBLED TO GIRDERS. SEE HE1 FOR MATCH MARK SEQUENCE.

REVISIONS			
DATE	NO.	BY	CHANGE
	R1		
	R2		
	R3		
	R4		

REQUIRED			
2	5G1 PL		
2	5G2 PL		
SC FILE 1438.315.1			
FAP # I-95-2(12)			
STA. 5246 + 79.00 TO			
STA. 5268 + 59.00			

ORDER NO. 69-9401451

DETAILS OF GIRDERS NBL

FOR BRIDGE OVER LAKE MARION NO. 2

CUSTOMER WANAMAKER & WELLS, INC.

AT CLARENDON & ORANGEBURG COUNTIES, SC

CAROLINA STEEL CORPORATION
GREENSBORO, N. C.

MADE BY NI FONG

TRACED BY

CHECKED BY

SCALE 27 JUNE 69 1 FT.

SHOP BILL NO. HB1

SHEET HF5 OF

©LENNON & KERR, INC., CHICAGO

1-PL 16×⅜×4'-8¾" - pa
2-PL 6½×⅞×4'-8¾" - pb
NO PAINT ON PLS pa - pb
BOLT FOR SHIPMENT

TOP FLG PL 16×1⅛×23'-7⅜
WEB PL 80⅛×⅞×26'-5⅞

75'-2¾" - OUT TO OUT

TOP FLG PL 16×1⅞×28'-0
WEB PL 93×⅞×22'-3

SHOPSPLICE - FLG WELD TO AWS SPECS.
SHOPSPLICE - WEB WELD TO AWS SPECS.
GRIND WELD SMOOTH T&B
SUBMERGED ARC WELD T&B FLGS

SYMM ABT ℄ (EXCEPT AS NOTED)

(1-PL pa - G1 & G3
1-PL pab - FS FOR G1 & G3
2-PL pa4 - FOR G2)

10 AT 2½ = 2'-1

(2-PL 17¼×⅝×41'-11" - pc
NO PAINT ON PLS pc
BOLT FOR SHIPMENT)

HOLES FOR G1 & G3

(1-PL pat FS FOR G1 & G3
1-PL pan NS FOR G1 & G3
2-PL pan - FOR G2)

(S-4'-8) DENOTES DEPTH OF WEB AT MIDPOINT OF STIFFENER SPACING

HOLES FOR 3¾" ϕ END

2-PL 5×⅜×5'-5½ - pan
2-PL 5×⅜×5'-7⅛ - pan
2-PL 5×⅜×5'-10⅝ - pa3
2-PL 5×⅜×6'-0½ - pa5
2-PL 5×⅜×6'-11¼ - pac
2-PL 5×⅜×7'-5¼ - pac
2-PL 5×⅜×7'-7⅛ - pac

(S-5'-6⅛)
(S-5'-5½)
(S-5'-3⅝)
(S-5'-0⅛)
(S-4'-8)
(6'-0)
(6'-4½)
(6'-2)
(7'-2⅛)

FOR FUTURE PL pat

1-PL pan - FS FOR G1 & G3
1-PL pan - NS FOR G1 & G3
2-PL pan - FOR G2

SUBMERGED ARC

2-PL pab
2-PL 4½×⅝×6'-5½ - pay
20'-0" RADIUS

PL 4×⅝×4'-4⅜ - pf
PL 4×⅝×4'-2¹³⁄₁₆ - pp
PL 4×⅝×4'-2½ - pw

HAUNCHED ARC LENGTH (24'-2½") TO ARC

BOTTOM FLG PL 16×1⅞×28'-1¾

(2'-5⅛")

7'-9 - WEB

(1-PL pa
2-PL pab) BOLT FOR SHIPMENT

FINISH END OF GIRDER

CLIP CORNERS - ½" x ½" TYP. AT LATERAL CONN. PLS

TYPICAL UNLESS NOTED

TYPICAL - ALL LATERAL CONN. PLS

45°

PL 8½×⅜×8½ - pd^R FOR G1 & G3

2'-6⅝ SLOPE

PL 8½×⅜×8½ - pe^R FOR G2

NO PAINT ON ALL LATERAL CONN. PLS

SHOP NOTE: DEVELOPED VIEW OF ALL LATERAL CONN PLS

PL 8½×⅜×2'-2½ - pf^R - FOR G1 & G3

PL 7×⅜×9 - pk^R FOR G1 & G3

PL 8½×⅜×8½ - pm^R FOR G2

PL 9×⅜×9 - pn^R FOR G1 & G3

1¹⁄₁₆" HOLES DRIVING FIT FOR ¹⁄₁₆" BOLTS

661 · 662 · 663^R

NO PAINT - WEB
NO PAINT T&B FLGS

BOTTOM FLG PL 16×1½×22'-7⅞

HOLES FOR G2

CLIP CORNERS - ¾" x ¾" T&B - TYPICAL

NO WELD TIGHT FIT

(PL 4½×⅝×7'-9 pab - FOR G1 & G3
paa - FOR G2)

NO PAINT - pab

DRILL TO BEAM SECT A-A SECT B

SECTION - A

SECTION - B

PL: pac - pad - pa5 - pag - pa10 - pa11

TIGHT FIT NO WELD

SECTION - C

SECTION - D

SECTION - F

TYP SECTION @ G FOR G1 & G3

TYP SECTION @ G FOR G2

(SECTIONS FOR LATERAL CONN PLS)

SYMM ABT - ℄

Top Flg

10'-0⅝	20'-1⅞	28'-0⅜	37'-7⅞

CAMBER DIAGRAM

SHOP NOTE:
HS2 - HAUNCHED GIRDERS - INCLUDING WELDING OF STIFFENERS
HS3 - FIELD SPLICES - INCLUDING DRILLING, FITTING & REAMING

Ⓡ - RADIOGRAPH INSPECTION REQUIRED

GENERAL NOTES
DESIGN BY
HOLES 13/16" ϕ UNLESS NOTED
RIVETS
SHOP PAINT RED LEAD, UNLESS NOTED
FIELD CONNS S.C. HWY. SPECS.
ERECTION BY
INSPECTION BY F & R
FABRICATED BY

NOTES. GIRDERS TO BE SHOP ASSEMBLED IN CAMBERED POSITION. HOLES FOR FIELD SPLICES TO BE SUBPUNCHED & REAMED TO SIZE OR DRILLED FROM THE SOLID AND MATCH MARKED WITH SPLICE MATERIAL ASSEMBLED TO GIRDERS - SEE 461 FOR MATCH MARK SEQUENCE

DATE	NO.	BY	REVISIONS CHANGE
	R1		
	R2		
	R3		
	R4		

	REQUIRED
4	661
8	662
4	663^R

S.C. FILE 1838.3(5.1
FED # I-75-2(12)
STA. 524G + 79.00 TO
STA. 526B + 54.00

ORDER NO. C9-940H62
DETAILS OF HAUNCH GIRDERS NO.
FOR BRIDGE OVER LAKE MARION NO. 2
CUSTOMER RUMBURGER & CO. U.S., INC.
AT CLARENDON & ORANGE BURG COUNTIES, S.C.

CAROLINA STEEL CORPORATION
GREENSBORO, N. C.

MADE BY N.L.T.
TRACED BY
CHECKED BY
ISSUED BY

SHEET NO. 462

Top Flg. PL 16 x 1⅛ x 64'-9 15/16

WEB PL G34 x 7/16 x 30'-3

WEB PL G34 x 7/16 x 34'-6 7/16

3 AT 4'-1 = 12'-3

8 AT 4'-4½ = 35'-0

3 AT 4'-1 = 12'-3

2'-7¼ | 6'-8¼ | 10'-7¼ | 14'-10¼ | 19'-2¾ | 23'-7¼ | 27'-11¾ | 32'-4¼ | 36'-8¾ | 41'-1¼ | 45'-5¾ | 49'-10¼ | 53'-11¼ | 58'-0¼ | 62'-1¼ | 2'-8 1/16

2'-6 NO PAINT T&B FLGS

2'-6 NO PAINT T&B FLGS

SHOP SPLICE WEB WELD TO AWS SPECS

10 NO PAINT WEB

10 NO PAINT WEB

10 AT 2½ = 2'-1

10 AT 2½ = 2'-1

5'-3¼ WEB

16 SPACES @ 3⅝ = 4'-8

5'-3 WEB

5'-2 WEB

5'-3¼ WEB

16 SPACES @ 3⅝ = 4'-8

16" cont

16" cont

SUBMERGED ARC

FINISH END OF GDR

FINISH END OF GDR

7G1R - 7G2R

2 PL ⅞ FS

3'-4 5/16

3'-4 5/16

10 @ 2½ = 2'-1

10 @ 2½ = 2'-1

TYPICAL

TYPICAL ALL LATERAL CONNS

PL 8¾ x ⅜ x 8¾ - psq F 72 F&G2

PL 8¾ x ⅜ x 8¾ psq F 72 F&G2

PL 8¾ x ⅜ x 8¾ psq F 72 F&G1

CHIP CORNER ½" x ½" TYPICAL ALL LATERAL CONN PLS

NO PAINT ON ALL LATERAL CONN PLS

SHIP NOTE: REMOVE ALL SHOP ASSEMBLY FIT-UP TABS, ETC.

2'-1 15/16 | 6'-8¼ | 8'-9 9/16 | 8'-2 | 8'-9 | 8'-7 | 8'-7 | 8'-7 | 8'-7 | 8'-2 | 6'-8 11/16 | 8'-10 | 2'-1 15/16 FOR LATERAL BRACING

BOTTOM FLG. PL 16 x 1⅛ x 64'-8 15/16

SECTION - C TYPICAL FOR ALL LATERAL CONN PLS

HOLES FOR G2

CLIP CORNER ½" x ½" T&B TYPICAL

4'-2"

2 AT 2½" = 5"

11 SPACES @ 3½" = 2'-10½"

2 AT 2½" = 5"

1'-3 NO PAINT PL PCF 5

1'-2 NO PAINT PL PCF 5

PL PCF 5

PL PCF 5

PL 5¾ x ⅜ x 5'-3 PCF 5 - G1

PL 6 x ⅜ x 5'-2 PCF 5 - EQ G1 & G2

No WELD TIGHT FIT

No WELD TIGHT FIT

SECTION - A

SECTION - B

TOP OF WEB

7 5/8 | 23 7/8 | 41 | 57 3/8

14' 10 5/8 | 32'-4 3/8 | 49'-10 5/8 | 64'-9 15/16

CAMBER DIAGRAM

SHIP NOTE:
HSB - FIELD SPLICES INCLUDING DRILLING, FITTING & REAMING
R - RADIOGRAPHIC INSPECTION REQUIRED

GENERAL NOTES

DESIGN BY

HOLES 15/16"ø

RIVETS

SHOP PAINT RED LEAD UNLESS NOTED S.C. HWY. SPECS.

FIELD CONNS.

ERECTION BY

INSPECTION BY F&G

FABRICATED BY

REVISIONS			
DATE	NO.	BY	CHANGE
	R1		
	R2		
	R3		
	R4		

NOTE: GIRDERS TO BE SHIP ASSEMBLED IN CAMBERED POSITION. HOLES FOR FIELD SPLICES TO BE SUBPUNCHED & REAMED TO SIZE OR DRILLED FROM THE SOLID AND MATCH MARKED WITH SPLICE MATERIAL ASSEMBLED TO GIRDERS. SEE HE1 FOR MATCH-MARK SEQUENCE.

REQUIRED			
2	7G1R		
2	7G2R		

SC FILE 1438.315.1
FED # I-95-2 (12)
STA. 5246 + 79.00 TO
STA. 5268 + 59.00

ORDER NO. C9-940HS1
DETAILS OF GIRDERS
NBL
FOR BRIDGE OVER LAKE MARION NO. 2
CUSTOMER WAHNENMAKER & WELLS, INC.
AT CLARENDON & ORANGEBURG COUNTIES, SC

CAROLINA STEEL CORPORATION
GREENSBORO, N. C.

MADE BY NI FONG
TRACED BY
CHECKED BY
SCALE 27 JUNE 69 1 FT.
SHOP BILL NO. HB2
SHEET 1 OF 2 SHEETS HE7

Top Flg PL 16 x 1'8 x 64'-9¼

Web PL 63¾ x 7/16 x 30'-3

Web PL 63¾ x 7/16 x 34'-6¼

2'-7¼ | 3 at 4'-1 = 12'-3 | 8 at 4'-4½ = 35'-0 | 3 at 4'-1 = 12'-3 | 2'-8

6'-8¼ | 10'-9¼ | 14'-10¼ | 19'-2¾ | 23'-7¼ | 27'-11¾ | 32'-4¼ | 36'-8¾ | 41'-1¼ | 45'-5¾ | 49'-10¼ | 53'-11¼ | 58'-0¼ | 62'-1¼

2'-6 No Paint T & B Flgs | 2'-6 No Paint T & B Flgs

Shopsplice Web Weld To AWS Specs

2-#pbF5

10 No Paint. Web | 10 No Paint. Web

10 at 2½ = 2'-1 | 10 at 2½ = 2'-1

5'-3¼ - Web | 16 Spaces @ 3½ = 4'-8 | 5'-3 - Web | Wt. 9 Tons | 1-#pbF5-FS - For G1, 1-#pbF5 - NS - For G1, 2-#pbF5 - For G2 | 2" Ø Holes For G1 | 1'-6 | Submerged Arc | 1'-9 | 1-#pbF5-FS - For G1, 1-#pbF5 - NS - For G1, 2-#pbF5 - For G2 | 1-#pbF5-FS - For G1, 1-#pbF5 - NS - For G1, 2-#pbF5 - For G1 | 5'-3 - Web | 5'-3¼ - Web | 16 Spaces @ 3½ = 4'-8

PT CONT | PC CONT | B | A | C | 1

Finish End of GDR | Finish End of GDR

30-1-2 N Radius | 30-1-2 N Radius

3'-4¾ | 3'-4¾

BG1R - BG2R

10@2½" = 2'-1 | 10@2½ = 2'-1

Typical All Lateral Conn Pls | Typical | Typical

#pbF5 x 5'-1½ - G1 #pbF5 - G1 #pbF5 x 5'-1½ - #pbF5 for G2

#pbF 7R For G2 | #pbF 7R For G2 | #pamF 7R For G2 | #pamF 7R For G2 | #pamF 7R For G2 | #pakF 7R For G2 | #pakF 7R For G2 | #pakF 7R For G2

#pbF5 x 3'-3 x 8¾ - #pakF 7R For G1 | #pbF5 x 3'-3 x 8¾ - #pamF 7R For G1 | #pacF 7R For G1 | #pacF 7R For G1 | #pakF 7R For G1 | #pakF 7R For G1

Clip Corner - 2" x 2" Typical All Lateral Conn Pls

No Paint on All Lateral Conn Pls

Shop Note: Developed View of All Lateral Conn Pls

2'-1 15/16 | 6'-8¼ | 8'-9 | 8'-9 | 8'-9 | 8'-9 | 8'-9 | 8'-9 | 8'-9 | 8'-9 | 8'-9 | 6'-8 5/8 | 2'-1 15/16

8'-C 9/16 | 8'-2 | 8'-9 | 8'-9 | 8'-9 | 8'-9 | 8'-2 | 8'-9 15/16

For Lateral Bracing

Bottom Flg PL 16 x 1'8 x 64'-8 5/8

Section - C
Typical For All Lateral Conn Pls

Holes For G2
Clip Corners - 3/4" x 3/4" - T & B Typical

5 | 3 at 2½ = 7½ | 1'-3 | No Paint on #pbF5 | 4'-2½ | (#pbF5 x 5'-1½ - G1 #pbF5 - G1 #pbF5 x 5'-1½ - #pbF5 for G2) | 3 at 2½ = 7½ | 1'-6 | No Paint on #pbF5 | 7½

#pbF5 | #pbF5 | No Weld Tight Fit | No Weld Tight Fit

Section - A | Section - B

Top of Web

7'-5 3/8 | 23'-7 3/8 | 41'-1 3/8 | 57'-3 3/8 | 14'-10 5/8 | 32'-4 3/8 | 49'-10 5/8 | 64'-9½

Camber Diagram

Shop Notes:
H55 - Field Splices - Including Drilling, Fitting & Reaming

(R) - Radiographic Inspection Required

General Notes

Design By NBL

Holes 15/16 ø

Rivets

Shop Paint Red Lead - Unless Noted S.C. Hwy. Spec's

Field Conns.

Erection By

Inspection By F & R.

Fabricated By

Note: Girders to be shop assembled in cambered positions. Holes for field splices to be subpunched & reamed to size or drilled from the solid and match marked with splice material assembled to girders. See HE1 for match mark sequence

Revisions			
Date	No.	By	Change
	R1		
	R2		
	R3		
	R4		

Required			
2	BG1R		
2	BG2R		

SC File 1438.315.1
FAP # I-95-2 (12)
STA 5246 + 79.00 To
STA 5268 + 59.00

Order No. 69-940H51
Details of Girders
NBL
For Bridge Over Lake Marion No. 2
Customer Wanamaker & Wells, Inc.
At Clarendon & Orangeburg Counties, SC

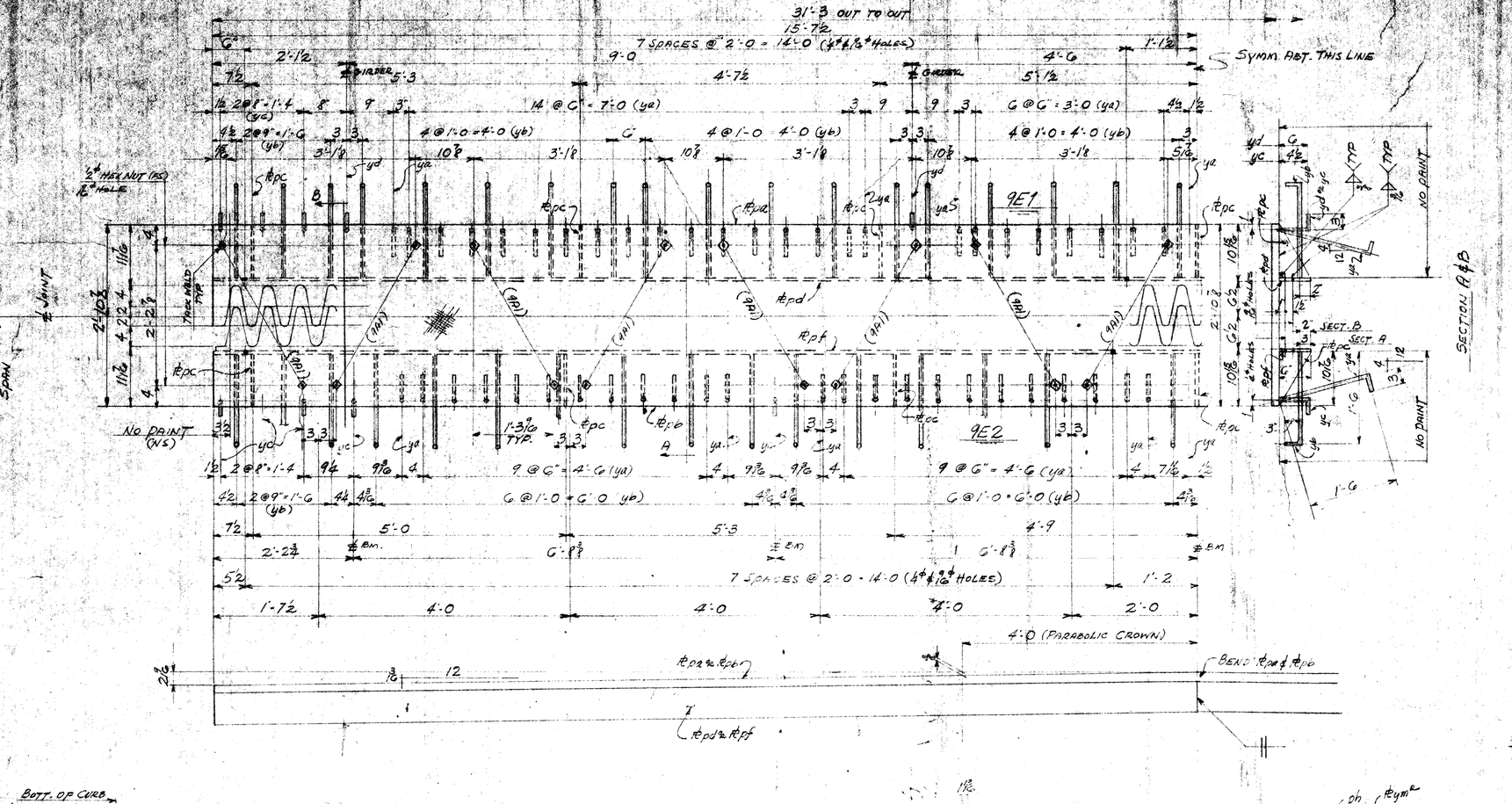
CAROLINA STEEL CORPORATION
GREENSBORO, N. C.

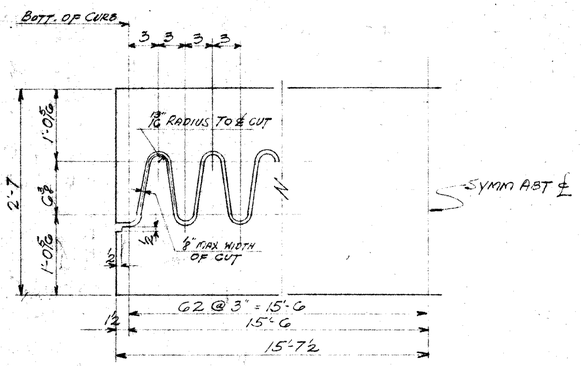
Made By NIF DWG | Traced By | Checked By | Scale 2" = 1 ft. June 19

Shop Bill No. HE4

Sheet HF8 of

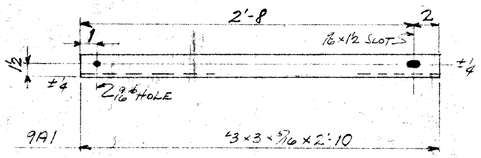
GLENNON & KEAN, INC., CHICAGO

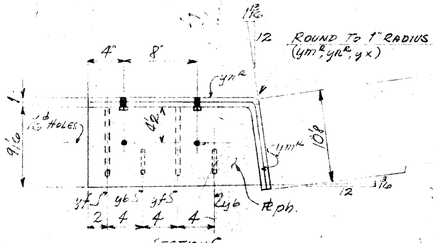


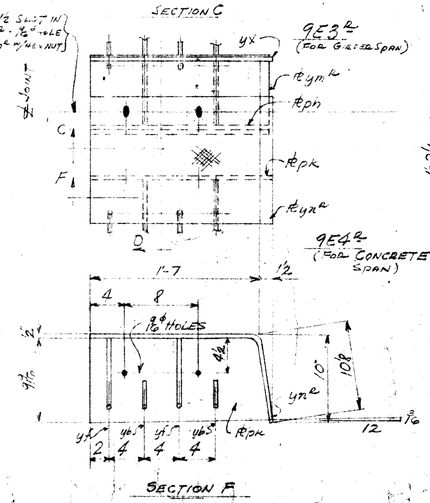


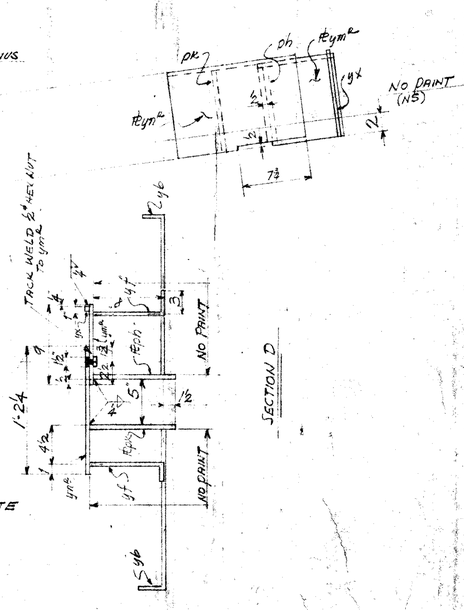
SCROLL DETAIL

THE SCROLL TO BE MADE BY A SINGLE CUT OF A MACHINE GUIDED TORCH. GRIND OFF BURRS ON THE ROADWAY SIDE OF CUT









NOTE: ¾ ANCHORS TO BE ELECTRICALLY WELDED

SHOP BILL

SHIPPING LIST NO.	SHIPPING LIST MARK	MATERIAL SPEC. NO.	GROUND NO.	GROUND FEET	GROUND INS.	QUANTITY	DESCRIPTION	WEIGHT PER	WEIGHT NO.	TOTAL WEIGHT
2	9E1	CMP/W				4	CHCK PL 31⅜ × 1½	31	3	DO (LIKE) TERM.
2	9E2									
		SHN				4	PL G × ½	15	7½	pf
						4	PL G × ½	15	7½	pd
		RG #340				224	¾" ANCHORS	1	9	ya, BEND
						136	¾" ANCHORS	1	8	yb
						32	¾" ANCHORS		7½	yc
						8	¾" ANCHORS		9	yd
		SHN				28	PL G × ⅜		10⅞	pe, TEMP
		SFP				64	½" HEX NUTS			
4	9E3²	SHN				4	PL 9 × ½	2	3⅜	ym², BEND
						4	PL 3½ × ½	1	7½	pk, TEMP
		SOC				4	BAR 2 × 2	2	8½	yx BEND
		RG #340				8	¾" ANCHORS	1	4	yf, BEND
		#340				8				yb
		SFP				8	½" HEX NUTS			
4	9E4²	SHN				4	CHCK PL 144 × ½	2	4⅜	ya², BEND
						4	PL 9⅞ × ½	1	8	pk, TEMP
		RG #340				8				yf
						8				yb
32	9A1	SOC				32	L 3×3×5/16 G	2	10	

J.C. FILE 1438.315.1
FAP # I-92-2(12)
STATION 5246+79.00 TO
STATION 5268+59.00

GENERAL NOTES
DESIGN BY
HOLES NOTED
RIVETS
SHOP PAINT RED LEAD (SC HWY SPECS) UNLESS NOTED
FIELD CONNS
ERECTION BY
INSPECTION BY F & R

REVISIONS			
DATE	NO.	BY	CHANGE
	R1		
	R2		
	R3		
	R4		

ORDER NO. 69-990456
DETAILS OF EXPANSION DAD NBL
FOR BRIDGE OVER CAEN CREEK ON I-95
CUSTOMER NORTHBROOK-SOUTH, INC.
AT CLARENDON - DARLINGTON COUNTIES, S.C.
CAROLINA STEEL CORPORATION
GREENSBORO, N.C.
MADE BY Wilfong
TRACED BY
CHECKED BY
DATE 2-3

GLEASON & KERN, INC., CHICAGO

Top Flg PL 16 x 1'-8 x 64'-9¼

WEB PL 63¾ x 7/16 x 30'-3

WEB PL 63¾ x 7/16 x 34'-6¼

3 AT 4'-1 = 12'-3

8 AT 4'-4½ = 35'-0

3 AT 4'-1 = 12'-3

2'-7¼ | 6'-8¼ | 10'-9¼ | 14'-10¼ | 19'-2¾ | 22'-7¼ | 27'-11¾ | 32'-4¼ | 36'-8¾ | 41'-1¼ | 45'-5¾ | 49'-10¼ | 53'-11¼ | 58'-0¼ | 62'-1¼ | 2'-8

2'-6 NO PAINT T&B FLGS

NO PAINT T&B FLGS 2'-6

SHOP SPLICE WEB WELD TO AWS SPECS

(CF)

10 AT 2½ = 2'-1

10 NO PAINT WEB

NO PAINT WEB 10

5'-3¾ WEB

16 SPACES @ 3½" = 4'-8

5'-3 WEB

2-PL 6 x 5/16 CONT

WT-9 TOWS

1-PL 6 x 5/16 FS FOR G1
1-PL 6 x 5/16 NS FOR G1
2-PL 6 x 5/16 FOR G2

HOLES FOR G1

SUPPRESSED

2-PL 6 x 5/16

1'-9

BT

BC

FINISH END OF GDR

3'-1'-2 LN RADIUS

3'-4¾

10 @ 2½ = 2'-1

TYPICAL ¾

TYPICAL ALL LATERAL CONN PLS

PL 8¾ x ⅜ x 8¾ - padF 7½ FOR G2

PL 8¾ x ⅜ x 8¾ padF 7½ FOR G2

PL 8¾ x ⅜ x 2¾ padF 7½ FOR G1

PL 8¾ x ⅜ x 8¾ pamF 7½ FOR G2

PL padF 7½ FOR G1

PL padF 7½ FOR G2

PL padF 7½ FOR G1

PL padF 7½ FOR G2

PL padF 7½ FOR G2

PL padF 7½ FOR G1

PL padF 7½ FOR G1

PL padF 7½ FOR G2

PL padF 7½ FOR G2

PL 8¾ x ⅜ x 8¾

CLIP CORNER ½" x ½" TYPICAL ALL LATERAL CONN PLS

NO PAINT ON ALL LATERAL CONN PLS

SHOP NOTE: DEVELOPED VIEWS OF ALL LATERAL CONN PLS

2'-1½ | 6'-8¼ | 8'-9⅛ | 8'-2 | 8'-9 | 8'-9 | 8'-9 | 8'-9 | 8'-2 | 6'-8⅝ | 8'-9⅛ | 2'-1½

BOTTOM FLG PL 16 x 1⅛ x 64'-8½

FOR LATERAL BRACING

10.G1R - 10.G2R

HOLES FOR G2
CLIP CORNERS ¾" x 4" T&B TYPICAL

PL 8¾ x ⅜ x 8¾ - padF 7½ FOR G2

PL 8¾ x ⅜ x 8¾ padF 7½ FOR G1

PL 8¾ x ⅜ x 2¾ padF 7½ FOR G1

PL 8¾ x ⅜ x 8¾ padF 7½ FOR G2

NO PAINT ON padF 7½

NO PAINT ON padF 7½

padF 7½

4'-2½

SECTION - A

PL padF 7½

PL padF 7½

NO WELD TIGHT FIT

SECTION - B

Top of WEB

0	1½	3	4½	6	7½	9	10½	12	13½
15⅝	28⅞	41⅛	51⅜						
14'-10⅝	32'-4⅝	49'-10⅝	64'-9¼						

CAMBER DIAGRAM

SHOP NOTE:
#53 - FIELD SPLICES. INCLUDING DRILLING, FITTING & REAMING

Ⓡ RADIOGRAPHIC INSPECTION REQUIRED

GENERAL NOTES

DESIGN BY: LD 4-04

HOLES

RIVETS

SHOP PAINT RED LEAD, UNLESS NOTED

FIELD CONN. S.C. HWY DEPTS

DRAWN BY: FEO

INSPECTION BY:

FABRICATED BY:

NOTE: GIRDERS TO BE SHOP ASSEMBLED IN CAMBERED POSITION. HOLES FOR FIELD SPLICES TO BE SUBPUNCHED & REAMED TO SIZE OR DRILLED FROM THE SOLID WITH MATCH MARKED WITH SPLICE MATERIAL ASSEMBLED TO GIRDERS. SEE HEI FOR ERECTION ASSEMBLY SEQUENCE

REVISIONS			
DATE	NO.	BY	CHANGE
	#1		
	#2		
	#3		

REQUIRED			
2	10 G1 Ⓡ		
2	10 G2 Ⓡ		

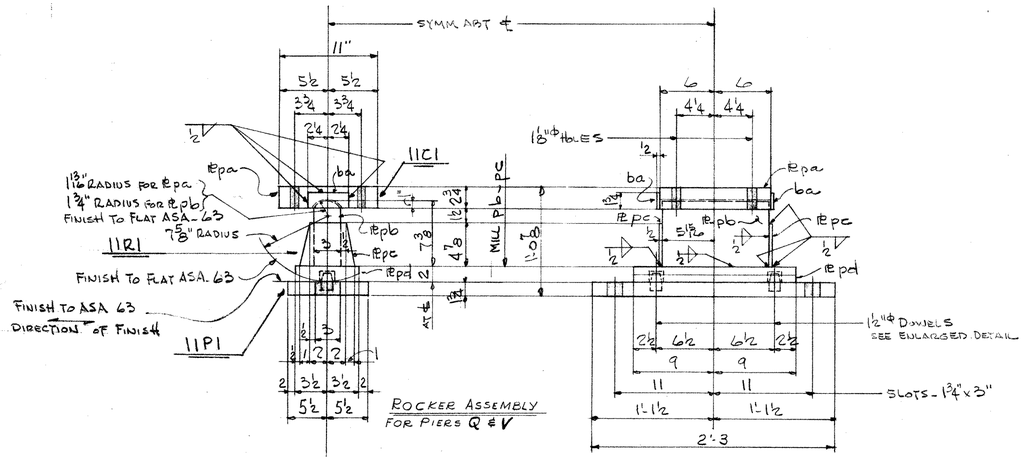
SC FILE 1631.315.1
FAP # I-95-2(42)
STA 5216 + 78.00 TO STA 5268 + 58.00

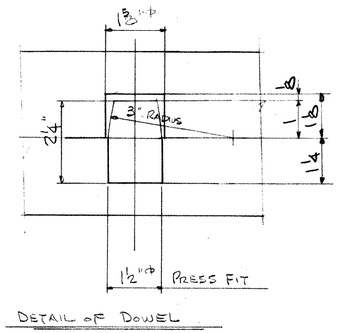
ORDER NO. 69-9204A1
DETAILS OF GIRDERS
FOR BRIDGE OVER LITTLE PEEDEE RIVER
CLIENT SC HIGHWAYS & PUBLIC WORKS
AT G.R.A. JUNCTION & GEORGETOWN
GEORGETOWN, SC
CAROLINA STEEL CORPORATION
GREENSBORO, N.C.

DRAWN: ALFRED
TRACED:
CHECKED:
APPROVED:

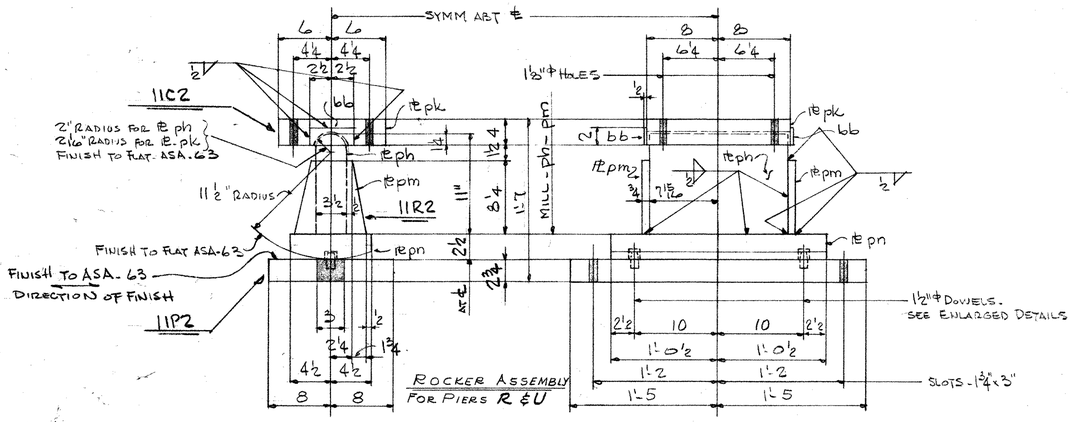
SHEET 10

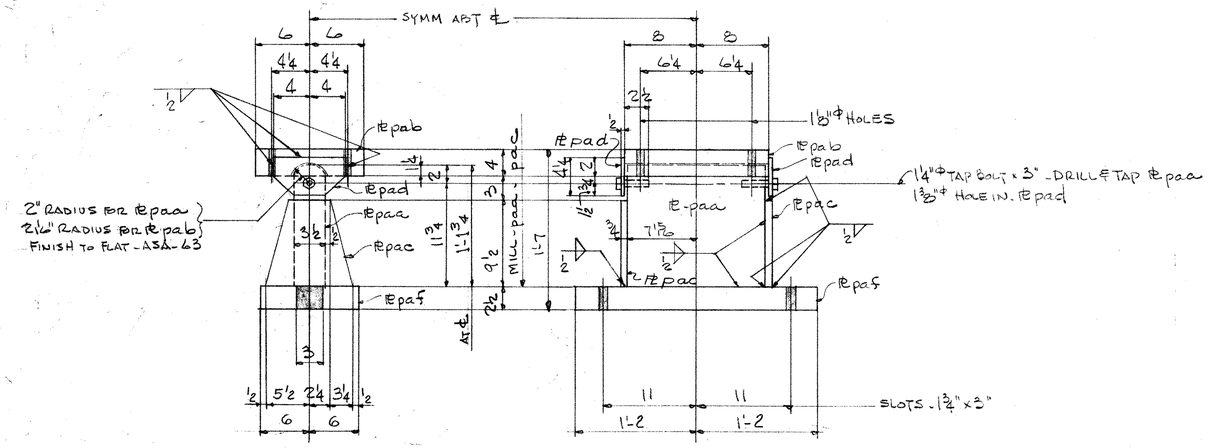
Prints for 1st Approval
Prints for 2nd Approval
Shop Prints





DETAIL OF DOWEL





FIXED SHOE ASSEMBLY - 11FS1
FOR PIERS S & T

NOTE:
ALL BEARING ASSEMBLIES TO BE FABRICATED FROM ROLLED STEEL. BEARING ASSEMBLIES TO BE CHECKED IN SHOP BY FROEHLING & ROBERTSON INC. FOR PROPER FINISHING & ALL OTHER REQUIREMENTS BEFORE PAINTING.

SHOP BILL

SHIPPING LIST NO. PIECES	SHIPPING LIST MARK	MATERIAL ORDER NO.	ORDERED NO.	ORDERED FEET	ORDERED INS.	NO. PIECES	DESCRIPTION	LENGTH FEET	LENGTH INS.	REMARKS	WEIGHT
8	11C1	SHN				8	℔ 11 x 2¾	1	0	pa - FIN	A36
		SOC				16	BARS 1¾ x ½	0	4½	ba	
8	11R1	SHN				8	℔ 7⅞ x 3		11⅞	pb (F-2-ENDS)	
		SOC				16	℔ 4⅞ x ½	0	6	pc (TEMP.)	
						8	℔ 7 x 2	1	6	pd (FIN.)	
8	11P1	SHN - USE 2"				8	℔ 11 x 1⅞	2	3	(PLANE TO 1¾")	
		SOC				16	1½"ϕ	0	2¼	DOWELS	
8	11C2	SHN				8	℔ 12 x 4	1	4	pk - FIN	A36
		SHN				16	BARS 2 x ½	0	5	bb	
8	11R2	SHN				8	℔ 11 x 3½	1	3⅞	ph (F-2-ENDS)	
		SHN				16	℔ 8 x 3¼	0	8¼	pm (TEMP.)	
		SHN				8	℔ 9 x 2½	2	1	pn (FIN.)	
8	11P2	SHN - USE 3"				8	℔ 16 x 2⅞	2	10	(PLANE TO 2¾")	
		SOC				16	1½"ϕ		2¼	DOWELS	
8	11FS1	SHN				8	℔ 13¾ x 3½	1	3⅞	paa - FINISH 2 EDGES	A36
		SHN				8	℔ 12 x 4	1	4	pab - FINISH	
		SHN				16	℔ 9½ x ¾	0	11	pac - TEMP	
		SHN				8	℔ 12 x 2½	2	4	paf	
		SHN				16	℔ 4¼ x ½		8	pad - TEMP	
		ABS 4335				16	1¼"ϕ TAP BOLTS x 3"			HEX. HD.	

SC FILE 438.315.1
FAP # I-95-2 (12)
STA. 5246+79.00 TO
STA. 5268+59.00

TAB DEPT

TOTAL WEIGHT

GENERAL NOTES
DESIGN BY
HOLES NOTED
RIVETS
SHOP PAINT RED LEAD (S.C. HWY SPECS)
FIELD CONNS
ERECTION BY
INSPECTION BY F & R

REVISIONS			
DATE	NO.	BY	CHANGE
	R1		
	R2		
	R3		
	R4		

ORDER NO. 69-940H64
DETAILS OF BRG ASSEMBLIES SBL
FOR BRIDGE OVER LAKE MARION NO. 2
CUSTOMER WANNAMAKER & WELLS, INC.
AT CLARENDON & ORANGEBURG COUNTIES, S.C.

CAROLINA STEEL CORPORATION
GREENSBORO, N. C.

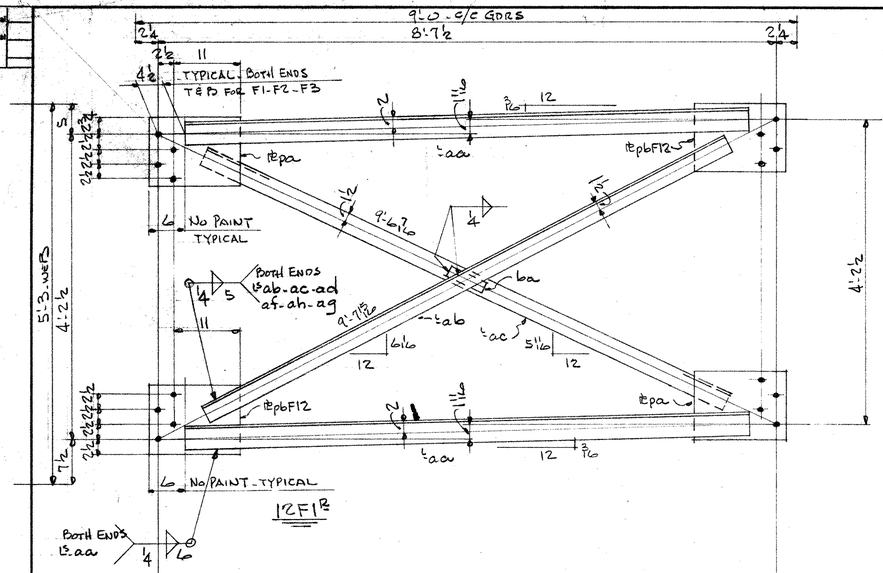
MADE BY NI Fong
TRACED BY
CHECKED BY
SCALE 27 JUNE 69 1 FT.
SHOP BILL NO.
SHEET 4E11 OF

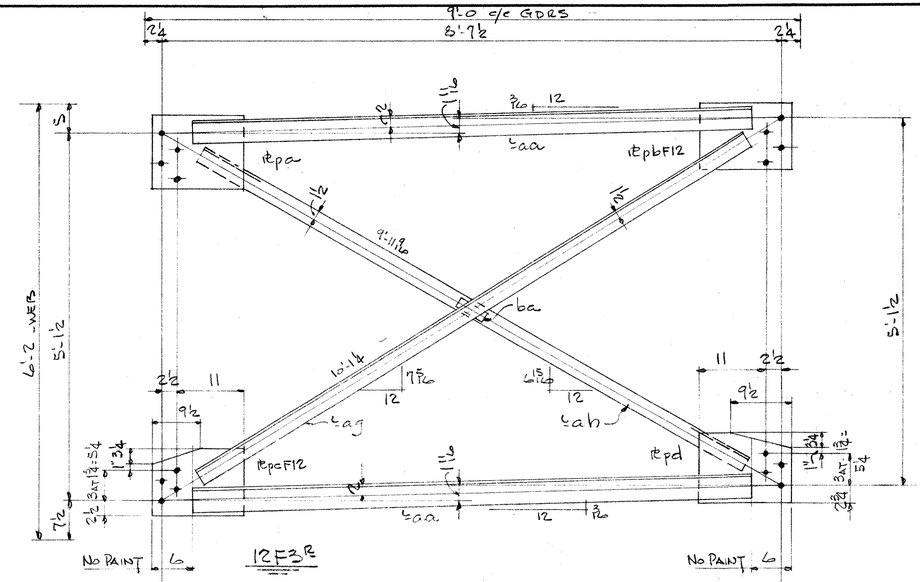
GLENNON & KERN, INC., CHICAGO

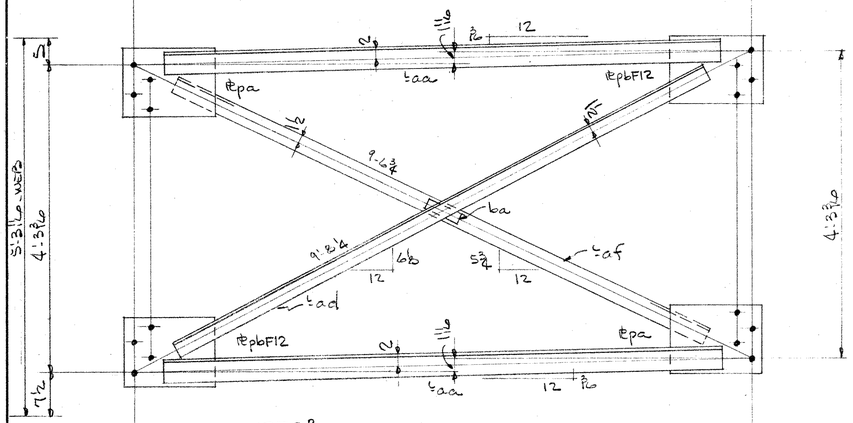
Prints for 1st Approval

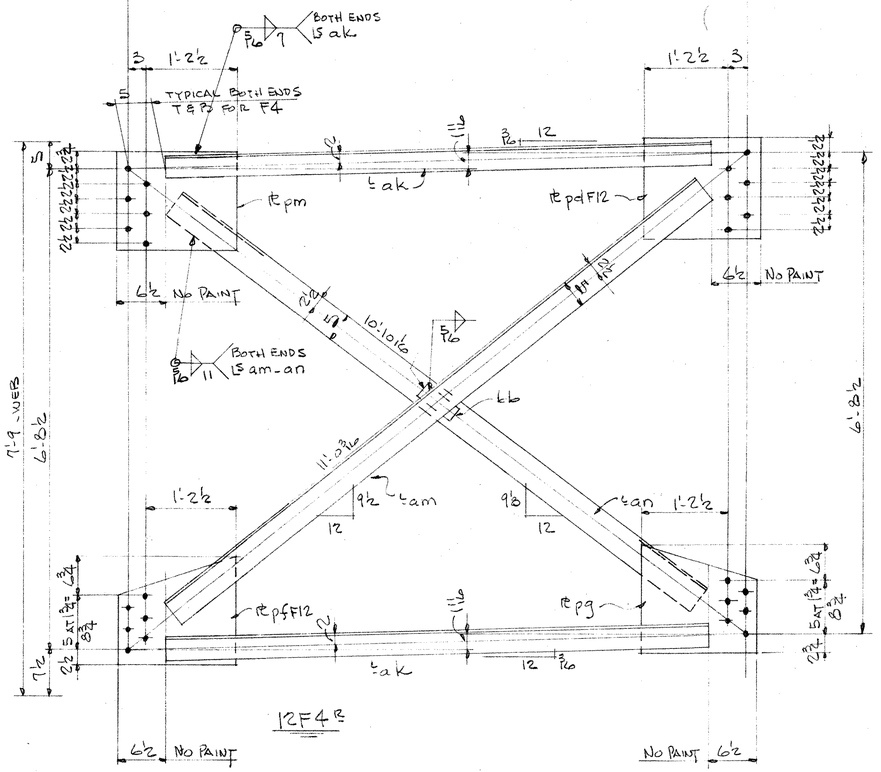
Prints for 2nd Approval

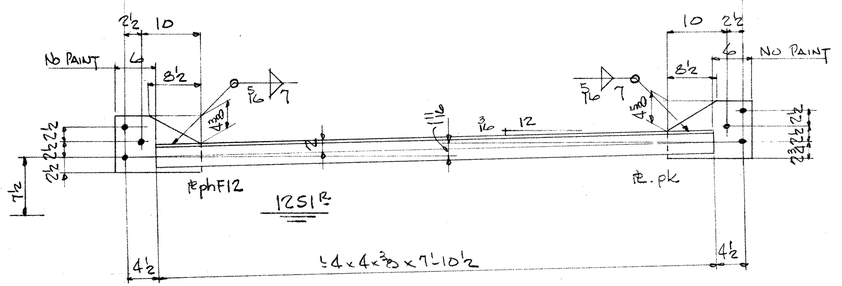
Shop Prints











SHOP BILL

SHIPPING LIST NO. PIECES	SHIPPING LIST MARK	MATERIAL ORDER NO.	ORDERED NO.	ORDERED FEET	ORDERED INS.	NO. PIECES	DESCRIPTION	LENGTH FEET	LENGTH INS.	REMARKS	WEIGHT
			(ALL MATERIAL - A36, A373)								
30	12F1R	CB-0470 thr	47	3	60	L	4x4x5/16	7	10½	aa	
			38	0	30	L	3x3x5/16	8	2½	ab	
			49	3	30	L	3x3x5/16	8	1¼	ac	
		SHN			60	PL	11¾x3/8	1	3	pa	
					60	PL	11½x3/8	1	3	pbF12	
		Soc			30	BARS	2½x3/8		7	ba	
16	12F2R	CB-0470 thr	47	3	32	L				aa	
			35	2	16	L	3x3x5/16	8	2¾	ad	
			38	0	16	L	3x3x5/16	8	1½	af	
		SHN			32	PL				pa	
					32	PL				pbF12	
		Soc			16	BARS				ba	
16	12F3R	CB-0470 thr	47	3	32	L				aa	
			35	8	16	L	3x3x5/16	8	10¼	ag	
			35	0	16	L	3x3x5/16	8	8	ah	
		SHN			16	PL				pa	
					16	PL				pbF12	
					16	PL	12x3/8	1	3	pcF12 - TEMP	
					16	PL	12¼x3/8	1	3	pd - TEMP	
		Soc			16	BARS				ba	
8	12F4R	Soc			16	L	4x4x3/8	7	9½	ak	
		Soc			8	L	5x3½x3/8	9	5¼	am	
		Soc			8	L	5x3½x3/8	9	3¼	an	
		SHN			8	PL	16¾x3/8	1	7	pm	
					8	PL	16½x3/8	1	7	pdF12	
					8	PL	18x3/8	1	7	pfF12 TEMP	
					8	PL	18¼x3/8	1	7	pg TEMP	
		Soc			8	BARS	4x3/8		8	bb	
4	12S1R	Soc			4	L	4x4x3/8	7	10½		
		SHN			4	PL	9x3/8	1	2	phF12 - TEMP	
					4	PL	9¼x3/8	1	2	pk - TEMP	

TOTAL WEIGHT

SC FILE 1438.315.1
FAP # I-95-2(12)
STA. 5246+78.00
STA. 5268+57.00

GENERAL NOTES

DESIGN BY

HOLES 15/16" ϕ

RIVETS

SHOP PAINT RED LEAD, UNLESS NOTED S.C. HWY. SPECS.

FIELD CONNS.

ERECTION BY

INSPECTION BY F&R

REVISIONS			
DATE	NO.	BY	CHANGE
	R1		
	R2		
	R3		
	R4		

ORDER NO. 69-940H65

DETAILS OF CROSSFRAMES SBL

FOR BRIDGE OVER LAKE MARION NO 2

CUSTOMER WINNINGHAM & WELLS, INC.

AT CLARENDON & ORANGEBURG COUNTIES, S.C.

CAROLINA STEEL CORPORATION
GREENSBORO, N. C.

MADE BY N.I.FONG

TRACED BY

CHECKED BY

SCALE 27 JUNE 69 1 FT.

SHOP BILL NO.

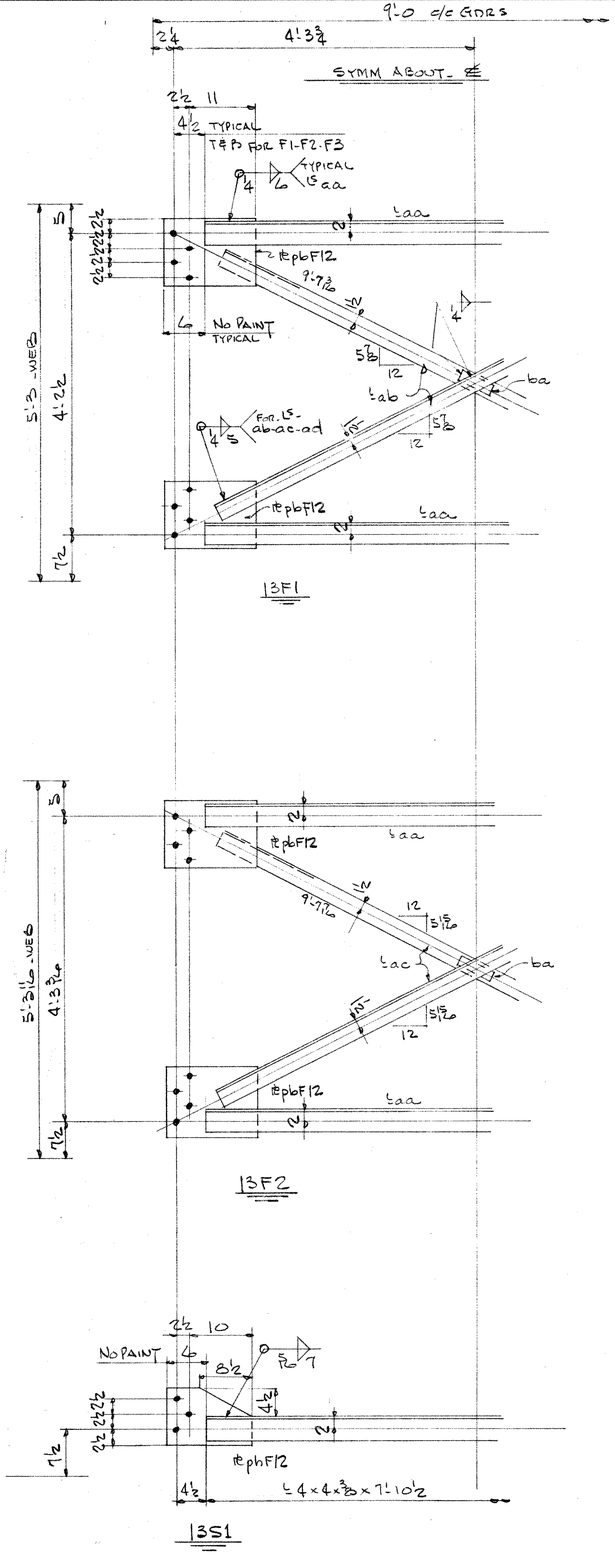
SHEET HF12 OF

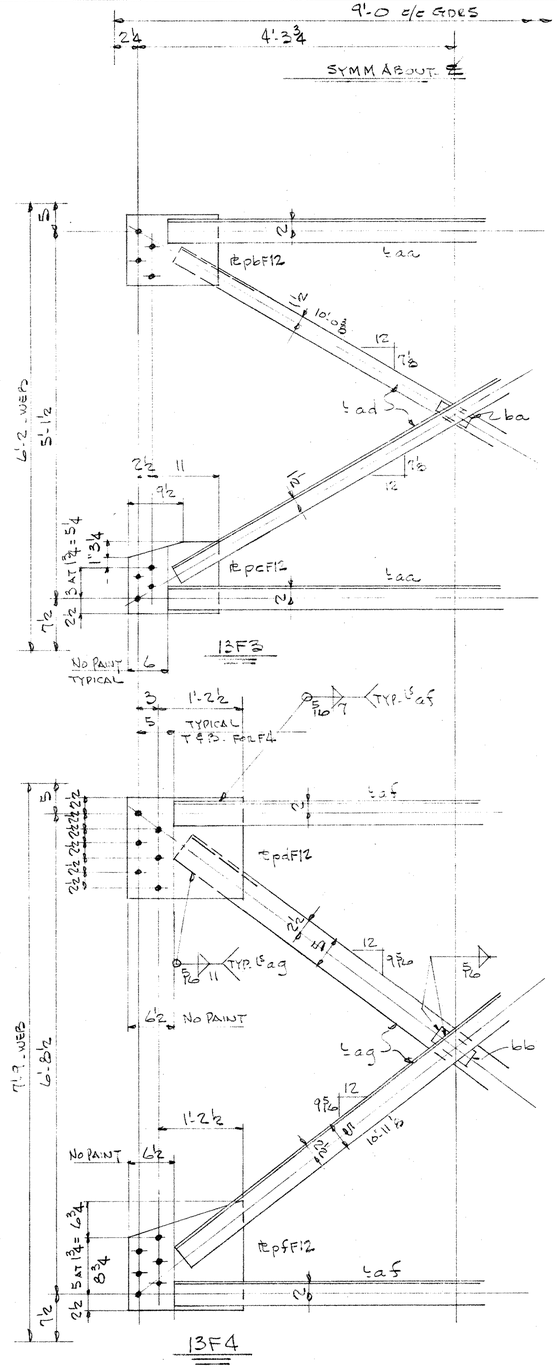
GLENNON & KERN, INC., CHICAGO

Prints for 1st Approval

Prints for 2nd Approval

Shop Prints





SHOP BILL

SHIPPING LIST NO. PIECES	SHIPPING LIST MARK	MATERIAL ORDER NO.	ORDERED NO.	ORDERED FEET	ORDERED INS.	NO. PIECES	DESCRIPTION	LENGTH FEET	LENGTH INS.	REMARKS	WEIGHT
			(ALL MATERIAL - A36, A270)								
15	13F1	CB.0670 MR.	47	3	30	L	4x4x5/16	7	10½	aa	
		↓	49	3	30	L	3x3x5/16	8	1¾	ab	
		SHN			60	PL	11½x3/8	1	3	pbF12	
		Soc			15	BARS	2½x3/8		7	ba	
8	13F2	CB.0670 MR.	47	3	16	L				aa	
		↓	33	2	16	L	3x3x5/16	8	2¼	ac	
		SHN			32	PL				pbF12	
		Soc			8	BARS				ba	
8	13F3	CB.0670 MR.	47	3	16	L				aa	
		↓	35	8	16	L	3x3x5/16	8	9½	ad	
		SHN			16	PL				pbF12	
		↓			16	PL	12x3/8	1	3	pcF12 TEMP	
		Soc			8	BARS				ba	
4	13F4	Soc			8	L	4x4x3/8	7	9½	af	
		Soc			8	L	5x3½x3/8	9	6¼	ag	
		SHN			8	PL	16½x3/8	1	7	pdF12	
		↓			8	PL	18x3/8	1	7	pfF12	
		Soc			4	BARS	4x3/8		8	bb	
2	13S1	Soc			2	L	4x4x3/8	7	10½		
		SHN			4	PL	9x3/8	1	2	phF12 TEMP	

TOTAL WEIGHT

SC FILE 1438.315.1
FAP # I-95-2 (12)
STA. 5246+79.00 TO
STA. 5268+59.00

GENERAL NOTES

DESIGN BY

HOLES 15/16 ϕ

RIVETS

SHOP PAINT RED LEAD - UNLESS NOTED

FIELD CONNS S.C. Hwy. Specs.

ERECTION BY

INSPECTION BY F&R

REVISIONS			
DATE	NO.	BY	CHANGE
	R1		
	R2		
	R3		
	R4		

ORDER NO. C9-940H65

DETAILS OF CROSS FRAMES SBL

FOR BRIDGE OVER LAKE MARION NO. 2

CUSTOMER HANNAMAKER & WELLS, INC.

AT CLARENDON & ORANGEBURG COUNTIES, SC

CAROLINA STEEL CORPORATION
GREENSBORO, N. C.

MADE BY NHong

TRACED BY

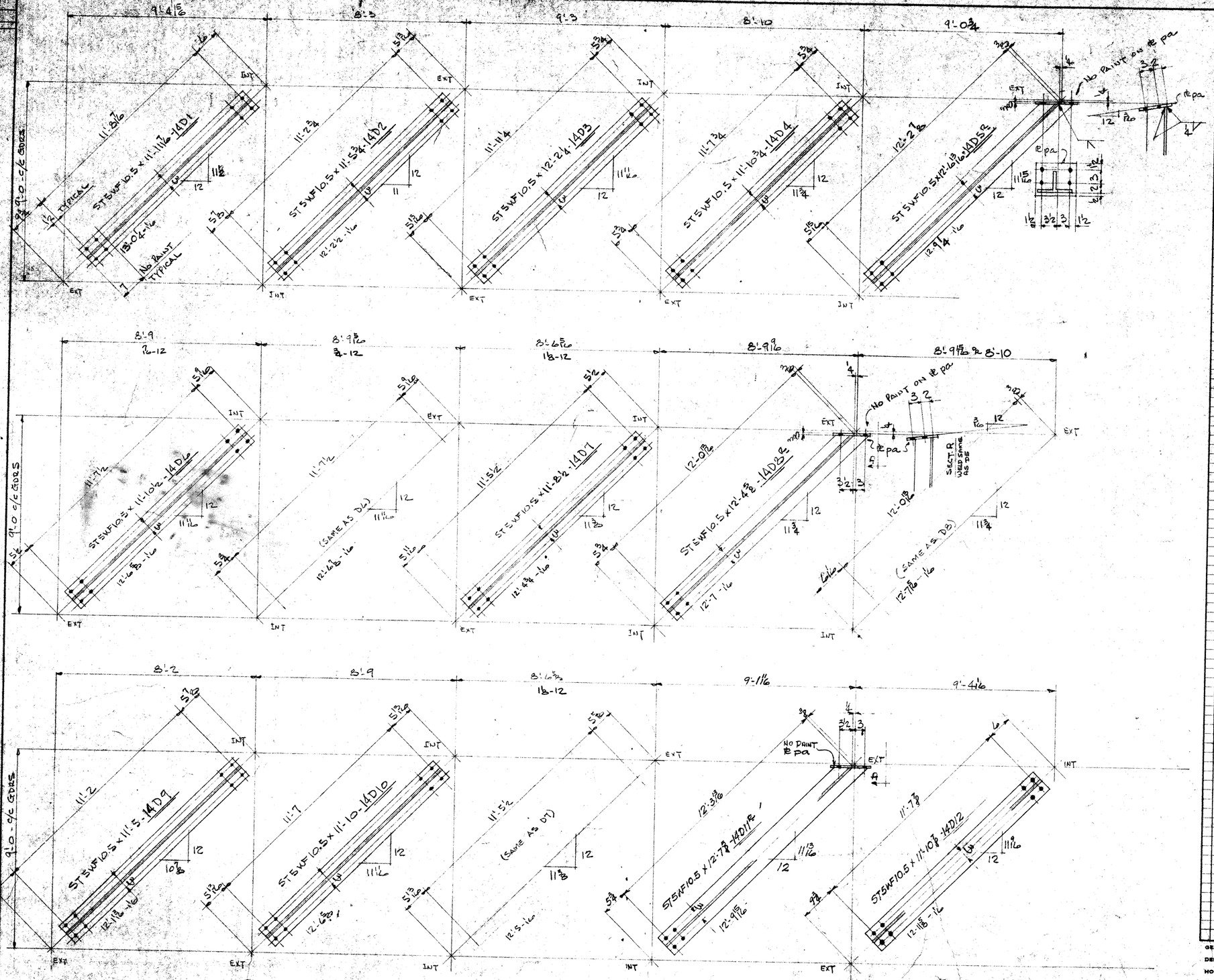
CHECKED BY

SCALE 27 JUNE 69 1 FT.

SHOP BILL NO.

SHEET HF13 OF

GLENNON & KERN, INC., CHICAGO



SHOP BILL

NO. PIECES	MARK	MATERIAL GRADE SPEC.	CROSSWISE NO.	CROSSWISE POST	LENGTH NO.	LENGTH FT.	SECTION	LENGTH IN.	REMARKS	WEIGHT
			(All Mark Pcs)				A36 or A572			
2	14D1	CB&W 70 mR	12	6	2		ST5WF10.5	11 11/16		
4	14D2		11	9	4		ST5WF10.5	11 5 3/4		
16	14D3		12	3 1/2	16		ST5WF10.5	12 2 1/4		
4	14D4		12	0	4		ST5WF10.5	11 10 3/4		
2	14D5E	↓	12	8 1/2	2		ST5WF10.5	12 6 9/16	@ DEV-1-E	
		Src			2	E	9 x 3/8		9 1/2 pa	
32	14D6	CB&W 70 mR	12	6	32		ST5WF10.5	11 10 1/2		
32	14D7		12	0	32		ST5WF10.5	11 8 1/2		
12	14D8E	↓	12	8 1/2	12		ST5WF10.5	12 4 5/8	@ DEV-1-E	
		Src			12	E			pa	
12	14D9	CB&W 70 mR	11	7	12		ST5WF10.5	11 5		
24	14D10		11	10	24		ST5WF10.5	11 10		
2	14D11E		12	8 1/2	2		ST5WF10.5	12 7 3/8	@ DEV-1-E	
					2	E			pa	
2	14D12	↓	12	0	2		ST5WF10.5	11 10 3/8		

TOTAL WEIGHT

S.C. FILE 1439-315.1
FAP # I-85 (2)(D)
STA. 3246+74.00 TO
STA. 3268+15.00

GENERAL NOTES: SPACING NOT GIVEN IS 3"
DESIGN BY:
HOLES: 15/16"ϕ
RIVETS:
SHOP PAINT: RED LEAD UNLESS NOTED
FIELD CONNS: S.C. HWY. SPECS.
ERECTION BY:
INSPECTION BY: FHR

REVISIONS			
DATE	NO.	BY	CHANGE
	R1		
	R2		
	R3		
	R4		

ORDER NO. 69-280465
DETAILS OF: LATERAL BRACING
SHT. (SBL)
FOR: BRIDGE OVER I-85 @ CHESTER, S.C.
CUSTOMER: Blythe Construction, Inc.
AT: Charlotte, N.C. Columbia, S.C.
CAROLINA STEEL CORPORATION
MADE BY: M.F.Long
TRACED BY:
CHECKED BY: F.H.R.

71'-0 - OUT TO OUT TOP FLG

Top Flg PL 16 x 1⅛ x 47'-3½

Top Flg PL 16 x 1⅝ x 23'-8½

3 AT 4'-1½ = 12'-4½

8 AT 4'-7½ = 37'-0

3 AT 4'-5 = 13'-3

10 AT 2½ = 2'-1 1/8

SHOP SPLICE FLG WELD TO ANG SPECS

GRIND WELD SMOOTH - TYP

SUBMERGED ARC WELD T & B FLGS

SUBMERGED ARC

12 TYPICAL

WT. 9 TONS

HOLES FOR G1

1-PL 6 x 15 FS FOR G1
1-PL 6 x 15 NS FOR G1
2-PL 6 x 15 FS FOR G2

1-PL 6 x 15 FS FOR G1
1-PL 6 x 15 NS FOR G1
2-PL 6 x 15 FS FOR G2

1-PL 6 x 15 FS FOR G1
1-PL 6 x 15 NS FOR G1
2-PL 6 x 15 FS FOR G2

5'-3 WEB

5'-3 WEB

14 AT 3½ = 4'-8

5'-3 WEB

No PAINT WEB

No PAINT - T&B FLGS

SHOP SPLICE FLG WELD TO ANG SPECS

SHOP SPLICE WEB WELD TO ANG SPECS

2 - PL 6 x 15 FS

3'-4⅜

FINISH END OF GDR

2'-6

15G1R - 15G2R

SHOP NOTE: BEVEL EDGE OF PL AT STIFF FOR WELD LENGTH

TYPICAL UNLESS NOTED

TYPICAL ALL LATERAL CONN'ES

CLIP CORNER TYPICAL ALL LATERAL CONN'ES

No PAINT ON ALL LATERAL CONN'ES

SHOP NOTE: DEVELOPED VIEW OF ALL LATERAL CONN'ES

SECTION - D

TYP FOR ALL LATERAL CONN'ES

9'-4 15/16

3'-3

7'-3

7'-3

9'-3

9'-3

8'-10

6'-11 7/16

9'-0¾

WEB PL 63 x 7/16 x 34'-5

WEB PL 63¾ x 7/16 x 36'-7⅛

BOTTOM FLG PL 16 x 15/16 x 22'-8½

BOTTOM FLG PL 16 x 1⅛ x 47'-4 3/16

71'-0 1/16 OUT TO OUT BOTTOM FLG

FOR LATERAL BRACING

CLIP CORNERS ¾" x ¾" T&B. TYPICAL

HOLES FOR G2

No WELD TIGHT FIT

SECTION - A

SECTION - B

SECTION - C

Top of WEB

8-9½ 20-9⅝ 45-3 1/16 G2-5 7/16 17-6 1/16 36-0 1/16 54-6 1/16 70-4⅜

BRG

CAMBER DIAGRAM

SHOP NOTE:
463 - FIELD SPLICES - INCLUDING DRILLING, FITTING, & REAMING

(R) RADIOGRAPH INSPECTION REQUIRED

GENERAL NOTES

DESIGN BY

HOLES 13/16" - UNLESS NOTED

RIVETS

SHOP PAINT RED LEAD - UNLESS NOTED

FIELD CONNS S.C. HWY. SPECS.

ERECTION BY

INSPECTION BY F&R

FABRICATED BY

REVISIONS			
DATE	NO.	BY	CHANGE
	#1		
	#2		
	#3		
	#4		

REQUIRED			
2	15G1R		
2	15G2R		

SCALE 1/4" = 1'-0"
FAP # I-85-2(12)
STA. 5276 + 00.00 TO
STA. 5248 + 67.08

ORDER NO. 69-7804(G&S)
DETAILS OF PLATE GIRDERS
SBL
FOR BRIDGE OVER [illegible]
CUSTOMER [illegible]
AT [illegible]
CAROLINA STEEL
CORPORATION
GREENSBORO, N. C.

DRAWN
TRACED
DESIGNED
CHECKED
APPROVED

16G1 - 16G2 - 16G3R

1-PL 16 x 5/8 x 4'-8 3/4 - pa
2-PL 6 1/2 x 7/8 x 4'-8 3/4 - pb
NO PAINT ON PLS pa - pb
BOLT FOR SHIPMENT

TOP FLG PL 16 x 1 1/8 x 23'-7 3/8
WEB PL 80 1/16 x 7/16 x 26'-5 7/8

75'-2 3/4 - OUT TO OUT
TOP FLG PL 16 x 1 7/16 x 28'-0
WEB PL 93 x 7/16 x 22'-3

SHOP SPLICE - FLG WELD TO AWS SPECS.
SHOP SPLICE - WEB WELD TO AWS SPECS.
GRIND WELD SMOOTH - T&B
SUBMERGED ARC WELD T&B - FLGS

SYMM. ABT ℄ (EXCEPT AS NOTED)

USE FILL PL fa BETWEEN TOP OF TOP FLG & PL pa AT SPLICE NO 5 THRU 28

1-PL pa
2-PL pb
BOLT FOR SHIPMENT

2-PL 17 1/4 x 4'-11 - pc
NO PAINT ON PLS pc
BOLT FOR SHIPMENT

HOLES FOR G1 & G3

(2-PL pat - FS FOR G1 & G3
1-PL pan - NS FOR G1 & G3
2-PL pan - FOR G2)

(1-PL pap - NS FOR G1 & G3
1-PL pab - FS - FOR G1 & G3
2-PL pap - FOR G2)

2-PL 5 x 3/8 x 5'-5 1/8 - pak
2-PL 5 x 3/8 x 5'-7 1/16 - pah
2-PL 5 x 3/8 x 5'-10 7/16 - pag
2-PL 5 x 3/8 x 6'-3 7/8 - paf
2-PL 5 x 3/8 x 6'-11 7/16 - pad
2-PL 5 x 3/8 x 7'-5 1/4 - pac
2-PL pab
2-PL 4 x 5/16 x 0'-5 3/8 - pv

(5'-4 7/16) DENOTES DEPTH OF WEB AT MIDPOINT OF STIFFENER SPACING

5/16 CONT
WT - 11 TONS

PL 4 x 7/16 x 4'-4 3/8 - pt
PL 4 x 7/16 x 4'-2 3/4 - ps
PL 4 x 7/16 x 4'-2 13/16 - pp
PL 4 x 7/16 x 4'-2 1/2 - pw

HOLES FOR G3 THIS END

BOTTOM FLG PL 16 x 1 1/8 x 23'-7 7/8
BOTTOM FLG PL 16 x 1 7/16 x 28'-1 3/4

RADIUS - 301'-2 1/2
ARC LENGTH (34'-2 7/16) TO PRC
20'-0 RADIUS
PRC
PT
(2'-5 15/16)

FOR LATERAL BRACING

5'-3 1/4 - WEB
16 AT 3 1/2 = 4'-8
7'-9 - WEB

NO PAINT - WEB 10
NO PAINT T&B - FLGS

PL fa 16 x 3/8 x 2'-4 1/4 - fa

USE FILL PL fa BETWEEN BOTTOM OF BOTTOM FLG & PL pc AT SPLICE NO 5 THRU 28

10 AT 2 1/2 = 2'-1
FINISH END OF GDR.
CLIP CORNER 1/2" x 1/2" TYPICAL - ALL LATERAL CONN PLS
TYPICAL UNLESS NOTED 3/16
TYPICAL - ALL LATERAL CONN. PLS
45°

PL 8 1/2 x 3/8 x 8 1/2 - pd^R - FOR G1 & G3
PL 8 1/2 x 3/8 x 8 1/2 - ph^R - FOR G2
PL 8 1/2 x 3/8 x 8 1/2 - pf^R - FOR G2
PL 8 1/2 x 3/8 x 8 1/2 - pt^R - FOR G1 & G3
PL 9 x 3/8 x 9 - pk^R - FOR G1 & G3
PL 9 x 3/8 x 9 - pa x^R - FOR G2
PL 8 1/2 x 3/8 x 8 1/2 - pm^R - FOR G2
PL 9 x 3/8 x 9 - pn^R - FOR G1 & G3

SHOP NOTE : DEVELOPED VIEW OF ALL LATERAL CONN. PLS

8'-9 - SLOPE
8'-9 7/16 - SLOPE
8'-6 5/8 - SLOPE

1" ℄ HOLES DRIVING FIT FOR 1" ℄ BOLTS

SECTION - A
SECTION - B
SECTION - C
SECTION - D
SECTION - F

TYP. SECTION @ G FOR G1 & G3
TYP. SECTION @ G FOR G2
(SECTIONS FOR LATERAL CONN. PLS)

CAMBER DIAGRAM

Top Flg	10'-0 5/8	20'-1 3/8	28'-10 3/8	37'-7 3/8

SHOP - NOTE :
H62 - HAUNCHED GIRDERS - INCLUDING WELDING OF STIFFENERS
H63 - FIELD SPLICES - INCLUDING DRILLING, FITTING & REAMING

(2) - RADIOGRAPH INSPECTION REQUIRED

GENERAL NOTES
DESIGN BY
HOLES 15/16 ℄ - UNLESS NOTED
RIVETS
SHOP PAINT RED LEAD - UNLESS NOTED
FIELD CONNS S.C. HWY. SPECS.
ERECTION BY
INSPECTION BY F & R
FABRICATED BY

NOTES . GIRDERS TO BE SHOP ASSEMBLED IN CAMBERED POSITION. HOLES FOR FIELD SPLICES TO BE SUBPUNCHED & REAMED TO SIZE OR DRILLED FROM THE SOLID AND MATCH MARKED WITH SPLICE MATERIAL ASSEMBLED TO GIRDERS. SEE HE3 FOR MATCH MARK SEQUENCE.

REVISIONS			
DATE	NO.	BY	CHANGE
29 AUG	R1		USE FILL fa AS NOTED
	R2		
	R3		
	R4		

REQUIRED			
4	16G1		
8	16G2		
4	16G3R		
SC FILE 1838.3/5.1			
FAP # I-95-2 (12)			
STA. 5246 + 79.00		TO	
STA. 5268 + 59.00			

ORDER NO. 69-940H62
DETAILS OF HAUNCH GIRDERS SBL
FOR BRIDGE OVER LAKE MARION NO. 2
CUSTOMER WANNAMAKER & WELLS, INC.
AT CLARENDON & ORANGEBURG COUNTIES, SC

CAROLINA STEEL CORPORATION
GREENSBORO, N. C.

MADE BY NI FONG
TRACED BY
CHECKED BY
SCALE 27 JUNE 69 1 FT.
SHOP BILL NO. H815
SHEET HF16 OF

GLENNON & KERR, INC., CHICAGO

Top Flg ℄ 16 × 1⅛ × 64'-9⅝

WEB ℄ G 34 × 7/16 × 30'-3

WEB ℄ G 34 × 7/16 × 34'-6⅝

1½" (R1)

2'-7¼ | 3 AT 4'-1 = 12'-3 | 8 AT 4'-4½ = 35'-0 | 3 AT 4'-1 = 12'-3 | 2'-8 1/16

6'-8¼ | 10'-9¼ | 14'-10¼ | 19'-2¾ | 23'-7¼ | 27'-11¾ | 32'-4¼ | 36'-8¾ | 41'-1¼ | 45'-5¾ | 49'-10¼ | 53'-11¼ | 58'-0¼ | 62'-1¼

2'-6 | NO PAINT T&P FLGS | NO PAINT T&P FLGS | 2'-6

3 3¼ 3¼ 3

10 AT 2½ = 2'-1 | 1¾ | 1¾ | 10 AT 2½ = 2'-1

10 NO PAINT WEB | NO PAINT WEB 10

(F) | (F) | (F)

B | A | C

SHOP SPLICE WEB WELD TO AWS SPECS

5'-3¼ WEB | 16 SPACES @ 3⅜" = 4'-6 | 5'-2 WEB | FLG CONT | 10 WT = (R1) TONS | 1-℄ pbF15 FS FOR G1, 1-℄ pcF15-NS FOR G1, 2-℄ pcF15 FOR G2 | 1'-6 HOLES FOR G1 | SUBMERGED ARC | 1'-9 (R2) | 1-℄ pbF15 FS FOR G1, 1-℄ pcF15-NS FOR G1, 2-℄ pcF15 FOR G2 | 1-℄ pbF15 FS FOR G1, 1-℄ pcF15-NS FOR G1, 2-℄ pcF15 FOR G2 | 5'-2 WEB | 2⅝ | 16 SPACES @ 3⅜" = 4'-6 | 5'-3¼ WEB

FINISH END OF GDR | 201.2 RADIUS | ET | 17G1℄ - 17G2℄ | 2-℄ pbF15 | BC | 201.2 RADIUS | FINISH END OF GDR

3'-4⅜ | 3'-4⅜

10 @ 2½ = 2'-1 | TYPICAL | TYPICAL - ALL LATERAL CONN ℄S | 10 @ 2½ = 2'-1

℄ 8¾ × ⅜ × 8¾ - paq F17R FOR G2 | ℄ 8¾ × ⅜ × 8¾ - pakF17R - FOR G2 | ℄ pamF17R - FOR G2 | ℄ pamF17L - FOR G2 | ℄ pamF17R - FOR G2 | ℄ pamF17L - FOR G2 | ℄ padF17R 8¾ × ⅜ × 8¾ FOR G2

℄ 8¾ × ⅜ × 8¾ ℄ 2¾ × ⅜ × 8¾ | ℄ pacF17L - FOR G1 | ℄ pacF17R FOR G1 | ℄ pacF17L - FOR G1 | ℄ pacF17R FOR G1 | ℄ pacF17L - FOR G1 | ℄ pakF17L FOR G1 | ℄ pabF17L - FOR G2

CLIP CORNER - 2" × ½" TYPICAL - ALL LATERAL CONN ℄S | No Paint on all lateral conn ℄s

SHOP NOTE: - DEVELOPED VIEW OF ALL LATERAL CONN. ℄S

2'-1 15/16 | 6'-8¼ | 8'-9 15/16 | 8'-2 | 8'-9 | 8'-9 | 8'-9 | 8'-7 | 8'-2 | 6'-8 1/16 | 2'-1 15/16 | FOR LATERAL BRACING

BOTTOM FLG ℄ 16 × 1⅛ × 64'-8 15/16 | 1½" (R1)

SECTION - C TYPICAL FOR ALL LATERAL CONN ℄S

4½ | 12 | 3/16

HOLES FOR G2 | CLIP CORNERS - ¾" × ¾" T&P - TYPICAL

2½ 2

2 AT 2½" = 5" | 1'-3 | NO PAINT ℄ pcF15 | 5 AT 2½" = 12½" | 1'-6 | NO PAINT ℄ pcF15

4'-2½

℄ 5-3⅜ × 5'-3 ℄ pbF15 - G1 ℄ 6 × 3⅜ × 5'-3 ℄ pcF15 - FOR G2

℄ pcF15 | ℄ pcF15 | No Weld Tight Fit

SECTION - A

℄ pbF15 | ℄ pcF15 | No Weld Tight Fit

SECTION - B

TOP OF WEB

7:5⅝	23:7⅝	41:1⅝	57:3⅞			
14:10⅝	32:4⅝	49:10⅝	64:9 15/16			

CAMBER DIAGRAM

SHOP NOTE:
H63 - FIELD SPLICES - INCLUDING DRILLING, FITTING & REAMING

(R) - RADIOGRAPHIC INSPECTION REQUIRED

GENERAL NOTES

DESIGN BY

HOLES 15/16 ℄

RIVETS

SHOP PAINT RED LEAD - UNLESS NOTED S.C. HWY. SPECS.

FIELD CONNS.

ERECTION BY

INSPECTION BY F & R

FABRICATED BY

NOTE: GIRDERS TO BE SHOP ASSEMBLED IN CAMBERED POSITION. HOLES FOR FIELD SPLICES TO BE SUBPUNCHED & REAMED TO SIZE OR DRILLED FROM THE SOLID AND MATCH MARKED WITH SPLICE MATERIAL ASSEMBLED TO GIRDERS. SEE HB3 FOR MATCH-MARK SEQUENCE.

REVISIONS			
DATE	NO.	BY	CHANGE
12 Aug	R1	THOMAS	T&P FLG ℄S TO 1½"
	R2		
	R3		
	R4		

REQUIRED			
2	17G1℄		
2	17G2℄		

SC FILE 1438.315.1
FAP # I-95-2 (12)
STA. 5246 + 79.00 TO
STA. 5268 + 59.00

ORDER NO. 69-940H61
DETAILS OF GIRDERS SBL
FOR BRIDGE OVER LAKE MARION NO. 2
CUSTOMER WANNAMAKER & WELLS, INC.
AT CLARENDON & ORANGEBURG COUNTIES, SC

CAROLINA STEEL CORPORATION
GREENSBORO, N. C.

MADE BY NI FONG
TRACED BY
CHECKED BY
SCALE 2"=1'-0" 1 FT.
SHOP BILL NO. H2816
SHEET HF17 OF

GLENNON & KERR, INC., CHICAGO

TOP FLG PL 16 × 1 1/8 × 64'-9 3/4

WEB PL 684 × 16 × 30'-3

WEB PL G34 × 16 × 34'-4 1/4

1 1/2" (R1)

8 AT 4'-4 1/2 = 35'-0

3 AT 4'-1 = 12'-3

3 AT 4'-1 = 12'-3

2'-7 1/2

2'-8

4'-6 3/4

10'-9 3/4

14'-10 1/4

19'-2 3/4

23'-7 1/4

27'-11 3/4

32'-4 1/4

36'-8 3/4

41'-1 1/4

45'-5 3/4

49'-10 1/4

53'-11 1/4

58'-0 1/4

62'-1 1/4

2'-6 NO PAINT T & B FLGS

NO PAINT T & B FLGS

2'-6

10 AT 2 1/2 = 2'-1

10 AT 2 1/2 = 2'-1

10 NO PAINT WEB

NO PAINT WEB 10

SHOPSPLICE WEB WELD TO AWS SPECS

2-PL 6 F15

(CF)

(CF)

(CF)

B

A

5/16 CONT

5/16 CONT

WT. 10 TONS

1-PL 6 F15 FS FOR G1
1-PL 6 PC F15 NS FOR G1
2-PL 6 PC F15 FOR G2

1-PL 6 F15 FS FOR G1
1-PL 6 PC F15 NS FOR G1
2-PL 6 PC F15 FOR G2

1-PL 6 F15 FS FOR G1
1-PL 6 PC F15 NS FOR G1
2-PL 6 PC F15 FOR G2

SUBMERGED ARC

11 HOLES FOR G1

2 1/2

2 1/2

2 1/2

4 1/2

1'-9

5'-3 WEB

5'-3 WEB

5'-3 WEB

16 SPACES @ 32 = 41'-8

16 SPACES @ 32 = 41'-8

2 1/2

2 1/2

1/2

PT

PT

FINISH END OF GDR

FINISH END OF GDR

301-12 1/2 BEARING

301-12 1/2 BEARING

3'-4 3/8

3'-4 3/8

1BG1 R - 1BG2 R

TYPICAL ALL LATERAL CONN. PLS

45°

TYPICAL

10 @ 2 1/2 = 2'-1

10 @ 2 1/2 = 2'-1

12 (D8) 11 3/4

12 (D8) 10 3/8

12 (D12) 11 1/16

12 (D10) 11 1/16

PL 8 3/4 × 5/16 × 8 3/4 - PL PAC F17 R FOR G2

PL 8 3/4 × 5/16 × 8 3/4 PAK F17 R FOR G2

PL 8 3/4 × 5/16 × 8 3/4 PAM F17 R FOR G2

PL PAM F17 L FOR G2

PL PAC F17 R FOR G1

PL PAC F17 L FOR G1

PL PAK F17 L FOR G2

PL PAD F17 L FOR G2

PL 8 3/4 × 5/16 × 8 3/4 PAK F17 R FOR G1

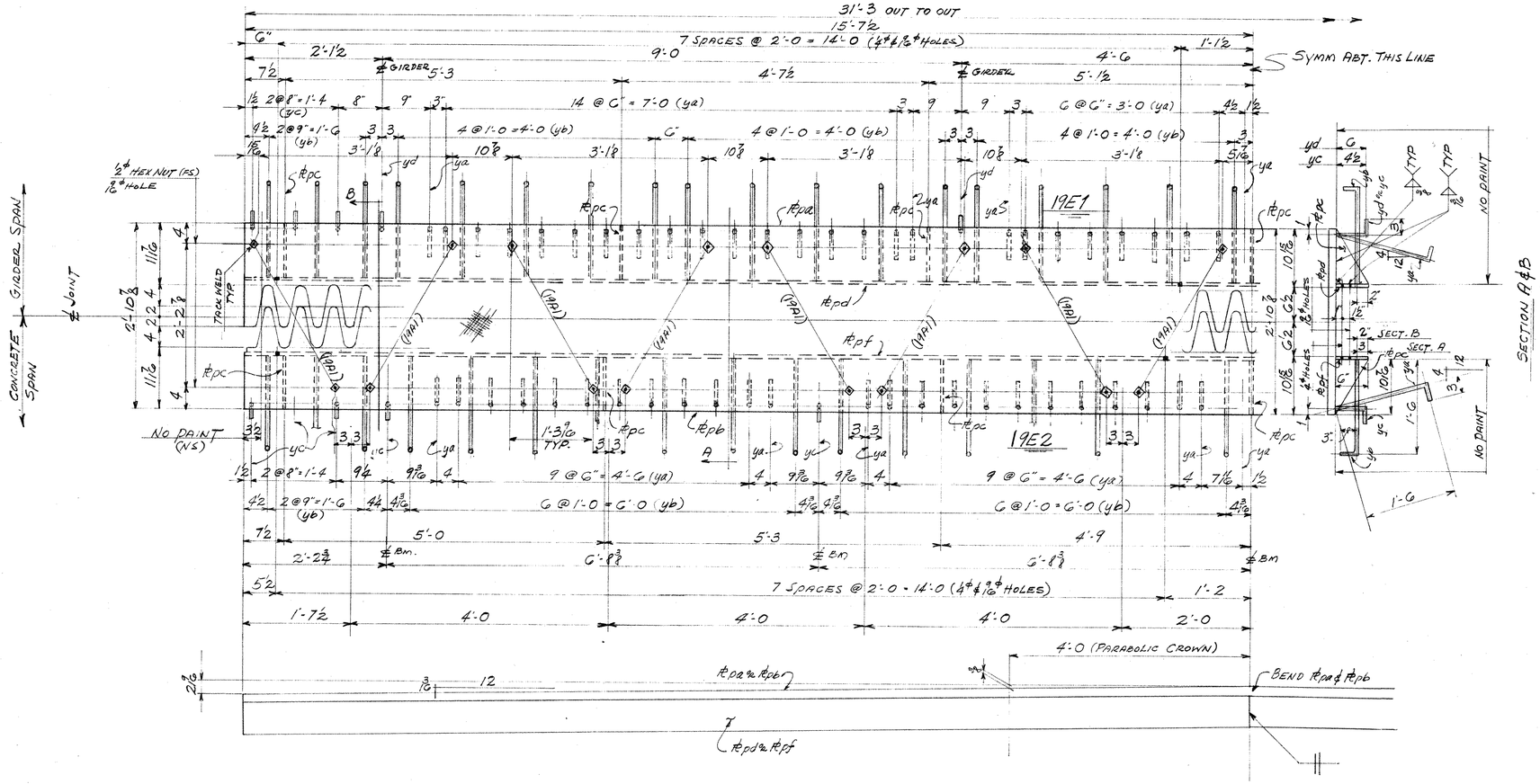
PL 8 3/4 × 5/16 × 8 3/4 PAM F17 R FOR G2

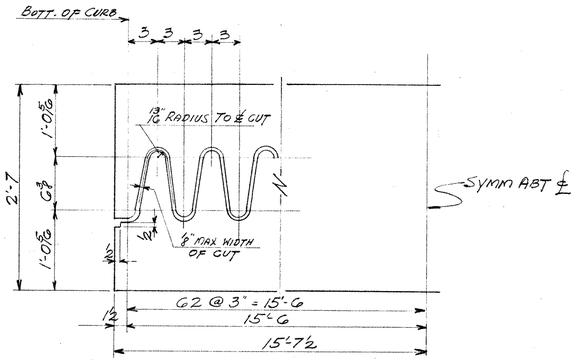
5/16

5/16

5/16

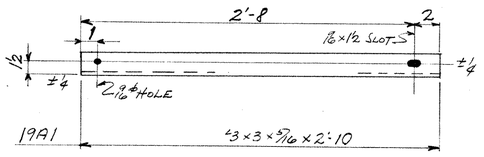
Prints for 1st Approval
Prints for 2nd Approval
Shop Prints

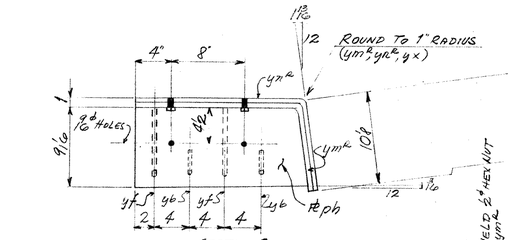


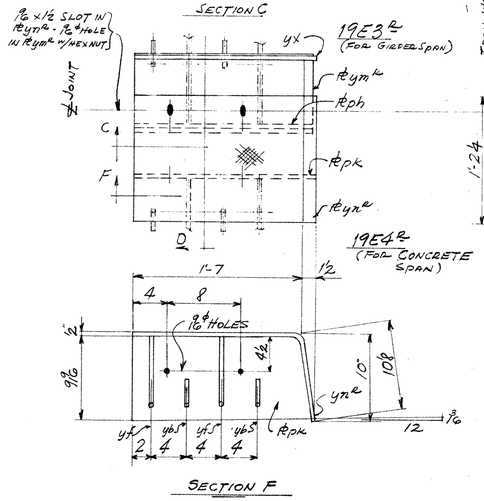


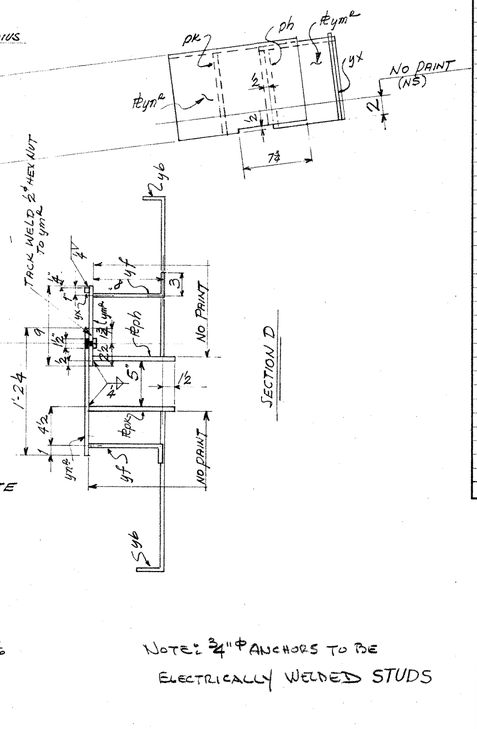
SCROLL DETAIL

THE SCROLL TO BE MADE BY A SINGLE CUT OF A MACHINE GUIDED TORCH. GRIND OFF BURRS ON THE ROADWAY SIDE OF CUT









NOTE: ¾" ø ANCHORS TO BE ELECTRICALLY WELDED STUDS

SHOP BILL

SHIPPING LIST NO. PIECES	SHIPPING LIST MARK	MATERIAL ORDER NO.	ORDERED NO.	ORDERED FEET	ORDERED INS.	NO. PIECES	DESCRIPTION	LENGTH FEET	LENGTH INS.	REMARKS	WEIGHT
2	19E1	CNO669				2	CHKD ℞ 31 × 1⅜	31	3	pa & pb, TEMP	
2	19E2										
		SHN				4	℞ 6 × ½	15	7½	pf	
		↓				4	℞ 6 × ½	15	7½	pd	
		RG4340				204	¾ø ANCHORS	1	9	ya,	
						136	¾ø ANCHORS	1	9	yb	
						32	¾ø ANCHORS		7½	yc	
						8	¾ø ANCHORS		9	yd	
		SHN				28	℞ G × ⅜		10⅞	pc, TEMP	
		SFP				64	⅞ø HEX NUTS				
4	19E3²	SHN				4	℞ 9 × ½	2	3⅝	ym², BEND	
						4	℞ 9⅛ × ½	1	7½	ph, TEMP	
		SOC				4	BAR ½ × ½	2	4⅝	yx BEND	
		RG4340				8	¾ø ANCHORS		11	yf, BEND	
		RG4340				8				yb	
		SFP				8	⅞ø HEX NUTS				
4	19E4²	SHN				4	CHCK ℞ 12 × ½	2	4⅝	yn², BEND	
						4	℞ 9⅛ × ½	1	8	pk TEMP	
		RG4340				8				yf	
						8				yb	
32	19A1	SOC				32	L 3×3×5/16	2	10		

TOTAL WEIGHT

SC FILE 1438.315.1
FAP # I-95-2(12)
STATION 5246 + 79.00 TO
STATION 5268 + 59.00

GENERAL NOTES
DESIGN BY
HOLES NOTED
RIVETS
SHOP PAINT RED LEAD (SC HWY SPECS) UNLESS NOTED
FIELD CONNS.
ERECTION BY
INSPECTION BY F & R

REVISIONS			
DATE	NO.	BY	CHANGE
	R1		
	R2		
	R3		
	R4		

ORDER NO. 69-990H66
DETAILS OF EXPANSION DAM SBL
FOR BRIDGE OVER LAKE MARION NO. 2
CUSTOMER WANNAMAKER RD WELLS, INC.
AT CLARENDON - ORANGEBURG COUNTIES, SC

CAROLINA STEEL CORPORATION
GREENSBORO, N. C.

MADE BY N.F.ong
TRACED BY
CHECKED BY
SCALE 2" = 1 FT.
DATE JUNE 69
SHOP BILL NO.
SHEET HF19 OF

GLEASON & KERN, INC., CHICAGO

WEB PL 63/4 x 7/16 x 30'-3

TOP FLG PL 16 x 1 1/2 x 64'-9 1/4

1 1/2" (R) BAT 4'-4 1/2 = 15'-0

WEB PL 63/4 x 7/16 x 34'-64

3 AT 4'-1 = 12'-3

3 AT 4'-1 = 12'-3

2'-7 1/4

6'-8 1/4

10'-9 1/4

14-10 1/4

19'-2 1/2

23'-7 1/4

27'-11 3/4

32'-4 1/2

36'-8 3/4

41'-1 1/4

45'-5 3/4

49'-10 1/4

53'-1 1/4

58'-0 1/4

62'-1 1/4

2'-8

2'-6 NO PAINT T&B FLGS

2'-6 NO PAINT T&B FLGS

10 AT 2 1/2 = 2'-1

10 NO PAINT WEB

10 NO PAINT WEB

SHOP SPLICE WEB, WELD TO FULL SPECS

PL 3/4 x 3'-3 3/4

PL 3/4 x 3'-3 3/4

PL 3/4 x 3'-3 3/4

71'-0⅞"

TOP FLG PL 16 × 1⅛ × 47'-3⅞

TOP FLG PL 16 × 1⅝ × 23'-8½

3 SPACES @ 4'-5 = 13'-3 | 8 SPACES @ 4'-7½ = 37'-0 | 3 SPACES @ 4'-12 = 12'-9½

2'-7⅞ | 7'-0⅞ | 11'-5⅞ | 15'-10⅞ | 20'-5⅞ | 25'-1⅞ | 29'-8⅞ | 34'-4⅞ | 38'-11⅞ | 43'-7⅞ | 48'-2⅞ | 52'-10⅞ | 56'-11⅞ | 61'-1⅞ | 65'-2⅞ | 67'-10 | 2'-7⅛ | 2'-7⅛ | 3'-2½ | 7⅛ | 2

70'-5⅝

10 @ 2½" = 2'-1

3 3⅛ 3⅛

10" NO PAINT WEB

WEB 5'-3½

16 SPACES @ 3½" = 4'-8

3½

2⅝

6"

5'-3 WEB

WT. 9 TONS

PT

3'-4⅞

(CF)

2 PDFS

1 PDFS - FS - G1
1 PDFS - NS - G1
2 PDFS - G2

1-G HOLES FOR G1

42

1-9 (2) SUBMERGED ARC

SHOPSPLICE FLG WELD TO AWS SPECS

(2) 60° GRIND WELD SMOOTH T & B

SUBMERGED ARC WELD T & B FLG

12 TYP 3

B C B

12" HOLES

G1 G2

8½ 8½

2'-7½

1 PDFS - FS - G1
1 PDFS - NS - G1
2 PDFS - G2

2 L 2½ × 2½ × ⅜ - G2
2 L 2½ × 2½ × ⅜ - G1

C59 WEB

D

SHOPSPLICE WEB WELD TO AWS SPECS

FIN END OF GRD.

2161 PL - 2162 PL

2'-6 NO PAINT - T & B FLG

3 3⅛ 3⅛

10 @ 2½ = 2'-1

2'-1⅛ | 7'-0⅜ | 9'-1⅛

9'-3 | 9'-3 | 9'-3 | 9'-3 | 9'-3 | 9'-4⅛

WEB PL G34 × 7/16 - 36'-7 15/16

BOTT. FLG PL 16 × 1⅛ × 47'-4

71'-0¾"

WEB PL G3 × 7/16 × 34'-5

BOTT. FLG PL 16 × 1⅝ × 23'-8½

SHOP NOTE: DEVELOPED VIEW OF ALL LATERAL CONN PLS

SECT D

TYP ALL LATERAL CONN PLS

TYP LATERAL CONN PLS

45° 3" TYP (U.N.O.)

CLIP PLS 2 × 2 - TYP LATERAL CONN PLS

2" × 3½" SLOT FOR PL part 4

1⅝ × 2½ SLOT IN FLG PL

74

5 PL

SECTION C

SECTION B

SECTION A

HOLES FOR G2

2½ 2

5

3½ 3½ 7½ 3

4'-2½

PL PDG FS - G1-G3 FOR G2

PL PDG FS - G1-G3 FOR G1

PL PDG FS - G3 FOR G2

NO WELD TIGHT FIT

NO PAINT 1'-0 (U.N.O.)

PL PDG 16 × ⅜ × 6'-3

CLIP PL ¾ × ¾ - TYP

PL PDG G1-G3 × 6'-3 FOR G1

PL PDG PL PDG FOR G2

MILL TO BEAR

2½

TOP FLG

7'-10⅞ | 15'-10⅛ | 25'-1½ | 34'-4½ | 43'-7½ | 52'-10½ | 61'-7⅛ | ℄ BRG

70'-5⅛

CAMBER DIAGRAM

NOTE: GIRDERS TO BE SHOP ASSEMBLED IN CAMBERED POSITION. HOLES FOR FIELD SPLICES TO BE SUBPUNCHED AND REAMED TO SIZE OR DRILLED FROM THE SOLID AND MATCH MARKED WITH SPLICE MATERIAL ASSEMBLED TO GIRDERS. SEE ERECTION PLAN FOR MATCH MARKS.

SHOP NOTE: H52 - FIELD SPLICES, INCLUDING DRILLING, FITTING, REAMING

(2) RADIOGRAPHIC INSPECTION REQUIRED

GENERAL NOTES

DESIGN BY

HOLES 13/16" UNLESS NOTED

RIVETS

SHOP PAINT RED LEAD (SCHWY SPECS) U.N.

FIELD CONNS

ERECTION BY

INSPECTION BY F & R

FABRICATED BY

REVISIONS			
DATE	NO.	BY	CHANGE
	R1		
	R2		
	R3		
	R4		

REQUIRED			
2	2161 PL		
2	2162 PL		

SC FILE 1438.357
FAP # I-95-2(12)
STR. 5246 + 79.00 TO
STR. 5268 + 59.00

ORDER NO. G9-940H51
DETAILS OF GIRDERS @ NBL
FOR BRIDGE OVER LAKE MARION NO. 2
CUSTOMER WRANNAMAKER & WELLS, INC.
AT CLARENDON - ORANGEBURG COUNTIES
SC

CAROLINA STEEL CORPORATION
GREENSBORO, N. C.

MADE BY N. Fong
TRACED BY
CHECKED BY
SCALE 1" = 1'-0"
SHOP BILL NO. H219
SHEET NO. HF21

GLENN & KERN, INC., CHICAGO

71'-0⅜

TOP FLG PL 16 x 1⅛ x 47'-3⅞ | 8 SPACES @ 4'-7½ = 37'-0 | TOP FLG PL 16 x 1⅝ x 23'-8½

3 SPACES @ 4'-1½ = 12'-9½

2'-7⅞ | 7'-0⅜ | 11'-5⅜ | 15'-10⅞ | 20'-5⅞ | 25'-1⅞ | 29'-8⅞ | 34'-4⅜ | 38'-11⅞ | 43'-7⅜ | 48'-2⅞ | 52'-10⅜ | 56'-11⅞ | 61'-1⅜ | 65'-2⅞ | 67'-10 | 2'-7⅞ | 2'-7⅞ | 3'-2⅜ | 10'-5⅛ | 7/16 | 9/16

1¾ | 10 @ 2½" = 2'-1

3 SPACES @ 3"=3"

(CF)

SHOPSPLICE FLG. WELD TO AWS SPECS

60°

GRIND WELD SMOOTH T&B

SUBMERGED ARC WELD T&B FLG

12 TYP. 3

10" NO PAINT WEB

2 PL 6"x15/16

1 PL 6"x15/16 FS - G1
1 PL 6"x15/16 NS - G1
2 PL 6"x15/16 - G2

WEB 5'-3¾

16 SPACES @ 3½" = 4'-8

5'-3 WEB

WT. 9 TONS

2⅜ | 2⅜ | 6" | 4½ | 1'-6 HOLES FOR G1 | 2⅜ | 6" | 1'-9 | 2⅜ | 6"

SUBMERGED ARC

SHOPSPLICE WEB WELD TO AWS SPECS

1 PL 6"x15/16 FS - G1
1 PL 6"x15/16 NS - G1
2 PL 6"x15/16 - G2

1 PL 6"x15/16 FS - G1
1 PL 6"x15/16 NS - G1
2 PL 6"x15/16 - G2

1 PL 6"x15/16 FS - G1
1 PL 6"x15/16 NS - G1
2 PL 6"x15/16 - G2

1 PL 6"x15/16 FS - G1
1 PL 6"x15/16 NS - G1
2 PL 6"x15/16 - G2

1 PL 6"x15/16 FS - G1
1 PL 6"x15/16 NS - G1
2 PL 6"x15/16 - G2
5"x5"x7/16 L

1½" HOLES

G1 | G2 | G2 | G2 | G2 | G2 | G2 | G2 | G1

2⅜ | 2½ | 2½ | 2½ | 2½ | 2½ | 2⅜ | 2⅜ | 2⅜

SHOP BILL

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

DS2

LINE NO.	NO. OF PIECES ON ORDER	NO. OF PIECES ON SHEET	MATERIAL SHAPE	LENGTH FT.	LENGTH INS.	+ INS.	ASSEMBLING MARK	REMARKS	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.	ORDERED SHAPE	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ORDERED ITEM
1		28	DRAIN PIPE				P1							
2														
3		28	4" X-HVY. C.I.											
4			DRAIN PIPE	6	7 3/4								10-0	3516
5														
6		10	DRAIN PIPE				P2							
7														
8		10	4" X-HVY. C.I.											
9			DRAIN PIPE	6	8 3/4								10-0	3516
10														
11		8	DRAIN PIPE				P3							
12														
13		8	4" X-HVY C.I.											
14			DRAIN PIPE	7	10								10-0	3516
15														
16														
17														
18		46	CLAMPS				C1							
19														
20		46	7/8" ϕ Rods	3	8			(bent)				20	0	S
21		276	Std. Hex Nuts	7/8" ϕ	TAP.									S
22		46	BAR 2½	12			8 3/4					30	0	S
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														
35														
36														
37														
38														
39														
40														
41														
42														
43														
44														
45														
46														

SHOP BILL

	DRAWINGS	NAME	DATE
	MADE BY	Sublette	9-24-58
	CHKD. BY		

REVISIONS: F E D C B X

DRAWINGS: ROANOKE

FABRICATION: ROANOKE

IN CHARGE OF: WEBBER

ORDER No. V2752

SHEET No. S 106

NAME OF STRUCTURE

SHOP BILL

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

D52

LINE NO.	NO. OF PIECES ON ORDER	NO. OF PIECES ON SHEET	MATERIAL SHAPE	LENGTH FT.	LENGTH INS.	+ INS.	ASSEMBLING MARK	REMARKS	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.	ORDERED SHAPE	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ITEM
1														
2		One	Expansion Dam				ED1	(See Note)						
3		One	Expansion Dam				ED3	(See Note)						
4		4	L 13 15/16 3/4	14	8 15/16		ha R	(Reat)			1½ 3/4	15	01	1
5		2	Ls 7 6 1/2	29	6		aa				L 8 6 1/2	30	0	S
6		8	R 4 1/2	0	5		paa					Rq.	0.	S
7		148	R 5 1/2	0	10		pk				6"	30	0	S
8		4	R 5½ 3/4	0	4 5/8		pz				6"	30	0	S
9		4	R 5½ 3/8	0	4 5/8		py							S
10		4	R 5½ 3/8	0	4 15/16		px							S
11		4	R 5½ 5/16	0	5 3/16		pw							S
12		4	R 5½ 3/8	0	5 7/16		pv							S
13		4	R 5½ 3/8	0	5 11/16		pu							S
14		4	R 5½ 3/8	0	5 13/16		pt							S
15		4	R 5½ 3/8	0	6		ps							S
16		4	R 5½ 3/8	0	6 3/16		pab							S
17		4	R 5½ 3/8	0	6 5/16		pp							S
18		8	R 5½ 3/8	0	6 7/16		pn							S
19		6	R 5½ 3/8	0	6 7/16		pm							S
20		24	Sq. Nuts ½" Tap											S
21		4	R 2½ 7/16	0	6¼		pa					Rq.	0.	S
22		20	R 2½ 1/8	0	6¼		pc							S
23		4	R 2½ 1/2	0	6¼		pad							S
24		8	R 2½ x 9/32 to 13/16 x	0	6¼		pe	FOR ED3						S
25		16	R 2½ 3/4	0	6¼		pg							S
26		12	Brs 2 1/4	1	2		hb					20	0	S
27		40	Brs 2½ 1/16	0	6¼		px							S
28		8	Brs 2½ x (11/16 to 7/16)	0	6¼		pw	FOR ED1				Rq.	0.	S
29		20	S. B. 7/8" ϕ											S
30														
31														
32			Note:											
33			Ship ED1, ED2 & A1 R-G L-G Assembled											
34			& ED2, ED3 & A1 R-G L-G Assembled											
35														
36														
37														
38		12	ANGLES				A1 R	(See Note)						
39		12	ANGLES				A1 L	(See Note)						
40		24	L 3 3 5/16	2	3							55	0	S
41														
42														
43														
44														
45			W.P. #101											
46														

SHOP BILL

	DRAWINGS	NAME	DATE
MADE BY		J.B.E.	9-22-38
CHKD. BY		CMS	10/29/38

F E D C B X

REVISIONS

DRAWINGS Roanoke

FABRICATION Roanoke

IN CHARGE OF Webber

ORDER No. V2751

SHEET No. S 102

NAME OF STRUCTURE

ERECTORS LIST

FIELD [redacted] BOLTS

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

LINE NO.	NO. PCS.	DIAM.	RIVETS	BOLTS: LENGTH UNDER HEAD	BOLTS: HEAD	BOLTS: NUT	BOLTS: WASHER	BOLTS: TYPE OF BOLT	GRIP	THICKNESS OF MATERIAL CONNECTED	LOCATION
1		7/8			Hex	Hex		H.S.			
2	36		✓	2 1/4					13/16	7/16 + 3/8	T2 to G3L & G4L
3	20		✓	2 3/4					3/16	3/8 + 7/16 + 3/8	T2 to G3L & G4L
4	54		✓	2 1/4					3/4	3/8 + 3/8	L5Z to G5L
5	60		✓	2 1/4					3/4	3/8 + 3/8	T5 & T3 to G5L & G4L
6	24		✓	2 1/4					11/16	5/16 + 3/8	D1 to T5
7	12		✓	3					1 1/16	7/16 + 1/8 + 1/8 + 3/4	S5L & S3L to FB3 & FB5
8	12		✓	3 1/2					1 15/16	7/16 + 1/8 + 1/8 + 1/4 + 1/4 + 3/4	S5L & S3L to FB3 & FB5
9	4		✓	3 1/4					1 5/8	7/16 + 1/8 + 1/8 + 15/16	S3L to FB7
10	4		✓	3 3/4					2 1/8	7/16 + 1/8 + 1/8 + 1/4 + 1/4 + 15/16	S3L to FB7
11	54			3					1 3/8	3/8 + 5/8 + 3/8	FB6 & FB7 to G6L (See Line 46)
12	332		✓	2 3/4					1 1/8	3/8 + 3/8 + 3/8	G6L to G4L & G7L
13	120		✓	4 1/2					2 7/8	5/8 + 5/8 + 3/8 + 5/8 + 5/8	
14	68		✓	4					2 3/8	3/8 + 7/8 + 3/8 + 3/8 + 3/8	
15	8		✓	4 3/4					3 1/4	3/8 + 5/8 + 5/8 + 3/8 + 5/8 + 5/8	
16	256		✓	3 3/4					2 1/4	9/16 + 7/16 + 5/8 + 5/8	
17	4		✓	3 1/2					2	5/8 + 9/16 + 7/16 + 5/8	
18	32		✓	2 3/4					1 5/16	3/8 + 9/16 + 3/8	FB5 to G6L
19	32		✓	2 1/4					3/4	3/8 + 3/8	FB5 to G6L
20	4		✓	3					1 7/16	7/16 + 1/8 + 1/8 + 3/4	S8L to FB5
21	4		✓	3 1/2					1 15/16	7/16 + 1/8 + 1/8 + 1/4 + 1/4 + 3/4	S8L to FB5
22	8		✓	3 1/4					1 5/8	7/16 + 1/8 + 1/8 + 15/16	S8L & S3L to FB6 & FB7
23	8		✓	3 3/4					2 1/8	7/16 + 1/8 + 1/8 + 1/4 + 1/4 + 15/16	S8L & S3L to FB6 & FB7
24	12		✓	3					1 1/16	7/16 + 1/8 + 1/8 + 3/4	S8L & S3L to FB5 & FB3
25	12		✓	3 1/2					1 15/16	7/16 + 1/8 + 1/8 + 1/4 + 1/4 + 3/4	S8L & S3L to FB5 & FB3
26	20		✓	3					1 1/16	7/16 + 1/8 + 1/8 + 3/4	S3L & S5L to FB3 & FB4
27	20		✓	3 1/2					1 15/16	7/16 + 1/8 + 1/8 + 1/4 + 1/4 + 3/4	S3L, S5L & S4L to FB3 & FB4
28	32		✓	2 3/4					1 5/16	3/8 + 9/16 + 3/8	FB3 to G7L
29	28		✓	2 1/2					1 1/16	5/8 + 7/16	FB2 to G7L
30	4			3 1/4					1 5/8	7/16 + 1/8 + 1/8 + 15/16	S5L to FB2
31	4		✓	3 3/4					2 1/8	7/16 + 1/8 + 1/8 + 1/4 + 1/4 + 15/16	S5L to FB2
32	12		✓	3 1/4					1 5/8	7/16 + 1/8 + 1/8 + 15/16	S3L & S6L to FB7
33	12		✓	3 3/4					2 1/8	7/16 + 1/8 + 1/8 + 1/4 + 1/4 + 15/16	S3L, S4L & S7L to FB7
34	4		✓	2 1/4					13/16	3/8 + 7/16	A1 to S4L
35	2		✓	2 3/4					1 1/8	3/8 + 3/8 + 3/8	H1 to A1
36	54		✓	3					1 3/8	3/8 + 5/8 + 3/8	FB7 to G2L
37	32		✓	2 3/4					1 5/16	3/8 + 9/16 + 3/8	FB4 to G2L (See Line 44)
38	166		✓	2 3/4					1 1/8	3/8 + 3/8 + 3/8	G2L to G7L
39	60		✓	4 1/2					2 7/8	5/8 + 5/8 + 3/8 + 5/8 + 5/8	
40	34			4					2 3/8	3/8 + 7/8 + 3/8 + 3/8 + 3/8	
41	4		✓	4 3/4					3 1/4	3/8 + 5/8 + 5/8 + 3/8 + 5/8 + 5/8	
42	128		✓	3 3/4					2 1/4	9/16 + 7/16 + 5/8 + 5/8	
43	2		✓	3 1/2					2	3/8 + 9/16 + 7/16 + 5/8	
44	86		✓	2 1/4					3/4	3/8 + 3/8	FB7 & FB4 to G2L
45	8		✓	3					1 1/16	7/16 + 1/8 + 1/8 + 3/4	S3L & S6L to FB4
46	54		✓	2 1/4					3/4	3/8 + 3/8	FB6 & FB7 to G6L

FIELD-[redacted] BOLTS

NAME	DATE
WCP	10/30/58
CET	11-12-58

REVISIONS: E W D C B X

DRAWINGS: Roanoke

FABRICATION: Roanoke

IN CHARGE OF: Webber

ORDER No.: V-2749

SHEET No.: EF 102

NAME OF STRUCTURE

D60

ERECTORS LIST

FIELD [redacted] BOLTS

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

LINE NO.	NO. PCS.	DIAM.	RIVETS	BOLTS: LENGTH UNDER HEAD	BOLTS: HEAD	BOLTS: NUT	BOLTS: WASHER	BOLTS: TYPE OF BOLT	GRIP	THICKNESS OF MATERIAL CONNECTED	LOCATION
1		7/8			Hex	Hex		H.S.			
2	8	"	✓	3 1/2	"	"		"	1 15/16	7/16 1/8 1/8 1/4 1/4 11/4	S3L^R & S7L^R to FB4
3	24	"	✓	2 1/2	"	"		"	15/16	3/8 9/16	S6L^R & S7L^R to FB1L
4	26	"	✓	2 1/2	"	"		"	1	9/16 7/16	FB1L to G2L^R
5	60	"	✓	2 1/4	"	"		"	3/4	3/8 3/8	T3 to G4L^R & G7L^R
6	36	"		2 1/4	"	"		"	11/16	5/16	D1 & D2 to T3
7	108	"		2 1/4	"	"		"	3/4	3/8 3/8	LS1 & LS2 to G2L^R & G6L^R
8	78	"		2 1/4	"	"		"	11/16	3/8 5/16	D1, D2 & D3 to G2L^R, G7L^R & G6L^R
9	80	"		2 1/4	"	"		"	3/4	3/8 3/8	T5 & T4 to G6L^R & G2L^R
10	24	"		2 1/4	"	"		"	11/16	5/16 3/8	D1 to T5
11	10	"	✓	2 3/4	"	"		"	1 3/16	3/8 7/16 3/8	T2 to G7L^R
12	6	"	✓	2 1/4	"	"		"	13/16	3/8 7/16	
13	12	"	✓	2 1/4	"	"		"	3/4	3/8 3/8	
14	24	"	✓	2 1/4	"	"		"	11/16	5/16 3/8	D3 to G2L^R & H1
15	24	"		2 1/4	"	"		"	11/16	5/16 3/8	D1 to LS1
16	10	"	✓	2 3/4	"	"		"	1 3/16	3/8 7/16 3/8	T1 to G2L^R
17	6	"	✓	2 1/4	"	"		"	13/16	3/8 7/16	
18	6	"	✓	2 1/2	"	"		"	7/8	3/8 1/2 3/8	
19	6	"	✓	2 3/4	"	"		"	1 1/8	3/8 3/8 3/8	
20	12	"	✓	2 1/4	"	"		"	3/4	3/8 3/8	T1 to FB1L^R (Pier A & E)
21	18	"	✓	2 1/4	"	"		"	3/4	3/8 3/8	T2 to FB2 (Pier B, C & D)
22	86	"		2 1/4	"	"		"	3/4	3/8 3/8	FB5, FB6, & FB7 to G5
23	2	"		3 1/2	"	"		"	2	3/8 9/16 7/16 5/8	G1L^R to G3L^R
24	4	"		3 1/2	"	"		"	2	3/8 9/16 7/16 5/8	G3L^R & G4L^R to G5L^R
25											
26		3/8			Hex	Hex		Mach.			
27	2	"		3 1/2	"	"		"	2 1/2	15/16 1/2 7/16 5/8	ED3 to G1L^R
28	8	"		3 3/4	"	"		"	2 5/8	3/8 1/2 3/4	ED3 to FB1^R
29	2	"		3 1/2	"	"		"	2 1/2	15/16 7/16 1/2 5/8	ED1 to G2L^R
30	8	"	✓	3 3/4	"	"		"	2 3/8	3/8 1/2 3/4	ED1 to FB1L
31	24	1/2		2	Sq	None		"	1 1/16	5/16 3/4	A1 to ED1 & ED3
32		"									
33											
34		7/8			Hex	Hex		H.S.			
35	60	"		3 1/4	"	"		"	1 5/8	7/16 9/16 5/8	G6L^R to G4L^R & G7L^R
36	30	"		3 1/4	"	"		"	1 5/8	7/16 9/16 5/8	G2L^R to G7L^R
37											
38	8	1/2		2 1/4	Sq	None		Mach.	1 1/2	1/2 1/2 1/2	ES1L^R to ES3L^R
39											
40		7/8			Hex	Hex		H.S.			
41	24	"		2 3/4	"	"		"	1 5/16	3/8 15/16	LS1 & LS2 to FB6 & FB7
42											
43	24	1/2		2 1/2	Sq	None		Mach.	1 9/16	5/16 3/4 1/2	A1 to ED2
44											
45											
46											

FIELD [redacted] BOLTS

NAME	DATE
WCP	10/31/58
CEP	11-12-58

REVISIONS

DRAWINGS: Roanoke

FABRICATION: Roanoke

IN CHARGE OF: Webber

ORDER No.: V-2749

SHEET No.: EF103

NAME OF STRUCTURE

SHOP BILL

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

LINE NO.	NO. OF PIECES ON ORDER	NO. OF PIECES ON SHEET	MATERIAL SHAPE				LENGTH FT.	LENGTH INS.	+ INS.	ASSEMBLING MARK	REMARKS	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.	ORDERED SHAPE			ORDERED LENGTH FT.	ORDERED LENGTH INS.	ITE
1																			
2			ONE GIRDER							G1 R ✓									
3			ONE GIRDER							G1 L ✓									
4										✓									
5										✓									
6																			
7		2	WEB PL		72	3/8	37	5 3/4		✓	✓F-2-E✓					72½"	37	7¾	4
8																			
9		2	WEB PL		72	3/8	42	0 3/4		✓	✓F-1-E✓					72½"	42	2½	3
10																			
11		4	L	8	6	5/8	79	3 15/16		✓	✓F-1-E		CF	79-8½			79	6	9
12		4	L	8	6	5/8	79	6 3/4		✓	✓F-1-E						79	8½	9
13		2	U.M. Cov. PL		18	7/16	19	0 8 1/2		✓	✓		CF	38-4			19	2	3
14		4	U.M. Cov PL		18	9/16	49	10½		✓	✓						50	0½	2
15		4	U.M. Cov PL		18	7/16	60	6 3/8		✓	✓						60	8¼	3
16		2	PL		16¼	3/8	2	10½		PP101	✓					18"	30	0	
17		2	U.M. Cov PL		18	7/16	18	9 5/16		✓	✓		CF	37-10½			18	11¼	3
18		4	PL		8½	5/8	5	0 1/4		DA101	✓					9"	20	0	
19		4	PL		18	9/16	5	1½		PM101	✓						30	9	2
20		38	L	6	4	3/8	5	11¼		SA101 R L	(CRIMP)+2¼						49	0	17
21		2	L	6	4	1/2	5	11 7/16		SFA R L	✓F.2E.						60	0	15
22		2	L	6	4	1/2	5	11 7/16		SCA R L	✓F.2E.								15
23		2	PL		17½	7/16	5	9 3/4		PK101	✓					22"	43-	2½	
24		2	L	6	4	1/2	5	11 7/16		SDA R L	✓F.2E.						60	0	15
25		2	L	6	4	1/2	5	11 7/16		SV R L	✓F.2E.								15
26		2	BAR		5½	7/16	5	10½		FG101	✓					6"	30	0	
27		20	BAR		4	5/8	5	0		FB101	✓						30	0	
28		6	L	6	4	3/8	5	11¼		SG101 R L	✓						47	10	18
29		6	L	7	4	3/8	2	3		AG101	✓						55	0	
30		10	L	6	4	3/8	5	11¼		SAA101 R L							47	10	18
31		4	L	6	4	3/8	5	11¼		SH101 R L	✓								18
32		4	L	7	4	3/8	2	0		AS101	✓						55	0	
33		8	BAR		5	3/8	3	7½		BA101	✓						30	0	
34		8	PL		19½	3/8	5	0		PA101	✓					60"	40	0	
35		2	BAR		4	5/8	5	0		FF101	✓						30	0	
36		2	L	6	4	3/8	5	11¼		SB101 R L	✓						47	10	18
37		8	L	7 3/8	5 3/8	5/8	4	1½		AW101 R L	(CF 8+6 L) ✓						49	6	14
38		2	PL		16¼	3/8	2	9¼		PS101	✓					18"	30	0	
39		2	BAR		4	7/8	5	0		FK101	✓						30	0	
40		2	L	6	4	3/8	5	10		SK101 R L	✓						60	0	16
41																			
42		2	PL		16	3/8	2	6 5/8		PB	✓						40	0	
43		4	PL		16	3/8	1	8		PC101	✓						40	0	
44		2	PL		16	3/8	3	3½		PD101	✓						40	0	
45		40	S.B	7/8															
46			ADV BILL # 101 & 102																

SHOP BILL

DRAWINGS	NAME	DATE
MADE BY Sublette		9-24-58
CHKD. BY SLUSHER		10/24/58

REVISIONS: F E D C B X

DRAWINGS: ROANOKE FABRICATION: ROANOKE

IN CHARGE OF: WEBBER ORDER No.: V2749

SHEET No.: S 101

NAME OF STRUCTURE

BRIDGE OVER SAVANNAH RIVER ~ PROJ FAP NO F2610(2) DOC. NO 27282
NEAR GARNETT. (JASPER CO.) SOUTH CAROLINA ~ ROBERT. E. LEE & COMPANY INC.

D60

ERECTORS LIST
FIELD [redacted] BOLTS

AMERICAN BRIDGE
DIVISION
UNITED STATES STEEL CORPORATION

LINE NO.	NO. PCS.	DIAM.	RIVETS	BOLTS: LENGTH UNDER HEAD	BOLTS: HEAD	BOLTS: NUT	BOLTS: WASHER	BOLTS: TYPE OF BOLT	GRIP	THICKNESS OF MATERIAL CONNECTED	LOCATION
1		7/8			Hex.	Hex.		H.S.			
2	26			2 1/2					1	9/16 7/16	FB1R to G1L
3	24			2 1/2					15/16	3/8 9/16	S1L & S2L to FB1R
4	8			3 1/4					1 5/8	7/16 1/8 1/8 15/16	S1L & S2L to FB7 & FB4
5	8			3 3/4					2 1/8	7/16 1/8 1/8 1/4 1/4 15/16	S1L & S2L to FB7 & FB4
6	54			3					1 3/8	5/8 3/8 3/8	FB7 to G1L
7	12			3					1 7/16	7/16 1/8 1/8 3/4	S3L to FB4
8	12			3 1/2					1 15/16	7/16 1/8 1/8 1/4 1/4 3/4	S4L & S3L to FB4
9	32			2 3/4					1 5/16	9/16 3/8 3/8	FB4 to G1L
10	8			3 1/4					1 5/8	7/16 1/8 1/8 15/16	S3L to FB7
11	8			3 3/4					2 1/8	7/16 1/8 1/8 1/4 1/4 15/16	S3L & S4L to FB7
12	4			2 1/4					13/16	3/8 7/16	A1 to S4L
13	166			2 3/4					1 1/8	3/8 3/8 3/8	G1L to G3L (See Line 33)
14	60			4 1/2					2 7/8	5/8 5/8 5/8 1/2 5/8	
15	34			4					2 3/8	3/8 7/8 3/8 3/8 3/8	
16	4			4 3/4					3 1/4	3/8 5/8 5/8 3/8 5/8 5/8	
17	24			3					1 1/16	7/16 1/8 1/8 3/4	S3L, S4L & S5L to FB3
18	24			3 1/2					1 15/16	7/16 1/8 1/8 1/4 1/4 3/4	S3L, S4L & S5L to FB3
19	64			2 3/4					1 5/16	3/8 9/16 3/8	FB3 to G3L & S4L (See Line 46)
20	56			2 1/2					1 1/16	5/8 7/16	FB2 to G3L & S4L
21	8			3 1/4					1 5/8	7/16 1/8 1/8 15/16	S5L to FB2
22	8			3 3/4					2 1/8	7/16 1/8 1/8 1/4 1/4 15/16	S5L to FB2
23	12			3 1/4					1 5/8	7/16 1/8 1/8 15/16	S3L & S8L to FB6 & FB7
24	12			3 3/4					2 1/8	7/16 1/8 1/8 1/4 1/4 15/16	S3L & S8L to FB6 & FB7
25	54			3					1 1/8	3/8 5/8 3/8	FB6 & FB7 to G5L
26	32			2 3/4					1 5/16	3/8 9/16 3/8	FB5 to G5L
27	120			4 1/2					2 7/8	5/8 5/8 3/8 5/8 5/8	G3L & G4L to G5L
28	332			2 3/4					1 1/8	3/8 3/8 3/8	
29	8			4 3/4					2 1/4	3/8 5/8 5/8 3/8 5/8 5/8	
30	256			3 3/4					2 1/4	7/16 7/16 5/8 5/8	
31	60			3 1/4					1 5/8	7/16 5/8 9/16	
32	68			4					2 3/8	3/8 7/8 3/8 3/8 3/8	
33	128			3 3/4					2 1/4	9/16 7/16 5/8 5/8	G1L to G3L
34	30			3 1/4					1 5/8	7/16 5/8 9/16	
35	16			3					1 1/16	7/16 1/8 1/8 3/4	S3L & S8L to FB5
36	16			3 1/2					1 15/16	7/16 1/8 1/8 1/4 1/4 3/4	S3L & S8L to FB5
37	6			2 1/2					7/8	3/8 1/8 3/8	T1 to G1L
38	16			2 3/4					1 3/16	3/8 7/16 3/8	T1 to G1L
39	6			2 3/4					1 1/8	3/8 3/8 3/8	T1 to G1L
40	94			2 1/4					3/4	3/8 3/8	LS1, LS2 & T4 to G1L
41	60			2 1/4					11/16	5/16 3/8	D1 & D2 to G3L, G4L, & G5L
42	2			2 3/4					1 1/8	3/8 3/8 3/8	H1 to A1
43	48			2 1/4					11/16	5/16 3/8	D1 to G1L & LS1
44	66			2 1/4					11/16	5/16 3/8	D3, D1 & D2 to H1, T3, & G1L
45	40			2 1/4					3/4	3/8 3/8	T3 to G3L
46	64			2 1/4					3/4	3/8 3/8	FB3 to G3L & G4L

FIELD [redacted] BOLTS

NAME	DATE
W.C.P.	10/29/58
C.E.T.	11-12-58

REVISIONS: L W D O M X

DRAWINGS: Ronnie
FABRICATION: Ronnie
IN CHARGE OF: Weber
ORDER No.: V-2749
SHEET No.: EF 101

NAME OF STRUCTURE: Bridge Over Savannah River
Proj. FAP No. F-2610(3) Dec. No. 27.282
Near Garnett (Jasper Co.) So. Carolina
Robert E. Lee & Co. Inc.

SHOP BILL

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

LINE NO.	NO. OF PIECES ON ORDER	NO. OF PIECES ON SHEET	MATERIAL SHAPE	LENGTH FT.	LENGTH INS.	+ INS.	ASSEMBLING MARK	REMARKS	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.	ORDERED SHAPE	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ITE
1			ONE GIRDER				2OE							
2			ONE GIRDER				G2L							
3														
4		4	L 8 x 6 x 5/8	78	10 7/8			F·I·E		CF	119-4	79	1	10
5		2	WF 36		72 3/8			F·I·E			72 1/2"	37	7 3/4	4(
6		2	WF 36		72 3/8			F·I·E			72 1/2"	4		3
7		4	L 8 x 6 x 5/8	7	1 1/16			F·I·E				79	4	10
8		4	U.M Cov. PL	13	3/16							5		2
9		4	U.M Cov. PL	18	7/16			F·I·E						3
10		2	U.M Cov. PL	18	7/16					CF	37-6 1/2			3
11		4	PL	8 1/2	5/8						9"	20	0	S
12		4	PL	18	7/16							30	9	28
13		38	L 6 x 4 x 3/8	5	11 1/4			(CE MK) +2				49	0	17
14		2	PL	17 1/2	7/16						22"	43-	2 1/2	S
15		2	BAR	5 1/2	7/16						6"	30	0	S
16		20	BAR	4	5/8							30	0	S
17		6	L 6 x 4 x 3/8	5	11/4							47	10	18
18		6	L 7 x 4 x 3/8	2	3							55	0	S
19		10	L 6 x 4 x 3/8	5	11 1/4							47	10	18
20		4	L 6 x 4 x 3/8	5	11 1/4									18
21		4	L 7 x 4 x 3/8	2	0							55	0	S
22		8	BAR	5	3/8	3	7 1/2					30	0	S
23		3	PL	19 1/2	3/8	5	0				60"	40	0	S
24		2	BAR	4	5/8	5	0					30	0	S
25		2	L 6 x 4 x 3/8	5	11 1/4							47	10	18
26		8	L 7 3/8 x 5 5/8 x 5/8	4	1 1/2			(C.F. 8×6L)				49	6	14
27		2	BAR	4	7/8	5	0					30	0	S
28		2	L 6 x 4 x 3/8	5	10							60	0	16
29		2	PL	16	3/8	2	6					40	0	S
30		4	PL	16	3/8	1	8					40	0	S
31		2	PL	16	3/8	5	3 1/2					40	0	S
32		2	PL	16 1/4	3/8	2	10 1/2				18"	30	0	S
33		2	PL	16 1/4	3/8	2	11 1/4							S
34		2	U.M Cov. PL	18	7/16	18	44			CF	37-0 1/2	18	6 4	3
35		2	L 6 x 4 x 1/2	5	11 7/16			F.2.E.				60	0	15
36		2	L 6 x 4 x 1/2	5	11 7/16			F.2.E						15
37		2	L 6 x 4 x 1/2	5	11 7/16			F.2.E.						15
38		2	L 6 x 4 x 1/2	5	11 7/16			F.2.E.						15
39		40	SB 3/8											S
40														
41														
42														
43														
44								ADV BILL #101&102						
45														
46														

SHOP BILL

DRAWINGS	NAME	DATE
MADE BY	Sublette	
CHKD. BY	CMS	10-1-X

REVISIONS: F E D C B X

DRAWINGS: ROANOKE

FABRICATION: ROANOKE

IN CHARGE OF: WEBBER

ORDER No.: V2749

SHEET No.: S 102

NAME OF STRUCTURE

SHOP BILL

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

LINE NO.	NO. OF PIECES ON ORDER	NO. OF PIECES ON SHEET	MATERIAL SHAPE	LENGTH FT.	LENGTH INS.	+ INS.	ASSEMBLING MARK	REMARKS	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.	ORDERED SHAPE	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ITE
1														
2			ONE GIRDER				G3 R							
3			ONE GIRDER				G3 L							
4			ONE GIRDER				G4 R							
5			ONE GIRDER				G4 L							
6			ONE GIRDER				G7 R							
7			ONE GIRDER				G7 L							
8														
9		6	Web PL 90 3/8	52	10 3/4						90 1/4"	53	0 3/4	3
10		12	L 8 6 5/8	52	10 3/4			(F-2-E)				53	0 3/4	13
11		12	L 8 6 5/8	52	11 7/8			(F-2-E)(bent)				53	6	12
12		6	UM Cov PL 18 7/16	52	10 3/4			(F-2-E)				53	0 3/4	3
13		4	UM Cov PL 18 5/8	36	1 3/4			(For G3 L & G7 L)		CF	103+6	36	3 1/4	C
14		2	UM Cov PL 18 5/8	30	0			(For G4 L)				30	2	C
15		4	UM Cov PL 18 5/8	18	0			(For G3 R & G7 R)		3 CF 1	103 6 25 5 3/4	18	2	C
16		2	UM Cov PL 18 3/8	18	0			(For G4 R)		CF	40 0	18	2	S
17		6	UM Cov PL 18 7/16	52	11 7/8			(F-2-E)(bent)				53	6	31
18		4	UM Cov PL 18 5/8	36	2 7/8			(For G3 R & G7 R) (bent)				36	9	21
19		2	UM Cov PL 18 5/8	30	0 3/4			(For G4) (bent)		CF	103 6	30	7	C
20		4	UM Cov PL 18 5/8	18	0 3/8			(For G3 R & G7 R) (bent)		CF	103 6	18	6	C
21		2	UM Cov PL 18 3/8	18	0 3/8			(For G4 R) (bent)		CF	40 0	18	6	C
22		24	L 6 4 3/8	6	0 9/16		sa L R	(CRIMP)+2 7/16				60	0	16
23		12	L 6 4 3/8	6	3 9/16		sb L R	(CRIMP)+2				60	0	16
24		24	BAR 4 5/8	5	7 1/4		fc					30	0	C
25		12	L 6 4 3/8	6	6 5/8		sm L R			CF	60 0			16
26		12	L 7 4 3/8	7	0		as101					55	0	C
27		12	L 6 4 3/8	6	6 5/8		sn L R			CF	60 0			16
28		12	L 6 4 3/8	6	9 1/2		sc L R	(CRIMP)+2 5/16				60	0	16
29		24	L 6 4 3/8	7	0 7/16		sd L R	(CRIMP)(F-2-E)+2 5/16						16
30		12	L 6 4 3/8	7	3 7/16		sf L R	(CRIMP)+2 3/8						16
31		24	L 6 4 1/2	7	5 1/4		sg L R	(F-2-E)				60	0	15
32		12	PL 23 5/8	6	6		da				24"	40	0	S
33		12	L 6 4 1/2	7	5 1/4		sh L R	(F-2-E)				60	0	15
34		6	PL 17 1/2 7/16	7	4 3/8		pa			CF	22" 43-2 1/2	7	4 1/2	S
35		12	L 6 4 1/2	7	5 1/4		sk L R	(F-2-E)				60	0	15
36		6	BAR 5 1/2 7/16	7	4		fa				6"	30	0	C
37		12	PL 16 3/8	1	8 5/8		pb				16"	40	0	C
38		6	PL 16 3/8	3	10 5/8		ha	(bent)						C
39		36	L 3 3 3/8	3	4		ae					60	0	24
40		12	L 3 3 3/8	3	6		af					60	0	24
41		12	L 3 3 3/8	3	1 1/2		ag					60	0	24
42		12	L 3 3 3/8	2	6 1/2		ak					60	0	24
43		24	SB 3/8											S
44			A.B #101 & 102											
45														
46														

SHOP BILL

	DRAWINGS	NAME	DATE
MADE BY	Sublette		9-24-58
CHKD. BY	CMS		10-23-58

REVISIONS: F E D C B X

DRAWINGS: ROANOKE

FABRICATION: ROANOKE

IN CHARGE OF: WEBBER

ORDER No.: V2749

SHEET No.: S 103

NAME OF STRUCTURE

SHOP BILL

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

LINE NO.	NO. OF PIECES ON ORDER	NO. OF PIECES ON SHEET	MATERIAL SHAPE	LENGTH FT.	LENGTH INS.	+ INS.	ASSEMBLING MARK	REMARKS	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.	ORDERED SHAPE	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ITEM
1			ONE GIRDER				G5 R							
2			ONE GIRDER				G5 L							
3			ONE GIRDER				G6 R							
4			ONE GIRDER				G6 L							
5														
6		8	WEB PL 72 3/8	33	6 13/16			(F.Z.E)				33	9	41
7		16	L 8 6 5/8	67	1 7/8			(F.Z.E)				67	3 3/4	11
8		8	U.M. Cov. PL 18 7/16	67	1 7/8			(F.Z.E)				67	3 3/4	21
9		16	PL 18 9/16	5	1 1/2		pm101					30	9	25
10		32	L 7 3/8 5 3/8 5/8	4	1 1/2		aw101 R L	(C.F 8·6L)				49	6	14X
11		16	PL 19 1/2 3/8	5	0		pa101				60"	40	0	S
12		8	L 6 4 3/8	5	10		sk101 R L					60	0	16X
13		8	BAR 4 7/8	5	0		fk101					30	0	S
14		64	L 6 4 3/8	5	11/4		sa101 R L	(CRIMP)+2"				49	0	17X
15		8	L 6 4 3/8	5	11/4		sg101 R L					47	10	18X
16		8	L 7 4 3/8	2	3		ag101					55	0	S
17		16	L 6 4 3/8	5	11/4		sa101 R L					47	10	18X
18		8	L 6 4 3/8	5	11/4		sh101 R L					}		18X
19		8	L 7 4 3/8	2	0		as101					55	0	S
20		4	L 6 4 3/8	5	11/4		sb R L					47	10	18X
21		4	L 7 4 3/8	2	3		ab					55	0	S
22		4	L 6 4 3/8	5	11/4		sc R L					47	10	18X
23		16	BAR 5 3/8	3	8 1/2		ba					30	0	S
24		8	BAR 4 5/8	5	0		fa					30	0	S
25		8	PL 20 1/2 3/8	5	0		pc				60"	40	0	S
26		8	PL 16 3/8	3	3 3/8		pa					40	0	S
27		8	PL 16 3/8	1	8		pc101					40	0	S
28		4	PL 16 3/8	3	5		pb					40	0	S
29		32	BAR 4 5/8	5	0		fb101					30	0	S
30		104	SB 78											S
31														
32														
33														
34														
35														
36														
37														
38														
39														
40														
41														
42														
43			A.3 #101 & 102											
44														
45														
46														

SHOP BILL

DRAWINGS	NAME	DATE
MADE BY	Sublette	9-25-58
CHKD. BY	cms	10/29/58

REVISIONS: F E D C B X

DRAWINGS: ROANOKE

FABRICATION: ROANOKE

IN CHARGE OF: WEBBER

ORDER No.: V2749

SHEET No.: S 104

NAME OF STRUCTURE

SHOP BILL

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

LINE NO.	NO. OF PIECES ON ORDER	NO. OF PIECES ON SHEET	MATERIAL SHAPE	LENGTH FT.	LENGTH INS.	+ INS.	ASSEMBLING MARK	REMARKS	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.	ORDERED SHAPE	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ITEM
1														
2		2	TRUSSES				T1							
3														
4		4	L 5 3½ ⅜	23	5		ae							19
5		12	L 3½ 3½ ⅜	4	4 7/16		aa					60	0	23
6		10	L 3½ 3½ ⅜	2	11¾		ab					}		23
7		8	PL 12¼ 7/16	1	1		pa				22"	43	2½	S
8		2	PL 12¼ 7/16		9		pb					15	0	S
9		4	PL 10½ (7/16 to 1/16)		9		da					15	0	S
10		4	BAR 3½ 7/16	2	9½		fa					20	0	S
11		4	BAR 3½ 7/16	2	10		fb					20	0	S
12		4	BAR 3½ 7/16	2	7½		fc					20	0	S
13														
14														
15														
16		3	TRUSSES				T2							
17														
18		6	L 5 3½ ⅜	23	5		ah							19
19		18	L 3½ 3½ ⅜	4	6 11/16		ac					60	0	23
20		15	L 3½ 3½ ⅜	3	3½		ad					}		23
21		12	PL 12¼ 7/16	1	1		pc				22"	43	2½	S
22		3	PL 12¼ 7/16		9		pg					15	0	S
23		6	BAR 3½ 7/16	2	9½		fg					20	0	S
24		6	BAR 3½ 7/16	2	10		fh					20	0	S
25		6	BAR 3½ 7/16	2	7½		fk					20	0	S
26														
27														
28														
29		4	STRUTS				LS1							
30		8	STRUTS				LS2							
31														
32		24	L 5 3½ ⅜	23	5									19
33		24	BAR 3½ ⅜	6	4¼		fe					30/33		4
34		12	BAR 3½ ⅜	7	6½		ff					}		4
35		24	PL 9 ⅜	1	3		pe					40	0	S
36		24	PL 9 ⅜	2	2½		pf					40	0	S
37		24	L 3½ 3½ ⅜	2	1 7/16		ag					60	0	23
38		24	BAR 3½ ⅜	1	7 7/16		fd					30/33		4
39		24	L 4 3½ ⅜		9		af					55	0	S
40		4	PL 25 ⅜	2	5¼		pd	For LS1			60"	40	0	S
41														
42			NOTE:											
43			TRUSSES TO BE SHOP RIVETED											
44			TO FLOOR BEAMS. SEE DWG											
45			E1-E2 FOR ARRANGEMENT											
46			ADV BILL #104 & 105											

SHOP BILL

	DRAWINGS	NAME	DATE
MADE BY	Sublette	9-24-58	
CHKD. BY	CMS	10/29/58	

REVISIONS: F E D C B X

DRAWINGS: ROANOKE

FABRICATION: ROANOKE

IN CHARGE OF: WEBBER

ORDER No.: V2749

SHEET No.: S105

NAME OF STRUCTURE

SHOP BILL

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

D.

LINE NO.	NO. OF PIECES ON ORDER	NO. OF PIECES ON SHEET	MATERIAL SHAPE	LENGTH FT.	LENGTH INS.	+ INS.	ASSEMBLING MARK	REMARKS	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.	ORDERED SHAPE	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ITEM
1														
2		44	DIAGIONAL				D1							
3														
4		44	L 4 4 5/16	17	4							34	8	22X
5														
6														
7		12	DIAGIONAL				D2							
8														
9		12	L 4 4 5/16	17	1 3/8							51	4½	21X
10														
11														
12		8	DIAGIONAL				D3							
13														
14		8	L 4 4 5/16	13	0 7/8							52	3½	20X
15														
16														
17		2	ANGLES				A1							
18														
19		2	L 6 4 3/8	5	6							60	0	16X
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														
35														
36														
37														
38														
39														
40														
41														
42														
43														
44														
45														
46														

SHOP BILL

	DRAWINGS	NAME	DATE
MADE BY	Sublette		9-24-58
CHKD. BY	CMS		10/1/58

REVISIONS F E D C B X

DRAWINGS FABRICATION: ROANOKE / ROANOKE

IN CHARGE OF: WEBBER.

ORDER No.: V2749

SHEET No.: S 105 B.

NAME OF STRUCTURE

SHOP BILL

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

LINE NO.	NO. OF PIECES ON ORDER	NO. OF PIECES ON SHEET	MATERIAL SHAPE	LENGTH FT.	LENGTH INS.	+ INS.	ASSEMBLING MARK	REMARKS	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.	ORDERED SHAPE	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ORDERED ITEM
1														
2		6	TRUSSES				T3							
3														
4		12	L 5 3½ ⅜	23	5									19
5		6	PL 25 ⅜	2	5⅛		pf				60"	40	0	S
6		36	L 3½ 3½ ⅜	4	1 15/16		aa					60	0	23X
7		30	L 3½ 3½ ⅜	2	7⅞		ab							23X
8		12	PL 12 ⅜	1	3		pa					40	0	S
9		24	PL 12¼ ⅜	1	1½		pb				26"	20	9½	S
10	14	6	PL 12¼ ⅜		9		px							S
11	56	24	BAR 3½ ⅜	2	9½		fa					30/33		42
12	28	12	BAR 3½ ⅜	2	7		fc							42
13														
14														
15														
16		2	HANGERS				H1							
17														
18		4	L 3½ 3½ ⅜	5	0							60	0	23X
19		2	BAR 3½ ⅜	4	5¾		fd					30/33		42
20		2	L 6 4 ⅜	1	3¼		ae					60	0	16X
21		2	15¼ ⅜	1	11¾		pg				16"	40	0	S
22														
23														
24														
25		4	TRUSSES				T4							
26		4	TRUSSES				T5							
27														
28		16	L 5 3½ ⅜	23	5									19
29		4	PL 25 ⅜	2	5¼		pd	(FOR T5)			60"	40	0	S
30		48	L 3½ 3½ ⅜	3	10¼		ac					55	0	S
31		40	L 3½ 3½ ⅜	2	0¾		ad							S
32		8	PL				px							
33		32	PL 12¼ ⅜	1	1½		pe				26"	20	9½	S
34		16	PL 12 ⅜	1	3¼		pd					40	0	S
35		32	BAR				fa							
36		16	BAR				fc							
37														
38			NOTE											
39			TRUSSES TO BE SHOP											
40			RIVETED TO FLOOR BEAMS											
41			SEE DWG E1 & E2 FOR											
42			ARRANGEMENT											
43			A.B. 104 & 105 & 106											
44														
45														
46														

SHOP BILL

DRAWINGS	NAME	DATE
MADE BY	Sublette	9-24-58
CHKD. BY	cms	10/20/58

F E D C B X

REVISIONS

DRAWINGS: ROANOKE

FABRICATION: ROANOKE

IN CHARGE OF: WEBBER

ORDER No. V2749

SHEET No. S 106

NAME OF STRUCTURE

SHOP BILL

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

LINE NO.	NO. OF PIECES ON ORDER	NO. OF PIECES ON SHEET	MATERIAL SHAPE	LENGTH FT.	LENGTH INS.	+ INS.	ASSEMBLING MARK	REMARKS	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.	ORDERED SHAPE	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ITEM
1			ONE FLOOR BEAM				FB1 R							
2			ONE FLOOR BEAM				FB1 L							
3														
4		2	30 CB 108	23	5									4
5		8	ST. 10 CB 31	1	0½		ma	SPLIT 21CB62			SPLIT 21CB62	48	0	Five
6		2	ST. 10 CB 31	1	10		mb	do			do			Five
7														
8														
9		3	FLOOR BEAMS				FB2							
10														
11		3	33 CB 141	23	5									2
12	120	24	BAR 7 ⅛		11½		fa				48"	20	0	E
13	52	12	BAR 7 ¼		11½		fb				½ 10 ⅜ 11½"	24 12	7 9¼	S
14		12	ST 10 CB 31	1	0¼		mc	SPLIT 21CB62			SPLIT 21CB62	48	0	Five
15		3	ST 10 CB 31	1	9½		md				do			Five
16		24	7/8 ϕ S.B.											E
17														
18		6	FLOOR BEAMS				FB3							
19		4	FLOOR BEAMS				FB4	} ALIKE						
20		4	FLOOR BEAMS				FB5							
21														
22		14	30 CB 108	24	4½									3
23		112	BAR 7 ⅛		10½		fc				48"	20	0	E
24		56	BAR 7 ¼		10½		fd				11½"	11	8	E
25		24	ST. 10 CB 31	1	1		me	(FOR FB3) Split 21CB62			SPLIT 21CB62	48	0	Five
26		6	ST 10 CB 31	1	11		mg	(FOR FB3) do			do			Five
27		32	ST 10 CB 31	1	1		mf	(FOR FB4 & FB5) do			do			Five
28		8	ST 10 CB 31	1	11		mk	(FOR FB4 & FB5) do			do			Five
29		112	7/8 ϕ S.B.											E
30														
31		2	FLOOR BEAMS				FB6							
32		10	FLOOR BEAMS				FB7							
33														
34		12	33 CB 141	24	4½									1
35		96					fa							
36		40					fb							E
37		96	7/8 ϕ S.B.											
38														
39														
40								TRUSSES TO BE SHOP RIVET						
41								TO FLOOR BEAMS. SEE DWG						
42								E7 FOR ARRANGEMENT						
43							48# 103							
44														
45														
46														

SHOP BILL

	DRAWINGS	NAME	DATE
MADE BY	Sublette		9-5-03
CHKD. BY	CMS		10/24/03

REVISIONS F E D C B X

DRAWINGS: ROANOKE

FABRICATION: ROANOKE

IN CHARGE OF: WEBBER

ORDER No.: V2749

SHEET No.: S107

NAME OF STRUCTURE

SHOP BILL.

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

D52

LINE No.	NO. OF PIECES ON ORDER	NO. OF PIECES ON SHEET	MATERIAL SHAPE	LENGTH FT.	LENGTH INS.	+ INS.	ASSEMBLING MARK	REMARKS	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.	ORDERED SHAPE	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ORDERED ITEM
1			ONE STRINGER				$S1^R$							
2			ONE STRINGER				$S1^L$							
3			ONE STRINGER				$S2^R$							
4			ONE STRINGER				$S2^L$							
5														
6														
7														
8														
9														
10		4	14 CB 34	30	$4\frac{3}{8}$							30	5	6
11														
12		8	L 6 4 $\frac{3}{8}$		$8\frac{1}{4}$		aa^R_L					19	0.	5
13														
14														
15														
16		14	STRINGERS				$S3^R$							
17		14	STRINGERS				$S3^L$							
18		2	STRINGERS				$S4^R$							
19		2	STRINGERS				$S4^L$							
20		6	STRINGERS				$S5^R$							
21		6	STRINGERS				$S5^L$							
22		4	STRINGERS				$S8^R$							
23		4	STRINGERS				$S8^L$							
24														
25		44	14 CB 34	29	$11\frac{1}{2}$			(For $S3^R_L$ & $S4^R_L$ & $S5^R_L$)						8
26		8	14 CB 34	30	$0\frac{5}{8}$			(For $S8^R_L$)				30	$0\frac{3}{4}$	7
27														
28														
29			ONE STRINGER				$S6^R$							
30			ONE STRINGER				$S6^L$							
31			ONE STRINGER				$S7^R$							
32			ONE STRINGER				$S7^L$							
33														
34		4	14 CB 34	29	$8\frac{3}{4}$							29	$11\frac{1}{2}$	8
35		8	L 6 4 $\frac{3}{8}$		$8\frac{1}{4}$		ab^R_L					19	0.	5
36								AB #104.						
37														
38														
39														
40														
41														
42														
43														
44														
45														
46														

SHOP BILL

DRAWINGS	NAME	DATE
MADE BY	Sublette	9-24-58
CHKD. BY	CMS	10/24/58

REVISIONS: F E D C B X 12/15/58

DRAWINGS: ROANOKE

FABRICATION: ROANOKE

IN CHARGE OF: WEBBER

ORDER No.: V2749

SHEET No.: S 108

NAME OF STRUCTURE

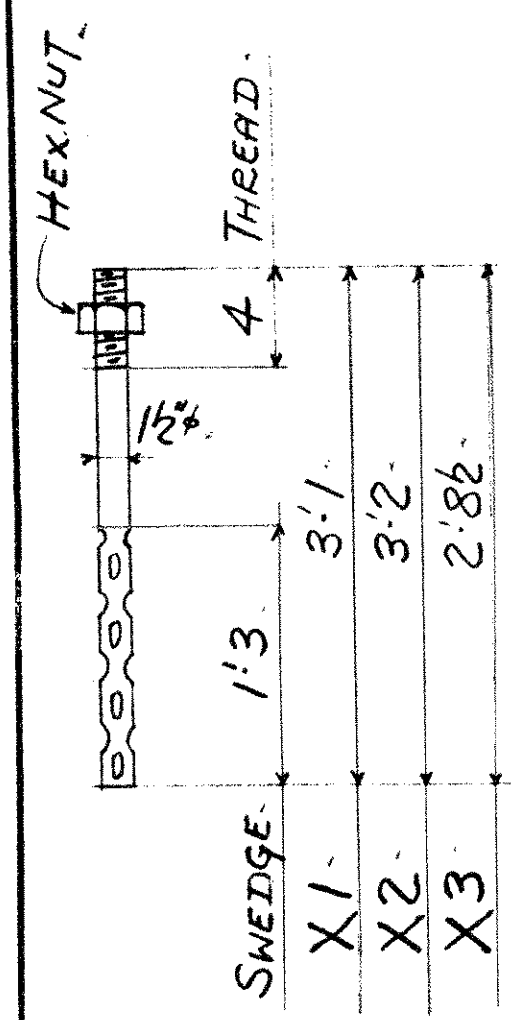
FORM D-56

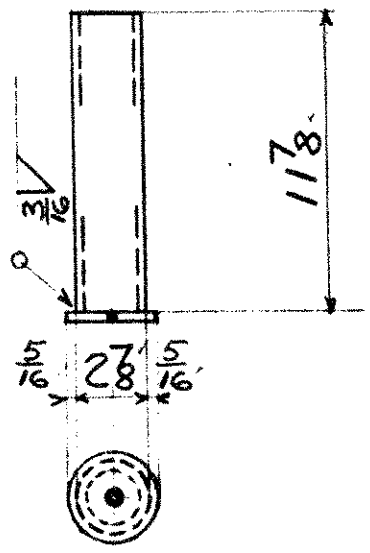
SKETCH, SHOP AND SHIPPING BILL

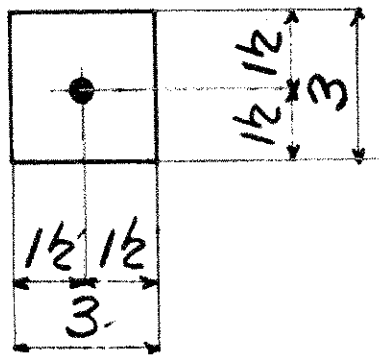
AMERICAN BRIDGE

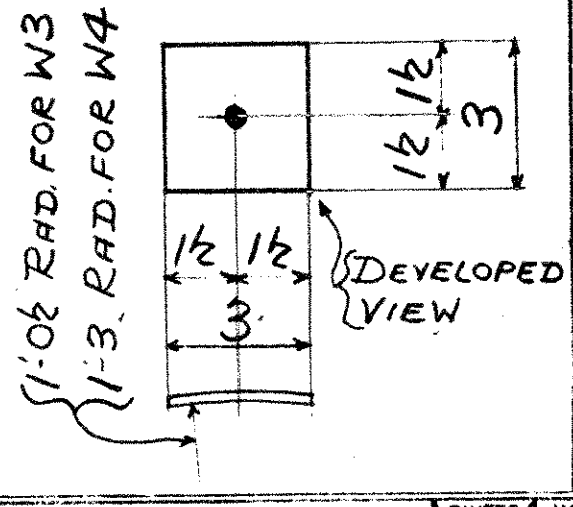
DIVISION

UNITED STATES STEEL CORPORATION









LINE NO.	NO. PCS.	MARK	MATERIAL SHAPE	LENGTH FT.	LENGTH INS.	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.		ORDERED LENGTH FT.	ORDERED LENGTH INS.	ORDERED ITEM	SHIPMENTS
1												
2												
3	8	X1	RODS 1½"ø	3	1	148		1 - 300			S	
4	8		HEX NUTS 1½"ø TAP			8					≀	
5												
6												
7												
8	8	X2	RODS 1½"ø	3	2	152		1 - 300			S	
9	8		HEX NUTS 1½"ø TAP			8					≀	
10												
11												
12												
13	8	X3	RODS 1½"ø	2	8½	150		1 - 300			S	
14	8		HEX NUTS 1½"ø TAP			8					≀	
15												
16												
17												
18												
19												
20												
21												
22												
23												
24	24	M5	STD. PIPE 2½"ø	11	8	138					S	
25	24		PL. 3½"ø x ¼" THK.			16					S	
26												
27												
28												
29												
30												
31												
32												
33												
34	8	W2	BARS 3 ¼		3	5					S	
35												
36												
37												
38												
39												
40												
41	8	W3	BARS 3 ¼		3	5					S	
42												
?	8	W4	BARS 3 ¼		3	5					S	
?4						623						
45												
46												

Advance Shipment

PAINT No

CONTACT SURFACES No

RIVETS X HOLES 1 9/16

	DRAWINGS	NAME	DATE
MADE BY	CMS		10/24/52
CHKD. BY	RLF		10/27/52

REVISIONS: E 12-54 D; E Q C B X

DRAWINGS: R'OKE

FABRICATION: R'OKE

IN CHARGE OF: WEBBER

ORDER No.: V-2749-X1

SHEET No.: C 1

NAME OF STRUCTURE: ROBERT E. LEE & CO. INC. SO. CAROLINA

BRIDGE OVER SAVANNAH RIVER, PROJ. FAP Nº F-2610(3) DOC. Nº 27.282, NEAR GARNETT (JASPER C

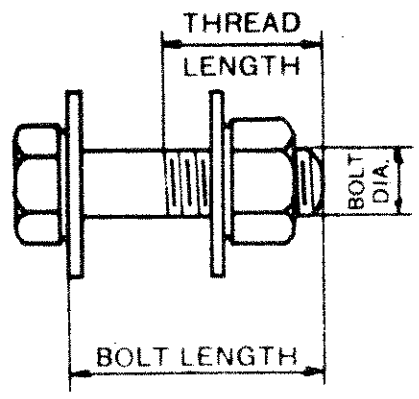
FORM D592

SKETCH, SHOP AND SHIPPING BILL

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION



HIGH STRENGTH STRUCTURAL BOLTS

Bolts, Nuts and Washers shall conform to ASTM Specification A325.

Bolts are identified by three radial lines forged on the head.

BOLT DIMENSIONS

Bolt dimensions shall conform to ASA standard B18.2 for Regular Semifinished Hexagon Head Bolts.

NUT DIMENSIONS

Nut dimensions shall conform to ASA standard B18.2 for Heavy Semifinished Hexagon Nuts.

WASHER DIMENSIONS

Washers shall be smooth and flat within a tolerance of 0.010".

Their dimensions shall conform to ASA standard B27.2 for Heavy Plain Washers.

(Dimensions are shown in table.)

INSTRUCTIONS FOR MANUFACTURE BY AMERICAN BRIDGE DIVISION

1. Bolts are to be made of C1045 steel.
2. Nuts are to be made of "standard nut stock".
3. Washers are to be made of .165" thick sheet or strip having a carbon content of .35 to .46%.
4. Use of the above bolt or washer material from stock is to be indicated by marking $^{S}_{A325}$ in the item column of the shop bill.
5. The following number of samples must be tested to show conformance to specification requirements:

   3 bolts of each size from each heat treatment lot.

   3 nuts of each size from each lot of 5,000 nuts or fraction thereof.

   3 washers from each heat treatment lot.

INSTRUCTIONS FOR PURCHASING BOLTS, NUTS, OR WASHERS

Vendor is to furnish American Bridge Division 3 copies of test report showing compliance with the requirements of ASTM specification A325.

LINE NO.	ACTUAL NUMBER REQ'D	NO SHIPPED	MATERIAL SHAPE	MATERIAL LENGTH FT.	MATERIAL LENGTH INS.	TOTAL CALCULATED WEIGHT	ORDERED NO. PCS.	ORDERED	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ORDERED ITEM	SHIPMENTS
1	24	30	Bolts 7/8"Ø		4 3/4	38			Req 10-0	3572		
2	330	347	" "		4 1/2	420						
3												
4	204	214	Bolts 7/8"Ø		4	246						
5	832	874			3 3/4	917	900					
6	120	130			3 1/2	137						
7	248	260			3 1/4	267						
8	324	340			3	335						
9	1316	1382			2 3/4	1322	1400					
10	196	206			2 1/2	204	225					
11	1332	1399	" "		2 1/4	1213						
12												
13												
14												
15												
16												
17	9852	10,364	Washers 2 1/4"Ø x .165			1401			Req 10-0	3573		
18			x 15/16"Ø Hole			6602						
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
32												
33												
34												
35												

Direct Shipment

BOLT DIA	WASHER DIMENSIONS	THREAD LENGTH ** Min.	THREAD LENGTH ** Max.	BOLT LENGTH **
7/8	1 3/4 x 3/16 Thick x 15/16 Hole	1 3/4	2 1/4	Grip + Allow. to 1 1/2
				1 1/2 to 2

** Bolt lengths are measured from underside of head to end of bolt. Thread length is measured from end of bolt to nearest edge of full thread.

HIGH STRENGTH STRUCTURAL BOLTS		WCP	10/31/58		Roanoke	Webber	SHEET C10
		CET	11-12-58	LWDOX	Roanoke	V-2749	

NAME OF STRUCTURE

Bridge Over Savannah River Near Garnett (Jasper Co.) So. Car.

Proj. FAP No. F2610(3) Doc. No. 27,282 Robert E. Lee & Co. Inc.

FORM D-73

FIELD RIVETS AND BOLTS

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

LINE NO.	ACTUAL NUMBER REQ'D.	NO. SHIPPED	DIAM.	RIVETS	BOLTS: LENGTH UNDER HEAD	BOLTS: HEAD	BOLTS: NUT	BOLTS: WASHER	BOLTS: TYPE OF BOLT	GRIP		CALCULATED WEIGHT TOTAL	SHIPMENTS
1													
2													
3													
4													
5													
6	16	21	7/8		3 3/4	Hex	Hex		Mach.		Stock	211	
7	4	6	7/8		3 1/2	〃	〃		〃		〃	6	
8													
9	24	30	1/2		2 1/2	Sq.	None		Mach		10-36207 Rel. #107	5	
10	8	11	1/2		2 1/4	〃	〃		〃		Stock	2	
11	24	30	1/2		2	〃	〃		〃		10-36201 Rel. #107	4	
12												38	
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32													
33													
34													
35													
36													
37													
38													
39													
40													
41													
42													
43													
44													
45													
46													

PAINT No

CONTACT SURFACES

A.T.C. STANDARD HIGH BUTTON HEAD RIVETS UNLESS OTHERWISE NOTED

A.T.C. STANDARD FLAT-TOP CSK. HEAD RIVETS UNLESS OTHERWISE NOTED

DRAWINGS	NAME	DATE
MADE BY	WCP	10/31/58
CHKD. BY	CET	11-12-58

REVISIONS: LEDGE X

DRAWINGS FABRICATION: Roanoke / Roanoke

IN CHARGE OF: Webb

ORDER No.: V-2747

SHEET No.: C 102

NAME OF STRUCTURE: Bridge Over Savannah River Near Garnett (Jasper Co.) So. Carolina

Proj. FAP No. F-2610 (3) Doc. No. 27,282

Robert E. Lee & Co. INC.

SHOP BILL

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

DB1

LINE NO.	NO. OF PIECES ON ORDER	NO. OF PIECES ON SHEET	MATERIAL SHAPE	LENGTH FT.	LENGTH INS.	+ INS.	ASSEMBLING MARK	REMARKS	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.	ORDERED SHAPE	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ORDERED ITEM
1														
2		4	CAST STEEL UPPER SHOES				SC1		191					10-03528
3														
4														
5														
6		6	CAST STEEL UPPER SHOES				SC2		497					10-03528
7														
8														
9														
10		2	CAST STEEL LOWER SHOES				FS2		1458					10-03528
11														
12														
13														
14		4	CAST STEEL ROCKERS				RS1		309					10-03528
15														
16														
17														
18		4	CAST STEEL ROCKERS				RS2		533					10-03528
19														
20														
21														
22														
23														
24														
25														
26														
27			WEIGHTS LISTED FOR ONE MEMBER ONLY.											
28														
29														
30														
31														
32														
33														
34														
35														
36														
37														
38														
39														
40														
41														
42														
43														
44														
45														
46														

SHOP BILL

CAST STEEL SHOES & ROCKERS

	NAME	DATE
DRAWINGS		
MADE BY	CCC	9/23/58
CHKD. BY	MFA	9/24/58

REVISIONS: L E D C B X

DRAWINGS: ROANOKE

FABRICATION: ROANOKE

IN CHARGE OF: WEBBER

ORDER No. V2750

SHEET No. S101

NAME OF STRUCTURE

BRIDGE OVER SAVANNAH RIVER PROJ. FAP No F-2610(3) DOC. No 27.282
NEAR GARNETT (JASPER CO.) SO. CAROLINA, ROBERT E. LEE CO. INC.

SHOP BILL

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

D52

LINE NO.	NO. OF PIECES ON ORDER	NO. OF PIECES ON SHEET	MATERIAL SHAPE	LENGTH FT.	LENGTH INS.	+ INS.	ASSEMBLING MARK	REMARKS	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.	ORDERED SHAPE	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ORDERED ITEM
1														
2		4	MASONARY PLATES				MP1							
3		4	PL 18 3½	3	0			FIN. 1 SIDE			20X3¾	13	1	S
4								Rolled steel						
5														
6		4	MASONARY PLATES				MP2	FIN. 1. SIDE						
7		4	PL 14 2½	2	0			Rolled Steel			16½X2⅞	30	0	S
8														
9														
10		4	SHIMS				S12							
11		4	PL 12 ½	1	6						18"	40	0	S
12														
13														
14		8	SHIMS				S13							
15		8	PL 12 ¼	1	6							4[illegible]	0	S
16														
17														
18		8	SHIMS				S14							
19		8	PL 12 ⅛	1	6							[illegible]	0.	S
20														
21														
22		6	SHIMS				S15							
23		6	PL 18 ½	1	8							[illegible]	0.	S
24														
25														
26		12	SHIMS				S16							
27		12	PL 13 ¼	1	8						20"	40	0	S
28														
29														
30		12	SHIMS				S17							
31		12	PL 13 ⅛	1	3						48"	20	0	S
32														
33														
34		6	PINS				P1	(C.R.S.) FIN ALL OVER						
35		6	ROD 5½"ϕ	2	1									10-03566 S
36		12	STD. RECESSED PIN NUTS				PN27					8 - - - 4	10A1-865	
37														
38														
39		4	PINS				P2	(C.R.S.) FIN ALL OVER						
40		4	RODS 4½"ϕ	1	6½									10-03566 S
41		8	STD. RECESSED PIN NUTS				PN25							
42														
43														
44														
45														
46														

SHOP BILL

DRAWINGS	NAME	DATE
MADE BY	Sublette	10-23-58
CHKD. BY	CMS	10/24/58

REVISIONS: F E D C B X 12/19/58 (2)

DRAWINGS: ROANOKE

FABRICATION: ROANOKE

IN CHARGE OF: WEBBER

ORDER No.: V2750

SHEET No.: S102AB

NAME OF STRUCTURE

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

LINE NO.	NO. OF PIECES ON ORDER	NO. OF PIECES ON SHEET	MATERIAL SHAPE	LENGTH FT.	LENGTH INS.	+ INS.	ASSEMBLING MARK	REMARKS	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.	ORDERED SHAPE	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ORDERED ITEM
1		2	PILOT NUTS				PL22						10A1-865	
2														
3		2	DRIVING NUTS				PD9						10A1-865	
4														
5		2	PILOT NUTS				PL18						10A1-865	
6														
7		2	DRIVING NUTS				PD7						10A1-865	
8														
9		40	WASHERS				W1							
10	B-~~40~~		R ? 12		4							30	0	5
11														
12		16	BOLTS				M1							
13		16	BOLTS 1"ϕ		6½			H.H.&N					10A1-865	
14														
15		16	BOLTS				M2							
16		16	BOLTS 1"ϕ		7¾			H.H.&N					10A1-865	
17														
18		8	BOLTS				M3							
19		8	BOLTS 1"ϕ		7½			H.H.&N					10A1-865	
20														
21														
22														
23														
24														
25														
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36														
37														
38														
39														
40														
41														
42														
43														
44														
45														
46														

SHOP BILL

DRAWINGS	NAME	DATE
MADE BY	Sublette	10-24-58
CHKD. BY	SLUSHER	10/29/58

REVISIONS: B 12/4/58 X; C 12/9/58 X

DRAWINGS: ROANOKE

FABRICATION: ROANOKE

IN CHARGE OF: WEBBER

ORDER No. V2750

SHEET No. S 102B

NAME OF STRUCTURE

SHOP BILL

AMERICAN BRIDGE

DIVISION

UNITED STATES STEEL CORPORATION

D52

LINE NO.	NO. OF PIECES ON ORDER	NO. OF PIECES ON SHEET	MATERIAL SHAPE	LENGTH FT.	LENGTH INS.	+ INS.	ASSEMBLING MARK	REMARKS	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.	ORDERED SHAPE	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ITEM
1														
2		2	Expansion Dams				ED2	(See Note)						
3														
4		4	W.F. 3	13 15/16	3/4	14	8 15/16	hfE	(Bent) (M-4)		19 3/4	15	0	1
5		2	Ls 5	3	1/2	29	6	ha	(Bent)	1 of 39-5 1 " 55-0		30	0	S
6		24	Bars	2	1/4	1	2	ha	(Bent)			20	0	S
7		36	Bars	2	1/4	1	2	hb	(Bent)			}		S
8		24	Sq. Nuts 1/2" ø Tap											S
9		8	R	5	1/2	0	5	pf				D.O.		S
10		150	R	5	1/2	0	10	pd			6"	30	0	S
11														
12														
13														
14		2	Expansion Devices				ES1E							
15		2	do				ES1L							
16														
17		4	Chld. R	13 1/2	1/2	2	5 1/8	hnE	Rdy. (Bent) (M-4)			12	0	2
18		4	Ls 6	2 1/2	1/2	2	4 1/8	hkE	(Bent)	L 6	3 1/2 1/2	55	0	S
19		4	Ls 6	4	1/2	0	6	ah				D.O.		S
20	8	4	Bars	2	1/4	1	0	hd	(Bent)			20	0	S
21	8	4	Bars	2	1/4	1	0	hc	(Bent)			}		S
22														
23														
24														
25														
26		2	Expansion Devices				ES3E							
27		2	do				ES3L							
28														
29		4	R	11 1/4	1/2	2	4 1/8	hmE	(Bent)		12"	40	0	S
30		4	Bars	1/2 ▭		2	5 1/2	hn	(Bent)			22	0	S
31		4	Ls 6	6	1/2	2	3 3/8	hpE	(Bent)			40	0	S
32		4	Bars					hc						
33		4	Bars					hd						
34		4	Ls					ah				D.O.		S
35														

Note:

Ship ED1, ED2 & A1 R-6 L-6 Assembled

& ED2, ED3 & A1 R-6 L-6 Assembled

A.E. # 101

SHOP BILL	DRAWINGS	NAME	DATE
	MADE BY	J.B.E.	9-22-54
	CHKD. BY	CMS	10/24/54

REVISIONS: F E D C B X (12-6-54) ⑦

DRAWINGS: Roanoke — FABRICATION: Roanoke

IN CHARGE OF WEBBER — ORDER No. V2751

SHEET No. S101

NAME OF STRUCTURE

Bridge Over Savannah River - Proj. FAP. No. F-2610(3) Doc. No. 27,282 - Near Garnett, Jasper County, South Carolina - Robert E. Lee & Company, Inc.

FED. ROAD DIV. NO.	STATE	COUNTY	FILE NO.	P. A. PROJ. NO.	NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	CLARENDON	14.391	I-95-2(12)	I-95	1	17

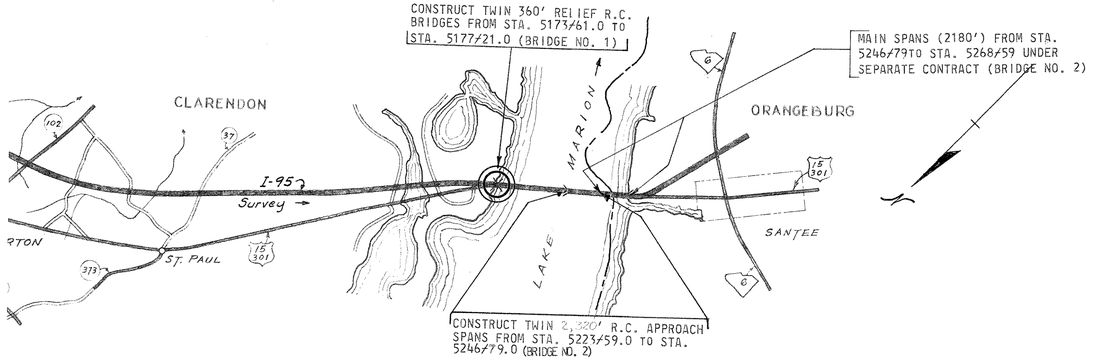
INDEX OF SHEETS

SHEET NO. 1 TITLE SHEET
2 TRAFFIC CONTROL DEVICES
3 FLARED CURB AND GUTTER
4 8" PIPE SLOPE DRAINS
5a STANDARD WELDING SHEET
5 STANDARD NOTES
6 STANDARD DETAILS — SCHEME I AND II
7 ROAD PLAN AND PROFILE SHEET BRIDGE NO. 1
8-10 ROAD PLAN AND PROFILE SHEET BRIDGE NO. 2
11 BRIDGE PLAN AND PROFILE SHEET BRIDGE NO. 1
12 LOG OF BORINGS
13a END BENTS SCHEME II
13 END BENTS SCHEME I
14a INTERIOR BENTS SCHEME II
14 INTERIOR BENTS SCHEME I
15a TOWER BENTS BRIDGE NO. 2 SCHEME II
15A TOWER BENTS 5 & 6 BRIDGE NO. SCHEME I
15Aa TOWER BENTS 5 & 6 BRIDGE NO. I SCHEME II
15 TOWER BENTS BRIDGE NO. 2 SCHEME I
16 21" R.C. PRESTR. PILING SCHEME I AND II
17a 40' SPAN SUPERSTRUCTURE SCHEME II
17b 40' SPAN SUPERSTRUCTURE DETAILS SCHEME II
17 40' SPAN SUPERSTRUCTURE SCHEME I

SOUTH CAROLINA
STATE HIGHWAY DEPARTMENT
COLUMBIA

PLAN AND PROFILE OF PROPOSED STATE HIGHWAY

F.A.P. NO. I-95-2 (12)
FILE NO. 14.391
TWIN RELIEF BRIDGES BRIDGE #1
AND THE APPROACH SPANS FOR
TWIN MAIN SPANS BRIDGE #2
FOR BRIDGE OVER LAKE MARION
CLARENDON COUNTY
ROUTE - I-95



①SUMMARY OF ESTIMATED QUANTITIES SCHEME I

	BRIDGE NO. 1	BRIDGE NO. 2	TOTAL
CLASS "A" CONCRETE	1339.6	8510.8	9,850.4 C.Y.
REINFORCING STEEL	432,000	2,771,334	3,203,334 LBS.
CREOSOTED TIMBER PILING	435,142 1010	2,791,630 710	3,226,772 1,720 L.F.
21" R.C. PRESTR. PILING	2880	24,496	27,376 L.F.
8" PIPE SLOPE DRAINS	225	110	335 L.F.
INTAKE SPILLWAY ASSEMBLIES	8	4	12 EA.

①For Summary of Quantities see sh. no. 14

②SUMMARY OF ESTIMATED QUANTITIES SCHEME II

	BRIDGE NO. 1	BRIDGE NO. 2	TOTAL
CLASS "A" CONCRETE	947.2	5,936.0	6,883.2 C.Y.
REINFORCING STEEL	269,354	1,722,736	1,992,090 LBS.
CREOSOTED TIMBER PILING	1010	710	1,720 L.F.
21" R.C. PRESTR. PILING	2,880	24,496	27,376 L.F.
8" PIPE SLOPE DRAINS	225	110	335 L.F.
INTAKE SPILLWAY ASSEMBLIES	8	4	12 EA.
40' R.C. PRESTR. BEAMS	90	580	670 EA.

②For Summary of Quantities see sh. no. 14a

CONVENTIONAL SIGNS

State Line	Trolley Poles
County Line	Power Poles
City or Town Limits	Telephone or Telegraph Poles
Property Line	Marsh
Fence	Trees
Retaining Wall	Brush
Existing Road	Stumps
℄ and R.O.W. Lines of	Buildings
Proposed Road	Bridge
Railroad	Concrete Box Culvert
Levee or Embankment	Pipe Culvert
Guard Rail	Drop Inlet and Culvert
Point of Intersection (P. I.)	Hub on Center Line

LEGEND

PROPOSED PROJECT
OTHER ROADS

SCHEME I & II

	BRIDGE NO.1	BRIDGE NO.2	TOTAL	
Net Length of Roadway	0.000	0.000	0.000	Miles
Net Length of Bridges	0.068	0.439	0.507	Miles
Net Length of Project	0.068	0.439	0.507	Miles
Length of Exceptions	0.000	0.000	0.000	Miles
Gross Length of Project	0.068	0.439	0.507	Miles

Exceptions or Stationing

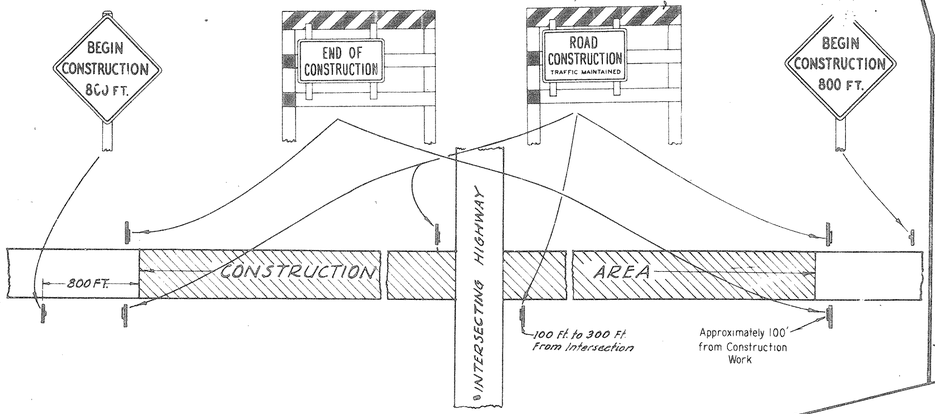
Note: All workmanship and material on this project to conform with South Carolina State Highway Department Standard Specifications for Highway Construction Edition of 1964

APPROVED:
[redacted] 7/26/65
STATE HIGHWAY ENGINEER DATE

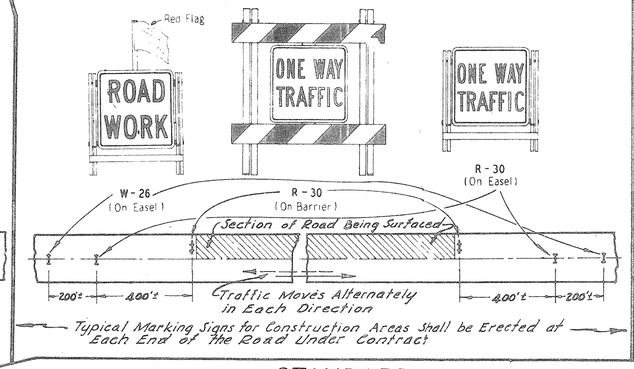
DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS
APPROVED:
[redacted]
DISTRICT ENGINEER DATE

Fed. Aid Proj. No.	State	County	P.E. No.	Road No.	Sheet No.	Total Sheets
3	S.C.	CLARENDON	14.391	I-95	2	17

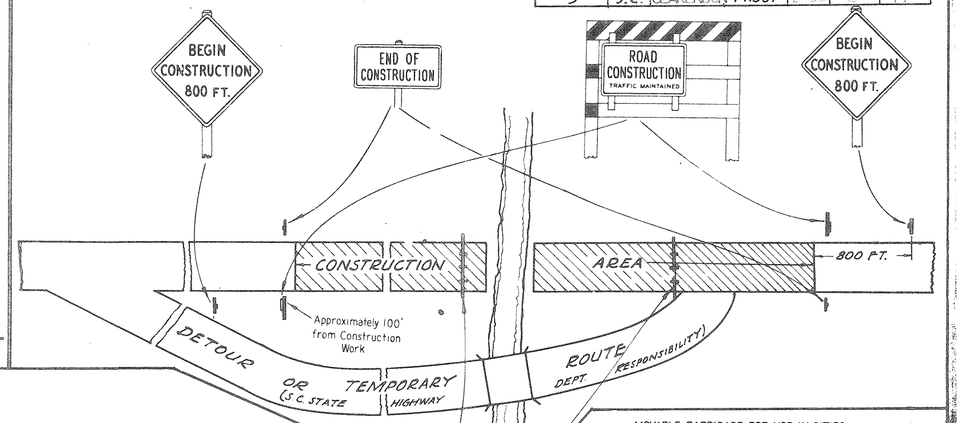
TYPICAL MARKING FOR CONSTRUCTION AREAS



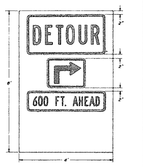
APPLICATION OF STANDARD SIGNS WHEN ROADWAY IS BEING SURFACED



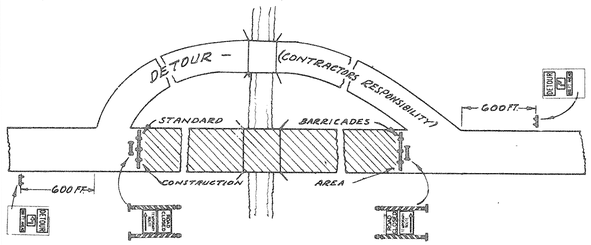
TYPICAL MARKING FOR CONSTRUCTION AREAS



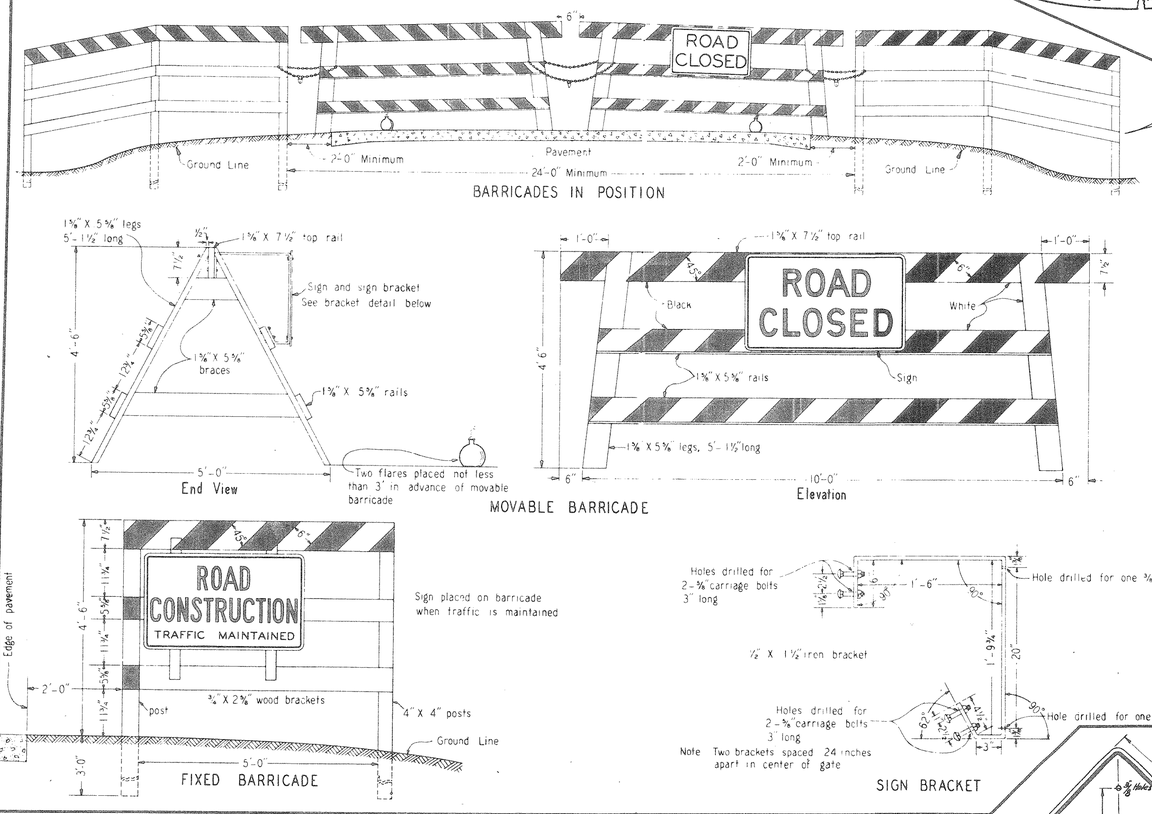
DETOUR 600 FT. AHEAD ASSEMBLY



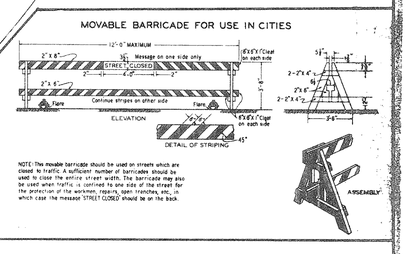
TYPICAL MARKING FOR CONSTRUCTION AREAS



STANDARD BARRICADES

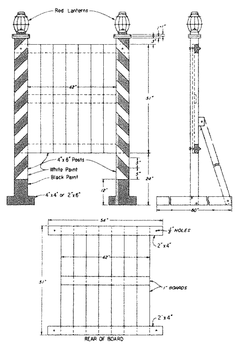


MOVABLE BARRICADE FOR USE IN CITIES



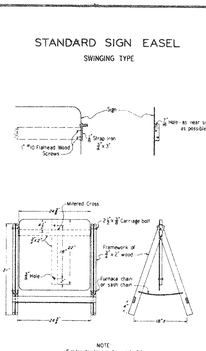
NOTE: The movable barricade should be used on streets which are closed to traffic. A sufficient number of barricades should be used to close the entire street width. The barricade may also be used to control traffic on one side of the street for the protection of the workmen, objects, open trenches, etc., in which case the message STREET CLOSED should be on the back.

ROAD CLOSED STANDARD

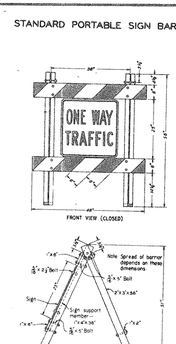


STANDARD SIGN EASEL

SWINGING TYPE

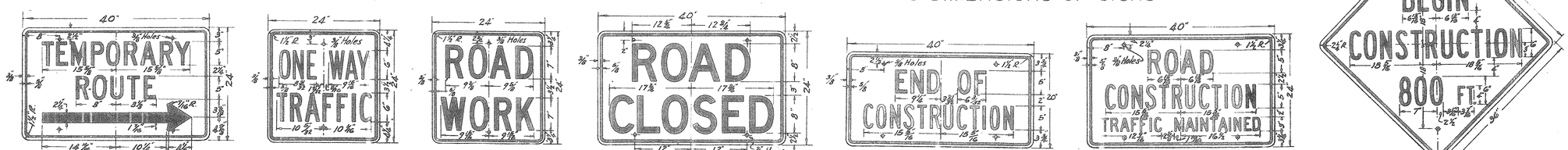


STANDARD PORTABLE SIGN BARRIER



STANDARD SIGN BRACKET

DRAWINGS SHOWING DIMENSIONS OF SIGNS



NOTES

ANY CONDITIONS NOT COVERED BY DETAILS AND SIGNS ON THIS DRAWING SHALL CONFORM TO THE LATEST S. C. STANDARD SPECIFICATIONS AND TO THE LATEST S. C. STANDARDS AND SPECIFICATIONS FOR UNIFORM TRAFFIC CONTROL DEVICES. THE LOCATION OF TYPICAL MARKINGS SHOWN HEREON MAY BE VARIED TO CONFORM TO FIELD CONDITIONS.

THE CONTRACTOR SHALL PROVIDE AND KEEP, PROPERLY SIGNS AND BARRICADES THE FIRST DAY ANY WORK IS PERFORMED OR AT THE TIME HE MOVES ANY MATERIAL OR EQUIPMENT ON TO THE PROJECT, WHICHEVER IS FIRST. HE SHALL MAINTAIN THESE SIGNS THROUGHOUT THE LIFE OF THE PROJECT UNTIL FINAL ACCEPTANCE OF THE CONTRACT, AT WHICH TIME THEY SHALL BE REMOVED.

WHEREVER SURFACING WORK IS BEING PERFORMED ON THE ROADWAY AND ONE-WAY TRAFFIC IS BEING MAINTAINED THROUGH THE SECTION BEING SURFACED, THE STANDARD SIGNS SHALL BE PLACED AND, ALSO, FLAGMEN SHALL BE POSTED AT EACH END OF THE SECTION OF ROAD BEING SURFACED EXCEPT IN CASES WHERE TRAFFIC VOLUMES IS LIGHT AND HIGH SPEEDS DO NOT PREVAIL; OR IN CASES WHERE THE SECTION OF ROAD BEING SURFACED IS NOT MORE THAN 100 FEET IN LENGTH AND THE SIGNS ARE CLEARLY VISIBLE FOR A DISTANCE OF 500 FEET.

THE DEPARTMENT WILL ERECT AND MAINTAIN PROPER SIGNS IN ACCORDANCE WITH THE MANUAL FOR UNIFORM CONTROL DEVICES ON ALL DETOURS OR TEMPORARY ROUTES THAT THE CONTRACTOR IS NOT REQUIRED TO MAINTAIN. THE CONTRACTOR WILL BE REQUIRED TO PROVIDE AND MAINTAIN PROPER DETOUR SIGNS AT AND ALONG ALL DETOURS FOR WHICH HE IS RESPONSIBLE.

THE CONTRACTOR WILL BE REQUIRED TO MAINTAIN AND RELOCATE, WHERE NECESSARY, ALL REGULATORY, WARNING AND GUIDE SIGNS IN PLACE, OR THOSE THAT MAY BE ERECTED BY THE DEPARTMENT, WITHIN THE LIMITS OF HIS CONTRACT.

BETWEEN THE HOURS OF SUNSET AND SUNRISE, THE CONTRACTOR WILL BE RESPONSIBLE FOR PROVIDING AND MAINTAINING TWO FLARES OR RED LANTERNS AT EACH BARRICADE, "ROAD CLOSED" SIGN, OBSTRUCTION OR AT SUCH OTHER POINTS AS ARE NECESSARY TO PROTECT THE TRAVELING PUBLIC.

ALL SIGNS SHALL BE REFLECTORIZED EXCEPT THOSE TEMPORARY SIGNS THAT ARE USED ONLY DURING DAYLIGHT HOURS. DRAWINGS SHOWING SIZES OF SIGNS, LETTERS AND NUMERALS ARE DETAILED HEREON. ALL SIGNS SHALL HAVE BLACK LETTERS ON HUNGRALS ON A WHITE BACKGROUND EXCEPT THE "ROAD WORK" (W-26), "BEGIN CONSTRUCTION - 800 FT." (C-9) AND "DETOUR" (C-5) SIGNS WHICH SHALL HAVE A YELLOW BACKGROUND.

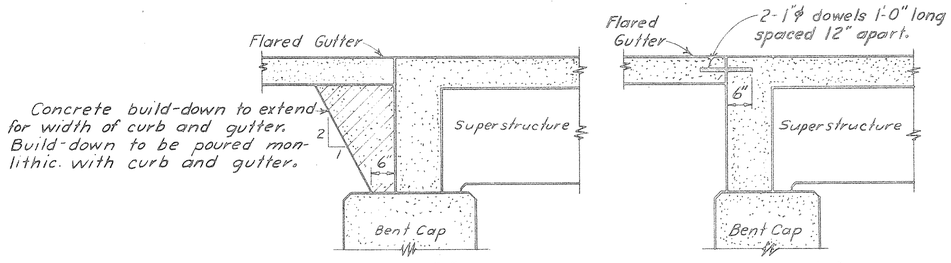
THE "ROAD CONSTRUCTION - TRAFFIC MAINTAINED" (C-7) SIGN SHALL BE MOUNTED ON A BARRICADE ON EACH SIDE OF THE INTERSECTION FACING TRAFFIC AT ALL IMPORTANT ROAD INTERSECTIONS. ON MAJOR ROUTES BEING CONSTRUCTED, THE BARRICADE SHALL BE ON BOTH SIDES OF THE ROAD AT THE EXTREME LIMITS OF THE PROJECT BUT THE SIGN MAY BE OMITTED ON THE BARRICADE ON THE LEFT SIDE OF ROAD FACING TRAFFIC. THE "END OF CONSTRUCTION" (C-8) SIGN MAY BE PLACED ON THE BACK OF THIS BARRICADE INSTEAD OF ON A POST.

WHEN A BRIDGE IS UNDER CONSTRUCTION AND TRAFFIC IS MAINTAINED, THE WORD "BRIDGE" SHALL BE SUBSTITUTED FOR "ROAD" ON THE "ROAD CONSTRUCTION - TRAFFIC MAINTAINED" SIGN AND THE SIGN ERECTED IN A LIKE MANNER.

DETAILS
SHOWING
STANDARD SIGNS, BARRIERS, LIGHTS, AND BARRICADES TO BE FURNISHED, ERECTED, AND MAINTAINED BY THE CONTRACTOR WHERE APPLICABLE ON ALL ROAD OR BRIDGE CONTRACTS

APPROVED S.M. Beaman STATE HIGHWAY ENGINEER
DATE 2/14/63

FED. ROAD DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON	14.391	I-95	3	17



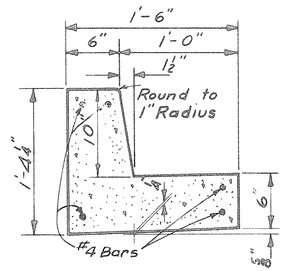
METHOD "A" METHOD "B"

NOTE: Ends of curb and gutter adjacent to bridge to be supported by one of the methods shown above. Use method "A" when there is sufficient width and length of bent cap to support concrete build-down. Otherwise use Method "B".

The quantity of concrete or reinforcing steel involved shall be computed by the Engineer and added to the quantities shown on this sheet.

CURB AND GUTTER SUPPORT

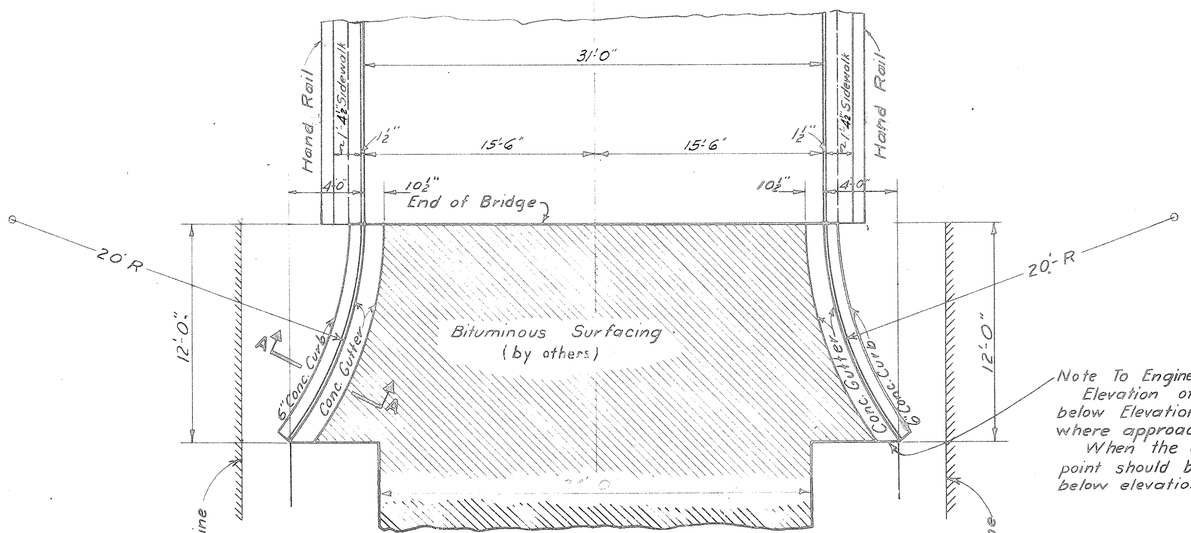
SCALE $\frac{3}{4}$"=1'-0"



SECTION A—A

SCALE 1½"=1'-0"

All costs of constructing the concrete curb and gutter at the ends of the bridge will be included in payment for the concrete and steel in place at the Unit Price Bid for those items.



PLAN

SCALE $\frac{1}{4}$"=1'-0"

*QUANTITIES	
ONE END OF BRIDGE	
Class "A" Concrete	1.7 C.Y.
* Reinf. Steel	79 LBS.

*Does not include quantities for Curb & Gutter Support. (See note above)
*Reinf. consists of 10 #4 Bars 11'-9" long.

Note To Engineer:
Elevation of this point to be set 6" below Elevation of gutter at end of Bridge where approach is on 0.0% grade.
When the approach is on a grade this point should be set (6" ± % of grade x 12') below elevation of gutter at end of bridge.

Rev.	USE 3.6.K.B.6 ~~REVISE for Reinf.~~		
REV.	T.M.L. EM.Q. Traced		2-51
	BY	CKD	DATE

S. C. STATE HIGHWAY DEPARTMENT
COLUMBIA

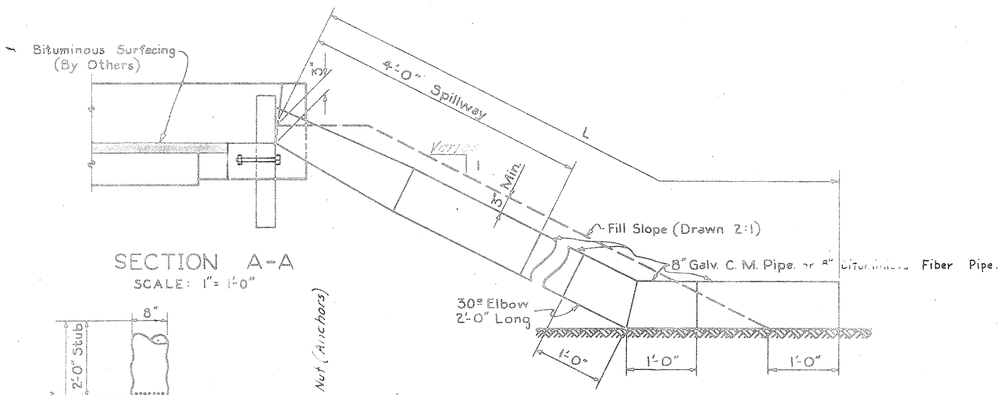
DETAILS OF FLARED CURB AND GUTTER AT ENDS OF BRIDGE

FILE NO. 14.391 ROUTE NO. I-95

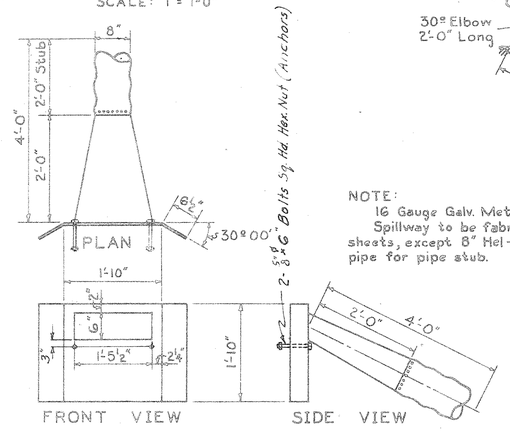
COUNTY CLARENDON DATE. 2-65

SCALE AS NOTED

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON	14.391	I-95	4	17



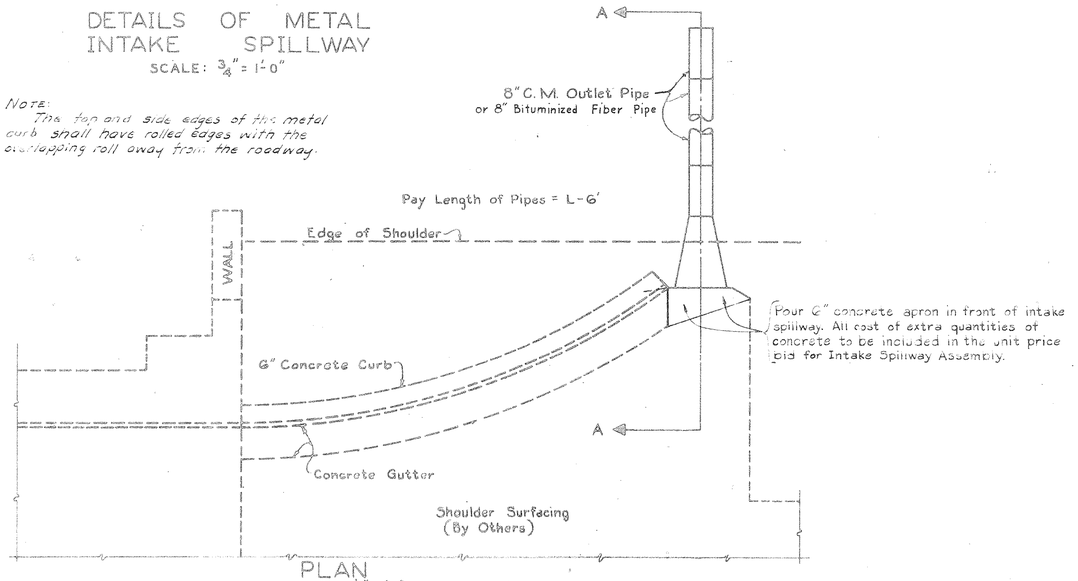
SECTION A-A
SCALE: 1" = 1'-0"



NOTE:
16 Gauge Galv. Metal to be used thruout.
Spillway to be fabricated from flat smooth sheets, except 8" Hel-Cor or equal non-perforated pipe for pipe stub.

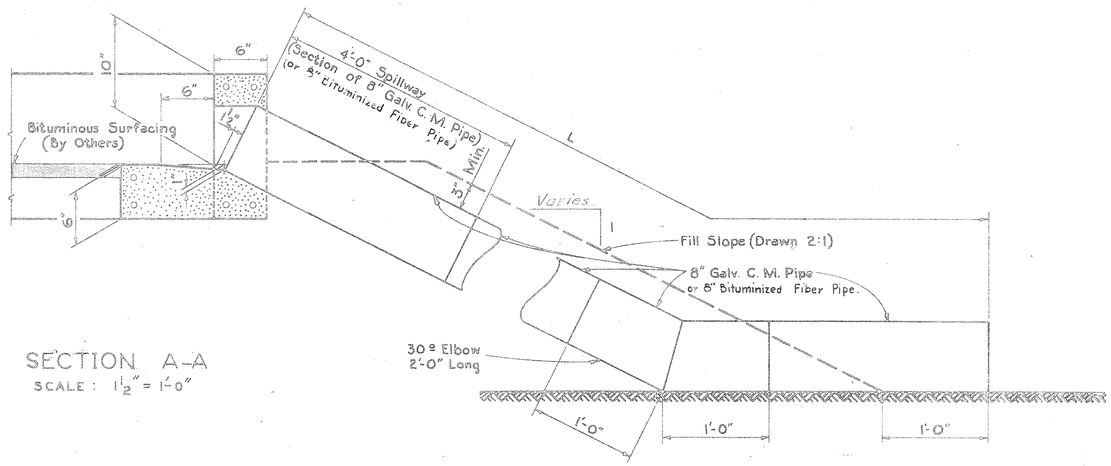
DETAILS OF METAL INTAKE SPILLWAY
SCALE: ¾" = 1'-0"

Note:
The top and side edges of the metal curb shall have rolled edges with the overlapping roll away from the roadway.

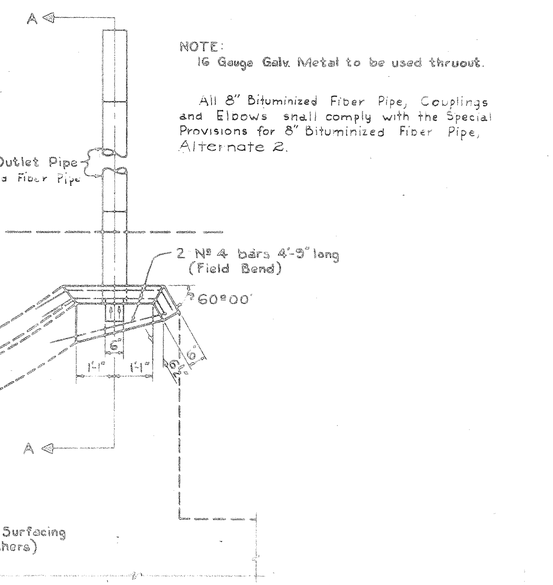


PLAN
SCALE: ½" = 1'-0"

METAL INTAKE OPTION



SECTION A-A
SCALE: 1½" = 1'-0"



PLAN
SCALE: ½" = 1'-0"

CONCRETE INTAKE OPTION

NOTE:
16 Gauge Galv. Metal to be used thruout.

All 8" Bituminized Fiber Pipe, Couplings and Elbows shall comply with the Special Provisions for 8" Bituminized Fiber Pipe, Alternate 2.

BID ITEMS

Intake Spillway Assembly (Includes one 4'-0" Spillway Intake and one 30° Elbow 2'-0" long)	8	4	Each
8" Galv. C. M. Pipe Slope Drain - Alternate 1 8" Bituminized Fiber Pipe Slope Drain - Alternate 2	225 225	110 110	L.F. L.F.
	Br. No. 1	Br. No. 2	

REV.				
REV.				
REV.	W.F.	LEW	11-62	
REV.	Anchor Bolts added			
REV.	W.A.E.	WFL	11-62	
REV.	Apron Added			
REVIEWED IN CHARGE	WFL			
QUAN.				
TR.				
DR.	W.A.E.	WFL	12/60	
CES.				
	BY	CK'D	DATE	

S. C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA, S.C.

DETAILS OF METAL PIPE SLOPE DRAINS

FILE NO.	COUNTY	ROUTE NO.	DATE
14.391	CLARENDON	I-95	2-65

APPROVED BY: W.E. Lyman, SR. DESIGN & PLANS ENGR.
APPROVED BY: W.F. Lewis, BRIDGE ENGINEER

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON	14.391	I-95	5	17

WIDENING EXISTING CONCRETE STRUCTURES

Existing structure is indicated on the plans by light lines, new structure by heavy lines.

All dimensions of new construction are subject to existing conditions.

Connecting surfaces of the old concrete shall be thoroughly roughened, cleaned of loose material, wetted and flushed with 1:2 cement mortar immediately before pouring new concrete, except as noted on other sheets of these plans.

All reinforcing steel protruding beyond surface after chipping shall be left in place and imbedded in new concrete if feasible. Reinforcing steel which can not be imbedded in new concrete shall be cut off flush with surface of concrete where asphalt surfacing will cover. Where exposed the old reinforcing shall be cut off 1/2" below the exposed concrete surface and the hole patched with dry 1:3 mortar to the satisfaction of the Engineer.

The Contractor shall repair or replace at his own expense, and in a manner satisfactory to the Engineer, any portion of the existing structure damaged as a result of his carelessness or negligence.

The entire cost of the above work including all drilling and chipping, and removing and disposing of portions of old structure necessary to construct new structure, shall be included in the unit price bid for Class "A" Concrete.

If expansion anchor bolts are called for they shall be similar and equal to Rawl's Multi-Calk Anchor or American Exp. Bolt and shall be installed in accordance with the manufacturer's directions.

Expansion anchor bolts will be paid for at unit price bid for reinforcing steel.

Unless otherwise specified in these plans or special provisions the Contractor shall provide necessary temporary supports for utilities attached to the bridge to maintain service during construction.

The owner will make all necessary changes in alignment and elevation of the utility and furnish permanent supports which shall be placed in the concrete by the Contractor.

All costs of the work to be performed by the Contractor shall be included in the unit price bid for Class "A" concrete.

Any necessary repairs to the existing structure, in the opinion of the Engineer, are to be paid for as extra work.

SPECIAL NOTE

Generally, in case of discrepancy, this standard sheet of notes shall govern over the Specifications, but the remainder of the plans shall govern over notes hereon, and Special Provisions shall govern over all. See Standard Specifications paragraph 504.

EXCAVATION FOR PILE TYPE END BENT

All cost of excavation necessary to construct end bents and to remove material under superstructure to an elevation 1'-0" below tops of end bent caps shall be included in the unit price bid for Class "A" Concrete.

EXCAVATION FOR CONCRETE FTG. END BENT

If a concrete footing is used for the end bent, the excavation below that included for the cap and berm in the above paragraph will be paid for at the unit price bid for excavation. Excavation above this shall be included in the unit price bid for Class "A" Concrete.

DRIVING PILES THROUGH FILL

Where piles occur in fill exceeding 10 ft. in height, the fill shall be in place before piles are driven.

HAMMER FOR STEEL PILES

Steel piles where required bearing exceeds 30 Tons shall be driven with a diesel, steam or air hammer having a minimum energy of 14,000 ft-lbs.

HAMMER FOR CONCRETE PILES

Concrete Piles shall be driven with steam, or air single-acting hammer or Diesel hammer of suitable size. The drop hammer allowed in Parag. 1105 of the Standard Specifications may not be used.

ALLOWANCE FOR DEAD LOAD DEFLECTION AND SETTLEMENT

Bridges shall be built on the grade or vertical curve shown on plans. Handrails, slabs and curbs shall conform to the grade or curve.

In setting forms for structural steel or prestressed concrete beam bridges, an allowance shall be made for dead load deflections in addition to the elevations shown.

In setting falsework and forms for reinforced concrete spans an allowance shall be made for dead load deflections, settlement of falsework, and permanent camber which shall be provided for in addition to the elevations shown. After removal of the falsework, the finished structure shall conform to the elevations shown plus the allowance for permanent camber specified by the Engineer.

BRONZE EXPANSION PLATES

Bronze plates to be self-lubricating Exp. Plates manufactured from rolled bronze alloy complying with A.S.T.M. B100 - Alloy 1, or A.S.T.M. B22 - Gr. B casting, and to have special inserts consisting of graphite and metallic substances with a lubricating binder in top plate only. Installation of [illegible] to be in accord. with manufacturer's directions. The coeff. of friction shall not exceed 0.1. The bronze plates shall be similar to those manufactured by Merriman Bros., Inc., 183 Canal St., Boston 30, Mass., or Whiteley Bearing Corporation Chicago, Ill., or an approved equal.

STRUCTURAL STEEL

Beams shall be cambered for vertical curve and dead load deflection either in mill or shop.

Layout dimensions and standard lengths of beams shown are horizontal dimensions and must have the additional length added for lengths along grade.

All rivets shall be 7/8" ϕ unless noted.

All high-tensile-strength bolts shall be 7/8" ϕ unless noted.

All holes shall be 15/16" ϕ unless noted.

Holes in all main member splices shall be sub-punched, the connecting members shop assembled in their proper positions, and the holes reamed to full size while assembled.

Floor beam connections shall be reamed to a metal template.

All stiffeners at floor beams and at pier reactions shall have fills. All interior stiffeners between floor beams shall be crimped or filled.

Shims shall be placed between beam flange and rocker plate where required and shall be adjusted to bring top of beam to theoretical grade.

Bearing plates and rocker plates to be rolled steel.

Nuts on Anchor Bolts at Expansion Ends to be tightened 1/8 clear to allow for movement.

Anchor bolt assemblies will be paid for as reinforcing steel and are included in the bent quantities unless specifically stated elsewhere as included in the structural steel quantities.

Mill and shop inspection of the structural steel will be performed by Froehling & Robertson, Inc., 814 West Cory St, Richmond, Virginia. The contractor shall notify that company of the name and address of the fabricator of the structural steel as soon as the fabricator has been given the contract to fabricate so that the inspection procedure can be set up. The contractor shall also stipulate in his order to the fabricator that Froehling & Robertson, Inc., will perform the mill and shop inspection of the structural steel.

COMPOSITE BEAMS

A 5 day interval shall be allowed between time of pouring slab and sidewalk.

Tops of beam flanges shall not be painted.

All equipment, materials and workmanship for electric arc welded stud shear connectors shall be in accordance with the recommendations of the manufacturer and Special Provisions.

Alternate for welded studs: an approved alternate method of securing composite action between beams and slab may be used, at no additional cost to the Dept. Details must be submitted for approval in advance of making the change.

7/8" ϕ studs may be substituted for 3/4" ϕ studs. The 7/8" ϕ studs shall be placed with the same number in each transverse row as the 3/4" ϕ studs. The pitch of the 7/8" ϕ studs shall be equal to 1.36 times the pitch of the 3/4" ϕ studs. The 7/8" ϕ studs must be welded within the recommended area of an approved arc stabilizer cart.

PRESTRESSED BEAMS

Tops of beams shall be rough floated. At the approximate time of initial set, entire top of beam shall be scrubbed with a coarse wire brush to remove all laitance, and to produce a roughened surface for bonding slab.

Membrane curing compound shall not be used on tops or ends of beams.

Concrete in prestressed beams shall be class "K" as described in the Special Provisions.

The prestressing strands, wire or bars, must be thoroughly cleaned of any loose rust, dirt, grease, form lubricant or other deleterious substances, to the satisfaction of the Engineer, before the concrete is placed.

Beams shall not be transported to the bridge site until concrete has cured for at least 6 days.

Beam lengths given are based on horizontal span only. These lengths shall be increased to correct for concrete shrinkage, concrete shortening when the strands are cut, and for beams being on a grade.

CONCRETE

All concrete shall be Class "A" unless noted below or on other sheets of these plans.

Build-ups on bent caps shall be cast monolithic with cap unless shown or noted elsewhere on these plans.

Top of each build-up shall be level.

Payment for Concrete in slab will be based on theoretical plan quantity.

Any necessary adjustment for Camber shall be at the Contractor's expense.

All exposed edges shall be chamfered 3/4" unless otherwise noted.

For simple spans over 70 Ft in length, the center portion (approximately 1/3 of the length) of the slab shall be poured first and allowed to cure for not less than 4 days before the remaining end sections are poured. However, when the temperature permits (in the opinion of the engineer) the entire slab may be poured provided a suitable retarding agent is used in such amounts that the slab concrete shall not have had its initial set prior to the completion of the casting of the slab concrete.

BEARINGS

For concrete beams bearing on concrete, the top of caps, or tops of build-ups, under bearing areas of beams shall receive a steel trowel finish to insure a smooth and level bearing surface. See Standard Specifications paragraph 710.14.

DESIGN DATA

SPECIFICATIONS: A.A.S.H.O. '61 with rev. thru. '64

LIVE LOAD: H S20-44 Includes provision for alternate loading of 2 axles 4' apart with each axle weighing 75% of rear loading for spans under 40'.

UNIT STRESSES

STRUCTURAL STEEL & REINFORCED CONCRETE:
fs (struct) = 20,000 psi
fs (reinf) = 20,000 psi
CLASS "A" CONCRETE:
fc=1200 psi; n=10; v=225 psi; u=300 psi

PRESTRESSED CONCRETE:
fc=5000 psi; f'ci=4,000 psi; fc=2,000 psi
PRESTRESSING STEEL:
fs=250,000 psi; fsi=175,000 psi

MATERIAL AND WORKMANSHIP

Except as may otherwise be specified on plans or in the Special Provisions, all material and workmanship shall be in accordance with the South Carolina Highway Department Standard Specifications for Highway Construction, Edition of 1964.

REV.						
REV.						
REV.						
REV.						
REVIEWED: WHL						
IN CHARGE						
QUAN.						
TR.	APD.	RWH	4-61			
DR.	APD.	RWH	4-61			
DES.						
	BY	CHK	DATE			

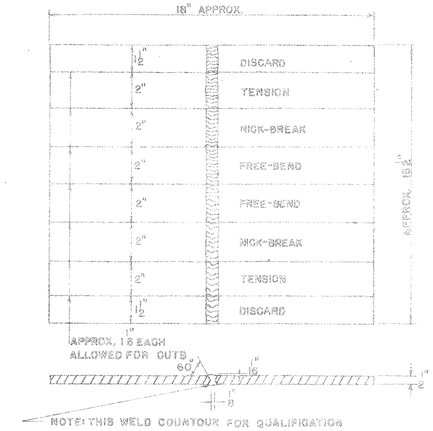
S.C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA, S. C.

STANDARD NOTES
BRIDGE OVER
LAKE MARION

FILE NO.	COUNTY	ROUTE NO.	DATE
14.391	CLARENDON	I-95	2-65

APPROVED BY: [signature] BRIDGE DESIGN & PLANS ENGR.
APPROVED BY: [signature] BRIDGE ENGINEER

FED.ROAD DIV. NO.	STATE:	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	CLARENDON	14.391	I-95	5a	17

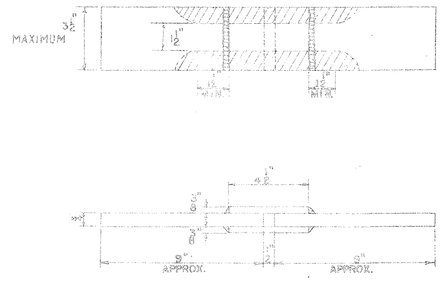


NOTE: THIS WELD COUNTOUR FOR QUALIFICATION TESTS. FOR FIELD TESTS WELD CONTOUR SHOULD BE SIMILAR TO ACTUAL WORK.

NOTE: WELD TO BE MADE HORIZONTALLY WITH PLATES IN VERTICAL POSITION. TACK WELD THE TWO PLATES TOGETHER AT EACH SIDE IN THE DISCARD AREA, THEN FIX IN VERTICAL PLANE WITH THE JOINT HORIZONTAL.

FIGURE II
BUTT WELD SPECIMEN

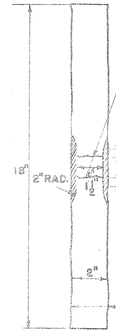
SPECIMEN TO BE CUT AS SHOWN AND SUBMITTED TO S.C.H.D. TESTING LAB.



NOTES: WELDS TO BE ¼" FILLET. CROSSHATCHED PORTION TO BE REMOVED FOR TESTS. FINAL CUT TO BE MADE BY MACHINE. WELD TO BE GAGED BEFORE TESTING.

FIGURE III
TRANSVERSE FILLET WELD TEST SPECIMEN

SPECIMEN AS SHOWN (UNCUT) TO BE SUBMITTED TO S.C.H.D. TESTING LAB.



NOTES: CROSS-HATCHED PORTION TO BE REMOVED BY MACHINING ONLY. FACE OF WELD SHOULD BE MILLED FLUSH WITH PLATES. MACHINE WORK SHOULD BE DONE PARALLEL WITH LENGTH OF PIECE. FOR ADDITIONAL DATA SEE FIGURE XI

FIGURE IV
REDUCED SECTION TENSION TEST PIECE

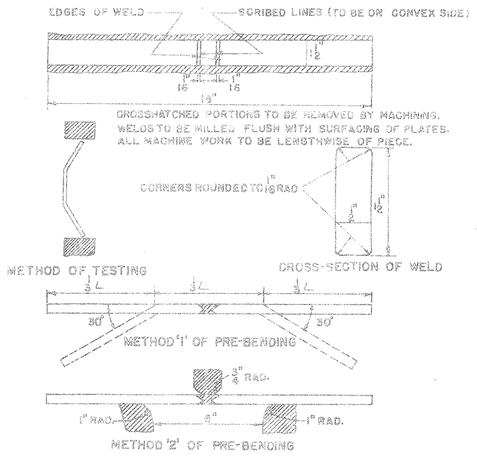
WELDING SYMBOLS

TYPE OF WELD										
BEAD	FILLET	GROOVE					PLUG & SLOT	FIELD WELD	WELD ALL AROUND	FLUSH
		SQUARE	V	BEVEL	U	J				
⌒	◺	|	∨	∨	⌄	⌄	▽	⊙	○	—

LOCATION OF WELDS

ARROW(OR NEAR) SIDE OF JOINT	OTHER(OR FAR) SIDE OF JOINT	BOTH SIDES OF JOINT
FIELD WELD, SIZE, SEE NOTE 6, FLUSH, ROOT OPENING	INCLUDED ANGLE, SIZE, ROOT OPENING, SEE NOTE 6	SIZE, INCREMENT LENGTH, WELD ALL AROUND, PITCH, OFFSET IF STAGGERED, NO. OF INCREMENTS

1 THE SIDE OF THE JOINT TO WHICH THE ARROW POINTS IS THE ARROW (OR NEAR) SIDE.
2 BOTH SIDES WELDS OF SAME TYPE ARE OF SAME SIZE UNLESS OTHERWISE SHOWN.
3 SYMBOLS APPLY BETWEEN ABRUPT CHANGES IN DIRECTION OF JOINT OR AS DIMENSIONED (EXCEPT WHERE ALL AROUND SYMBOL IS USED).
4 ALL WELDS ARE CONTINUOUS AND OF USER'S STANDARD PROPORTIONS, UNLESS OTHERWISE SHOWN.
5 TAIL OF ARROW USED FOR SPECIFICATION REFERENCE (TAIL MAY BE OMITTED WHEN REFERENCE NOT USED).
6 DIMENSIONS OF WELD SIZES, INCREMENTS, LENGTHS AND SPACINGS, IN INCHES.



SHOWING DIE FOR PREFORMING. TEST PIECE TO BE BENT 90° IN DIE. REMAINDER OF BEND TO BE MADE FREE.

FIGURE V
FREE BEND TEST PIECE

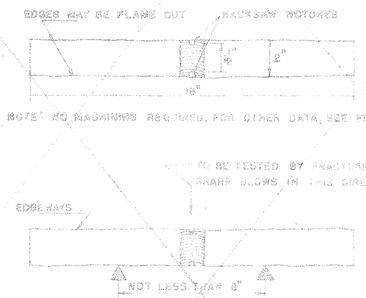
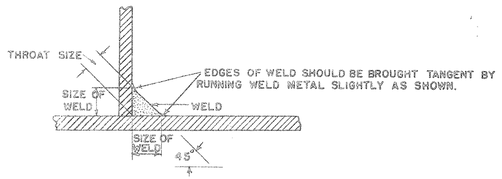


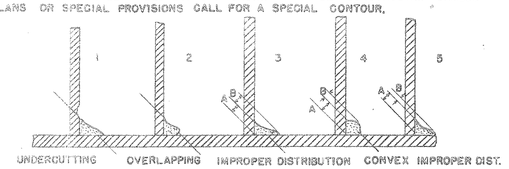
DIAGRAM SHOWING METHOD OF TESTING

FIGURE VI
NICK-BREAK TEST PIECE



DESIRABLE FILLET WELD CONTOUR

NOTE:
THE DESIRABLE FILLET WELD CONTOUR SHOWN SHALL BE CONSTRUCTED UNLESS THE PLANS OR SPECIAL PROVISIONS CALL FOR A SPECIAL CONTOUR.



UNDESIRABLE FILLET WELD CONTOUR

1 AND 2 ARE NOT PERMITTED. 3, 4 AND 5 PERMITTED IF RATIO $\frac{A}{B}$ IS NOT OVER 60% (CONVEXITY RATIO) AND DIMENSIONS ARE WITHIN TOLERANCES ALLOWED.

FIGURE VII

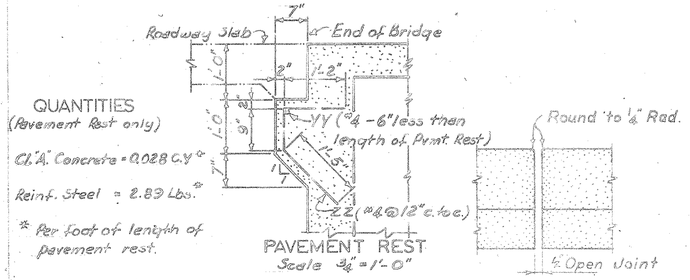
S.C. STATE HIGHWAY DEPARTMENT
COLUMBIA

WELD SYMBOLS AND TEST SPECIMENS

R.A.S.	L.G.	10-12-55	
Retraced			
BY	CHECKED	DATE	

DOCKET NO. 14.391 ROUTE NO. I-95
COUNTY CLARENDON DATE 5-65

Fed. Rd. Div. No.	State	County	File No.	Route No.	Sheet No.	Total Sheets
3	S.C.	Clarendon	14.391	I-95	6	17



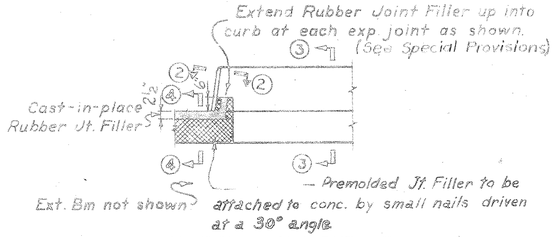
QUANTITIES
(Pavement Rest only)

Cl. "A" Concrete = 0.028 C.Y.*

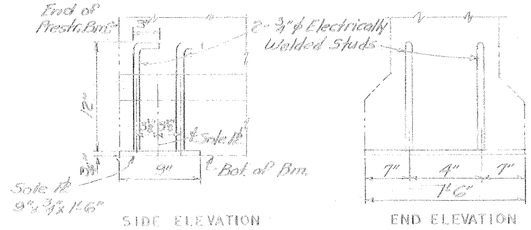
Reinf. Steel = 2.83 Lbs.*

* Per foot of length of pavement rest.

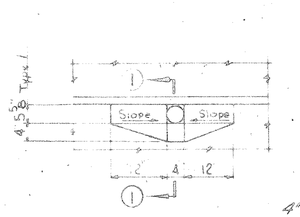
SECTION ③-③
SCALE: 1"=1'-0"



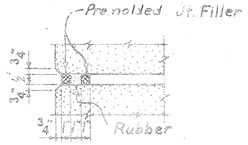
SECTION ALONG EXP. JT.
SCALE: ¾"=1'-0"



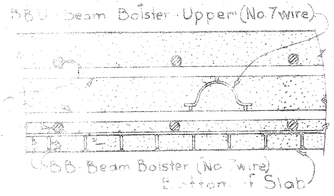
DETAIL OF ELECTRICALLY WELDED STUD ALTERNATE SCHEME II



DRAIN DETAILS
SCALE: ¾" = 1'-0"

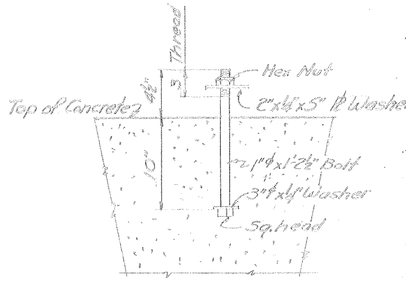


SECTION ②-②
SCALE: 1"=1'-0"



SECTION PARALLEL TO ℄ RDWY.

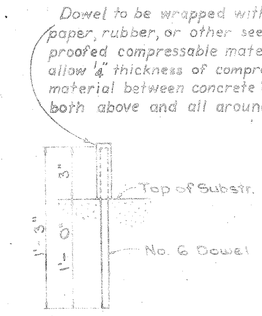
BOLSTER DETAIL
SCALE: 3" = 1'-0"
For Bolster heights, see Sh. No. 17



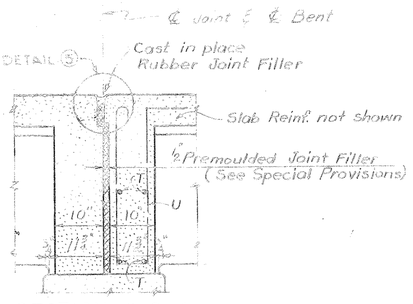
DETAIL OF ANCHOR BOLT
SCHEME II

Note:
Bolsters to be spaced so that they provide adequate support for the slab reinforcing steel. The BBU bolsters shall be spaced at approx. 3'-0" ctrs. The BB bolsters shall be placed with one at the near end edge of the slab and the max. spacing of approx. 3'-0" ctrs. between bolsters shall be equal to beam bolsters BB and BBU as Mfg'd by Meadow Steel Products and Screw Anchor Co.

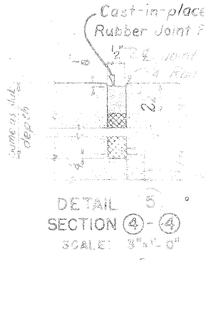
The lengths of bolsters shown in reinforcing steel schedules are approximate weights and are included in the reinforcing steel quantities and payment will be made at the unit price bid for Reinforcing Steel.



DOWEL DETAIL
SCALE 1½" = 1'-0"
SCHEME I



SECTION THRU JOINT
(LOOKING IN DIRECTION PARALLEL TO JOINT)
SCALE: ¾" = 1'-0"

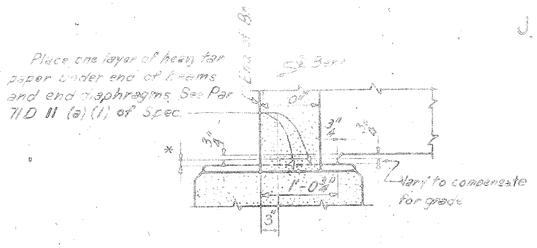


DETAIL ⑤
SECTION ④ - ④
SCALE: 3"=1'-0"

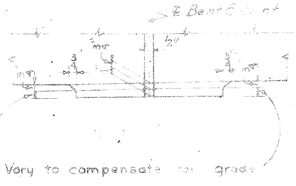
Place one layer of heavy tar paper under fixed ends of beams and two layers under expansion ends.* Place one layer under end diaphragms. See paragraph 7.D.11 (a)(1) of the Specifications.

* See Sheet No. 15 for details of expansion ends using metal plates.

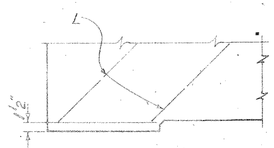
JOINT DETAILS



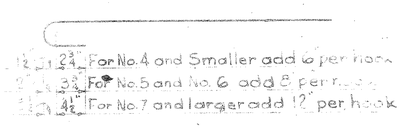
* Varies, See Sheet No. 17



BEAM BUILD DOWN DETAILS
SCALE: 1"=1'-0"



DETAIL SHOWING LOCATION OF INCLINED STIRRUPS AT ENDS OF CONCRETE BEAMS (OTHER REINFORCING NOT SHOWN)
SCALE: 1'2"= 1'-0"



HOOK DETAILS
FOR STEEL REINFORCING BARS

REV.			
REV.	AMZ	HDL	4-59
	Bearing Detail		
REV.	WEB	MDS	12-58
	Drain Detail		
REV.	AMZ	RWH	1-58
	Build-down Detail		
REV.	RWH	ALH	7-57
	Add Dome Detail		
REV.	AGW	WFL	3-65
	Fr. Dk. 37.468.1		
REV.	BAM	RWH	1-65
	Pavement Rest		
REV.	C.D.K.	EAS.	4-62
	Jt Details & New Fail		
REV.	C.D.K.	MDS	4-60
	Exp. Anchor Detail		

REVIEWED with
IN CHARGE

QUAN.			
TR.	WCF	EAS	12-56
DR.	JCW	EAS	12-56
DES.			
BY.	CHK.	DATE	

S. C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA, S.C.

STANDARD DETAILS

FILE NO.	COUNTY	ROUTE NO.	DATE
14.391	CLARENDON	I-95	3-65

APPROVED BY: [signature] BRIDGE DESIGN & PLANS ENG.
APPROVED BY: [signature] BRIDGE ENGINEER

190 c

FED. ROAD DIV. NO.	STATE	COUNTY	FILE NO.	PROJECT NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	Florence	14391	I-95-2(12)	I-95	7	12

PLAN — SCALE: 1" = 50' — CHECKED — NOTE BOOK — DATE — NO

PROFILE — SCALE: HOR. 1" = 50' VERT. 1" = 10' — CHECKED — NOTE BOOK — DATE — NO

SOUTH CAROLINA STATE HIGHWAY DEPT. 11 5.34 AC.

PUEY P. LEVI 45.1 AC. 10

PUEY P. LEVI 45.1 AC. 1

TRANSITION R/W

Take 1.91 Ac.

6" Oak
5" Oak
10" Oak
30" Oak
3" Blueberry
4" Crape Myrtle stump
2" Cherry
2 Oak
3 Oak

34.60'
6.54'
26.28'
16.95'
15.85'
15.88'
14.04'
11.45'
4.40'
2392'
1251'
19.02'

P.T. 5165/86.3
P.O.T. 5167/156
P.O.T. 5169/918
P.O.T. 5171/50

LINE "A"

Woods Road

185' Woods Road

EQUALITY
P.O.T. STA. 5171/50.0 (BACK)
P.O.T. STA. 5171/57.2 (AHEAD)

EQUALITY
P.I. STA. 5172+81.6 (LINE "A") IS 60' LT.
P.O.T. STA. 5172+45.72 (ROUTE I-95)

LAKE MARION

S 50°-09' W

Controlled Access Line

Beginning of Bridge Sta. 5173+61.8

STA. 5174+14.9 END PAV. NO. 2 OF 2 (T)
FILE NO. 14344 (LIMIT NO. 1) AND BEGIN
PAV. NO. 1 OF 2 (T) FILE NO. 14344 (LIMIT NO. 2)
INTERSTATE ROUTE I-95

50' TAPER

~~Place one (1) Shft. Federal Highway Construction Sign to face Route 301 (See Sheet No. 4)~~

~~Construct Concrete Catch Basin (Type K-1)~~

SOUTH BOUND LANE
P.I. = 5165/86.3
P.C. = 5+01.56 OT BACK
STA. 4+73.56 AHEAD

SOUTH BOUND LANE
P.I. = 5165/86.3
P.C. = 5+01.56 OT BACK
STA. 4+73.56 AHEAD

Present U.S. Route 301

B.V.C. N=2.72
275' Ex. Sta. 5172+00
X. Work on End of Bridge
EL. = 92.39

FILL

9 spans @ 40' = 360'-0"

Finished Grade

0.00%

-0.20%

~~Construct Special Ditch Rt. Sta. 5165+00 To Sta. 5172+00~~

~~USE TYPICAL SECTION NO. 1 & 2 THIS SHEET SEE SHEET NO. 2 & 2A~~

2½:1
6:1

Special Ditch Ex. Rt.

92.60 92.80 92.80 92.80 92.60 92.40 92.30 92.21

92.50

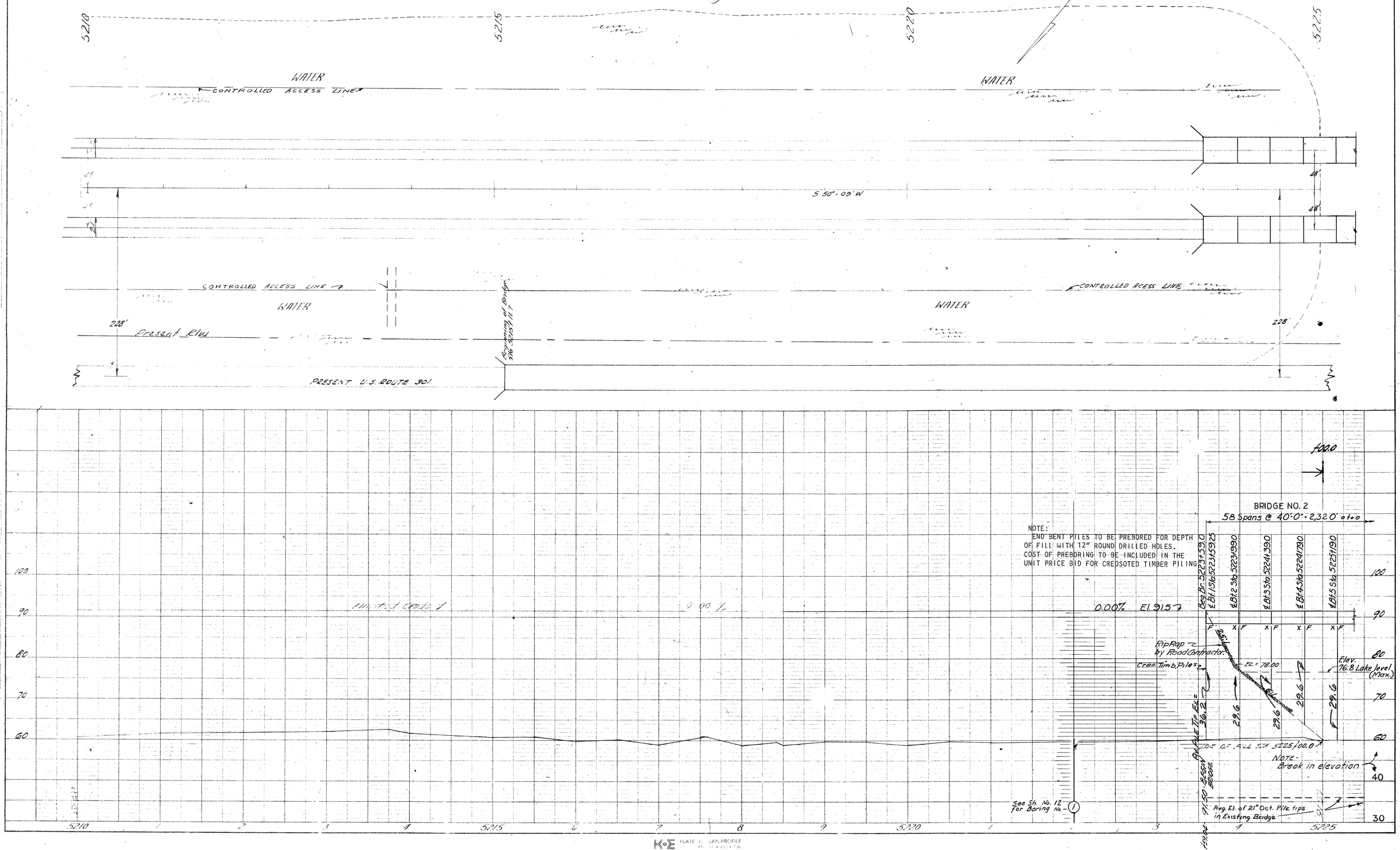
100 90 80 70 60

5165 6 7 8 9 5170 1 2 3 4 5 6 7 8 9 5180

FED. ROAD DIV. NO.	STATE	COUNTY	FILE NO.	PROJECT NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	CLARENDON	14,391	I 95-2(12)	I 95	8	17

SOUTH CAROLINA PUBLIC SERVICE AUTH.

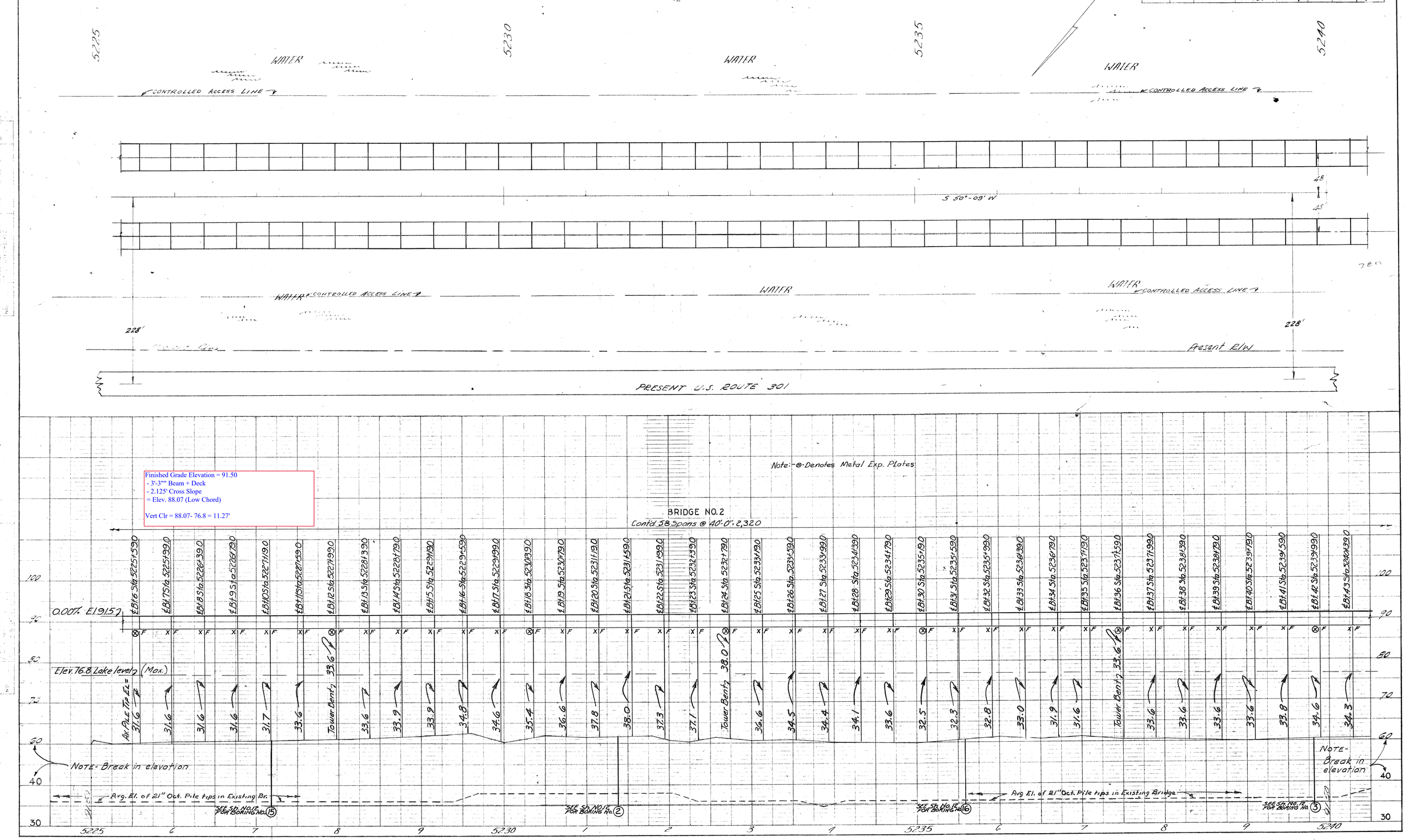
(12)



K+E PLATE 1. PLAN-PROFILE

FED. ROAD DIV. NO.	STATE	COUNTY	FILE NO.	PROJECT NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	CLARENDON	14.391	I-95-2(12)	I-95	9	17

SOUTH CAROLINA PUBLIC SERVICE AUTH.



Finished Grade Elevation = 91.50
- 3'-3"" Beam + Deck
- 2.125' Cross Slope
= Elev. 88.07 (Low Chord)

Vert Clr = 88.07- 76.8 = 11.27'

PLAN

PROFILE

K+E PLATE 1, PLAN-PROFILE

SITE PLAN

SITE PLAN

SOUTH CAROLINA PUBLIC SERVICE AUTH.

FED. ROAD D.V. NO.	STATE	COUNTY	FILE NO.	PROJECT NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON	14391	F-052(10) I-95		10	17

5240 5245 5250 5255

WATER

CONTROLLED ACCESS LINE

1'-6" Curb | 31'-0" Roadway | 1'-6" Curb

48'-0"

S 50°-09' W

25'

15'

228'

PRESENT U.S. ROUTE 301

PLAN

PROFILE

Note:- ⊗ Denotes Metal Exp. Plates

BRIDGE NO. 2
Cont'd. 58 Spans @ 40'-0" = 2,320'

Pc. Sta. 5241+29.00

4,500' total length of Bridge No. 2

Main Spans Bridge No. 2 = 2,180'

P.T. Sta. 5247+49.0

FINISHED GRADE

3.0%

0.00%

Sta. 5246+79.0 end of File 14.391

℄ Bl. 44 Sta. 5240+79.0 F.G. Elev. 91.500

℄ Bl. 45 Sta. 5241+19.0 F.G. Elev. 91.500

℄ Bl. 46 Sta. 5241+59.0 F.G. Elev. 91.522

℄ Bl. 47 Sta. 5241+99.0 F.G. Elev. 91.619

℄ Bl. 48 Sta. 5242+39.0 F.G. Elev. 91.793

℄ Bl. 49 Sta. 5242+79.0 F.G. Elev. 92.048

℄ Bl. 50 Sta. 5243+19.0 F.G. Elev. 92.374

℄ Bl. 51 Sta. 5243+59.0 F.G. Elev. 92.760

℄ Bl. 52 Sta. 5243+99.0 F.G. Elev. 93.264

℄ Bl. 53 Sta. 5244+39.0 F.G. Elev. 93.823

℄ Bl. 54 Sta. 5244+79.0 F.G. Elev. 94.462

℄ Bl. 55 Sta. 5245+19.0 F.G. Elev. 95.180

℄ Bl. 56 Sta. 5245+59.0 F.G. Elev. 95.974

℄ Bl. 57 Sta. 5245+99.0 F.G. Elev. 96.842

℄ Bl. 58 Sta. 5246+39.0 F.G. Elev. 97.793

Av. Pile Tip Elev. = 35.6 | 34.6 | 35.3 | 35.1 | Tower Beach 34.5 | 34.5 | 34.1 | 33.7 | 33.5 | 33.4 | 33.3 | 33.0 | 33.4 | 33.5 | 33.7

P.I. = 5244+39.0
EL. = 91.50
V.C. = 620'

NOTE:
The Contractor for File No. 14.391 shall furnish the bottom Stainless Steel Exp. Plates for Pier A to the Contractor for File No. 1438.315 to install Pier A under contract as File No. 1438.315.

Max. Lake Level El. 76.82

Drainage Area = 14,700 Sq. Mi. approx.
Q = 374,000 c.f.s. under H.W. El. 85.0 (1916)
Max. Velocity in Channel = 5.7 Ft./sec.
" " " Overflow Sec. = 3.1 Ft./sec.

Note:- Break in elevation

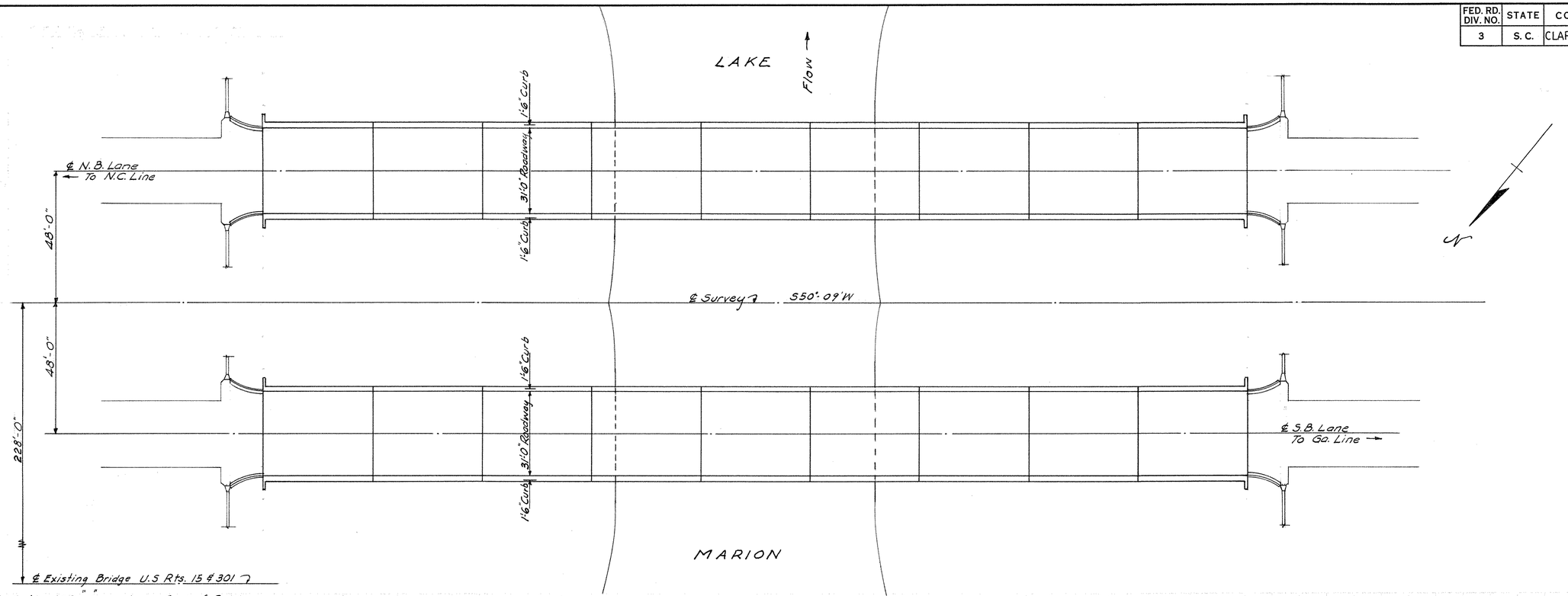
Avg. El. of 21" Oct. Pile tips in Existing Bridge
SEE Sh. No. 12 FOR BORING No. (17)

100 90 80 70 60 40 30

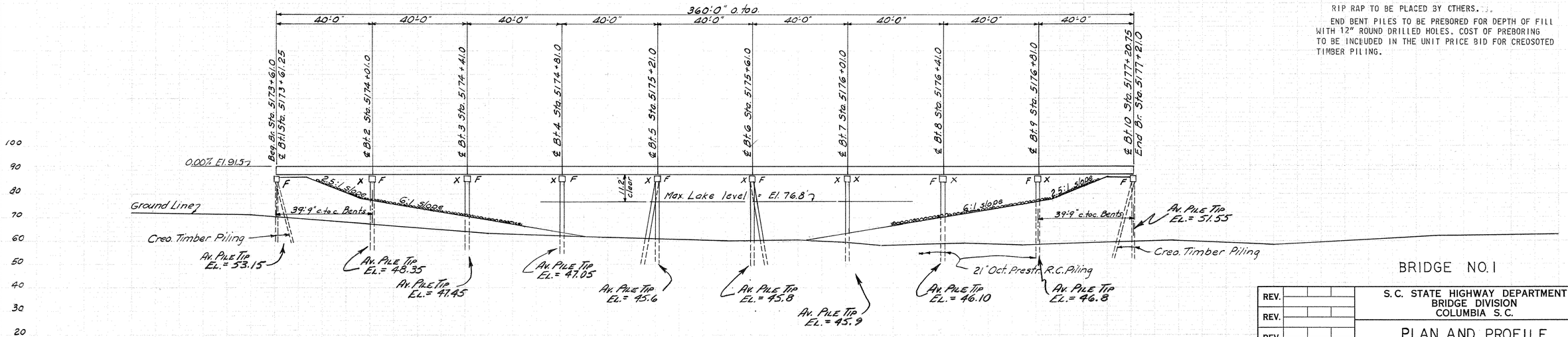
120 110 100 90 80 70 60

5240 1 2 3 4 5245 6 7 8 9 5250 1 2 3 4 5255

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON	14.391	I-95	11	17



B.M. No. 102 "X" mark on End of Bridge
Lt. going South 228' Rt. Sta. 5+72+00 El. 92.80



SECTION ON ℄ LANE

NOTES:
CONSTRUCT FLARED CURB AND GUTTER AND SLOPE DRAINS ON EACH SIDE OF BRIDGE, AT THE BEG. AND END OF N.B. LANE AND S.B. LANE.

RIP RAP TO BE PLACED BY OTHERS.

END BENT PILES TO BE PREBORED FOR DEPTH OF FILL WITH 12" ROUND DRILLED HOLES. COST OF PREBORING TO BE INCLUDED IN THE UNIT PRICE BID FOR CREOSOTED TIMBER PILING.

BRIDGE NO. 1

REV.			
REV.			
REV.			
REV.			
REVIEWED	WAH		
	IN CHARGE		
QUAN.			
TR.			
DR.	W.F.L.	M.F.H.	2-65
DES.			
	BY	CHK'D	DATE

S. C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA S. C.

PLAN AND PROFILE
FOR BRIDGE OVER
LAKE MARION

FILE NO.	COUNTY	ROUTE NO.	DATE
14.391	CLARENDON	I-95	2-65

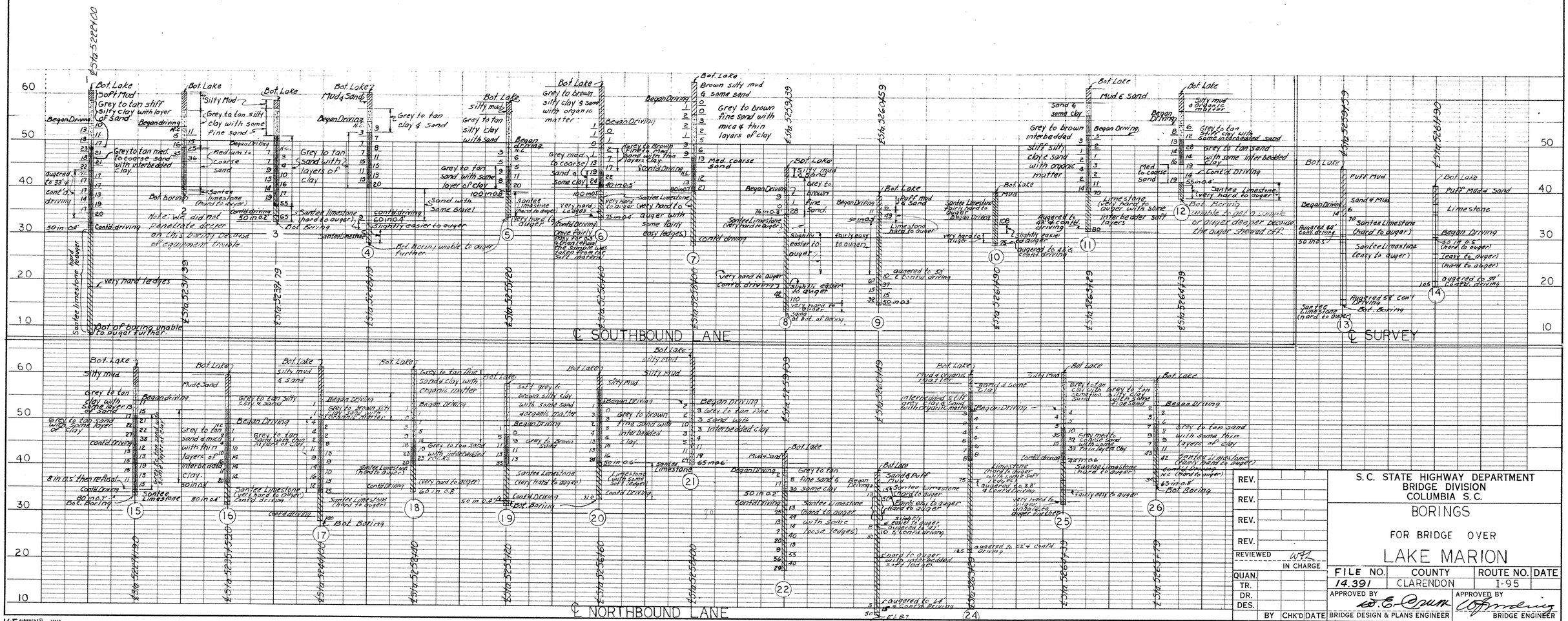
APPROVED BY: W. E. Crum — BRIDGE DESIGN & PLANS ENGINEER
APPROVED BY: W. Armstrong — BRIDGE ENGINEER

K&E ALBANENE TRACING PAPER 72488

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON	14.391	I-95	12	17

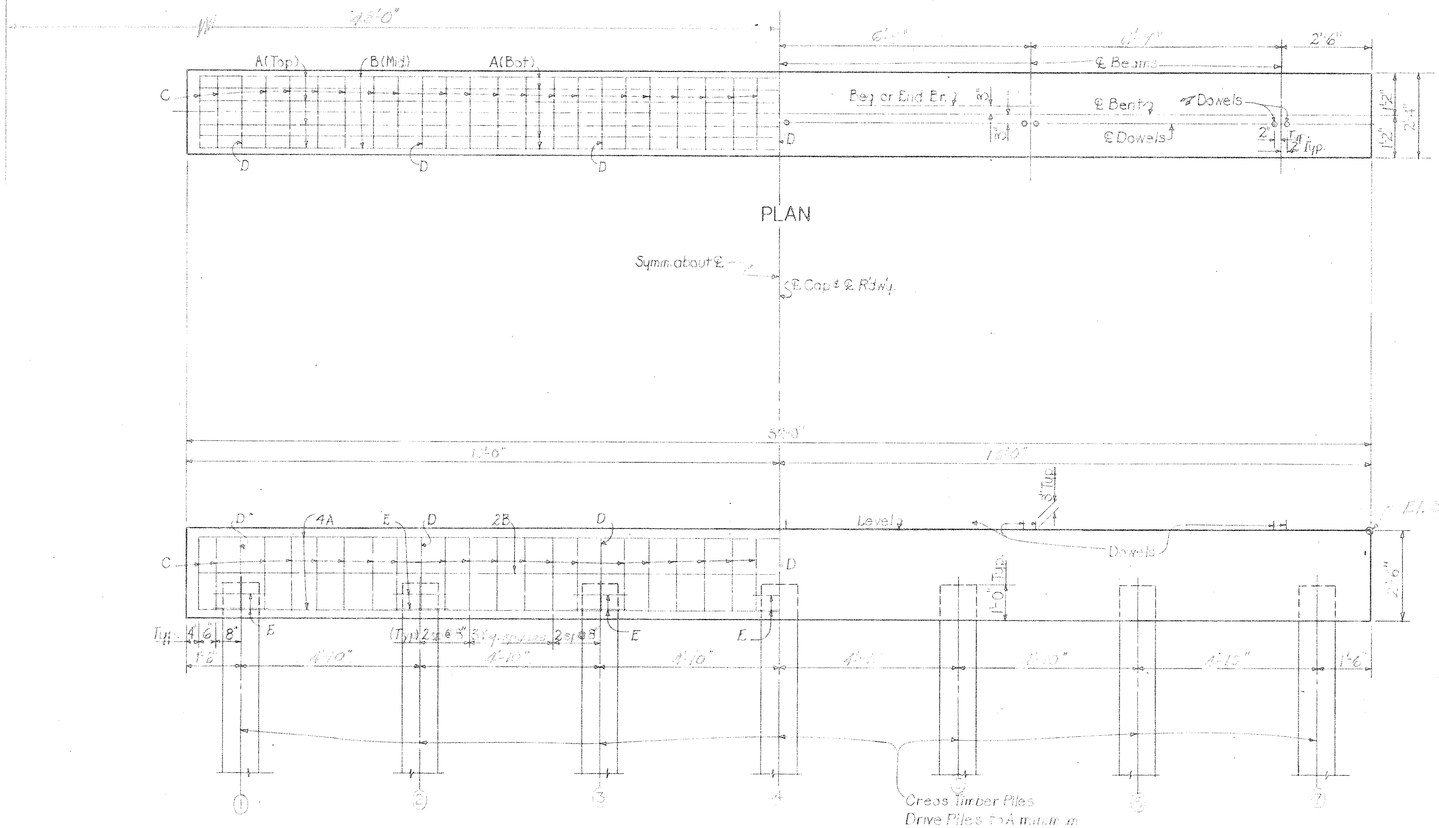
Location of Boring							℄ NBL	℄ NBL	℄ NBL	℄ SBL	℄ Survey	℄ Survey	℄ Survey	℄ NBL	℄ NBL	℄ NBL	℄ NBL	℄ SBL	℄ SBL	℄ SBL	℄ SBL
Station	5175+00	5175+00	5175+00	5175+00	5184+00	5184+00	5227+19	5227+19	5227+19	5231+39	5259+35	5259+35	5259+35	5259+35	5259+39	5259+39	5259+39	5259+39	5259+39	5259+39	5259+39
Sample Elevation							52.5	43.5	33.0	52.0	35.0	26.0	16.0	38.0	35.0	32.0	30.0	38.0	35.0	18.0	16.0
% Pass #10 Ret #60							2	25	9	1	18	8	10	30	14	10	9	25	12	4	6
% Pass #60 Ret #200							15	5	12	7	13	15	15	5	12	7	10	3	12	16	11
% Silt							23	5	22	34	18	23	24	4	19	14	21	2	21	30	27
% Clay							46	5	32	55	22	30	27	2	28	21	31	3	30	33	35
A.A.S.H.O. Class.							A-6(7)	A-3		A-6(10)	A-4(1)	A-4(4)	A-4(3)	A-3		A-2-4		A-1-b			
Chem. Analysis (%)							$CaCo_3$ 87.2 $MgCo_3$ 8.9														
Rock									Santee Limestone		Santee Limestone	Santee Limestone	Santee Limestone		Santee Limestone	Santee Limestone	Santee Limestone	Santee Limestone	Santee Limestone	Santee Limestone	Santee Limestone

Location of Boring	℄ SBL	℄ SBL	℄ SBL	℄ NBL	℄ NBL	℄ NBL	℄ SBL	℄ SBL	℄ Survey	℄ SBL	℄ SBL	℄ NBL	℄ NBL	℄ NBL	℄ NBL	℄ NBL	℄ NBL	℄ NBL	℄ NBL	℄ NBL	℄ SBL
Station	5260+49	5263+29	5263+29	5263+29	5263+29	5263+29	5261+90	5291+90	5261+90	5260+59	5260+59	5260+49	5260+49	5260+49	5264+39	5264+39	5264+39	5265+79	5265+79	5280+00	5258+00
Sample Elevation	8.5	40.0	31.8	41.3	37.6	22.5	33.5	28.7	21.0	35.0	25.0	35.0	33.0	26.0	51.0	46.0	41.7	49.0	38.5	52.0	54.0
% Pass #10 Ret #60	13	6	9	6	4	5	14	8	7	14	10	4	15	5	20	2	——	18	4	24	7
% Pass #60 Ret #200	9	10	12	14	16	11	14	11	12	11	13	14	11	13	15	9	——	14	11	12	34
% Silt	26	23	17	24	30	26	18	20	24	18	21	30	16	24	7	18	——	6	21	9	14
% Clay	28	40	38	41	39	41	27	28	39	32	36	40	32	40	10	63	——	18	30	5	7
A.A.S.H.O. Class.	A-4(4)		A-4(4)	A-4(6)		A-4(6)	A-4(2)	A-4(3)	A-4(6)	A-4(3)	A-4(4)	A-4(7)	A-4(3)	A-4(6)	A-2-4		——	A-2-4	A-4(3)	A-2-4	A-2-4
Chem. Analysis (%) $CaCo_3$	79.1								82.1								74.3		70.9		
Chem. Analysis (%) $MgCo_3$	1.8								1.1								0.8		0.8		
Rock							Santee Limestone		Santee Limestone	Santee Limestone	Santee Limestone	Santee Limestone	Santee Limestone	Santee Limestone			Santee Limestone		Santee Limestone		

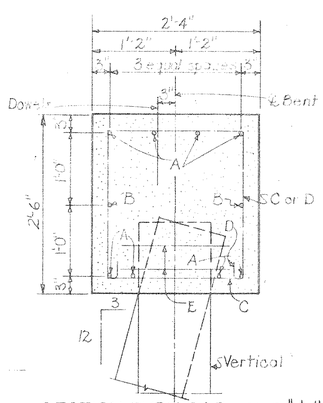

℄ SOUTHBOUND LANE
℄ NORTHBOUND LANE
℄ SURVEY
Bot. Lake
Soft Mud
Grey to tan stiff silty clay with layer of Sand
Began Driving
Augered to 33'& cont'd driving
50 in 0.6'
Contd driving
very hard to edges
Santee Limestone (hard to auger)
Bot of boring unable to auger further.
Silty Mud
Grey to tan silty clay with some Pine sand
Medium to Coarse sand
Bot boring
Note: We did not penetrate deeper on this boring because of equipment trouble.
Mud & Sand
Grey to tan clay & Sand
Grey to tan sand with layers of clay
Santee limestone (hard to auger)
Bot Boring
Sand with Some Gravel
Bot Boring, unable to auger further.
Silty mud
Grey to tan silty clay with Sand
Began N.C.
Grey to tan sand with some layer of clay
100 in 0.8'
Grey to brown silty clay & sand with organic matter
Grey med. to coarse sand & some clay
100 in 0.5'
very hard to auger
Rotary Drilling
Grey to brown fine sand with mica & thin layers of clay
Brown silty mud & some sand
Grey to brown fine sand with mica & thin layers of clay
Med. Coarse Sand
Silty mud
Grey to brown Sand
Fine Sand
Puff Mud & Sand
Santee Limestone (very hard to auger)
Limestone hard to auger
Slightly easier to auger
Fairly easy to auger
Augered to 55' Contd driving
very hard to auger
Mud & Sand
Sand & some clay
Grey to brown interbedded stiff silty clay & sand with organic matter
Limestone (very hard to auger with some interbedded soft layers
Bot. Boring unable to get a sample of auger deeper because the auger sheared off.
Silty mud & organic matter
Grey to tan with some interbedded sand
Grey to tan sand with some interbedded clay
Contd Driving
Santee Limestone (very hard to auger)
Puff Mud
Puff Mud & Sand
Limestone
Began Driving
Augered to 99' Contd Driving
Augered 58' Cont'd Driving
Bot. Boring
Mud & Sand
Grey to tan clay with some layers of Sand
Grey to tan sand with some layers of clay
Grey to tan sand & mica with thin layers of clay interbedded clay
50 in 0.6'
Santee Limestone (very hard to auger)
80 in 0.5' Bot. Boring
8 in 0.5' then refusal
Santee Limestone
Grey to tan silty clay & sand
Grey to tan sand with some layer of clay
Grey to tan silty clay with some Pine sand
Grey to tan clay with organic matter
Grey to tan fine sand with layers of clay
Grey to tan sand with interbedded clay
Santee Limestone (very hard to auger)
66 in 0.8'
Bot Boring
Soft grey to brown silty clay with some sand & organic matter
Grey to brown fine sand with interbedded clay
Limestone (with some soft layers)
50 in 0.6'
Santee Limestone
Grey to brown fine sand with mica & thin layers of clay
Grey to tan fine Sand with interbedded clay
65 in 0.6'
Mud & Sand
Grey to tan fine Sand & some clay
Santee Limestone (hard to auger)
Sand & Puff Mud
Santee Limestone (hard to auger with some loose ledges)
Slightly easier to auger
Fairly easy to auger
Knard to auger with interbedded soft layers
Augered to 55' & Contd Driving
Augered to 44' Contd Driving
Mud & organic matter
Interbedded silty clay & Sand with organic matter
Sand & some clay
Grey to tan clay with some layers of Sand
Grey to tan with some interbedded Sand
Grey to tan Sand with some thin layers of clay
Santee Limestone (very hard to auger)
Limestone (hard to auger with some soft layers)
Very hard to auger
Augered to 58' & Contd Driving
Augered to 43' Contd Driving
Bot. Boring
Began Drilling
Augered to 50' & Contd driving
Augered to 55' & Contd driving
Augered to 58' & Contd Driving
Augered to 44' Contd Driving
Augered to 55' & Contd Driving
Augered to 58' & Contd Driving
Augered to 99' Contd Driving
Augered to 43' Contd Driving
Began Drilling
Began Driving
Began Drilling
Began Driving
Began Driving
Began Driving

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON	14.391	I-95	13	17

See Survey



ELEVATION



Batter piles ②③⑥ in direction of abutment

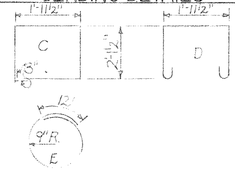
SECTION THRU CAP-SCALE 1"=1'-0"

- El. 52.9 ± Bk. I @ 10 Br. No. 1 & Bk. I Br. No. 2

REINFORCING STEEL SCHEDULE

MARK	SIZE NO.	D	END BENTS (for 10 Bents) NO REQ'D	LENGTH		
A	8	S	3	31'-2"		
B	4	S	2	31'-2"		
C	4	B	40	8'-8"		
D	4	B	7	1'-8"		
E	5	B	14	6'-9"		
Dow.	6	S	10	1'-3"		

BENDING DETAILS



QUANTITIES (ONE BENT)

ITEM	UNIT	
Class "A" Concrete	C.Y.	6.7
Reinforcing Steel	Lbs.	1027
Creos. Timber Piles	L.F.	See Summary
		(at Bk. 14)

* Use 1 - #19 ℄ for Dowels.

Notes:
For Standard Specifications, See Sh. No. 2
For Structural Details, See Sh. No. 4
For Hook & Stirrup Details, See Sh. No. 5

SCHEME I

BRIDGE NO. 1 BENTS 1 & 10
BRIDGE NO. 2 BENT 1

REV.			
REV.			
REV.			
REV.	W.F.L. from 37.4681	AGW	2-65
REVIEWED			
IN CHARGE			
QUAN.	REK	MEJ	5-64
TR.			
DR.	REK	CHE	5-64
DES.	JRC	CHE	5-64
BY		CHK'D	DATE

S. C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA S. C.

END BENTS
FOR BRIDGE OVER

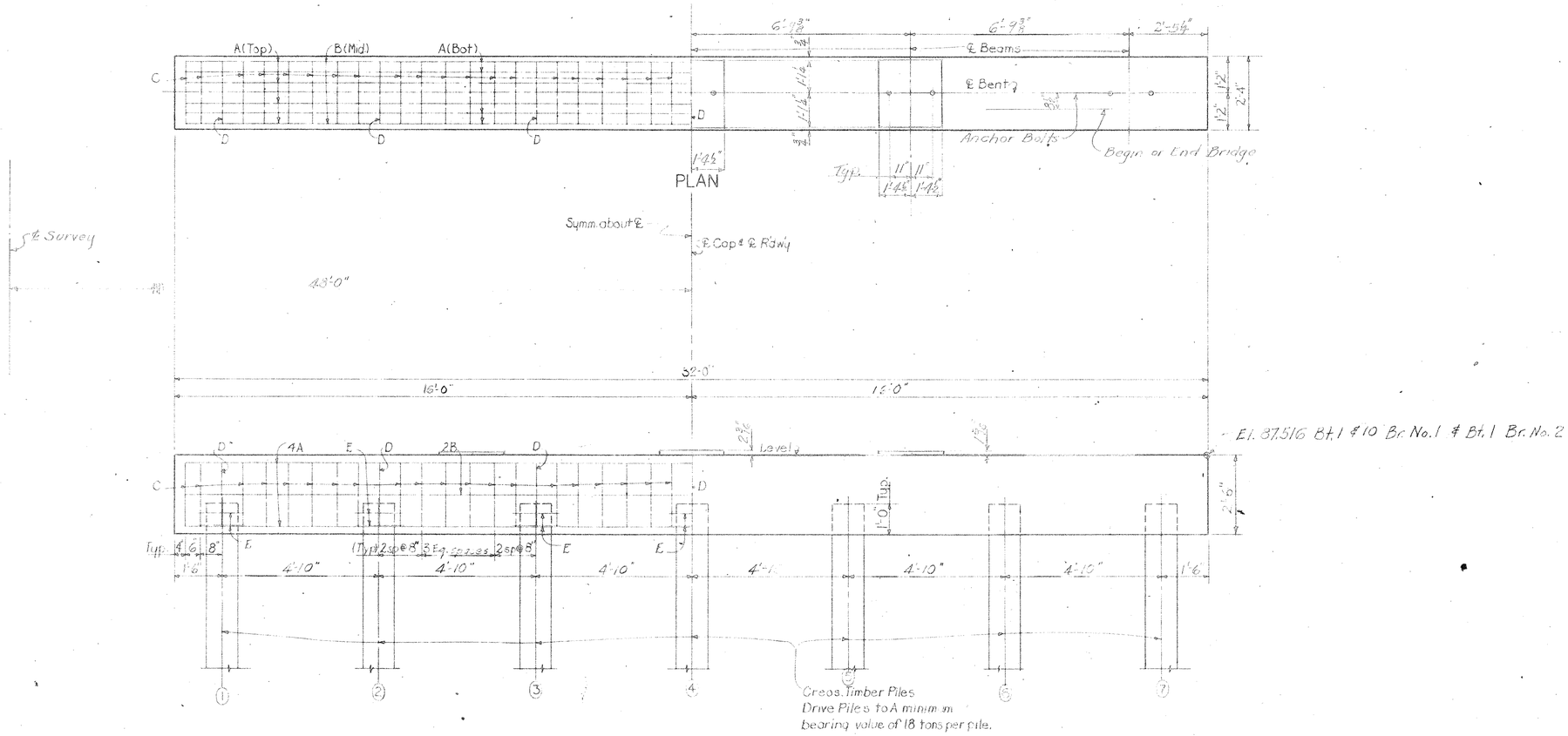
LAKE MARION

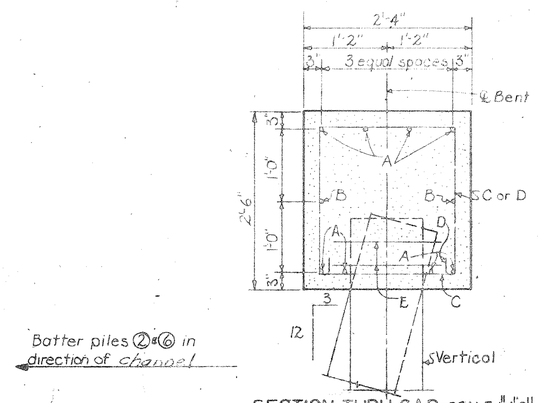
FILE NO.	COUNTY	ROUTE NO.	DATE
14.391	CLARENDON	I-95	2-65

APPROVED BY: W. E. Quinn — BRIDGE DESIGN & PLANS ENGINEER
APPROVED BY: — BRIDGE ENGINEER

K+E ALBANENE 1881 TRACING PAPER 46613

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	CLARENDON	14.391	I-95	13a	17

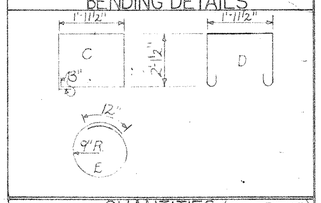




REINFORCING STEEL SCHEDULE

MARK	SIZE NO.	D	END BENTS 1 & 10 NO. REQ'D	LENGTH
A	8	S	3	31'-4"
B	4	S	2	31'-6"
C	4	B	40	8'-8"
D	4	B	7	7'-3"
E	3	B	14	5'-9"

BENDING DETAILS



QUANTITIES (ONE BENT)

ITEM	UNIT	
Class "A" Concrete	C.Y.	6.8
Reinforcing Steel	Lbs.	* 1061
Creos. Timber Piles	L.F.	See Summary on Sh. 14

*Includes 51 lbs for Anchor Bolts

Notes:
For Standard Notes, See Sh. No. 5.
For Standard Details, See Sh. No. 6.
For Hook Bolt Details See Sh. No. 6.

SCHEME II

BRIDGE NO. 1 BENTS 1 & 10
BRIDGE NO. 2 BENT 1

REV.			
REV.			
REV.	WFL	AGW	8-65 For Scheme II.
REV.	WFL	AGW	2-65 From 37.468.1
REVIEWED			
	IN CHARGE		
QUAN.	REK	MEJ	5-64
TR.			
DR.	REK	CHE	5-64
DES.	JRC	CHE	5-64
	BY	CHK'D	DATE

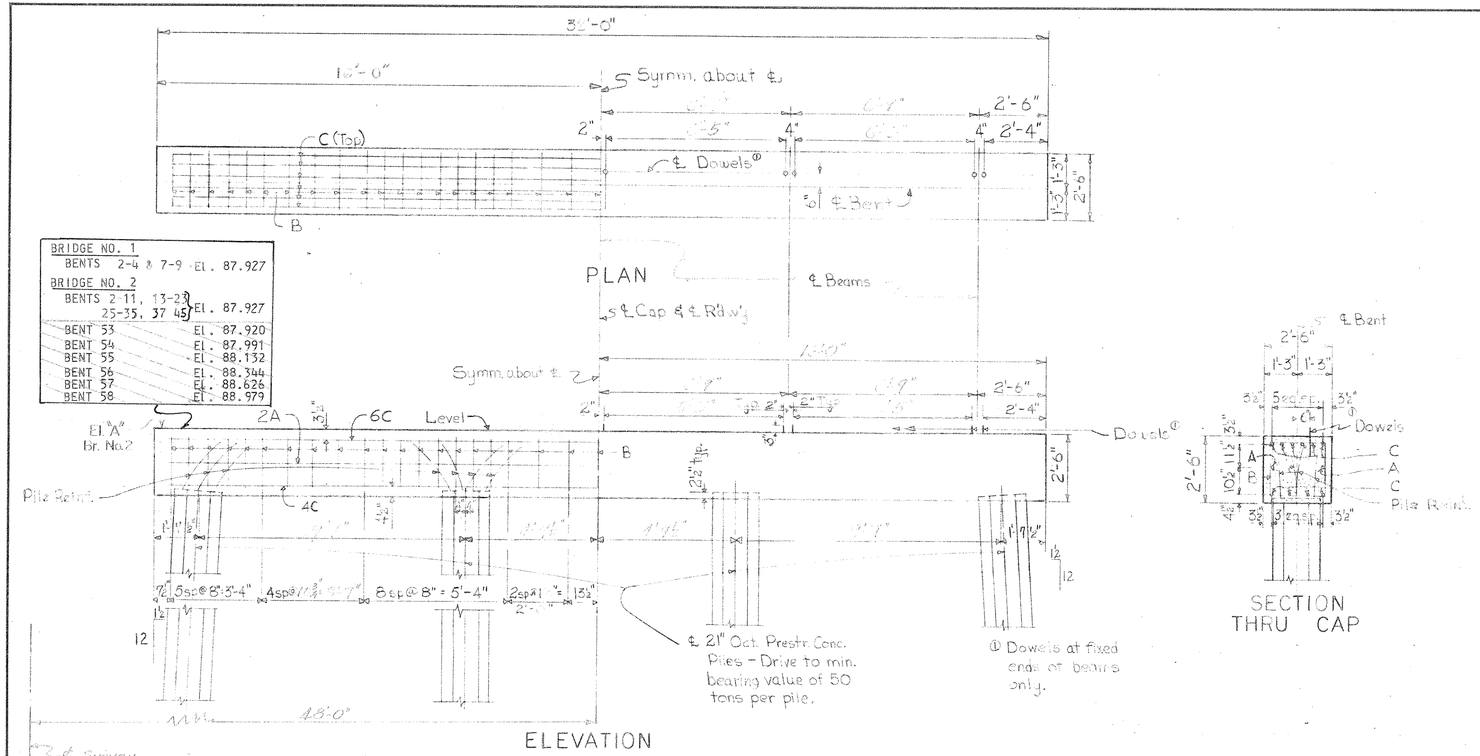
S.C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA S.C.

END BENTS
FOR BRIDGE OVER
LAKE MARION

FILE NO.	COUNTY	ROUTE NO.	DATE
14.391	CLARENDON	I-95	2-65

APPROVED BY — BRIDGE DESIGN & PLANS ENGINEER
APPROVED BY — BRIDGE ENGINEER

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON	14.391	I-95	14	17



BRIDGE NO. 1	
BENTS 2-4 & 7-9	El. 87.927
BRIDGE NO. 2	
BENTS 2-11, 13-23, 25-35, 37-45	El. 87.927
BENT 53	El. 87.920
BENT 54	El. 87.991
BENT 55	El. 88.132
BENT 56	El. 88.344
BENT 57	El. 88.626
BENT 58	El. 88.979

REINFORCING STEEL

ONE INT. BENT					BENDING DETAILS
MK.	SIZE	D	NO.	LENGTH	
A	4	5	3	31'-6"	
B	5	8	41	8'-7"	
C	9	5	10	31'-6"	
Dowl. ①	6	5	10	1'-3"	

QUANTITIES

ONE INTERIOR BENT		
Class 'A' Concrete	7.3	C.Y.
Reinforcing Steel	*1698	Lbs.
21" Oct. Prestr. Conc. Piles	See summary	L.F.

* Includes 19 lbs. for dowels. Omit dowels on Bent No. 7 where ends of all beams are expansion for Bridge No. 1 only.

Notes:
For Standard Notes, See Sheet No. 5
For Standard Details, including Dowel Details, See Sheet No. 6
For Pile Details, See Sheet No. 16

ELEVATION "A"
Bridge No. 2

Bents	
46	87.849
47	88.046
49	88.472
50	88.801
51	89.207
52	89.691
53	90.252
54	90.891
55	91.607
56	92.401
57	93.272
58	94.220

SCHEME I

SUMMARY OF QUANTITIES

BRIDGE NO. 1

		Class "A" Concrete C.Y.	Reinforcing Steel Lbs.	Creo. Timb. Piling L.F.	21" R.C. Prestr. Piling L.F.	8" Pipe Slope Dr. L.F.	Spillway Assem. Ea.	
End Bents	4	26.8	4,116	1,010	———	———	———	
Interior Bents	12	87.6	17,938	———	1,920	———	———	
Tower Bents	4	29.2	6,212	———	960	———	———	
40' End Spans	4	270.0	90,056	2,772	———	———	———	
40' Int. Spans	14	921.2	313,362	3,234	———	———	———	
Curb & Gutter	4	4.8	316	———	———	225	8	
TOTAL		1339.6	432,000	1,010	2,880	225	8	

BRIDGE NO. 2

End Bents	2	13.4	2,058	710	———	———	———	
Interior Bents	106	773.8	158,788	———	22,000	———	———	
Tower Bents	8	73.6	13,640	———	2,496	———	———	
40' End Spans	2	135.0	45,028	1,782	———	———	———	
40' Int Spans	114	7,512.6	2,551,662	25,740	———	———	———	
Curb & Gutter	2	2.4	158	———	———	110	4	
TOTAL		8,510.8	2,771,334	710	24,496	110	4	

2,731,684

SCHEME I
BRIDGE NO.1 BENTS 2-4 & 7-9
BRIDGE NO.2 BENTS 2-11, 13-23, 25-35, 37-47 & 49-58
Scale: 3/8" = 1'-0"

REV.			
REV.			
REV.			
REV.	WFL	AGM	2-65
	From 37.463 I		
REVIEWED			
IN CHARGE			
QUAN.	TRC	ATD	5-64
TR.			
DR.	F.S.W.	CHE	5/64
DES.	W.C.	CHE	5-64
	BY	CHK'D	DATE

S. C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA S. C.

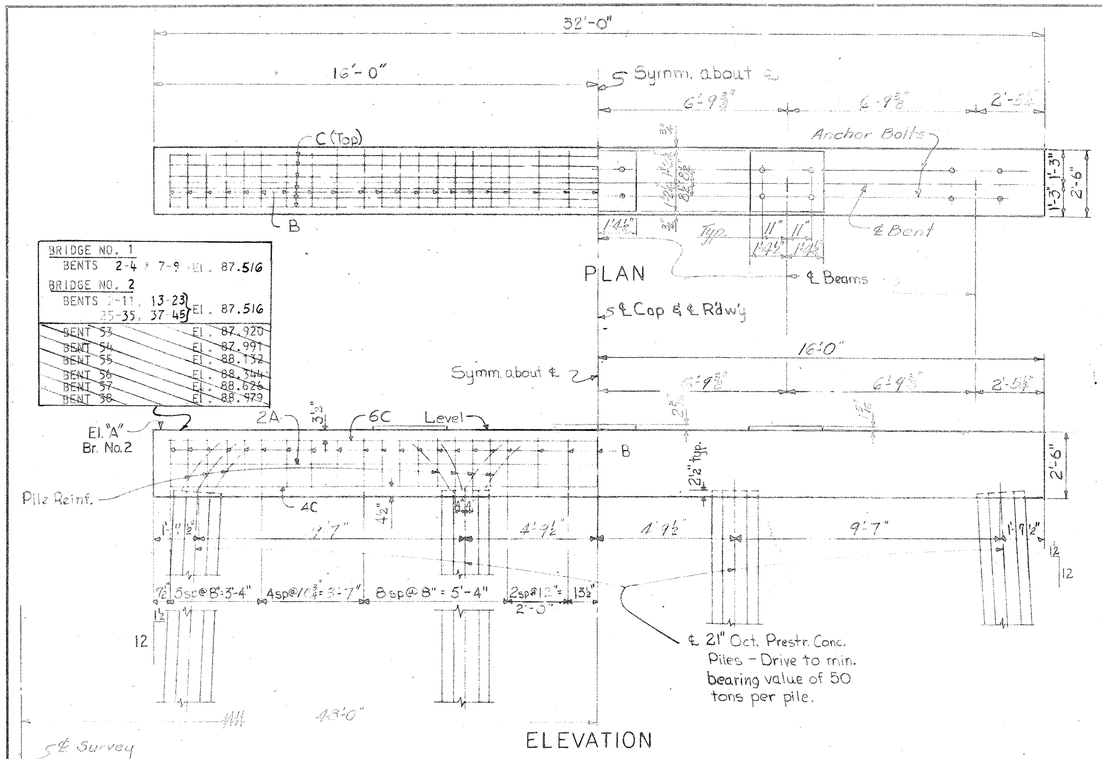
INTERIOR BENTS
FOR BRIDGE OVER
LAKE MARION

FILE NO.	COUNTY	ROUTE NO.	DATE
14.391	CLARENDON	I-95	2-65

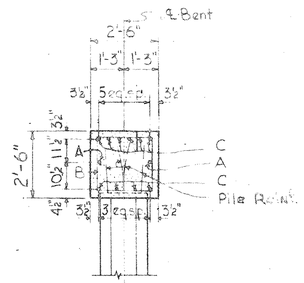
APPROVED BY: W. E. Green — BRIDGE DESIGN & PLANS ENGINEER
APPROVED BY: [signature] — BRIDGE ENGINEER

K-E ALBANENC 1881 Printed in U.S.A. 60613

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON	14.391	I-95	14a	17



ELEVATION



SECTION THRU CAP

REINFORCING STEEL

ONE INT. BENT

MK.	SIZE	NO.	LENGTH
A	4	2	31'-6"
B	5	41	8'-7"
C	9	10	31'-6"

BENDING DETAILS

QUANTITIES

ONE INTERIOR BENT

Class 'A' Concrete	7.4	C.Y.
Reinforcing Steel	1,507*	Lbs.
21" Oct. Prestr. Conc. Piles	See summary	L.F.

* Includes 102 lbs. for Anchor Bolts

Notes:
For Standard Notes, See Sheet No. 5
For Standard Details, including Anchor Bolt Details, See Sheet No. 6
For Pile Details, See Sheet No. 16

ELEVATION "A"
Bridge No. - 2

Bents	
46	87.536
47	87.632
49	88.055
50	88.382
51	88.766
52	89.270
53	89.830
54	90.467
55	91.112
56	91.874
57	92.844
58	93.791

SCHEME II

SUMMARY OF QUANTITIES

BRIDGE NO. 1

		Class "A" Concrete C.Y.	Reinforcing Steel Lbs.	Creo. Timb. Piling L.F.	21" R.C. Prestr. Piling L.F.	8" Pipe Slope Dr. L.F.	Spillway Assem. Ea.	40' R.C. Prestr. Spn. Ea.
End Bents	4	27.2	4,244	1,010	——	——	——	——
Interior Bents	12	88.8	18,972	——	1,920	——	——	——
Tower Bents	4	29.6	6,544	——	960	——	——	——
40' End Spans	4	188.4	53,624	——	——	——	——	20
40' Int. Spans	14	610.4	185,654	——	——	——	——	70
Curb & Gutter	4	4.8	316	——	——	225	8	——
TOTAL		947.2	269,354	1,010	2,880	225	8	90

BRIDGE NO. 2

End Bents	2	13.6	2,122	710	——	——	——	——
Interior Bents	106	784.4	167,786	——	22,000	——	——	——
Tower Bents	8	74.4	14,304	——	2,496	——	——	——
40' End Spans	2	93.2	26,812	——	——	——	——	10
40' Int Spans	114	4,970.4	1,511,754	——	——	——	——	570
Curb & Gutter	2	2.4	158	——	——	110	4	——
TOTAL		5,936.0	1,722,736	710	24,496	110	4	580

1722736

SCHEME II
BRIDGE NO.1 BENTS 2-4 & 7-9
BRIDGE NO 2 BENTS 2-11, 13-23, 25-35, 37-47 & 49-58
Scale: 3/8" = 1'-0"

REV.			
REV.			
REV.	WFL	AGW	8-65 For Scheme II
REV.	WFL	AGW	12-65 From 37.463-1
REVIEWED	4:42		
IN CHARGE			
QUAN. RC	ATD		5-64
TR.			
DR	F.S.W.	CHE	5/64
DES.	J.R.C.	CHE	5/64
BY	CHK'D		DATE

S. C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA S. C.

INTERIOR BENTS
FOR BRIDGE OVER
LAKE MARION

FILE NO.	COUNTY	ROUTE NO.	DATE
14.391	CLARENDON	I-95	2-65

APPROVED BY: W. S. Lacy — BRIDGE DESIGN & PLANS ENGINEER
APPROVED BY: W. J. Mullins — BRIDGE ENGINEER

K+E ALBANENE 1901, S

	FILE NO.		
S.C. CLARENDON	14.391	I-95	15 17

PLAN OF CAP

END ELEVATION

ELEVATION

SECTION A-A

SIDE ELEVATION

SECTION D-D

DETAILS OF EXPANSION PLATES
NO SCALE

STEEL SCHEDULE

9	10	31'-6"	S
5	31	8'-7"	S
	16	3 1	S
5	8	10'-2"	S
6	10	1'-3"	S
E 4	2	27'-0"	S

CONCRETE

9.2 CU. YDS.
1705 LBS.

NOTES:
FOR STANDARD NOTES SEE SHEET NO. 5
FOR STANDARD DETAILS SEE SHEET NO. 6
FOR DETAILS OF PRESTRESSED PILES SEE SHEET NO. 16.

SCHEME I

BRIDGE NO. 2 BENTS 12, 24, 36 & 48

REV.			
REV.			
REV.	WFL	NFH	2-65
	From 3.320.1		
REV.	NFH	WFL	8-62
	from 27.282.1		

Reviewed WFL In Charge

Quan.			
Tr.			
Dr.			
Des.			
	By	Chkd	Date

S. C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA, S.C.

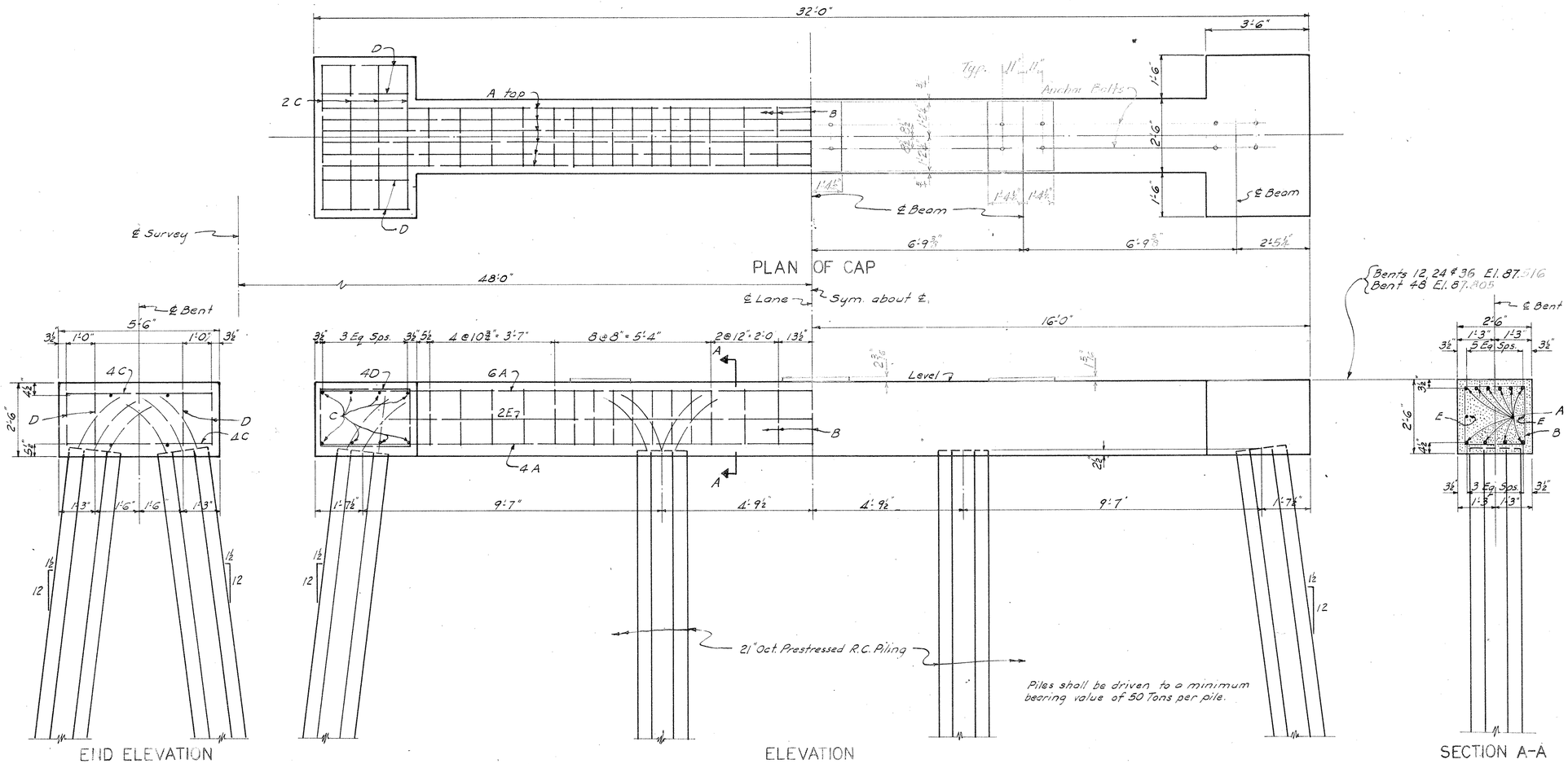
TOWER BENTS
FOR BRIDGE OVER
LAKE MARION

FILE NO.	COUNTY	ROUTE NO.	DATE
14.391	CLARENDON	I-95	3-65

Approved By _____ Bridge Des. & Plans Engr.

Approved By _____ Br. Engineer

	FILE NO.			
S.C. CLARENDON	14.391	I-95	15a	17



STEEL SCHEDULE

A	9	10	31'-6"	S
B	5	31	8'-7"	A
C	8	16	5'-1"	S
D	5	8	10'-2"	A
E	4	2	27'-0"	S

BENDING DETAILS

QUANTITIES

[illegible]	9.3 C.Y.
[illegible]	* 1788 LBS.
21" [illegible]	

*Includes Wt. of Anchor Bolts 102 Lbs.

NOTES:
FOR STANDARD NOTES SEE SHEET NO. 5
FOR STANDARD DETAILS SEE SHEET NO. 6
FOR DETAILS OF PRESTRESSED PILES SEE SHEET NO. 16.

SCHEME II

BRIDGE NO. 2 BENTS 12, 24, 36 & 48

REV.			
REV.	WFL	AGW	8-65
	For Scheme II		
REV.	WFL	HFH	2-65
	From 3.320.1		
REV.	H.F.H.	WFL	8-62
	From 27.282.1		
Reviewed	WFL		
	In Charge		
Quan.			
Tr.			
Dr.			
Des.			
	By	Chkd	Date

S.C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA, S.C.

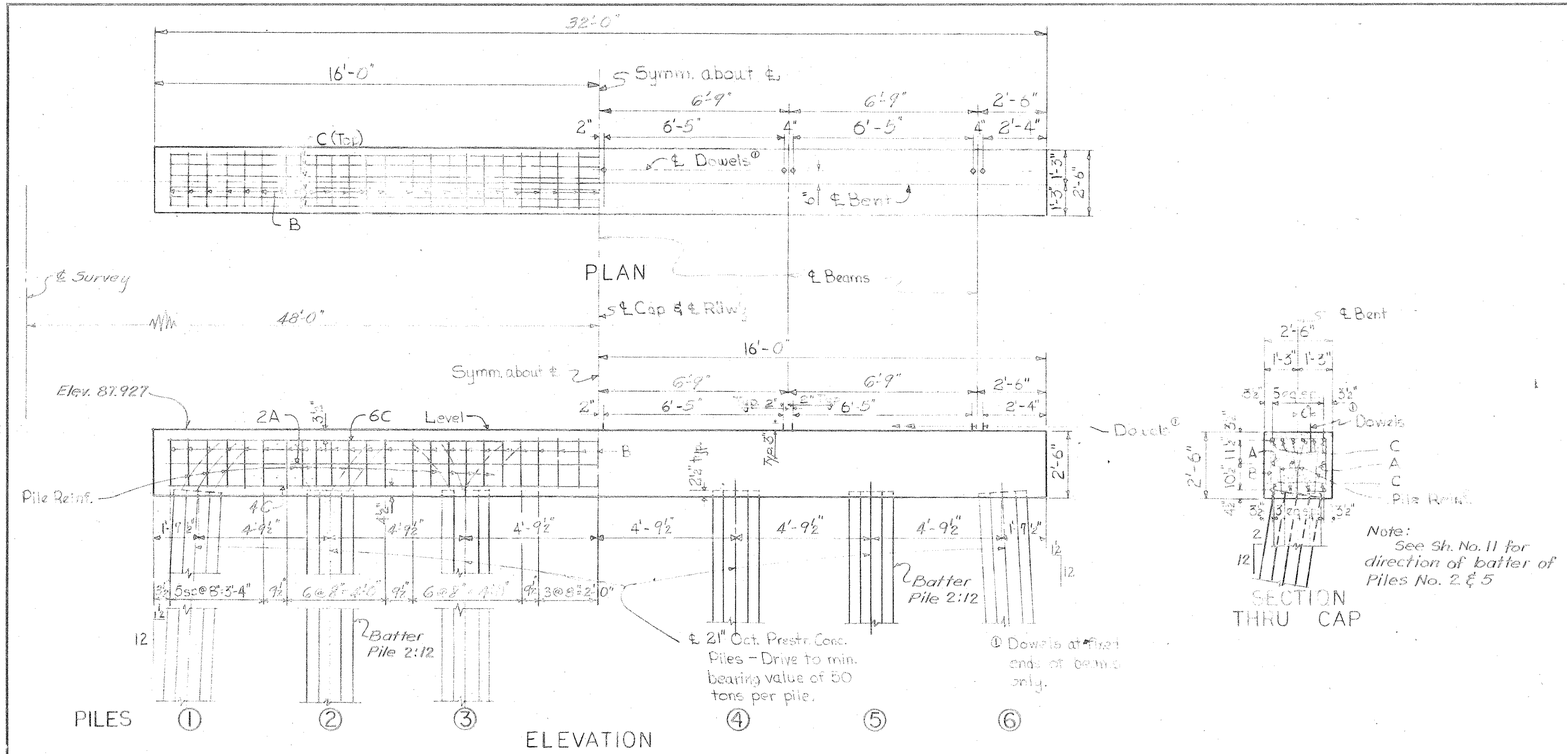
TOWER BENTS
FOR BRIDGE OVER
LAKE MARION

FILE NO.	COUNTY	ROUTE NO.	DATE
14.391	CLARENDON	I-95	3-65

Approved By W.E. Crum — Bridge Des. & Plans Engr.

Approved By [signature] — Br. Engineer

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON	14.391	I-95	15A	17



Note:
See Sh. No. 11 for direction of batter of Piles No. 2 & 5

REINFORCING STEEL

ONE INT. BENT				
MK.	SIZE	D	NO.	LENGTH
A	4	6	2	31'-6"
B	5	8	47	8'-7"
C	9	5	10	31'-6"
Dow.	6	5	10	1'-3"

BENDING DETAILS

QUANTITIES

ONE INTERIOR BENT		
Class 'A' Concrete	7.3	C.Y.
Reinforcing Steel	* 1553	Lbs.
21" Oct. Prestr. Conc. Piles	See Summary	L.F.

* Includes 19 lbs. for dowels.

Notes:
For Standard Notes See Sheet No. 5
For Standard Details, including Dowel Details, See Sheet No. 6
For Pile Details, See Sheet No. 16

SCHEME I

BRIDGE NO. 1
Scale: 3/8" = 1'-0"

REV.			
REV.			
REV.			
REV.	AGW	NFH	7-65
	From 37.468.1		
REVIEWED	WFL		
	IN CHARGE		
QUAN.	R.C.	ATD	5-64
TR.			
DR.	F.S.W.	CHE	5/64
DES.	J.M.C.	CHE	5/64
	BY	CHK'D	DATE

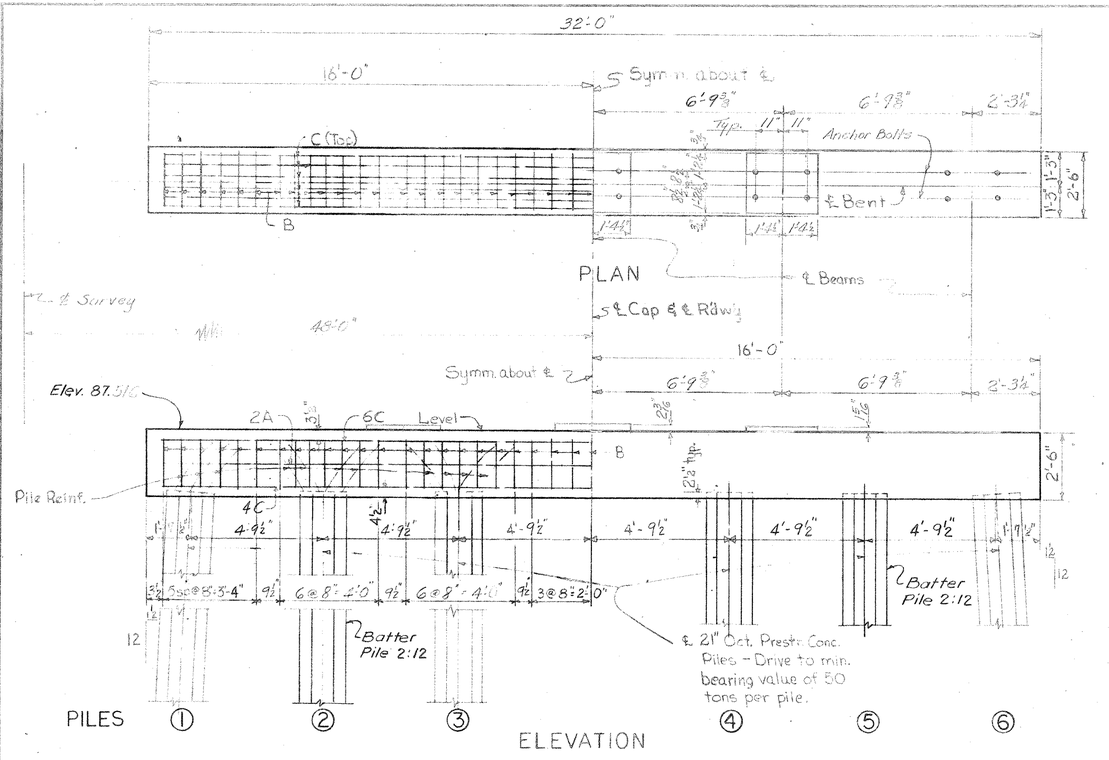
S. C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA S. C.

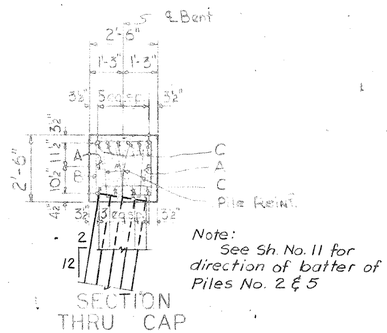
TOWER BENTS 5 & 6
FOR BRIDGE OVER
LAKE MARION

FILE NO.	COUNTY	ROUTE NO.	DATE
14.391	CLARENDON	I-95	7-65

APPROVED BY W. E. Cheeves — BRIDGE DESIGN & PLANS ENGINEER
APPROVED BY [signature] — BRIDGE ENGINEER

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON	14.391	I-95	15	17





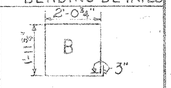
Note:
See Sh. No. 11 for direction of batter of Piles No. 2 & 5

REINFORCING STEEL

ONE INT. BENT

MK.	SIZE	D	NO.	LENGTH
A	4	5	2	31'-6"
B	5	3	47	8'-7"
C	9	5	10	31'-6"

BENDING DETAILS



QUANTITIES

ONE INTERIOR BENT

Class 'A' Concrete	7.4	C.Y.
Reinforcing Steel	* 1,536	Lbs.
21" Oct. Prestr. Conc. Piles	See Summary	L.F.

* Includes 102 lbs. for Anchor Bolts.

Notes:
For Standard Notes, See Sheet No. 5
For Standard Details, including Anchor Bolts Details, See Sheet No. 6
For Pile Details, See Sheet No. 16

SCHEME II
BRIDGE NO. 1
Scale: ⅜" = 1'-0"

REV.			
REV.			
REV.	WFL	AGW	9-65
	For Scheme II		
REV.	AGW	NFH	7-65
	From 31468.1		
REVIEWED	WFL		

	IN CHARGE		
QUAN.	JRC	ATD	5-64
TR.			
DR.	F.S.W.	CHE	5/64
DES.	JTG	CHE	5/64
	BY	CHK'D	DATE

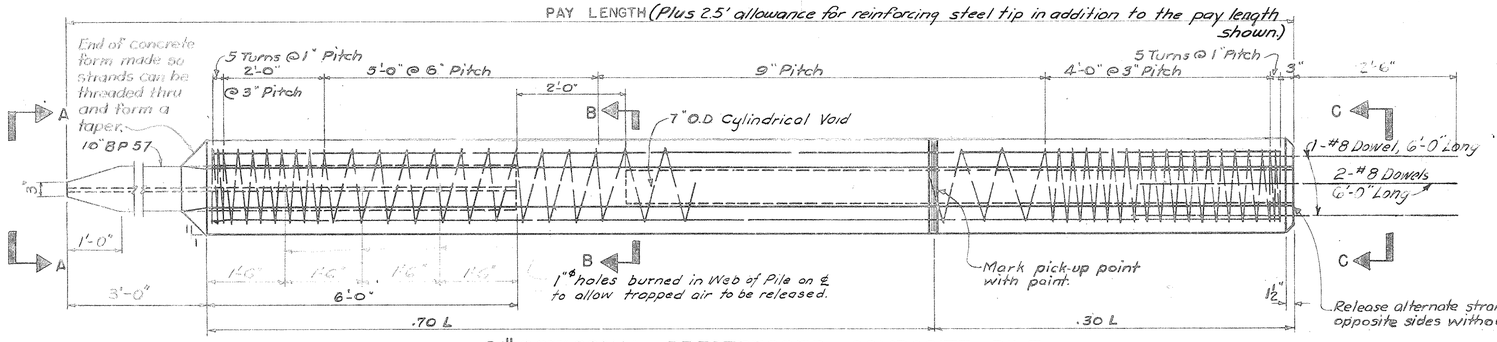
S. C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA S. C.

TOWER BENTS 5&6
FOR BRIDGE OVER
LAKE MARION

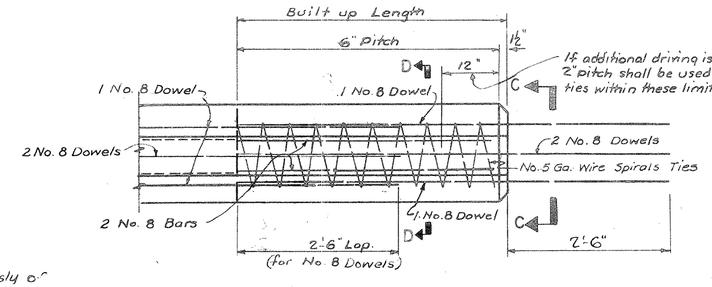
FILE NO.	COUNTY	ROUTE NO.	DATE
14.391	CLARENDON	I-95	7-65

APPROVED BY: W. E. Lyon — BRIDGE DESIGN & PLANS ENGINEER
APPROVED BY: [signature] — BRIDGE ENGINEER

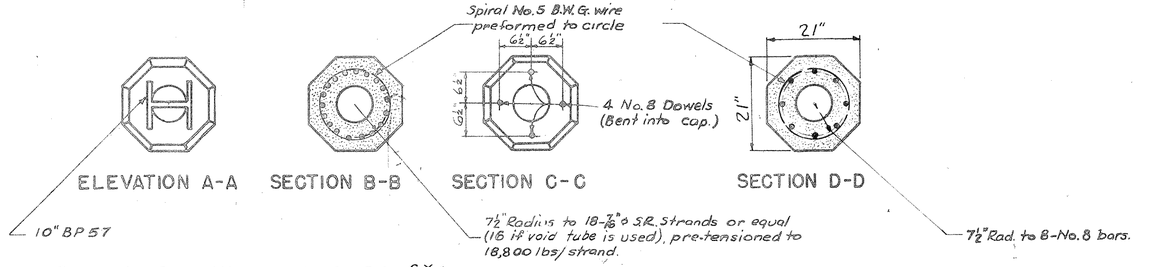
FED ROAD DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON	14.391	I-95	16	17



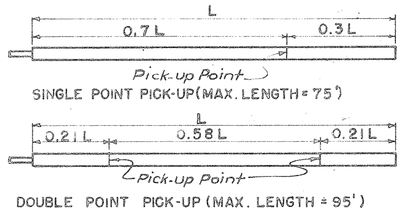
21" OCTAGONAL PRESTRESSED COMPOSITE PILE



BUILD - UP



Concrete Quantity per pile = 0.0940 C.Y./L.F.



Note:
Piles shall be marked at Pick-up Points to indicate proper points for attaching handling lines.

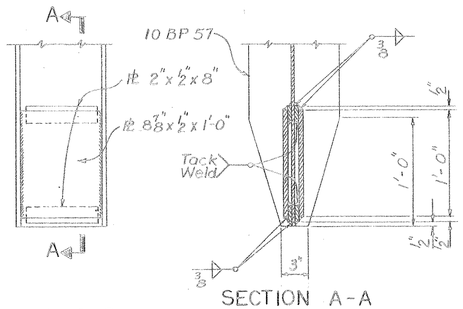
Note:
Void Tubes are optional with Contractor. In the event they are used approved means shall be adopted to positively hold them in exact position.

Notes:
Spiral ties shall be tied to all Cables and reinf. bars.

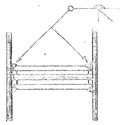
Waterproofing not required for prestressed piles.

All concrete shall be Class "X". See Standard Specifications.

Prestressed piles shall not be transported to the bridge site or driven until the concrete has cured for at least 6 days.



SECTION A-A



DETAILS OF STEEL PILE TIP REINFORCING
SCALE: 1½" = 1'-0"

Note:
Steel Pile tips shall be reinforced as shown. All costs of furnishing and welding the plates for one pile tip will be paid for as 2.5' of 21" R.C. Prestressed Pile at the unit price bid for that item. The right is reserved to omit steel pile tip reinforcing if deemed advisable by the Engineer.

f'_c = 5,000 psi.
f_{ci} = 4,000 psi.
t_u = -500 psi.
t_c = -50,000 psi.
t_{ci} = 115,000 psi.

SCALE: ¾" = 1'-0" OR AS NOTED

SCHEME I & II

REV			
REV	AGW	WFL	3-65
	Pile Tip Reinf.		
REV	JRC.	C.H.A.	5-60
	Remove Rail Point		
REV	N.E.H.	F.M.	4-68
	Add 3 No. 8 Dowels		
REVIEWED WITH IN CHARGE			
OJAN.			
TR.			
DR.	W.E.B.		
DES.			
	BY	CHK'D	DATE

S.C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA, S.C.

21" OCT. PRESTRESSED CONCRETE PILES

FILE NO.	COUNTY	ROUTE NO.	DATE
14.391	CLARENDON	I-95	3-65

APPROVED BY: D.E. Quinn — BRIDGE DESIGN & PLANS ENG.
APPROVED BY: L.D. Gooding — BRIDGE ENGINEER

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	CLARENDON	14.391	I-95	17	17

Design Data: LL H20-S16-44 using alternate loading of 2 axles 4' apart with each axle weighing 75% of loading, f_s = 20,000 psi, f'_c = 1200 psi, V_c = 90 psi, n = 10, U = 300 plf, n = 10
A.A.S.H.O. Specifications 1961 with rev. thru 1962

END ELEVATION

Note: Pavement Reinforcement not shown. See Sheet No. 6 for reinforcement details.

Place year of completion on inside face of rail on right at end of Bridge and on left at End of Bridge.

PLAN END SPAN

HALF PLAN-INT. SPAN

Drain spacing omit over end fills

SECTION D-D
(SHOWING RAIL, POST, POST BASE & SAFETY CURB STEEL)

See Sheet No. 6 for SECTION G-G

SECTION A-A

SECTION C-C

BEAM SECTION

SECTION B-B

SIDE ELEVATION

NOTE: DURING CONSTRUCTION THE REINFORCING STEEL TO BE REVISED BY EXTENDING THE CURB BARS TO SPLICE WITH BENT BARS ANCHORED IN THE SLAB. ALSO THE (F_1) BARS, NO. 3 BARS, TO BE INCREASED FROM NO. 3 TO NO. 4 BARS. QUANTITIES TO BE ADJUSTED ON THE FINAL ESTIMATE.

SECTION F-F

HALF BEAM DETAIL
(EXT. & INT. BEAM)

REINFORCING STEEL SCHEDULE

MARK	SIZE	TYP	40' END SPAN NO REQD	40' END SPAN LENGTH	40' INT SPAN NO REQD	40' INT SPAN LENGTH
A	5	S	106	33'-1"	106	32'-10"
B_1	5	S	82	39'-8"	82	39'-8"
C	5	S	82	0'-10"	82	0'-10"
E_1	10	S	10	30'-0"	1	30'-0"
E_5	10	S	5	18'-0"	5	18'-0"
F	5	S	5	37'-0"	15	37'-0"
G_1	10	S	10	36'-6"	10	36'-6"
G_2	10	S	5	32'-6"	5	32'-6"
H	4	B	275	7'-8"	275	7'-8"
H_1	3	B	60	2'-0"	60	2'-0"
H_2	7	B	64	4'-7"	64	4'-7"
H_4	7	B	34	3'-10"	32	3'-10"
J	6	B	24	19'-7"	24	19'-7"
K	3	B	130	3'-2"	132	3'-2"
K_1	3	B	10	4'-6"	2	5'-0"
K_2	3	B	70	3'-6"	60	3'-6"
L	6	B	20	7'-1"	20	7'-1"
M	8	S	2	27'-8"	2	27'-8"
N	4	B	24	5'-9"	24	5'-9"
P	4	S	2	26'-1"	2	26'-1"
Q	4	S	2	41'-10"	-	-
Q_1	4	S	4	4'-2"	-	-
Q_2	4	S	4	4'-9"	-	-
R_1	4	B	6	10'-4"	-	-
R_2	4	B	2	8'-3"	-	-
S_1	4	B	8	4'-5"	-	-
S_2	4	B	56	3'-9"	64	3'-9"
H_2	7	S	34	2'-7"	32	2'-7"
B_2	4	S	8	39'-8"	8	39'-8"
E_6	11	B	30	6'-6"	30	6'-6"
T	4	S	6	27'-8"	10	27'-8"
U	4	B	26	7'-9"	24	7'-9"
U_2	4	B	24	7'-11"	24	7'-11"
BP	1" HT	-	REQD 475'-0"		REQD 475'-0"	
BBU	1⅜" HT	-	REQD 475'-0"		REQD 475'-0"	

BENDING DETAILS

QUANTITIES

ITEM		140' END SPAN	140' INT SPAN
CONCRETE CLASS "A"	C.Y.	67.5	65.9
REINFORCING STEEL ①	LBS.	22,514	22,835
		22,681	22,558

① Includes 322 Lbs. For Bolsters.

SCHEME I

NOTES
For Standard Notes see Sheet No. 5.
For Standard Details, including bolster details, hook details, drain details, beam seat details, and expansion joint details, see Sheet No. 6.
Diaphragms and Wings shall be cast monolithic with slab and beams.
No sidewalk concrete shall be cast until beam falsework has been struck.

REV.				
REV.				
REV.	WEL	AGW	2-65	from 37,468.1
REV.	CHE	JRC	5-64	from 24,254.1
REVIEWED	WEL			

	IN CHARGE		
QUAN.	ATD	MEJ	5-64
TR.			
DR.	CHE	JRC	2-64
DES.	CHE	JRC	12-63
	BY	CHK'D	DATE

S.C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA S.C.

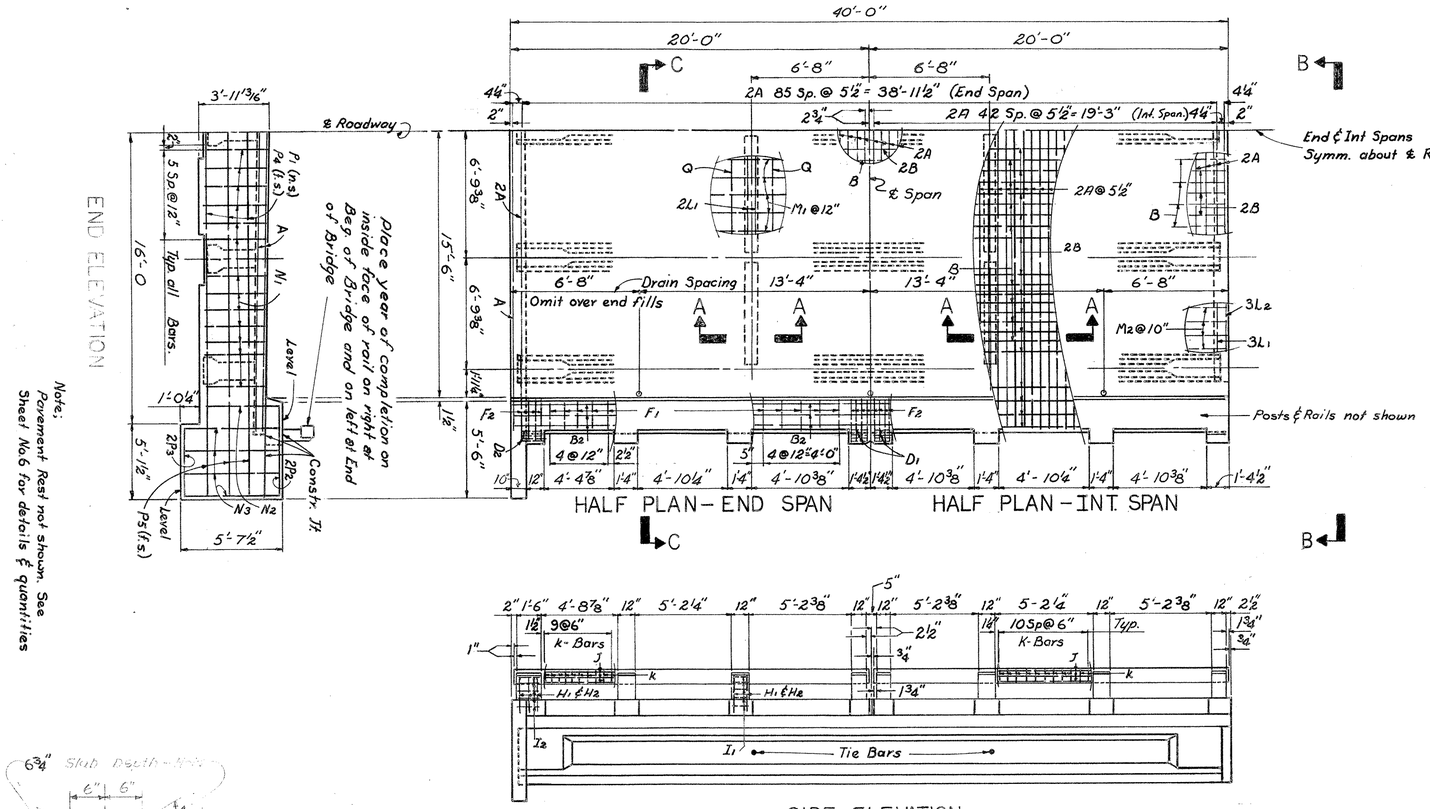
40 FT. END & INT. SPAN FOR BRIDGE OVER LAKE MARION

FILE NO.	COUNTY	ROUTE NO.	DATE
14.391	CLARENDON	I-95	2-65

APPROVED BY: BRIDGE DESIGN & PLANS ENGINEER

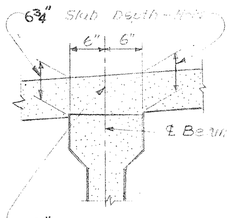
APPROVED BY: BRIDGE ENGINEER

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON	14.391	I-95	17a	17



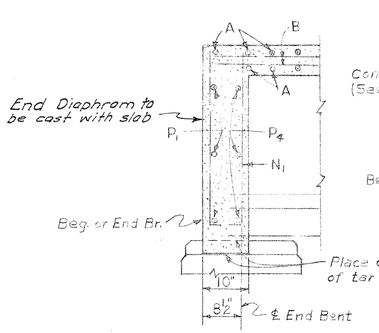
Note:
Pavement Rest not shown. See Sheet No. 6 for details & quantities

LL-H20-S16
fs = 20,000 p.s.i.
fc = 1,200 p.s.i.
n = 10
v = 225 p.s.i.
u = 300 p.s.i.

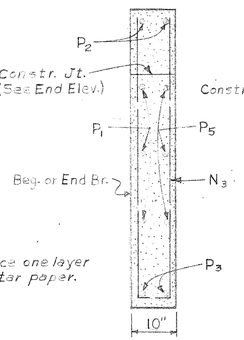


6¾" at ℄ of bearing for all beams. Vary in span to compensate for variation in camber if necessary.

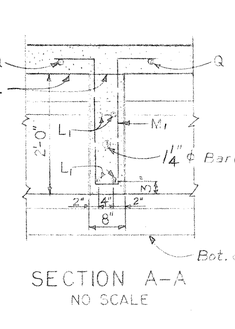
DETAIL "B"
SCALE: 1" = 1'-0"



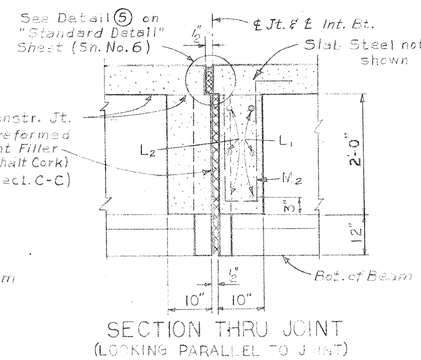
SECTION THRU END DIAPHRAGM
SCALE: ¾" = 1'-0"



SECTION THRU WING
SCALE: ¾" = 1'-0"



SECTION A-A
NO SCALE

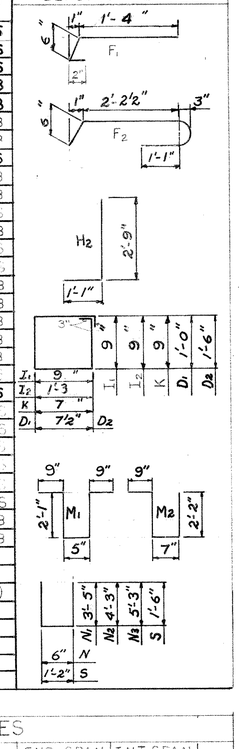


SECTION THRU JOINT
(LOOKING PARALLEL TO JOINT)

REINFORCING STEEL SCHEDULE

MARK	SIZE	END SPAN NO. REQ'D	END SPAN LENGTH	INT. SPAN NO. REQ'D	INT. SPAN LENGTH	D
A	5	175	34'-10"	176	34'-10"	S
B1	5	72	39'-8"	72	39'-8"	S
C	5	80	0'-10"	80	0'-10"	S
D1	4	56	3'-9"	64	3'-9"	B
D2	4	8	4'-9"	—	—	B
F1	3	60	2'-0"	60	2'-0"	B
F2	7	64	4'-7"	64	4'-7"	B
H1	7	34	2'-7"	32	2'-7"	S
I1	3	70	3'-6"	80	3'-6"	B
I2	3	10	4'-6"	—	—	B
J	6	24	19'-7"	24	19'-7"	S
K	3	130	3'-2"	132	3'-2"	B
L1	4	44	5'-5"	56	5'-5"	S
L2	4	3	27'-9"	6	27'-9"	S
M1	4	48	6'-1"	48	6'-1"	B
M2	4	28	5'-8"	56	5'-8"	B
N1	4	26	7'-4"	—	—	B
N2	4	2	9'-0"	—	—	B
N3	4	8	11'-0"	—	—	B
Q	4	4	25'-6"	4	25'-6"	S
B2	4	8	39'-8"	8	39'-8"	S
P1	4	3	41'-10"	—	—	S
P2	4	4	5'-2"	—	—	S
P3	4	4	4'-10"	—	—	S
P4	4	12	5'-2"	—	—	S
P5	4	6	6'-7"	—	—	S
R	3	15	2'-7"	30	2'-7"	S
S	3	5	4'-2"	10	4'-2"	B
H2	7	34	3'-10"	32	3'-10"	B
1¼" Tie Bar Assy (2-ea. span @ 28'-1")						
BB	1"	Reqd.	520'	Reqd.	520'	
BBU	1¼"	Reqd.	490'	Reqd.	490'	

BENDING DETAILS



QUANTITIES

	END SPAN		INT. SPAN		
Concrete, Class "A"	46.6		43.6		C.Y.
Reinforcing Steel ②	① 13,406		① 13,261		Lbs.
40' Prestressed Concrete Beams ③	5		5		Ea.

① Includes 338 Lbs. for Bolsters and 241 Lbs. for 1¼" Tie Bar Assemblies.
② Does not include reinforcing steel in prestressed beams.
③ The price bid for prestressed concrete beams shall include S.R. cables, reinforcing steel, lifting devices and all other material complete in place. The price shall also include the sole plate assemblies and bearing assemblies (including shims and boosters, but not including anchor bolts).

NOTES:
No Construction Joints other than those shown shall be permitted. Diaphragms between beams shall be cast at least 7 days before slab*. Wings to end construction joint shall be cast monolithic with end diaphragms.

Partial payment for prestressed concrete beams:
When prestressed concrete beams are delivered to the bridge site, the Engineer will enter 80% of the Contract Unit Price on the current estimate and, after erection 100% of the Contract Unit Price. Such percentages shall be subject to the usual retainage.

Allow a 5 day waiting period after pouring slab before pouring sidewalk.

*The Diaphragms may be poured monolithic with the slab provided the prestressed beams are temporarily strutted at top at bottom flange and top flange and Forms are reasonably tight during the Slab and Diaphragm pouring.

For Standard Notes See Sheet No. 5

This Sheet To Accompany Sheet No. 17b

SCHEME II

REV.			
REV.			
REV.			
REV.	D.W.M.	A.G.W.	8-65
	From 2342.291		

REVIEWED _____ IN CHARGE _____

QUAN.	K.H.M.	B.M.M.	9-62
TR.	—	—	—
DR.	K.H.M.	R.A.B.	9-62
DES.	(Slab)	J.F.D.	Sept 62
	BY	CHK'D	DATE

S. C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA S. C.

40' END & INT. SPAN
SUPERSTRUCTURE
FOR BRIDGE OVER
LAKE MARION

FILE NO.	COUNTY	ROUTE NO.	DATE
14.391	CLARENDON	I-95	8-65

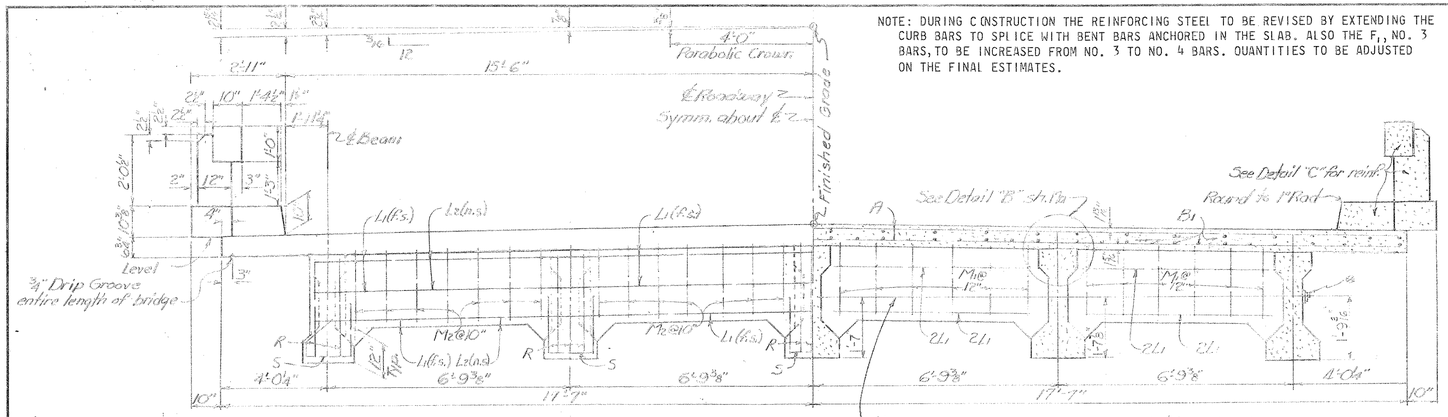
APPROVED BY _____ BRIDGE DESIGN & PLANS ENGINEER

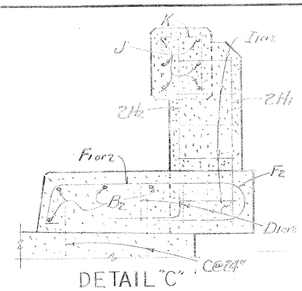
APPROVED BY _____ BRIDGE ENGINEER

K&E ALBANENE 1961 TRACING PAPER 46613

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CLARENDON	14.391	I-95	17b	17

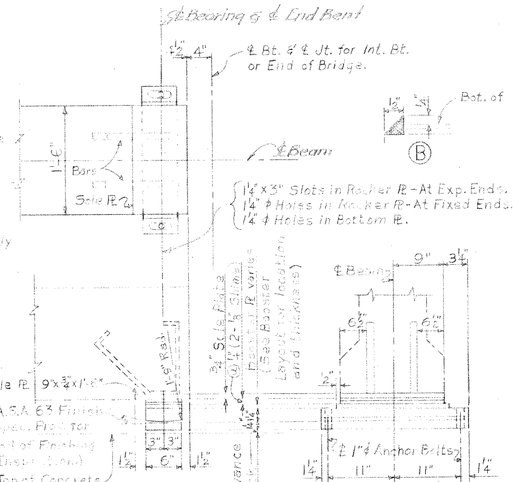
NOTE: DURING CONSTRUCTION THE REINFORCING STEEL TO BE REVISED BY EXTENDING THE CURB BARS TO SPLICE WITH BENT BARS ANCHORED IN THE SLAB. ALSO THE F, NO. 3 BARS, TO BE INCREASED FROM NO. 3 TO NO. 4 BARS. QUANTITIES TO BE ADJUSTED ON THE FINAL ESTIMATES.





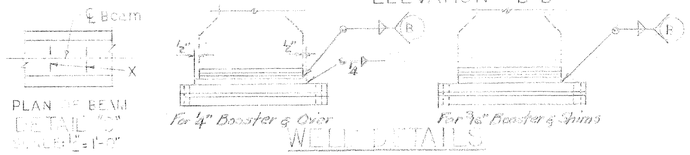
DETAIL "C"

* For details of electrically welded stud alternate see Sh. No. 6



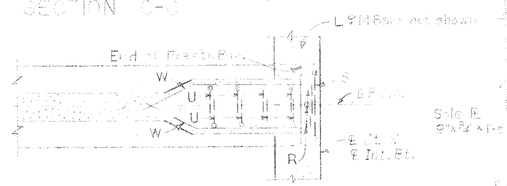
BEARING DETAILS
SCALE: 1" = 1'-0"

① Adjust to bring top of bms. to theoretical grade.



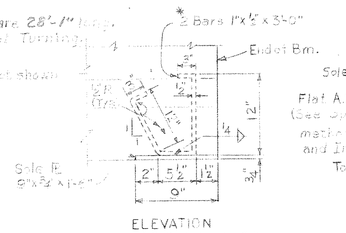
ELEVATION B-B

40' SPAN
SCALE: ½" = 1'-0"

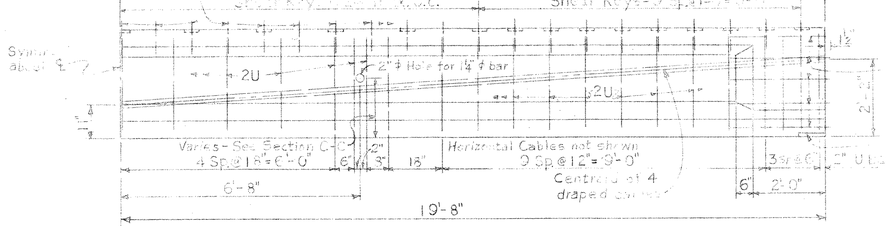


SECTION C-C

SECTION THRU HAUNCH & END DIA.
SCALE: ¾" = 1'-0"



ELEVATION
DETAIL OF SOLE PLATE
NO SCALE



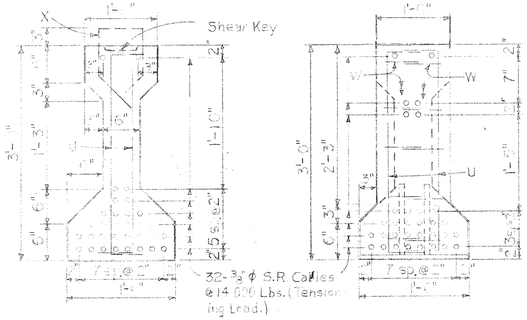
HALF ELEVATION 40' SPAN
SCALE: ½" = 1'-0"

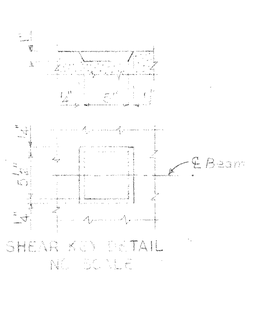
BEAM DEFLECTION AND CAMBER	
Est. deflection at top surface of Bm. when casting bms released	½" Up.
Est. defl. of top surface of Bm. due to Wt. of Slab & Bkgh. when placed	½" Dn.

Note:
Note that the holes for Diaphragm Rods must be located as shown on plans. These holes should be formed with a 2" inside diameter pipe. It may be necessary to expand the concrete slightly in order to loosen the pipe in certain positions. Pipe to be taken out gently to avoid breaking the strands.

Note:
The top surface of beam is to be finished off level.

The entire slab is to be retained by longitudinal pedestal slab below top of beam if necessary.

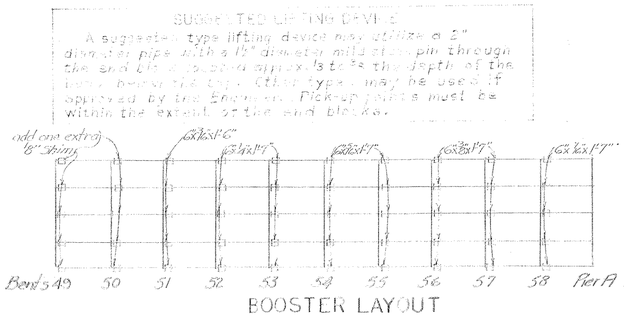




Notes Cont'd:
...ping, which must be Horizontal must be Tensioned to 14^K each, with a tolerance of ±2%.
The pl... ...ing ... ...s to be cut to extend 1½" ... ...ft ... ...ge Beam.
Regar... ...ropped Cables shown above are for single isolated ... ...ps, for pre-set length setups adjustments may be ... ...for the additional cable length.
The Pr... ...ad ... ...be rounded to the Nearest ¼ Kip.
... ½". If a plate is used it shall have a min. thickness of ¾". The ... ...surface in all ... ...ches after draping shall be 14^K.
Ⓢ Paint The Bar End, Nut and Washer before assembly with two coats of Red Lead Affet nut is set on, all exposed portions of Bar, Nut and Washer shall be painted with two coats of Asphalt Paint. The Bars shall be tightened ... ...before ... ...ete. Nuts shall be reasonably tight and not ... ...than 48 hours after pouring ... ...

SUGGESTED LIFTING DEVICE

A suggested type lifting device may utilize a 2" dia. steel pipe with a 1½" diameter mild steel pin through the end like a double shear approx. 1'3" to 1'6" the depth of the beam above the top. Other types may be used if approved by the Engineer. Pick-up points must be within the extent of the end blocks.



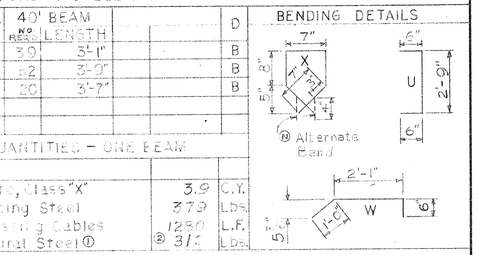
BOOSTER LAYOUT

SCHEME II

REINFORCING STEEL SCHEDULE FOR PRESTRESSED BEAMS

MARK	SIZE NO.	40' BEAM NO.	LENGTH		D
X	5	20	3'-1"		B
U	4	12	3'-0"		B
W	4	20	3'-7"		B

BENDING DETAILS



QUANTITIES - ONE BEAM		
Concrete, Class "X"	3.9	C.Y.
Reinforcing Steel	379	Lbs.
Prestressing Cables	1280	L.F.
Structural Steel ①	② 31	Lbs.

① Diagonal legs of X bar may be bent parallel as shown to clear prestressed cables if desired by the Contractor.
① Includes Sole Plate Assemblies and Bearing Assemblies.
② Includes 2 Lb for Boosters (Approx. Ave. Wt. Per Bm.)

Notes:
Concrete in Prestressed Beams shall be Class "X" as described in the Special Provisions.
The Prestressed Beams must always be maintained in an upright position. When being stored, care must be taken to eliminate intermediate supports which would cause Negative Moments.
Note that a Total Force of 14^K is required in each cable at the ends of castings. Therefore if the Draped Cables are ... to secure the Draped position by first anchoring the ends at their final location and then depressing the ... to its final location, the Tensioning Load required ... the casting in the initial (Horizontal) position will be 9,471 lbs. Lbs. The Vertical Load then required to depress each cable to its final location will be 1,810 Lbs. All cables (cont'd above).

This Sheet To Accompany Sh. No. 17a

REV.				
REV.				
REV.				
REV.	W.F.L.	V.G.W.	8-62	
	Form 2548-391			
REVIEWED		with		
	IN CHARGE			
QUAN.	K.J.M.	E.H.M.	10-62	
TR.	—	—	—	
DR.	K.H.M.	R.A.P.	10-62	
DES.	COM	R.A.B.	9-62	
	BY	CH'K'D	DATE	

S. C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA S. C.

40' SPAN SUPERSTRUCTURE FOR BRIDGE OVER LAKE MARION

FILE NO.	COUNTY	ROUTE NO.	DATE
14.391	CLARENDON	I-95	5-63

APPROVED BY: W. E. Lewis — BRIDGE DESIGN & PLANS ENGINEER
APPROVED BY: W. J. Harding — BRIDGE ENGINEER

L.L. H20-S16
f'c = 5,000 p.s.i.
f'ci = 4,000 p.s.i.
fc = 2,000 p.s.i.
fs = 20,000 p.s.i.
fsi = 17,500 p.s.i.

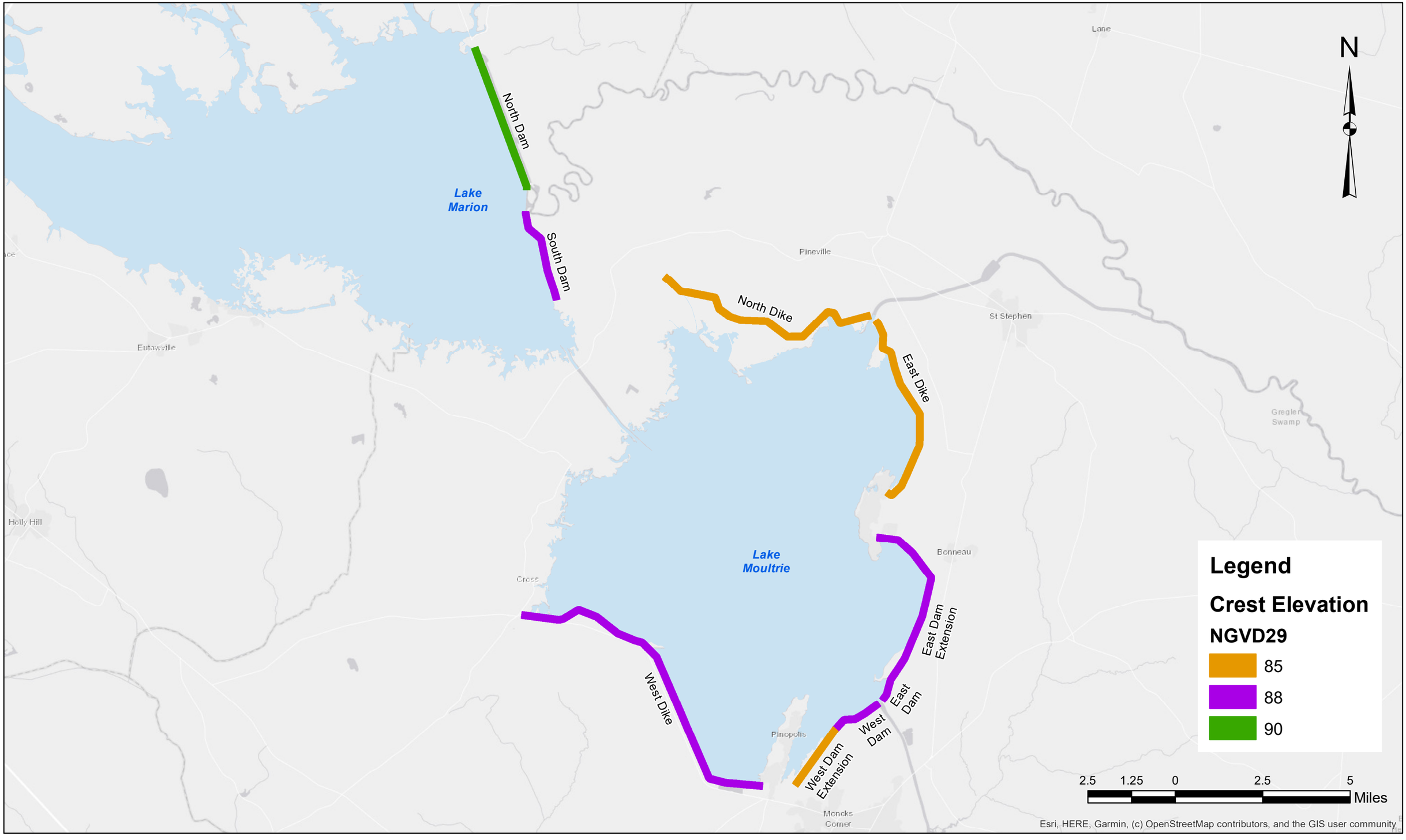
For Prestressed Bms.

K-E ALBUQUERQUE 10X6 TRACING PAPER

Santee Cooper Provided Information

TRANSYSTEMS

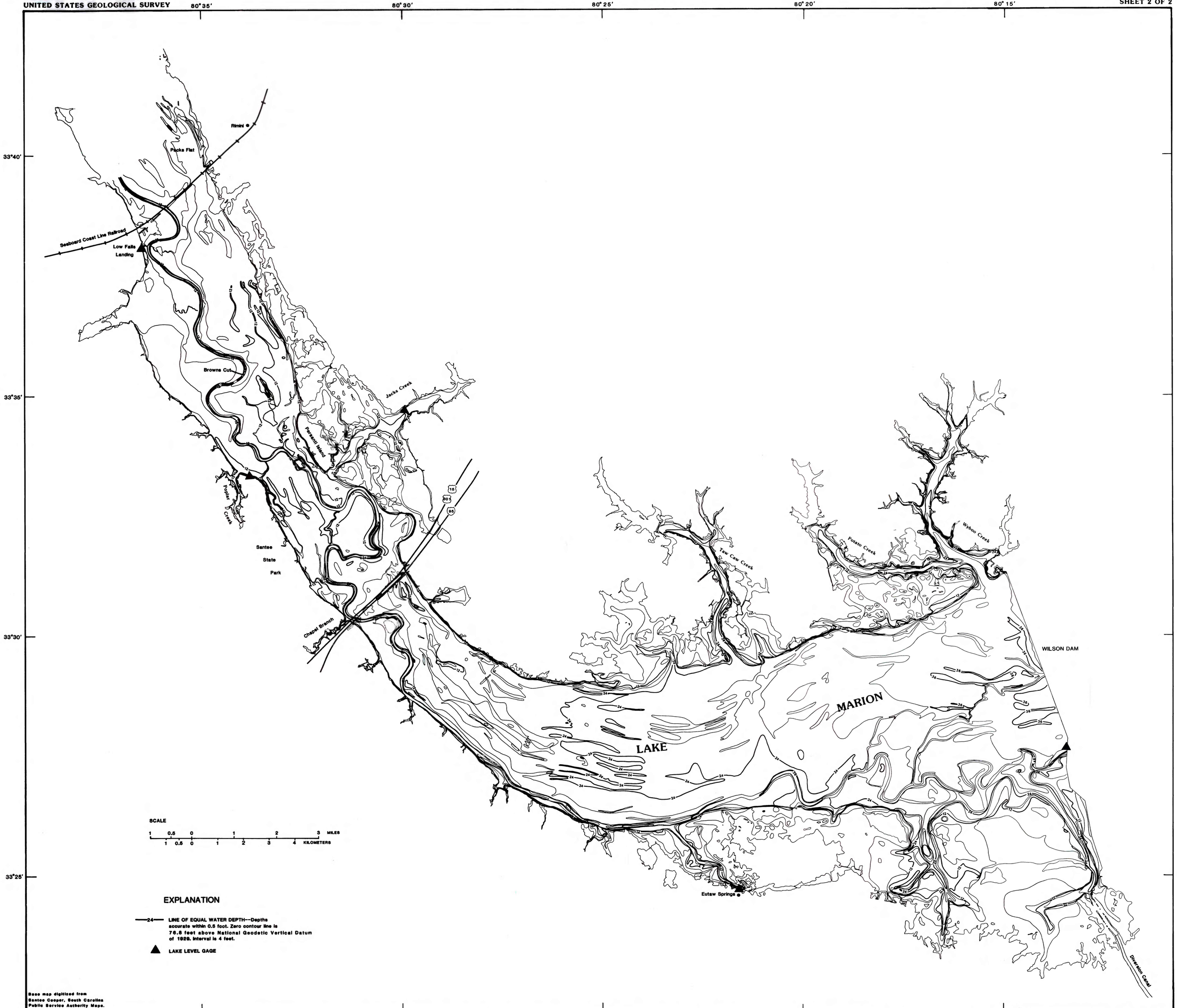
Project 199 Crest Elevations



DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

Prepared in cooperation with the
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WATER RESOURCES INVESTIGATIONS REPORT 88-4062
SHEET 2 OF 2



BATHYMETRY OF LAKES MARION AND MOULTRIE, SOUTH CAROLINA, 1984-85

BY G. G. PATTERSON AND S. W. LOGAN

Base map digitized from Santee Cooper, South Carolina Public Service Authority Maps. Scale 1" 400', March 1977

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Columbia, South Carolina 29201

Black and white copies of the report can be purchased from:
Book and Open File Reports Section U.S. Geological Survey
Federal Center Box 25425 Denver, Colorado 80225
Telephone 303/236-7476

Orangeburg County Land Use Maps

TRANSYSTEMS

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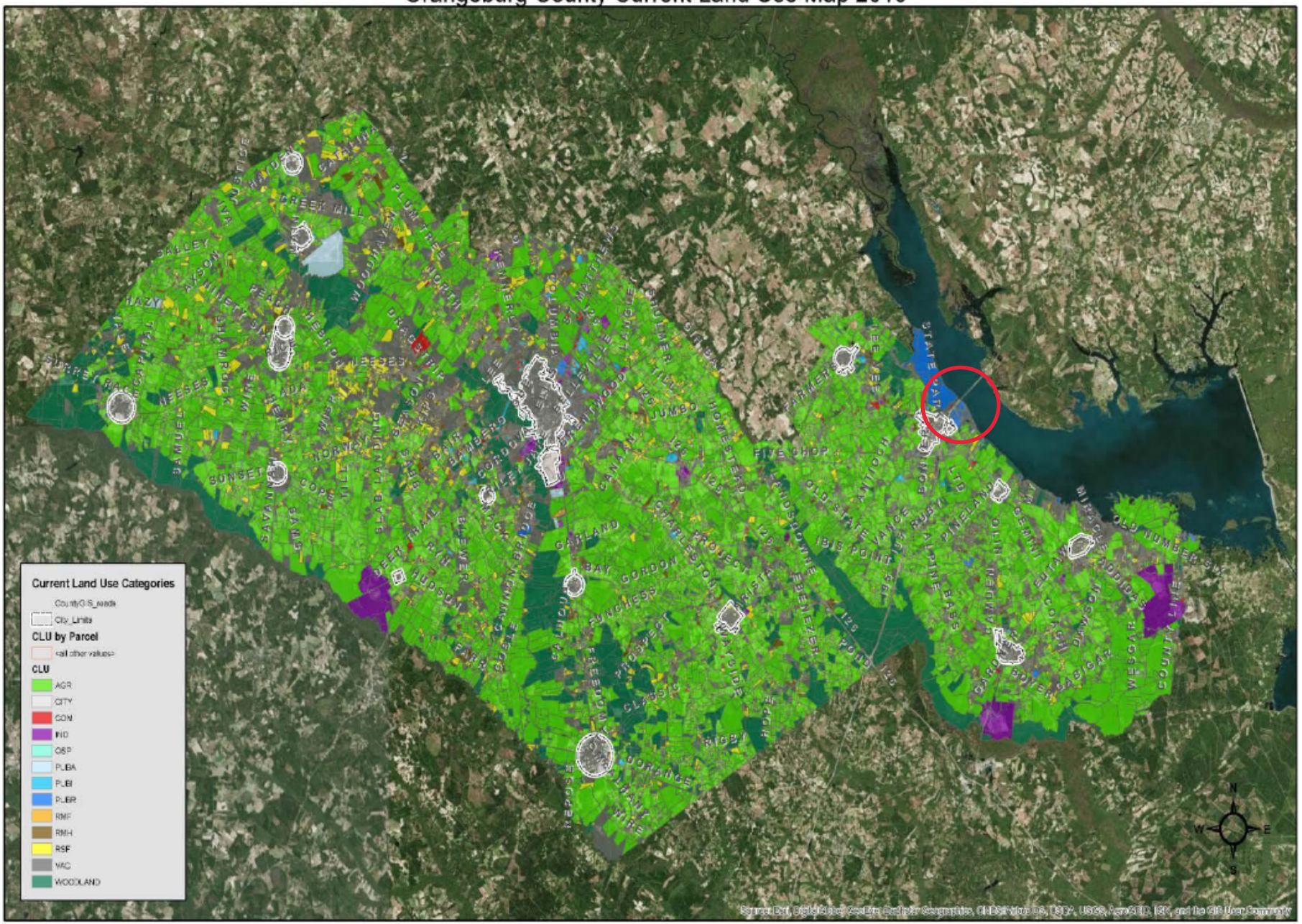
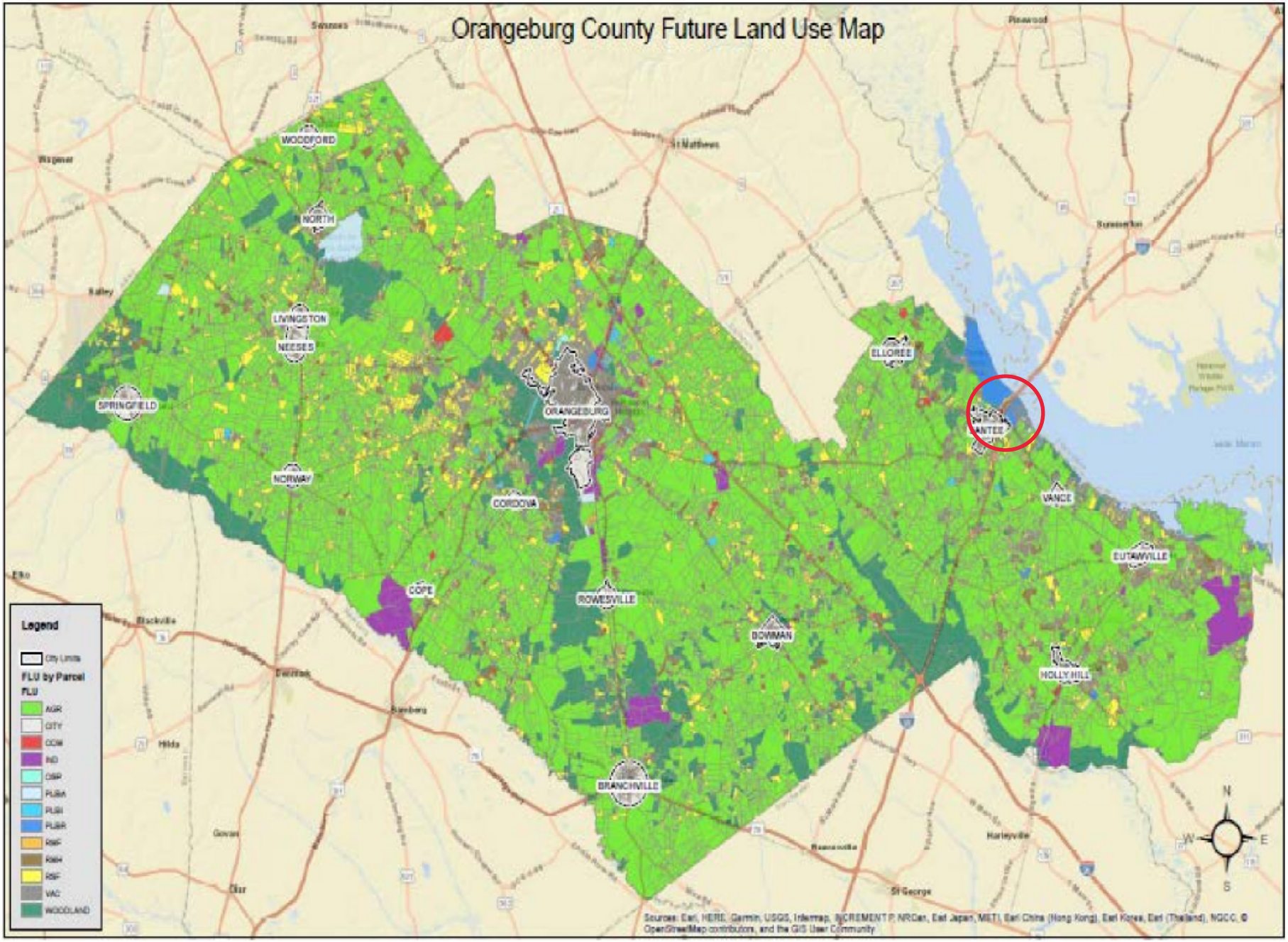
Orangeburg County Current Land Use Map 2016




Orangeburg County Future Land Use Map
WOODFORD
NORTH
LIVINGSTON
NEESES
SPRINGFIELD
ORANGEBURG
NORWAY
CORDOVA
ELLOREE
VANCE
EUTAWVILLE
COPE
ROWESVILLE
BOWMAN
HOLLY HILL
BRANCHVILLE
Legend
City Limits
FLU by Parcel
FLU
AGR
CITY
COM
IND
OSP
PUBA
PUBI
PUBR
RMF
RMH
RSF
VAC
WOODLAND
N
S
E
W

Appendix III:
Scour Documentation

TRANSYSTEMS

Two-Dimensional Hydraulic Modeling Report

USGS Bridge-Scour Envelope Curve Approach

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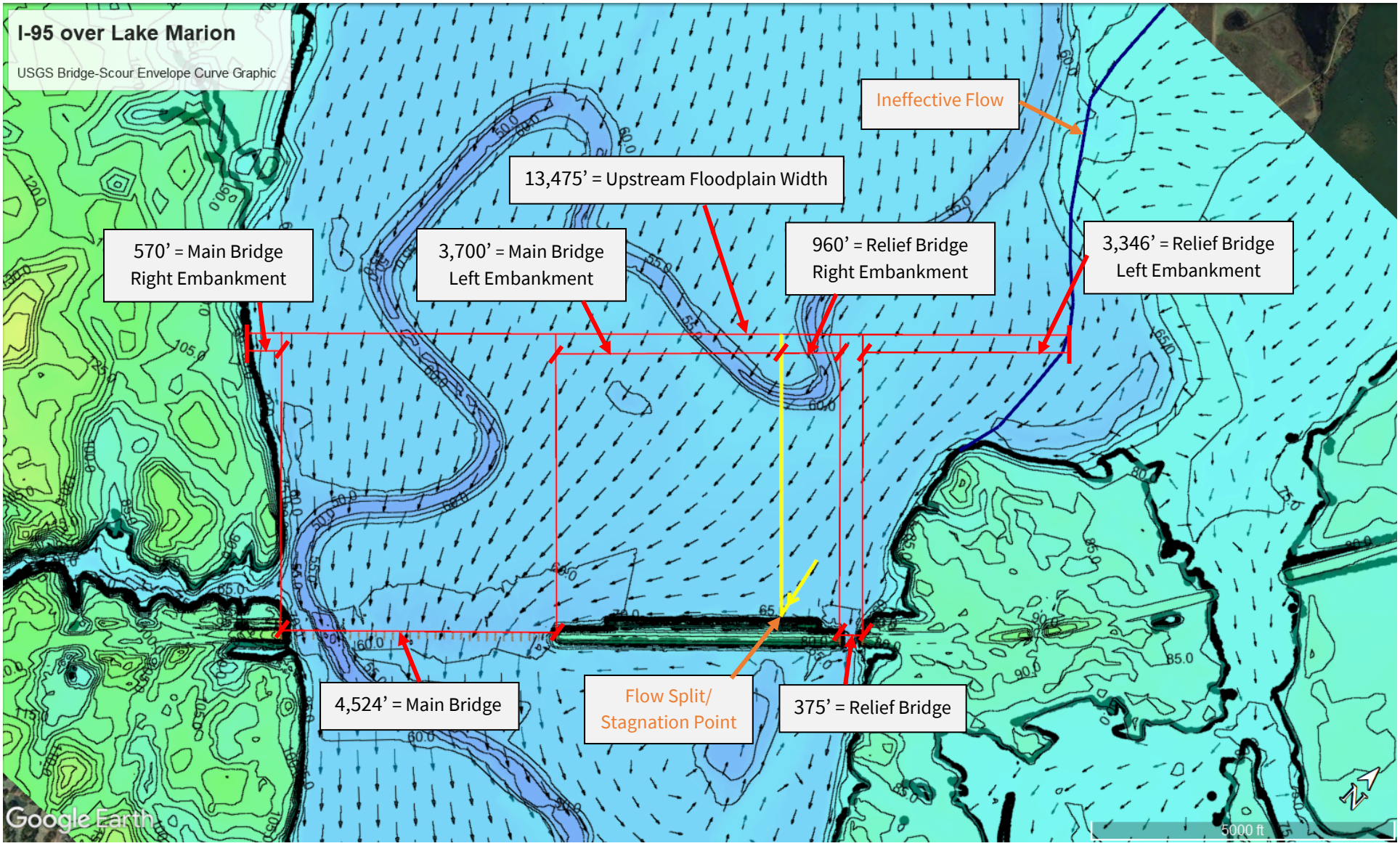
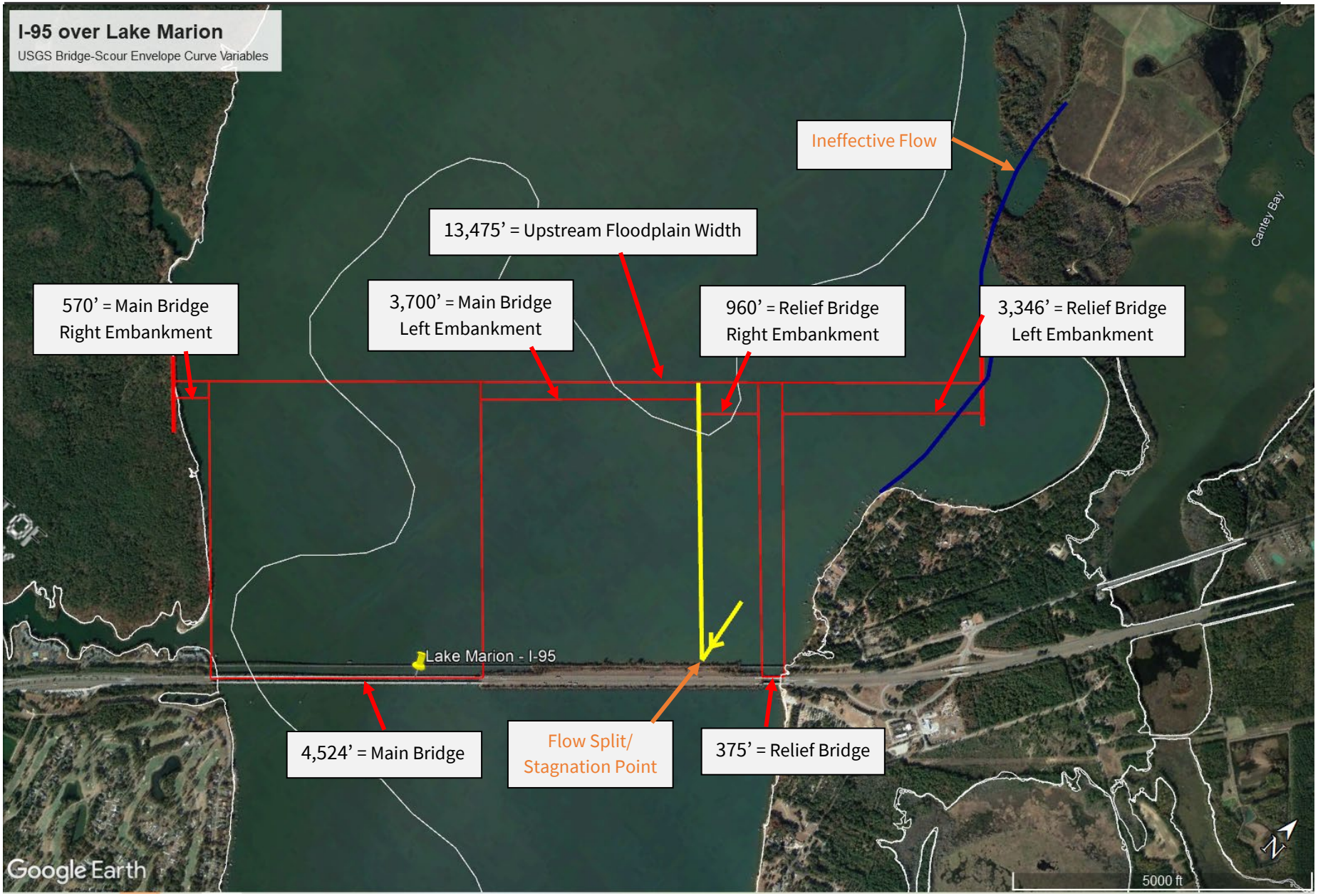


Lake Marion Proposed Conditions – USGS Bridge-Scour Envelope Curves Method

Average m value = [1-(Summation of Bridges/Total Floodplain Width)] = [1- (4,899'/13,475')] = **0.64**

TRANSYSTEMS



Lake Marion Proposed Conditions – USGS Bridge-Scour Envelope Curves Method – FEMA Delineation Identical

Average m value = [1-(Summation of Bridges/Total Floodplain Width)] = [1- (4,899'/13,475')] = **0.64**

Main Bridge Envelope Curve 100-year Scour:

(Abutment scour hole top width of 70FT begins at toe of abutment - only expected to affect 1 bent on each side)

Scour region	Pier location	Use clear-water abutment scour?	Clear-water abutment scour from USGS curves (feet)	Use clear-water overbank contraction scour?	Clear-water overbank contraction scour from USGS curves (feet)	Use live-bed channel contraction scour?	Live-bed channel contraction scour from USGS curves (feet)	Use pier scour?	Pier scour (feet)	Total scour at bent (feet)	Computed embedment of pile from consultant (feet)	Remaining pile penetration (feet)	Embedment below thalweg from consultant (feet)	Remaining pile penetration (at thalweg) (feet)
Left Abutment	LABUT	Yes	18.69	No	0.00	No	0.00	No	0.00	18.69		-18.69		-18.69
Left Overbank	LOB	No	0.00	Yes	4.53	No	0.00	Yes	9.74	14.27		-14.27		-14.27
Channel	CH	No	0.00	No	0.00	No	0.00	No	0.00	N/A		N/A		N/A
Right Overbank	ROB	No	0.00	Yes	4.53	No	0.00	Yes	9.74	14.27		-14.27		-14.27
Right Abutment	RABUT	Yes	14.59	No	0.00	No	0.00	No	0.00	14.59		-14.59		-14.59

Main Bridge Envelope Curve 500-year Scour:

Abutment scour hole top width of 70FT begins at toe of abutment - only expected to affect 1 bent on each side)

Scour region	Pier location	Use clear-water abutment scour?	Clear-water abutment scour from USGS curves (feet)	Use clear-water overbank contraction scour?	Clear-water overbank contraction scour from USGS curves (feet)	Use live-bed channel contraction scour?	Live-bed channel contraction scour from USGS curves (feet)	Use pier scour?	Pier scour (feet)	Total scour at bent (feet)	Computed embedment of pile from consultant (feet)	Remaining pile penetration (feet)	Embedment below thalweg from consultant (feet)	Remaining pile penetration (at thalweg) (feet)
Left Abutment	LABUT	Yes	22.60	No	0.00	No	0.00	No	0.00	22.60		-22.60		-22.60
Left Overbank	LOB	No	0.00	Yes	6.60	No	0.00	Yes	10.60	17.20		-17.20		-17.20
Channel	CH	No	0.00	No	0.00	No	0.00	No	0.00	N/A		N/A		N/A
Right Overbank	ROB	No	0.00	Yes	6.60	No	0.00	Yes	10.60	17.20		-17.20		-17.20
Right Abutment	RABUT	Yes	17.70	No	0.00	No	0.00	No	0.00	17.70		-17.70		-17.70

Relief Bridge Envelope Curve 100-year Scour:

(Abutment scour hole top width of 70FT begins at toe of abutment - only expected to affect 1 bent on each side)

Scour region	Pier location	Use clear-water abutment scour?	Clear-water abutment scour from USGS curves (feet)	Use clear-water overbank contraction scour?	Clear-water overbank contraction scour from USGS curves (feet)	Use live-bed channel contraction scour?	Live-bed channel contraction scour from USGS curves (feet)	Use pier scour?	Pier scour (feet)	Total scour at bent (feet)	Computed embedment of pile from consultant (feet)	Remaining pile penetration (feet)	Embedment below thalweg from consultant (feet)	Remaining pile penetration (at thalweg) (feet)
Left Abutment	LABUT	Yes	18.23	No	0.00	No	0.00	No	0.00	18.23		-18.23		-18.23
Left Overbank	LOB	No	0.00	Yes	4.53	No	0.00	Yes	9.74	14.27		-14.27		-14.27
Channel	CH	No	0.00	No	0.00	No	0.00	No	0.00	N/A		N/A		N/A
Right Overbank	ROB	No	0.00	Yes	4.53	No	0.00	Yes	9.74	14.27		-14.27		-14.27
Right Abutment	RABUT	Yes	15.10	No	0.00	No	0.00	No	0.00	15.10		-15.10		-15.10

Relief Bridge Envelope Curve 500-year Scour:

Abutment scour hole top width of 70FT begins at toe of abutment - only expected to affect 1 bent on each side)

Scour region	Pier location	Use clear-water abutment scour?	Clear-water abutment scour from USGS curves (feet)	Use clear-water overbank contraction scour?	Clear-water overbank contraction scour from USGS curves (feet)	Use live-bed channel contraction scour?	Live-bed channel contraction scour from USGS curves (feet)	Use pier scour?	Pier scour (feet)	Total scour at bent (feet)	Computed embedment of pile from consultant (feet)	Remaining pile penetration (feet)	Embedment below thalweg from consultant (feet)	Remaining pile penetration (at thalweg) (feet)
Left Abutment	LABUT	Yes	22.10	No	0.00	No	0.00	No	0.00	22.10		-22.10		-22.10
Left Overbank	LOB	No	0.00	Yes	6.60	No	0.00	Yes	10.60	17.20		-17.20		-17.20
Channel	CH	No	0.00	No	0.00	No	0.00	No	0.00	N/A		N/A		N/A
Right Overbank	ROB	No	0.00	Yes	6.60	No	0.00	Yes	10.60	17.20		-17.20		-17.20
Right Abutment	RABUT	Yes	18.30	No	0.00	No	0.00	No	0.00	18.30		-18.30		-18.30

The South Carolina
Bridge-Scour Envelope Curve Template
2016

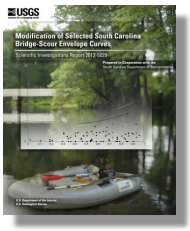
The South Carolina Bridge-Scour Envelope Curve Template was designed to provide a consistent procedure to apply the South Carolina bridge-scour envelope curves. The template was tested with a limited number of bridges and corrections were made as necessary.

The development of the South Carolina bridge-scour envelope curves is documented in a series of five reports published over a period from 2003 to 2014 (reports listed below with website links). Benedict and others (2016; website link below) provides a summary of those five previous reports and the 2016 report should be used as the primary source for guidance in applying the envelope curves and understanding their limitations. However, the earlier five reports provide important background information, and users of this template should be familiar with their content. The South Carolina bridge-scour envelope curves are useful supplementary tools for assessing scour potential at bridges in South Carolina. However, there are limitations associated with these empirical methods that must be considered in their application. The reports listed below (with website links) describe these limitations, and users of this template should be familiar with their content.

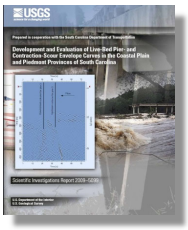
Although much effort was expended in the development and review of this template, no warranty, expressed or implied, is made by the U.S. Geological Survey as to the accuracy and functioning of the template and related template materials.

Benedict, S.T., Feaster, T.D., and Caldwell, A.W., 2016, The South Carolina bridge-scour envelope curves: U.S. Geological Survey Scientific Investigations Report 2016-5121, 96 p.
https://pubs.er.usgs.gov/publication/sir20165121

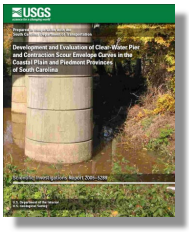
Benedict, S.T., and Caldwell, A.W., 2014, A pier-scour database 2,427 field and laboratory measurements of pier scour: U.S. Geological Survey Data Series 845, 22 p.
http://pubs.usgs.gov/ds/0845/



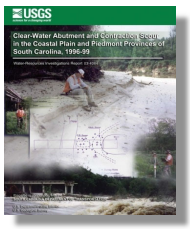
Benedict, S.T., and Caldwell, A.W., 2012, Modification of selected South Carolina bridge-scour envelope curves:U.S. Geological Survey Scientific Investigations Report 2012-5029, 37 p.
http://pubs.usgs.gov/sir/2012/5029/



Benedict, S.T., and Caldwell, A.W., 2009, Development and evaluation of live-bed pier and contraction scour envelope curves in the Coastal Plain and Piedmont Provinces of South Carolina, U.S. Geological Survey Scientific Investigations Report 2009 5099, 108 p.
http://pubs.usgs.gov/sir/2009/5099/



Benedict, S.T., and Caldwell, A.W., 2006, Development and evaluation of clear-water pier and contraction scour envelope curves in the Coastal Plain and Piedmont Provinces of South Carolina: U.S. Geological Survey Scientific Investigations Report 2005 5289, 98 p.
http://pubs.usgs.gov/sir/2005/5289/



Benedict, S.T., 2003, Clear-water abutment and contraction scour in the Coastal Plain and Piedmont Provinces of South Carolina, 1996 99: U.S. Geological Survey Water-Resources Investigations Report 03 4064, 137 p.

http://pubs.usgs.gov/wri/wri034064/

A Note to Template Users:

Throughout this workbook there are several locations where users are asked to fill in bridge-site information and where users have the option to select their preferred bridge-scour envelope curve. The authors recommend that a blank template be used when starting a new bridge-scour assessment to avoid mistakes possible when back-tracking through a previously populated template.

Abbreviations Used in the Template

#	number
CH	channel
D/S	downstream
DA	drainage area
DMS	degrees-minutes-seconds
FEMA	Federal Emergency Management Agency
ft	feet
HEC-18	Hydraulic Engineering Circular No. 18 (Arneson and others, 2012)
HWM	high water mark
LABUT	left abutment
LEW	left edge of water
LTB	left top bank
LOB	left overbank
m	geometric-contraction ratio
N/A	not applicable
RABUT	right abutment
REW	right edge of water
ROB	right overbank
RTB	right top bank
SCDOT	South Carolina Department of Transportation
sq mi	square mile
topo	topographic
USGS	U.S. Geological Survey
WSEL	water-surface elevation

References Used in the Template

Arneson, L.A., Zevenbergen, L.W., Lagasse, P.F., and Clopper, P.E., 2012, Evaluating scour at bridges (5th ed.): Federal Highway Administration Hydraulic Engineering Circular No. 18, Publication No. FHWA-HIF-12-003, 340 p.

Benedict, S.T., 2003, Clear-water abutment and contraction scour in the Coastal Plain and Piedmont Provinces of South Carolina, 1996 99: U.S. Geological Survey Water-Resources Investigations Report 03 4064, 137 p.

Benedict, S.T., and Caldwell, A.W., 2006, Development and evaluation of clear-water pier and contraction scour envelope curves in the Coastal Plain and Piedmont Provinces of South Carolina: U.S. Geological Survey Scientific Investigations Report 2005 5289, 98 p.

Benedict, S.T., and Caldwell, A.W., 2009, Development and evaluation of live-bed pier and contraction scour envelope curves in the Coastal Plain and Piedmont Provinces of South Carolina, U.S. Geological Survey Scientific Investigations Report 2009 5099, 108 p.

Benedict, S.T., and Caldwell, A.W., 2012, Modification of selected South Carolina bridge-scour envelope curves: U.S. Geological Survey Scientific Investigations Report 2012-5029, 37 p.

Benedict, S.T., and Caldwell, A.W., 2014, A pier-scour database 2,427 field and laboratory measurements of pier scour: U.S. Geological Survey Data Series 845, 22 p.

Benedict, S.T., Feaster, T.D., and Caldwell, A.W., 2016, The South Carolina bridge-scour envelope curves: U.S. Geological Survey Scientific Investigations Report 2016-5121, 96 p.

Site Information

Use a blank template when starting new assessments

(Fill in gray shaded cells; leave blank if data not available.)

Bridge Number:	05249 & 05258	Stream:	Lake Marion	Date of Analysis:	6/7/2023
County:	Orangeburg & Clarendon	Road:	I-95		
Physiographic Region (for scour):	Coastal Plain	Multiple Bridge?	Yes	Bridge Length:	4523.67 ft
		Relief Bridge?	No		
Latitude:	33:30:15.83 DMS	Swampy, Poorly Defined Channel?	Yes	Drainage Area:	14400 sq mi
Longitude:	80:27:14.98 DMS				

Hydraulic Model Data (Stations for bridge cross section are based on unconstricted approach section station with bridge projected on to approach)

Data Available?	No
Quality of Model Data:	

LEW station at unconstricted approach cross section; OR left stagnation point for multiple bridge (if no data, leave cell empty):		ft	
REW station at unconstricted approach cross section; OR right stagnation point for multiple bridge (if no data, leave cell empty):		ft	
Unconstricted cross-section topwidth from model data (approach before cross-section):	No Data	ft	
CHECK (Single bridge data): Do embankment lengths and toe-to-toe distance equal unconstricted cross-section topwidth? (approach before cross-section)	N/A		

LEW station at bridge (based on approach):		ft
REW station at bridge (based on approach):		ft
Left abutment toe station (based on approach):		ft
Right abutment toe station (based on approach):		ft
LTB station at bridge (if relief bridge or swampy, poorly defined channel, leave cell empty):		ft
RTB station at bridge (if relief bridge or swampy, poorly defined channel, leave cell empty):		ft
Channel topwidth (model):	0	ft
Distance from toe to toe (model):	No Data	ft
Left embankment length (model):	No Data	ft
Right embankment length (model):	No Data	ft
m (model):	No Data	

SCDOT Plan Data (Be sure to check for tie equalities)

Data Available?	No
Quality of Plan Data:	

SCDOT Road Plan number:			
Use HWM or average flood-plain flow depth for WSEL?**			
WSEL on SCDOT datum:		ft	
LEW station at unconstricted cross section from plans (if no data, leave cell empty):		ft	
REW station at unconstricted cross section from plans (if no data, leave cell empty):		ft	
Unconstricted cross-section topwidth from plans:	No Data	ft	
CHECK (Single bridge data): Do embankment lengths and toe-to-toe distance equal unconstricted cross-section topwidth?	N/A		

LEW station at bridge:		ft
REW station at bridge:		ft
Left abutment toe station:		ft
Right abutment toe station:		ft
LTB station at bridge (if relief bridge or swampy, poorly defined channel, leave cell empty):		ft
RTB station at bridge (if relief bridge or swampy, poorly defined channel, leave cell empty):		ft
Channel topwidth (plans):	0	ft
Distance from toe to toe (plans):	No Data	ft
Left embankment length (plans):	No Data	ft
Right embankment length (plans):	No Data	ft
m (plans):	No Data	

**NOTE: Average flood-plain flow depth in Coastal Plain and Piedmont is approximately 7 ft.

Topographic Map Data

Data Available?	Yes
Quality of Map Data:	Good

Does topo indicate wide, flat floodplain?	Yes		
Does topo indicate severe meander just upstream?	No		
Bridge length as provided by SCDOT (verify with topo map if possible):	4899	ft	
CHECK (Single bridge data): Does sum of embankment and bridge lengths	N/A		

Approach flood-plain topwidth (topo map):**	13475	ft	**equal approach flood-plain topwidth?**	N/A
Left embankment length (topo map):	3700	ft		
Right embankment length (topo map):	570	ft		
m (topo map):	0.64			

****NOTE:** The approach cross section should represent the unconstricted natural cross section located approximately one bridge-width upstream of the bridge of interest.
****NOTE:** The HWM from the SCDOT plans, HWM from flood documentation, or the average flood-plain flow depth should be used to approximate the flood-plain topwidth.

FEMA/Other Map Data

Data Available?	Yes
Quality of Map Data:	Good
If "Other Map," describe:	

Bridge length as provided by SCDOT (verify with FEMA/Other map if possible):	4899	ft		
Approach flood-plain topwidth (FEMA/Other map):**	13475	ft	**CHECK (Single bridge data):**	
Left embankment length (FEMA/Other map):	3700	ft	**Does sum of embankment and bridge lengths equal approach flood-plain topwidth?**	**N/A**
Right embankment length (FEMA/Other map):	570	ft		
m (FEMA/Other map):	0.64			

****NOTE:** The approach cross section should represent the unconstricted natural cross section located approximately one bridge-length upstream of the bridge of interest.
****NOTE:** The inundated areas on the FEMA/Other map should be used to approximate the flood-plain topwidth.

Comparison of Geometric-Contraction Ratios [m]

Select Source for m: Source Used: Topo Map

	m Value	Quality of Source Data
m from model:	No Data	No Data
m from road plans:	No Data	No Data
m from topographic map:	0.64	Good
m from FEMA/Other map:	0.64	Good
USE m:	0.64	

****NOTE: The "USE m" value is automatically selected, but can be overridden by typing in another value. If the originally selected value of m is overridden, justification should be provided in the comments below.**

**NOTE: In most cases, the model data should provide a reasonable estimate of m and should be given strong consideration in the selection of the final m. The other sources of data (road plans and maps) should be used to confirm the m estimate based on the model data. The road plans are based on an actual survey, likely providing a better data source for confirming the m determined from the model data. The details associated with the topographic and FEMA/Other maps will often be limited, causing discrepancies in the estimate of m. When significant discrepancies in the estimate of m exist between the four data sources, the user should determine the reason for the discrepancy and then select a reasonable, but conservative estimate of m. As a general rule, the selected m and embankment lengths should come from the same data source.

Comparison of Embankment Lengths

Select Source for Embankment Length: Source Used: Topo Map

	Left		Right	
	Embankment Length (ft)	Quality of Source Data	Embankment Length (ft)	Quality of Source Data
Embankment length from model:	No Data	No Data	No Data	No Data
Embankment length from road plans:	No Data	No Data	No Data	No Data
Embankment length from topographic map:	3700	Good	570	Good
Embankment length from FEMA/Other map:	3700	Good	570	Good
USE embankment length:	3700 ft		570 ft	

CHECK:

Is this a relief or swampy bridge with a poorly defined channel and a bridge length less than or equal to 240 ft?	**No**
If so, use the maximum embankment length from the selected "Source Used" for left and right embankment length.	

****NOTE:** The "USE embankment length" value is automatically selected, but can be overridden by typing in another value. If the originally selected value of embankment length is overridden, justification should be provided in the comments below.

**NOTE: In most cases, the model data should provide a reasonable estimate of embankment lengths and should be given strong consideration in the selection of the final embankment lengths. The other sources of data (road plans and maps) should be used to confirm the embankment length estimates baed on the model data. The road plans are based on an actual survey, likely providing a better data source for confirming the embankment lengths determined from the model data. The details associated with the topographic and FEMA/Other maps will often be limited, causing discrepancies in the estimate of embankment length. When significant discrepancies in the estimate of embankmnent lengths exist between the four data sources, the user should determine the reason for the discrepancy and then select a reasonable, but conservative estimate of embankment length. As a general rule, the selected m and embankment lengths should come from the same data source.

Comparison of Overbank Widths underneath Bridge

Select Source for Overbank Width: Source Used: SCDOT Plans

	Left Overbank Width (Left abutment toe to left top of bank)**	Right Overbank Width (Right top of bank to right abutment toe)**
Overbank width (Old SCDOT plans if available):	No Data ft	No Data ft
Overbank width (Hydraulic Model):	No Data ft	No Data ft
USE overbank width:	No Data ft	No Data ft
CHECK: **Is overbank width greater than or equal to 10 feet?++**	No Data	No Data

****NOTE:** The overbank width information is compared with the topwidth of the abutment-scour hole to determine how much of the overbank width will be covered by the abutment-scour hole and how much will remain for overbank scour.
****NOTE:** If the site is a relief bridge or has a swampy, poorly defined channel, then the overbank width will be determined by splitting the toe-to-toe width between the left and right overbanks.
++**NOTE:** The SCDOT Requirements Manual recommends for new and replacement bridges that there be a minimum 10 foot setback distance from the top of bank to the abutment toe (written commun., S.T. Benedict, South Carolina Department of Transportation, September 12, 2016).

Comments:

1	These and other limitations should be kept in mind when using the envelope curves to assess scour potential. The envelope curves are empirical methods that are based on limited field samples; it is possible that scour could exceed the envelope curves; therefore, application of a safety factor may be prudent. Application of the envelope curves is constrained to the range of data and site characteristics used to develop the envelope curves. The uncertainty associated with the envelope curves increases near the limits of the data range. The live-bed scour data have the largest uncertainty.
2	The envelope curves do not account for unusual site conditions such as: debris; channel bank failures; pressure flow; unusual flow patterns created by unique site conditions; unusual pier geometries; and washout of approach road embankments.
3	The field data generally represent scour associated with flows approaching the 100-year flow magnitude but should not be considered a definitive estimate of the scour depth associated with the 100-year flow. Similarly, the 500-year flow adjustment coefficients can be used to provide perspective on the relative increase in theoretical scour associated with the 100- to 500-year flow condition, but should not be considered a definitive estimate of the scour depth associated with the 500-year flow.
4	Subsurface soils can impede or promote scour. Therefore, assessing the potential effect of subsurface soils on scour is important.
5	
6	

Clear-Water Abutment-Scour Estimate

(occurs in the abutment region)

(Option to fill in/modify gray shaded cells. Other cells are selected/calculated automatically.)

Bridge Number:	05249 & 05258	**Stream:**	Lake Marion	**Date of Analysis:**	6/7/2023
County:	Orangeburg & Clarendon	**Road:**	I-95		
Physiographic Region:	Coastal Plain	**Multiple Bridge?**	Yes	**Bridge Length:**	4523.67 ft
		Relief Bridge?	No		
		Swampy, Poorly Defined Channel?	Yes	**Drainage Area:**	14400 sq mi
Latitude:	33:30:15.83 DMS				
Longitude:	80:27:14.98 DMS				

Drainage Area Check -- Original Curve (Benedict and others, 2016; Benedict, 2003): **DA OUTSIDE RANGE (Above)**

Drainage Area Check -- Modified Curve (Benedict and others, 2016; Benedict and Caldwell, 2012): **DA OUTSIDE RANGE (Above)**

Comparison of Geometric-Contraction Ratios [m]

	m Value	Quality of Source
m from model:	No Data	No Data
m from road plans:	No Data	No Data
m from topographic map:	0.64	Good
m from FEMA/Other map:	0.64	Good
USE m: (from "Site Info" Sheet)	0.64	

m range check -- Original Curve (Benedict and others, 2016; Benedict, 2003):	**OK**
m range check -- Modified Curve (Benedict and others, 2016; Benedict and Caldwell, 2012):	**OK**

****NOTE: The "USE m" value is automatically pulled from the Site Info Sheet.**

Guidance:

Original Clear-Water Abutment-Scour Curves

(Benedict and others, 2016; Benedict, 2003)

Limits:
1) For Piedmont sites the maximum m =0.82, but 0.86 could be justified with caution.
2) For Coastal Plain sites the maximum m =0.98, but use caution when greater than 0.9.
3) Drainage area should fall within range of measured data and caution should be used as drainage area approaches limits of data.

Modified Clear-Water Abutment-Scour Curve

(Benedict and others, 2016; Benedict and Caldwell, 2012)

Limits:
1) For Piedmont sites the maximum m =0.85.
2) For Coastal Plain sites the maximum m =0.9.
3) Drainage area should fall within the range of measured data and caution should be used as drainage area approaches limits of data.

Comparison of Embankment Lengths

	Left		Right	
	Embankment Length (ft)	Quality of Source Data	Embankment Length (ft)	Quality of Source Data
Embankment length from model:	No Data	No Data	No Data	No Data
Embankment length from road plans:	No Data	No Data	No Data	No Data
Embankment length from topographic map:	3700	Good	570	Good
Embankment length from FEMA/Other map:	3700	Good	570	Good
USE embankment length *(from Site Info Sheet)*:	**3700**		**570**	

Embankment length range check -- Original Curve (Benedict and others, 2016; Benedict, 2003): *(from "EQUATIONS" Sheet)*	CAUTION	OK
Embankment length range check -- Modified Curve (Benedict and others, 2016; Benedict and Caldwell, 2012): *(from "EQUATIONS" Sheet)*	OUTSIDE RANGE	OUTSIDE RANGE

****NOTE:** The "USE embankment length" value is automatically pulled from the Site Info Sheet.

CHECK:

Is this a relief or swampy bridge with a length less than or equal to 240 ft?	**No**
If so, use the maximum embankment length from the selected "Source Used" (see "Site Info" Sheet) for left and right embankment lengths.	

Guidance:

Original Clear-Water Abutment-Scour Curves

(Benedict and others, 2016; Benedict, 2003)

Limits:
1) If the bridge is a relief or swampy bridge with a length of 240 ft or less, the longest embankment length for the left or right embankments should be used at both abutments.
2) For Piedmont sites the maximum embankment length = 950 ft.
3) For Coastal Plain sites the maximum embankment length = 7,440 ft, but most of the data is for lengths of about 2,000 ft or less. Caution must be used when values exceed 2,000 ft.
4) Drainage area should fall within the range of measured data and caution should be used as drainage area approaches limits of data.

Modified Clear-Water Abutment-Scour Curve

(Benedict and others, 2016; Benedict and Caldwell, 2012)

Limits:
1) If the bridge is a relief or swampy bridge with a length of 240 ft or less, the longest embankment length for the left or right embankments should be used at both abutments.
2) For Piedmont and Coastal Plain sites, the maximum embankment length = 500 ft.
3) Drainage area should fall within the range of measured data and caution should be used as drainage area approaches limits of data.

Clear-Water Abutment-Scour Depth from Envelope Curves

	Left Abutment		Right Abutment	
Original Clear-Water Abutment-Scour Curves (Benedict and others, 2016; Benedict, 2003):				
Abutment-scour depth by embankment length:	18.7	ft	14.6	ft
Abutment-scour depth by geometric-contraction ratio m:	7.0	ft	7.0	ft
Original abutment-scour curve selection:	**Automatic Calculation**		**Automatic Calculation**	
Selected original abutment-scour depth:	**18.7**	ft	**14.6**	ft
Modified Clear-Water Abutment-Scour Curve (Benedict and others, 2016; Benedict and Caldwell, 2012):				
Abutment-scour depth by embankment-length category:	N/A	ft	N/A	ft
Abutment-scour depth by interpolation:	N/A	ft	N/A	ft
Modified abutment-scour curve selection:	**Automatic Calculation**		**Automatic Calculation**	
Selected modified abutment-scour depth:	**N/A**	ft	**N/A**	ft
Final Selected Clear-Water Abutment-Scour Depth:				
Final abutment-scour curve selection:	**Automatic Selection**		**Automatic Selection**	
Final selected clear water abutment-scour depth:	**18.7**	ft	**14.6**	ft
Relative Increase in Theoretical Clear-Water Abutment-Scour from the 100- to 500-Year Flows (Benedict and others, 2016):				
500-yr flow coefficient:	1.21		1.21	
Abutment-scour by 500-year flow coefficient:	**22.6**	ft	**17.7**	ft

Guidance:

Original Clear-Water Abutment-Scour Curves
(Benedict and others, 2016; Benedict, 2003)

1) If the bridge is a relief or swampy bridge with a length of 240 ft or less, the scour depth determined by embankment length for the left and right abutments should be based on the longest embankment length. NOTE: The "Use embankment length" from above should reflect the maximum embankment length from the left or right embankment if the bridge meets the criteria in item 1. Check to verify.
2) For single bridge, the spreadsheet will use the embankment-length envelope curves. However, there are cases when it may be appropriate to use the geometric-contraction ratio envelope curve if a more conservative estimate is deemed appropriate. Refer to Benedict and others (2016) for additional discussion.
3) For multiple bridge in Piedmont, use m envelope curve.
4) For multiple bridge in Coastal Plain, for embankment length < 426 ft use m envelope curve.
5) For multiple bridge in Coastal Plain: for embankment length >= 426 ft, the spreadsheet will use the embankment-length envelope curves. However, there are cases when it may be appropriate to use the geometric-contraction ratio envelope curve if a more conservative estimate is deemed appropriate. Refer to Benedict and others (2016) for additional discussion.
6) If the m and (or) embankment lengths are near the limits or beyond the range of the envelope data a caution or warning message, respectively, will appear in the "m range check" and (or) "Embankment length range check" cells above. For these cases judgment, must be used to assess the best estimate of clear-water abutment scour.

Modified Clear-Water Abutment-Scour Curve
(Benedict and others, 2016; Benedict and Caldwell, 2012)

1) If the bridge is a relief or swampy bridge with a length of 240 ft or less, the scour depth determined by embankment length for the left and right abutments should be based on the longest embankment length. NOTE: The "Use embankment length" from above should reflect the maximum embankment length from the left or right embankment if the bridge meets the criteria in item 1. Check to verify.
2) Use for single bridges only. Use original curve (Benedict and others, 2016; Benedict, 2003) for multiple bridges.
3) If the estimate of scour using the original envelope curves is less than that using the modified curve, then use the scour depth associated with the original curve.
4) If the m and (or) embankment lengths are near the limits or beyond the range of the envelope data a caution or warning message, respectively, will appear in the "m range check" and (or) "Embankment length range check" cells above. For these cases judgment must be used to assess the best estimate of clear-water abutment scour.

Relative Increase in Theoretical Clear-Water Abutment-Scour from the 100- to 500-Year Flows
(Benedict and others, 2016)

1) The 500-year flow adjustment coefficient (K_{500}) is used to calculate the relative abutment scour increase from 100- to 500-year flows.
2) The K_{500} is a helpful tool for gaining perspective on the relative increase of theoretical scour associated with the 100- to 500-year abutment-scour depth. However, the adjusted envelope curve values should not be considered a definitive estimate of the abutment scour associated with the 500-year flow.

Scour-Hole Topwidths

(Benedict and others, 2016; Benedict, 2003)

	Left Abutment		Right Abutment	
Use Abutment Scour-Hole Topwidth Curve (select from 1 or 2 below):	**1**		**1**	
(1) Any length bridge with a well defined channel or any bridge longer than 240 feet				
(2) Flood-plain relief or swampy bridge with length of 240 ft or less				
Abutment scour-hole topwidth:	**70.0**	ft	**70.0**	ft
Is scour depth outside range of graph?	**Yes**		**Yes**	

NOTE: The "Abutment scour-hole topwidth" is automatically calculated. The scour-hole topwidth equations coded in the spreadsheet limit the abutment-scour depth to 25 feet, which is beyond the range of the original graphs. The cell below the scour-hole topwidth will indicate if the abutment-scour depth exceeds the graph range and judgment must be used with regard to utilizing the estimated value.

Comments:

1	These and other limitations should be kept in mind when using the envelope curves to assess scour potential. The envelope curves are empirical methods that are based on limited field samples; it is possible that scour could exceed the envelope curves; therefore, application of a safety factor may be prudent. Application of the envelope curves is constrained to the range of data and site characteristics used to develop the envelope curves. The uncertainty associated with the envelope curves increases near the limits of the data range. The live-bed scour data have the largest uncertainty.
2	The envelope curves do not account for unusual site conditions such as: debris; channel bank failures; pressure flow; unusual flow patterns created by unique site conditions; unusual pier geometries; and washout of approach road embankments.
3	The field data generally represent scour associated with flows approaching the 100-year flow magnitude but should not be considered a definitive estimate of the scour depth associated with the 100-year flow. Similarly, the 500-year flow adjustment coefficients can be used to provide perspective on the relative increase in theoretical scour associated with the 100- to 500-year flow condition, but should not be considered a definitive estimate of the scour depth associated with the 500-year flow.
4	Subsurface soils can impede or promote scour. Therefore, assessing the potential effect of subsurface soils on scour is important.
5	

Clear-Water Contraction-Scour Estimate

(occurs in the overbank region)

(Option to fill in/modify gray shaded cells. Other cells are selected/calculated automatically.)

Bridge Number:	05249 & 05258	**Stream:**	Lake Marion	**Date of Analysis:**	6/7/2023
County:	Orangeburg & Clarendon	**Road:**	I-95	**Bridge Length:**	4523.67 ft
Physiographic Region:	Coastal Plain	**Multiple Bridge?**	Yes		
		Relief Bridge?	No	**Drainage Area:**	14400 sq mi
Latitude:	33:30:15.83 DMS	**Swampy, Poorly Defined Channel?**	Yes		
Longitude:	80:27:14.98 DMS			**Drainage Area Check:**	DA OUTSIDE RANGE (Above)

Comparison of Geometric-Contraction Ratios [m]

	m Value	Quality of Source Data
m from model:	No Data	No Data
m from road plans:	No Data	No Data
m from topographic map:	0.64	Good
m from FEMA/Other map:	0.64	Good
USE m: (from "Site Info" Sheet)	0.64	
m range check: (from "EQUATIONS" Sheet)	OK	

****NOTES:** If the geometric-contraction ratio is greater than 0.95 message is **OUTSIDE RANGE**.
If the geometric-contraction ratio is between 0 and 0.85 message is **OK**.
If the geometric-contraction ratio is between 0.85 and 0.95 message is **CAUTION**.

**NOTE: The "USE m" value is automatically pulled from the Site Info Sheet.

Guidance:

(Benedict and others, 2016; Benedict and Caldwell, 2006)

1) For the Piedmont data the maximum m for clear-water overbank contraction scour was 0.85.
2) For the Coastal Plain data the maximum m for clear-water overbank contraction scour was 0.95 with data sparse for m greater than 0.9.
3) Caution must be used when m nears or exceeds the upper limits of the data and the "m range check" cell above should be used to help evaluate the final selection of m.

Clear-Water Contraction-Scour Depth from Envelope Curves

	Left Overbank	Right Overbank
Clear-Water Contraction-Scour Curve (Benedict and others, 2016; Benedict and Caldwell, 2006)		
Clear-water contraction-scour depth by geometric-contraction ratio m:	4.5 ft	4.5 ft
Final Selected Clear-Water Contraction-Scour Depth:	**4.5** ft	**4.5** ft
Relative Increase in Theoretical Clear-Water Contraction Scour from the 100- to 500-Year Flows (Benedict and others, 2016):		
500-yr flow coefficient:	1.46	1.46
Clear-water contraction-scour by 500-year flow coefficient:	**6.6** ft	**6.6** ft

****NOTE:** The "Selected clear-water overbank-contraction-scour depth" value is automatically selected, but can be overridden by typing in another value. If the originally selected value of overbank-contraction-scour depth is overridden, justification should be provided in the comments below.

Guidance:

Clear-Water Contraction-Scour Curve

(Benedict and others, 2016; Benedict and Caldwell, 2006)

1) If the m is near the limits or beyond the range of the envelope data a caution or warning message, respectively, will appear in the "m range check" cell above. For these cases judgment must be used to assess the best estimate of clear-water overbank-contraction scour.

Relative Increase in Theoretical Clear-Water Contraction-Scour from the 100- to 500-Year Flows
(Benedict and others, 2016)

1) The 500-year flow adjustment coefficient (K_{500}) is used to calculate the relative clear-water contraction scour increase from 100- to 500-year flows.
2) The K_{500} is a helpful tool for gaining perspective on the relative increase of theoretical scour associated with the 100- to 500-year clear-water contraction-scour depth. However, the adjusted envelope curve values should not be considered a definitive estimate of the scour associated with the 500-year flow.

Comments:

1	These and other limitations should be kept in mind when using the envelope curves to assess scour potential. The envelope curves are empirical methods that are based on limited field samples; it is possible that scour could exceed the envelope curves; therefore, application of a safety factor may be prudent. Application of the envelope curves is constrained to the range of data and site characteristics used to develop the envelope curves. The uncertainty associated with the envelope curves increases near the limits of the data range. The live-bed scour data have the largest uncertainty.
2	The envelope curves do not account for unusual site conditions such as: debris; channel bank failures; pressure flow; unusual flow patterns created by unique site conditions; unusual pier geometries; and washout of approach road embankments.
3	The field data generally represent scour associated with flows approaching the 100-year flow magnitude but should not be considered a definitive estimate of the scour depth associated with the 100-year flow. Similarly, the 500 year flow adjustment coefficients can be used to provide perspective on the relative increase in theoretical scour associated with the 100- to 500-year flow condition, but should not be considered a definitive estimate of the scour depth associated with the 500-year flow.
4	Subsurface soils can impede or promote scour. Therefore, assessing the potential effect of subsurface soils on scour is important.

Live-Bed Contraction-Scour Estimate

(occurs in the channel region)

(Option to fill in/modify gray shaded cells. Other cells are selected/calculated automatically.)

Bridge Number:	05249 & 05258	**Stream:**	Lake Marion	**Date of Analysis:**	6/7/2023
County:	Orangeburg & Clarendon	**Road:**	I-95		
				Bridge Length:	4523.67 **ft**
Physiographic Region:	Coastal Plain	**Multiple Bridge?**	Yes		
		Relief Bridge?	No	**Drainage Area:**	14400 **sq mi**
		Swampy, Poorly Defined Channel?	Yes		
Latitude:	33:30:15.83 **DMS**				
Longitude:	80:27:14.98 **DMS**				

Drainage Area Check -- Original Curve (Benedict and others, 2016; Benedict and Caldwell, 2009): DA OUTSIDE RANGE (Above)

Drainage Area Check -- Modified Curve (Benedict and others, 2016; Benedict and Caldwell, 2012): DA OUTSIDE RANGE (Above)

Comparison of Geometric-Contraction Ratios [m]

	m Value	Quality of Source Data
m from model:	No Data	No Data
m from road plans:	No Data	No Data
m from topographic map:	0.64	Good
m from FEMA/Other map:	0.64	Good
USE m: (from "Site Info" Sheet)	0.64	

m range check -- Original Curve (Benedict and Caldwell, 2009) (m <=0.82):	OK
m range check -- Modified Curve (Benedict and Caldwell, 2012) (m <=0.90):	OK

**NOTE: The "USE m" value is automatically pulled from the Site Info Sheet.

Guidance:

Original Live-Bed Contraction-Scour Curve:
(Benedict and others, 2016; Benedict and Caldwell, 2009)

NOTE: Only the field envelope curve for live-bed contraction scour is used in the spreadsheet template. The user may refer to Benedict and others (2016) for application of the dimensionless envelope curve, if deemed appropriate.

Limits:
1) For Piedmont and Coastal Plain sites the maximum m =0.82.
2) Limited clear-water scour data suggests that it may be appropriate to extend the live-bed curve beyond a value of 0.82; however caution and judgment must be used.
3) Drainage area should fall within range of the measured data and caution should be used as drainage area approaches limits of data.
4) Because of uncertainty associated with the live-bed contraction-scour data, caution and judgment must be used in the final estimate of live-bed contraction scour.

Modified Live-Bed Contraction-Scour Curve:
(Benedict and others, 2016; Benedict and Caldwell, 2012)

Limits:
1) For Piedmont and Coastal Plain sites the maximum m =0.9.
2) Drainage area should be 200 square miles or less.
3) Because of uncertainty associated with the live-bed contraction-scour data, caution and judgment must be used in the final estimate of live-bed contraction scour.

Live-Bed Contraction-Scour Depth from Envelope Curves (NOTE: Only the Field Envelope Curves are Used)

	Scour Depth	
Original Field Envelope Curve for Live-Bed Contraction-Scour Curve (Benedict and others, 2016; Benedict and Caldwell, 2009):		
Live-bed contraction-scour depth:	N/A	ft
Modified Field Envelope Curve for Live-Bed Contraction-Scour Curve (Benedict and others, 2016; Benedict and Caldwell, 2012):		
Live-bed contraction-scour depth:	N/A	ft
Final Selected Live-Bed Contraction-Scour Depth:		
Final live-bed contraction-scour curve selection:	**Automatic Selection**	
Final selected live-bed contraction-scour depth:	**N/A**	ft
Relative Increase in Theoretical Live-Bed Contraction Scour from the 100- to 500-Year Flows (Benedict and others, 2016):		
500-yr flow coefficient:	1.32	
Live-bed contraction-scour by 500-year flow coefficient:	**N/A**	ft

Guidance:

Original and Modified Live-Bed Contraction-Scour Curve
(Benedict and others, 2016; Benedict and Caldwell, 2012; Benedict and Caldwell, 2009)

NOTE: Only the field envelope curve for live-bed contraction scour is used in the spreadsheet template. The user may refer to Benedict and others (2016) for application of the dimensionless envelope curve, if deemed appropriate.

1) If drainage area is 200 square miles or less, then use the live-bed contraction-scour estimate based on the modified envelope curve (Benedict and Caldwell, 2012). Otherwise, use the estimate based on the original envelope curve (Benedict and others, 2016; Benedict and Caldwell, 2009).

2) If site is a relief bridge or is swampy with a poorly defined channel, it will be assumed that live-bed contraction scour will not occur and the scour depths in the above cells will be set to "N/A."

Relative Increase in Theoretical Live-Bed Contraction-Scour from the 100- to 500-Year Flows
(Benedict and others, 2016)

1) The 500-year flow adjustment coefficient (K_{500}) is used to calculate the relative abutment scour increase from 100- to 500-year flows.

2) The K_{500} is a helpful tool for gaining perspective on the relative increase of theoretical scour associated with the 100- to 500-year live-bed contraction-scour depth. However, the adjusted envelope curve values should not be considered a definitive estimate of the scour associated with the 500-year flow.

Comments:

1	These and other limitations should be kept in mind when using the envelope curves to assess scour potential. The envelope curves are empirical methods that are based on limited field samples; it is possible that scour could exceed the envelope curves; therefore, application of a safety factor may be prudent. Application of the envelope curves is constrained to the range of data and site characteristics used to develop the envelope curves. The uncertainty associated with the envelope curves increases near the limits of the data range. The live-bed scour data have the largest uncertainty.
2	The envelope curves do not account for unusual site conditions such as: debris; channel bank failures; pressure flow; unusual flow patterns created by unique site conditions; unusual pier geometries; and washout of approach road embankments.
3	The field data generally represent scour associated with flows approaching the 100-year flow magnitude but should not be considered a definitive estimate of the scour depth associated with the 100-year flow. Similarly, the 500-year flow adjustment coefficients can be used to provide perspective on the relative increase in theoretical scour associated with the 100- to 500-year flow condition, but should not be considered a definitive estimate of the scour depth associated with the 500-year flow.
4	Subsurface soils can impede or promote scour. Therefore, assessing the potential effect of subsurface soils on scour is important.

Pier Scour Estimate

(Fill in gray shaded cells. Other cells are selected/calculated automatically.)

Bridge Number:	05249 & 05258	**Stream:**	Lake Marion	**Date of Analysis:**	6/7/2023
County:	Orangeburg & Clarendon	**Road:**	I-95		
Physiographic Region:	Coastal Plain	**Multiple Bridge?**	Yes	**Bridge Length:**	4523.67 ft
		Relief Bridge?	No		
Latitude:	33:30:15.83 DMS	**Swampy, Poorly Defined Channel?**	Yes	**Drainage Area:**	14400 sq mi
Longitude:	80:27:14.98 DMS				

Guidance:

Use of Pier Scour Table below
- See cell comments for guidance on using the Pier Scour Table below.

Pier Scour Computations
- If a pier or bent falls anywhere on the overbank, pier scour will be computed for both the abutment and overbank regions.
- If there are piers or bents of varying geometries on the same overbank, use the worst case pier geometry in both the abutment and overbank areas.
- When a pier is on the floodplain, but near the channel bank, the user must decide if the pier should be considered to be a channel pier or not; in addition to the proximity of the pier to the bank, the user should consider other factors such as bends that may increase potential for scour.

Pier Scour Table

(Benedict and others, 2016; Benedict and Caldwell, 2009; Benedict and Caldwell, 2006)

	Left Abutment	Left Overbank	Channel	Right Overbank	Right Abutment
Location of pier	LABUT	LOB	CH	ROB	RABUT
Type of pier or bent **(choose from list)**	Multiple Column Pier	Multiple Column Pier	Multiple Column Pier	Multiple Column Pier	Multiple Column Pier
Envelope curve used **(choose from list)**	Automatic Calculation	Automatic Calculation	Automatic Calculation	Automatic Calculation	Automatic Calculation
Pier width (feet)	5.5	5.5	5.5	5.5	5.5
Pier length (feet) **(should not be less than pier width)**	33	33	33	33	33
Angle of attack (degrees) **(should not exceed 90)**	0	0	0	0	0
Multiple column pier or bent? **(choose from list)**	Yes	Yes	Yes	Yes	Yes
Estimate of minimum spacing between columns (feet)	14.5	14.5	14.5	14.5	14.5
Column spacing to width ratio **(should be between 2 and 10)**	2.64	2.6	2.6	2.6	2.6
Skew coefficient [Based on guidance in Benedict and others (2016) and HEC-18]	1.00	1.00	1.00	1.00	1.00
Skew coefficient (selected value; **should not exceed a value of 5**)	1.00	1.00	1.00	1.00	1.00
Envelope curve used in pier scour estimate	PSDb-2014	PSDb-2014	PSDb-2014	PSDb-2014	PSDb-2014
Pier scour from envelope (feet) (no adjustment)	9.7	9.7	9.7	9.7	9.7
Pier scour adjusted for skew (feet)	9.7	9.7	9.74	9.7	9.7
Final selected pier scour depth (feet)	**9.7**	**9.7**	**9.7**	**9.7**	**9.7**
500-year flow coefficient:	1.09	1.09	1.09	1.09	1.09
Relative Increase in Theoretical Pier-Scour from the 100- to 500-Year Flows (Benedict and others, 2016):	**10.6**	**10.6**	**10.6**	**10.6**	**10.6**

****NOTE:** The K_{500} is a helpful tool for gaining perspective on the relative increase of theoretical scour associated with the 100- to 500-year clear-water contraction-scour depth. However, the adjusted envelope curve values should not be considered a definitive estimate of the scour associated with the 500-year flow.

	2
	Comments:
1	These and other limitations should be kept in mind when using the envelope curves to assess scour potential. The envelope curves are empirical methods that are based on limited field samples; it is possible that scour could exceed the envelope curves; therefore, application of a safety factor may be prudent. Application of the envelope curves is constrained to the range of data and site characteristics used to develop the envelope curves. The uncertainty associated with the envelope curves increases near the limits of the data range. The live-bed scour data have the largest uncertainty.
2	The envelope curves do not account for unusual site conditions such as: debris; channel bank failures; pressure flow; unusual flow patterns created by unique site conditions; unusual pier geometries; and washout of approach road embankments.
3	The field data generally represent scour associated with flows approaching the 100-year flow magnitude but should not be considered a definitive estimate of the scour depth associated with the 100-year flow. Similarly, the 500-year flow adjustment coefficients can be used to provide perspective on the relative increase in theoretical scour associated with the 100- to 500-year flow condition, but should not be considered a definitive estimate of the scour depth associated with the 500-year flow.
4	Subsurface soils can impede or promote scour. Therefore, assessing the potential effect of subsurface soils on scour is important.

Pile Penetration Table for Scour Estimates Using Flows Approaching the 100-year Flow

Scour analysis using USGS Bridge-Scour Envelope Curves

(Fill in gray shaded cells. Other cells are selected/calculated automatically.)

Bridge Number:	05249 & 05258	**Stream:**	Lake Marion	**Date of Analysis:**	6/7/2023
County:	Orangeburg & Clarendon	**Road:**	I-95		
				Bridge Length:	4523.67 **ft**
Physiographic Region:	Coastal Plain	**Multiple Bridge?**	Yes		
		Relief Bridge?	No	**Drainage Area:**	14400 **sq mi**
Latitude:	33:30:15.83 **DMS**	**Swampy, Poorly Defined Channel?**	Yes		
Longitude:	80:27:14.98 **DMS**				

NOTE: Bents are listed from left to right looking downstream

GUIDANCE FOR LEFT AND RIGHT ABUTMENT SCOUR:

Refer to Benedict and others (2016) and Benedict (2003) for additional guidance.

1) Do not include clear-water overbank scour depth in abutment-scour area.

2) If site is in the Piedmont region and the abutment-scour depth is less than or equal to 5 feet then add pier-scour depth for determining total scour.

3) If the pier in the abutment area is a multiple column bent/pier with minimal skew or a solid, long pier with no skew, and the pier width is less than or equal to 2.3 ft, then do not add pier scour to total scour. (NOTE: The exception to this guidance is for sites in the Piedmont with abutment-scour depths less than or equal to 5 ft as noted in item 2 above.)

4) The spreadsheet assumes that abutment scour will always occur at the left and right abutments. The spreadsheet will automatically make an initial determination regarding the inclusion of pier scour in the total scour estimate. The user should review this initial determination and if appropriate override the automated value by typing "Yes" or "No" (case sensitive) in the "Use pier scour?" column. If the pier is skewed, the user should apply judgment to determine if pier scour should be included in the total scour estimate, especially for long solid piers where a pier skew can cause large scour depths.

5) If the site is a relief or swampy bridge that is 240 ft or less, the abutment-scour depth will be applicable from toe-to-toe; if the relief or swampy bridge is greater than 240 ft, the abutment scour-hole depths will be limited to the abutment scour-hole topwidths and the clear-water overbank contraction scour will be applied to the remaining overbank area. The spreadsheet will automatically determine if there is any overbank area on which overbank contraction scour will occur.

6) If clear-water overbank contraction scour depth (with no adjustment for pier scour) is greater than the abutment scour depth (with no adjustment for pier scour), then the clear-water overbank contraction scour depth will be used as the best representation of the abutment scour depth. The spreadsheet will automatically determine if the clear-water overbank contraction scour depth is to be used in place of the abutment scour depth.

GUIDANCE FOR LEFT AND RIGHT OVERBANK CONTRACTION SCOUR:

Refer to Benedict and others (2016) and Benedict and Caldwell (2006) for additional guidance.

1) If the abutment-scour hole topwidth is greater than the overbank width then it will be assumed that the abutment-scour depth will cover the entire overbank area and there will be no clear-water overbank scour applied to the bridge overbank. However, if the abutment-scour hole topwidth is less than the overbank width then it will be assumed that clear-water overbank scour occurs in the overbank area not affected by the abutment scour hole.

2) The spreadsheet will automatically determine if clear-water overbank scour should be applied or not.

3) If clear-water overbank scour is determined to be applicable to the overbank area, then the spreadsheet will automatically apply the calculated pier scour to the overbank as well.

GUIDANCE FOR LIVE-BED CHANNEL SCOUR:

Refer to Benedict and others (2016) and Benedict and Caldwell (2009) for additional guidance.

1) If the main channel is well defined and considered to be live-bed in nature, it will be assumed that the live-bed contraction scour and channel pier scour will be included in the estimate for total scour in the main channel. The spreadsheet will automatically determine if these scour components are to be included in the estimate of total scour in the main channel.

2) Live-bed contraction scour will not be applied to a relief bridge or to a bridge with a swampy, poorly defined channel; at such bridges, it will be assumed that clear-water scour conditions prevail and the procedures for applying clear-water abutment and contraction scour, as noted previously, will be used. The spreadsheet will automatically determine if live-bed scour should or should not be applied to the channel.

GENERAL GUIDANCE:

1) Drainage area should fall within the range of measured data and caution should be used as drainage area approaches limits of the data or exceeds the data range.

2) If the m and (or) embankment lengths are near the limits or beyond the range of the envelope data caution should be used.

3) User should review automatically determined values to assure that selected values are reasonable.

Scour region	Pier location	Use clear-water abutment scour?	Clear-water abutment scour from USGS curves (feet)	Use clear-water overbank contraction scour?	Clear-water overbank contraction scour from USGS curves (feet)	Use live-bed channel contraction scour?	Live-bed channel contraction scour from USGS curves (feet)	Use pier scour?	Pier scour (feet)	Total scour at bent (feet)	Computed embedment of pile from consultant (feet)	Remaining pile penetration (feet)	Embedment below thalweg from consultant (feet)	Remaining pile penetration (at thalweg) (feet)
Left Abutment	LABUT	Yes	18.69	No	0.00	No	0.00	No	0.00	18.69		-18.69		-18.69
Left Overbank	LOB	No	0.00	Yes	4.53	No	0.00	Yes	9.74	14.27		-14.27		-14.27
Channel	CH	No	0.00	No	0.00	No	0.00	No	0.00	N/A		N/A		N/A
Right Overbank	ROB	No	0.00	Yes	4.53	No	0.00	Yes	9.74	14.27		-14.27		-14.27
Right Abutment	RABUT	Yes	14.59	No	0.00	No	0.00	No	0.00	14.59		-14.59		-14.59

	Comments:	2
1	These and other limitations should be kept in mind when using the envelope curves to assess scour potential. The envelope curves are empirical methods that are based on limited field samples; it is possible that scour could exceed the envelope curves; therefore, application of a safety factor may be prudent. Application of the envelope curves is constrained to the range of data and site characteristics used to develop the envelope curves. The uncertainty associated with the envelope curves increases near the limits of the data range. The live-bed scour data have the largest uncertainty.	
2	The envelope curves do not account for unusual site conditions such as: debris; channel bank failures; pressure flow; unusual flow patterns created by unique site conditions; unusual pier geometries; and washout of approach road embankments.	
3	The field data generally represent scour associated with flows approaching the 100-year flow magnitude but should not be considered a definitive estimate of the scour depth associated with the 100-year flow. Similarly, the 500-year flow adjustment coefficients can be used to provide perspective on the relative increase in theoretical scour associated with the 100- to 500-year flow condition, but should not be considered a definitive estimate of the scour depth associated with the 500-year flow.	
4	Subsurface soils can impede or promote scour. Therefore, assessing the potential effect of subsurface soils on scour is important.	
5		

Pile Penetration Table for Scour Estimates Using Flows Approaching the 100-year Flow and Adjusted by the 500-year Flow Adjustment Coefficient

1

Scour analysis using USGS Bridge-Scour Envelope Curves

(Fill in gray shaded cells. Other cells are selected/calculated automatically.)

Bridge Number:	05249 & 05258	**Stream:**	Lake Marion	**Date of Analysis:**	6/7/2023
County:	Orangeburg & Clarendon	**Road:**	I-95		
				Bridge Length:	4523.67 **ft**
Physiographic Region:	Coastal Plain	**Multiple Bridge?**	Yes		
		Relief Bridge?	No	**Drainage Area:**	14400 **sq mi**
Latitude:	33:30:15.83 **DMS**	**Swampy, Poorly Defined Channel?**	Yes		
Longitude:	80:27:14.98 **DMS**				

NOTE: Bents are listed from left to right looking downstream

GUIDANCE FOR LEFT AND RIGHT ABUTMENT SCOUR:

Refer to Benedict and others (2016) and Benedict (2003) for additional guidance.

1) Do not include clear-water overbank scour depth in abutment-scour area.

2) If site is in the Piedmont region and the abutment-scour depth is less than or equal to 5 feet then add pier-scour depth for determining total scour.

3) If the pier in the abutment area is a multiple column bent/pier with minimal skew or a solid, long pier with no skew, and the pier width is less than or equal to 2.3 ft, then do not add pier scour to total scour. (NOTE: The exception to this guidance is for sites in the Piedmont with abutment-scour depths less than or equal to 5 ft as noted in item 2 above.)

4) The spreadsheet assumes that abutment scour will always occur at the left and right abutments. The spreadsheet will automatically make an initial determination regarding the inclusion of pier scour in the total scour estimate. The user should review this initial determination and if appropriate override the automated value by typing "Yes" or "No" (case sensitive) in the "Use pier scour?" column. If the pier is skewed, the user should apply judgment to determine if pier scour should be included in the total scour estimate, especially for long solid piers where a pier skew can cause large scour depths.

5) If the site is a relief or swampy bridge that is 240 ft or less, the abutment-scour depth will be applicable from toe-to-toe; if the relief or swampy bridge is greater than 240 ft, the abutment scour-hole depths will be limited to the abutment scour-hole topwidths and the clear-water overbank contraction scour will be applied to the remaining overbank area. The spreadsheet will automatically determine if there is any overbank area on which overbank contraction scour will occur.

6) If clear-water overbank contraction scour depth (with no adjustment for pier scour) is greater than the abutment scour depth (with no adjustment for pier scour), then the clear-water overbank contraction scour depth will be used as the best representation of the abutment scour depth. The spreadsheet will automatically determine if the clear-water overbank contraction scour depth is to be used in place of the abutment scour depth.

GUIDANCE FOR LEFT AND RIGHT OVERBANK CONTRACTION SCOUR:

Refer to Benedict and others (2016) and Benedict and Caldwell (2006) for additional guidance.

1) If the abutment-scour hole topwidth is greater than the overbank width then it will be assumed that the abutment-scour depth will cover the entire overbank area and there will be no clear-water overbank scour applied to the bridge overbank. However, if the abutment-scour hole topwidth is less than the overbank width then it will be assumed that clear-water overbank scour occurs in the overbank area not affected by the abutment scour hole.

2) The spreadsheet will automatically determine if clear-water overbank scour should be applied or not.

3) If clear-water overbank scour is determined to be applicable to the overbank area, then the spreadsheet will automatically apply the calculated pier scour to the overbank as well.

GUIDANCE FOR LIVE-BED CHANNEL SCOUR:

Refer to Benedict and others (2016) and Benedict and Caldwell (2009) for additional guidance.

1) If the main channel is well defined and considered to be live-bed in nature, it will be assumed that the live-bed contraction scour and channel pier scour will be included in the estimate for total scour in the main channel. The spreadsheet will automatically determine if these scour components are to be included in the estimate of total scour in the main channel.

2) Live-bed contraction scour will not be applied to a relief bridge or to a bridge with a swampy, poorly defined channel; at such bridges, it will be assumed that clear-water scour conditions prevail and the procedures for applying clear-water abutment and contraction scour, as noted previously, will be used. The spreadsheet will automatically determine if live-bed scour should or should not be applied to the channel.

GENERAL GUIDANCE:

1) Drainage area should fall within the range of measured data and caution should be used as drainage area approaches limits of the data or exceeds the data range.

2) If the m and (or) embankment lengths are near the limits or beyond the range of the envelope data caution should be used.

3) User should review automatically determined values to assure that selected values are reasonable.

Scour region	Pier location	Use clear-water abutment scour?	Clear-water abutment scour from USGS curves (feet)	Use clear-water overbank contraction scour?	Clear-water overbank contraction scour from USGS curves (feet)	Use live-bed channel contraction scour?	Live-bed channel contraction scour from USGS curves (feet)	Use pier scour?	Pier scour (feet)	Total scour at bent (feet)	Computed embedment of pile from consultant (feet)	Remaining pile penetration (feet)	Embedment below thalweg from consultant (feet)	Remaining pile penetration (at thalweg) (feet)
Left Abutment	LABUT	Yes	22.60	No	0.00	No	0.00	No	0.00	22.60		-22.60		-22.60
Left Overbank	LOB	No	0.00	Yes	6.60	No	0.00	Yes	10.60	17.20		-17.20		-17.20
Channel	CH	No	0.00	No	0.00	No	0.00	No	0.00	N/A		N/A		N/A
Right Overbank	ROB	No	0.00	Yes	6.60	No	0.00	Yes	10.60	17.20		-17.20		-17.20

Right Abutment	RABUT	Yes	17.70	No	0.00	No	0.00	No	0.00	17.70		-17.70		-17.70

	Comments:	2
1	These and other limitations should be kept in mind when using the envelope curves to assess scour potential. The envelope curves are empirical methods that are based on limited field samples; it is possible that scour could exceed the envelope curves; therefore, application of a safety factor may be prudent. Application of the envelope curves is constrained to the range of data and site characteristics used to develop the envelope curves. The uncertainty associated with the envelope curves increases near the limits of the data range. The live-bed scour data have the largest uncertainty.	
2	The envelope curves do not account for unusual site conditions such as: debris; channel bank failures; pressure flow; unusual flow patterns created by unique site conditions; unusual pier geometries; and washout of approach road embankments.	
3	The field data generally represent scour associated with flows approaching the 100-year flow magnitude but should not be considered a definitive estimate of the scour depth associated with the 100-year flow. Similarly, the 500-year flow adjustment coefficients can be used to provide perspective on the relative increase in theoretical scour associated with the 100- to 500-year flow condition, but should not be considered a definitive estimate of the scour depth associated with the 500-year flow.	
4	Subsurface soils can impede or promote scour. Therefore, assessing the potential effect of subsurface soils on scour is important.	
5		

Application of Selected Envelope-Curve Equations

Do not modify this worksheet. This worksheet uses data entered in other worksheets of this workbook and uses the various South Carolina Bridge-Scour Envelope Curves to calculate the upper bound of selected scour parameters.

Estimate of Upper Bound of Clear-Water Abutment-Scour Depth from Envelope Curves

I. Estimate from abutment-length envelope curves -- Original Curves (Benedict and others, 2016; Benedict, 2003)

		Left Abutment		Right Abutment	
Coastal Plain	Scour Depth:	18.7	ft	14.6	ft
	Embankment Length:	3700	ft	570	ft
	Embankment Length Check:	CAUTION		OK	

NOTES:
If embankment length is greater than 7,440 ft it is **OUTSIDE RANGE**.
If embankment length is greater than 2,000 ft but less than 7,440 ft use **CAUTION**.
If embankment length is between 0 and 2,000 ft it is **OK**.

Piedmont	Scour Depth:	-21.1	ft	12.8	ft
	Embankment Length:	3700.0		570.0	
	Embankment Length Check:	OUTSIDE RANGE		OK	

NOTES:
If embankment length is greater than 950 ft it is **OUTSIDE RANGE**.
If embankment length is between 0 and 950 ft it is **OK**.

II. Estimate from the geometric contraction ratio m -- Original Curves (Benedict and others, 2016; Benedict, 2003)

		Left Abutment		Right Abutment	
Coastal Plain	Scour Depth:	7.0	ft	7.0	ft
	Contraction Ratio:	0.64		0.64	
	Contraction Ratio Check:	OK		OK	

NOTES:
If contraction ratio is greater than 0.98 it is **OUTSIDE RANGE.**
If contraction ratio is greater than 0.9 but less than 0.98 use **CAUTION.**
If contraction ratio is between 0 and 0.9 it is **OK.**

Piedmont	Scour Depth:	12.0	ft	12.0	ft
	Contraction Ratio:	0.64		0.64	
	Contraction Ratio Check:	OK		OK	

NOTES:
If contraction ratio is greater than 0.86 it is **OUTSIDE RANGE.**
If contraction ratio is greater than 0.82 but less than 0.86 use **CAUTION.**
If contraction ratio is between 0 and 0.82 it is **OK.**

III. Estimate by embankment-length category -- Modified Curves (Benedict and others, 2016; Benedict and Caldwell, 2012)

Coastal Plain

	Left Abutment		Right Abutment	
Initial Estimate of Scour Depth (by Category):	N/A	ft	N/A	ft
Final Selection of Scour Depth (by Category):	N/A	ft	N/A	ft
Initial Estimate of Scour Depth (by Interpolation):	N/A	ft	N/A	ft
Final Selection of Scour Depth (by Interpolation):	N/A	ft	N/A	ft
Embankment Length:	3700	ft	570	ft
Embankment Length Check:	OUTSIDE RANGE		OUTSIDE RANGE	
Contraction Ratio:	0.64		0.64	
Contraction Ratio Check:	OK		OK	

Interpolation Table

Embankment Length Category (ft)	Lower m Limit	m used in equation	Abutment-Scour Depth (ft)
0	0.00	0.00	0.0
100	0.25	0.64	2.0
200	0.50	0.64	4.5
300	0.65	0.65	7.4
400	0.76	0.76	11.2
500	0.84	0.84	14.9

NOTES:

If embankment length is greater than 500 ft it is **OUTSIDE RANGE**.
If embankment length is between 0 and 500 ft it is **OK**.
If contraction ratio is greater than 0.9 it is **OUTSIDE RANGE.**
If contraction ratio is between 0 and 0.9 it is **OK.**

Piedmont

Initial Estimate of Scour Depth (by Category):	N/A	ft	N/A	ft
Final Selection of Scour Depth (by Category):	N/A	ft	N/A	ft
Initial Estimate of Scour Depth (by Interpolation):	N/A	ft	N/A	ft
Final Selection of Scour Depth (by Interpolation):	N/A	ft	N/A	ft
Embankment Length:	3700	ft	570	ft
Embankment Length Check:	OUTSIDE RANGE		OUTSIDE RANGE	
Contraction Ratio:	0.64		0.64	
Contraction Ratio Check:	OK		OK	

Interpolation Table

Embankment Length Category (ft)	Lower m Limit	m used in equation	Abutment-Scour Depth (ft)
0	0.00	0.00	0.0
100	0.14	0.64	1.9
200	0.25	0.64	3.9
300	0.34	0.64	5.6
400	0.42	0.64	7.3
500	0.50	0.64	8.9

NOTES:

If embankment length is greater than 500 ft it is **OUTSIDE RANGE**.
If embankment length is between 0 and 500 ft it is **OK**.
If contraction ratio is greater than 0.85 it is **OUTSIDE RANGE.**
If contraction ratio is between 0 and 0.85 it is **OK.**

Estimate of Clear-Water Abutment-Scour Hole Topwidth from Envelope Curve (Benedict and others, 2016; Benedict, 2003)

Using "final selected abutment-scour depth"

	Left Abutment		Right Abutment	
Any length bridge with well defined channel	70.0	ft	70.0	ft
Is scour depth greater than 18 feet and therefore outside range of graph?	Yes		Yes	
Relief or swampy bridge with length of 240 ft or less	115.1	ft	102.7	ft
Is scour depth greater than 23.6 feet and therefore outside range of graph?	No		No	

NOTES:

If scour depth is outside the range of the graph then cell is highlighted in **red.**

If scour depth is within the range of the graph then cell is highlighted in **green.**

Estimate of Clear-Water Overbank Contraction-Scour Depth from Envelope Curves (Benedict and others, 2016; Benedict and Caldwell, 2006)

	Left Overbank		Right Overbank	
Scour Depth:	4.5	ft	4.5	ft
Contraction Ratio:	0.64		0.64	
Contraction Ratio Check:	OK		OK	

NOTES:

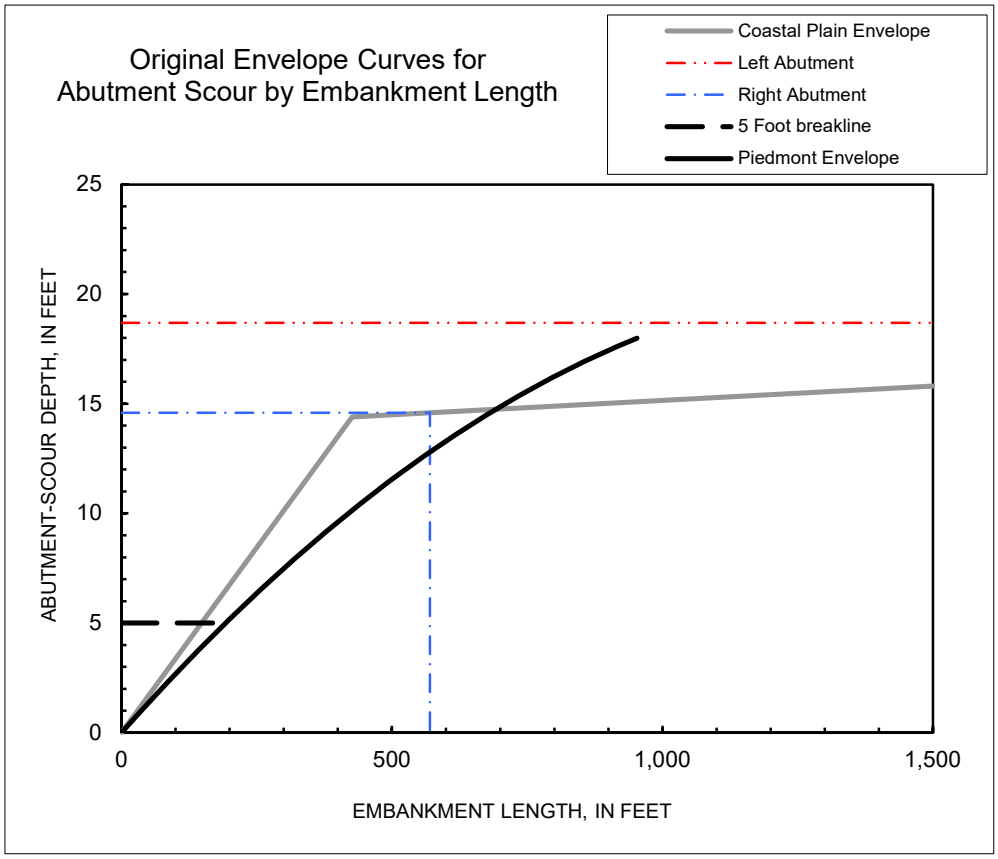
If contraction ratio is greater than 0.95 it is **OUTSIDE RANGE.**

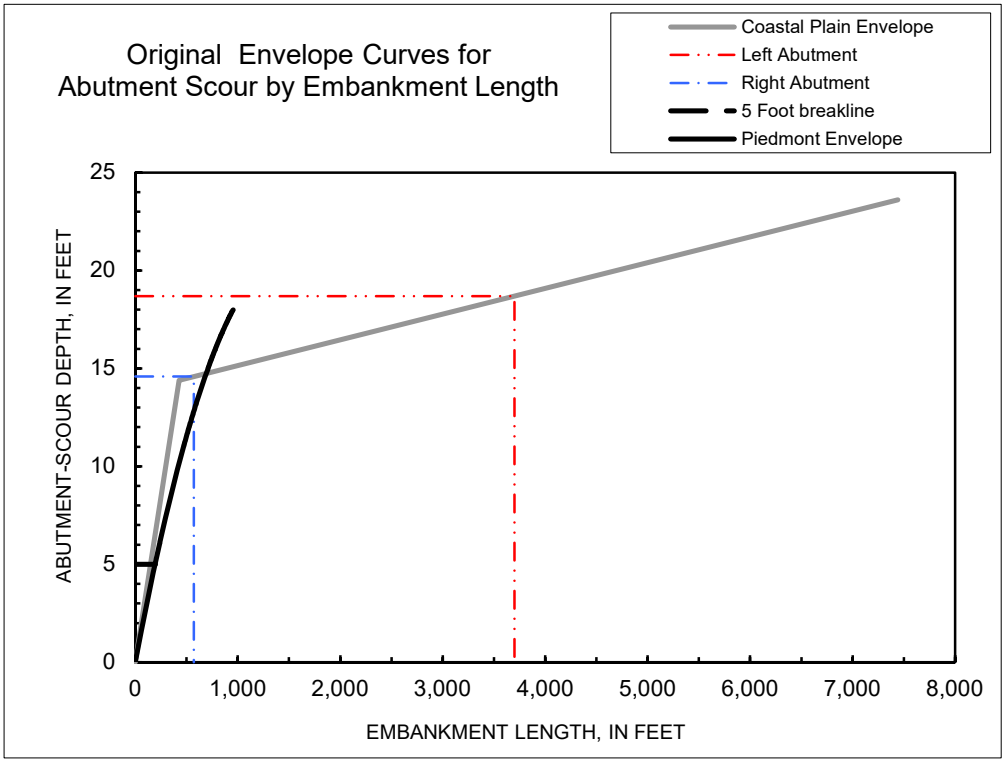
If contraction ratio is greater than 0.85 but less than 0.95 use **CAUTION.**

If contraction ratio is between 0 and 0.85 it is **OK.**

Bridge Number: 05249 & 05258 **1**
County: Orangeburg & Clarendon
Stream: Lake Marion
Road: I-95
Region: Coastal Plain

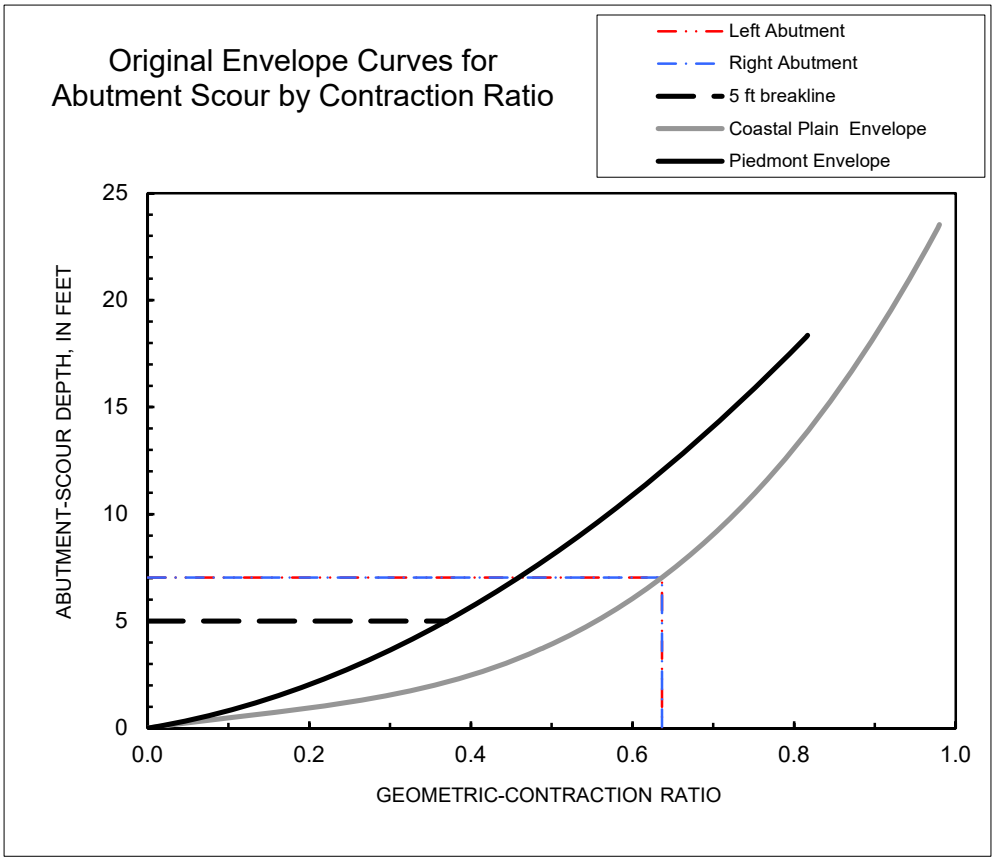
Original Clear-Water Abutment-Scour Envelope Curves (Benedict and others, 2016; Benedict, 2003)

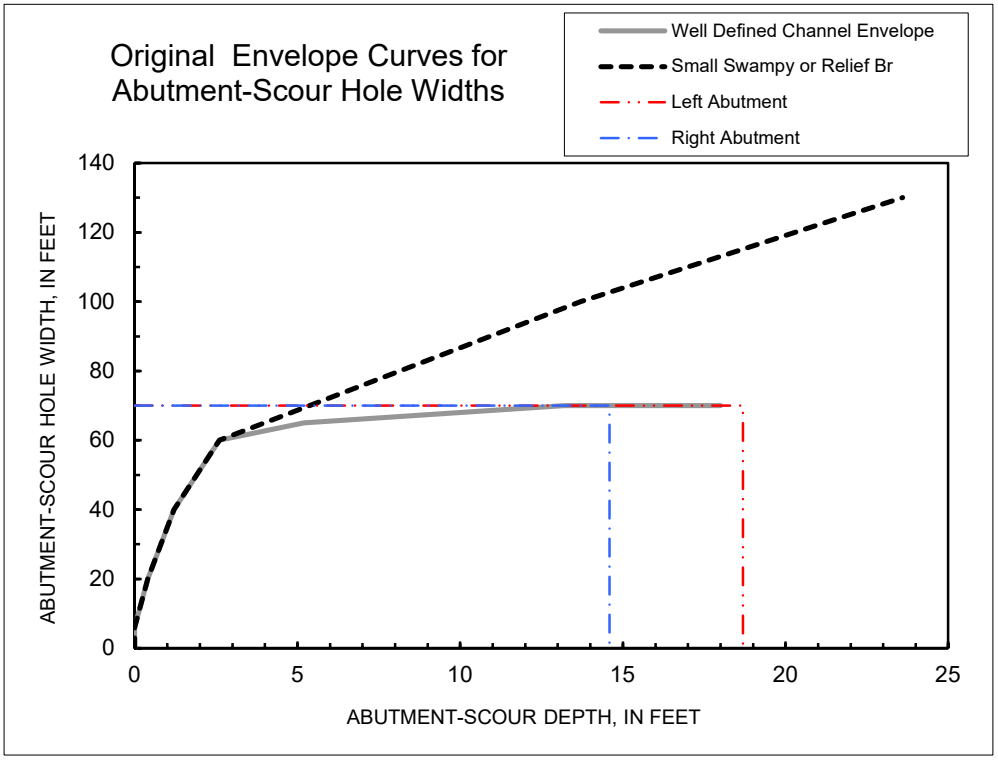




Bridge Number: 05249 & 05258 **2**
County: Orangeburg & Clarendon
Stream: Lake Marion
Road: I-95
Region: Coastal Plain

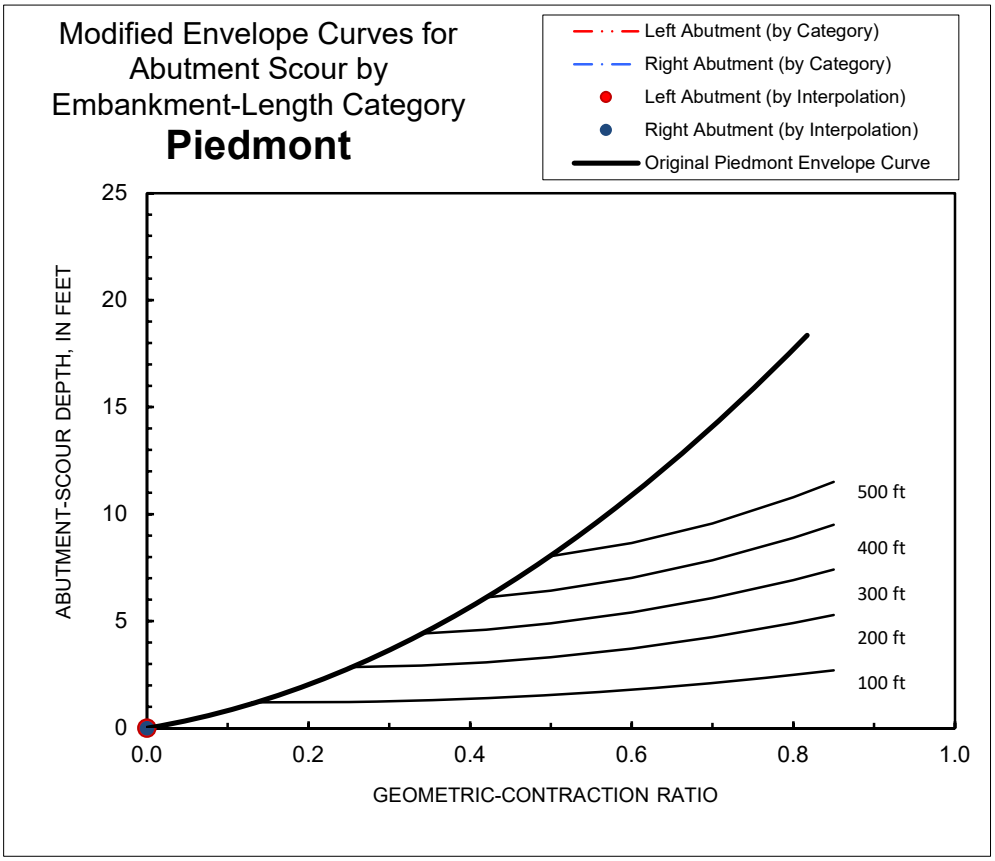
Original Clear-Water Abutment-Scour Envelope Curves (Benedict and others, 2016; Benedict, 2003)

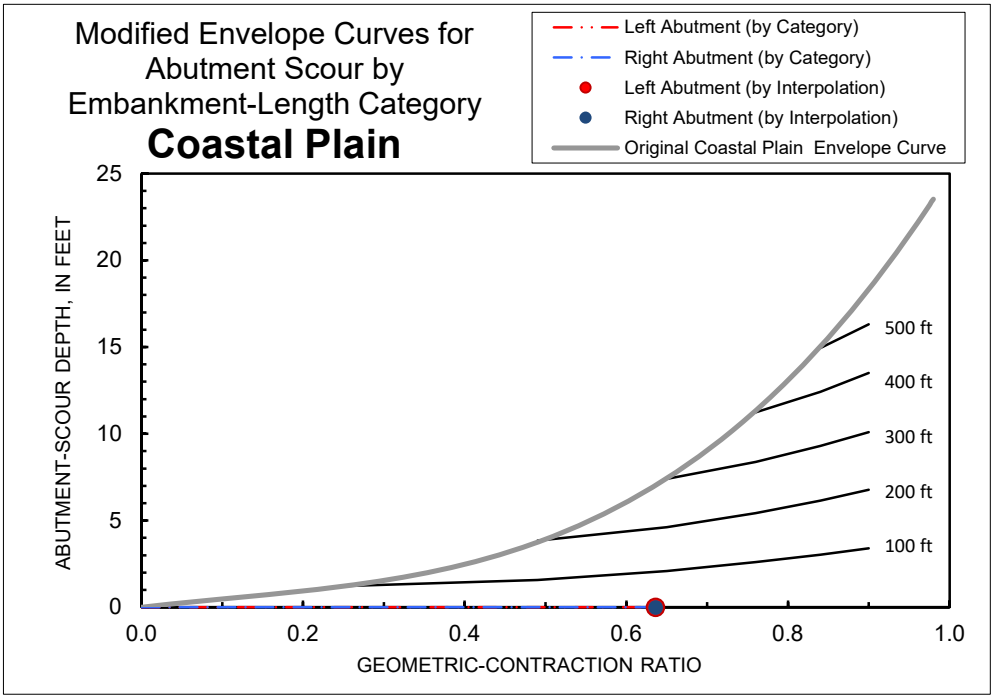




Bridge Number: 05249 & 05258 **3**
County: Orangeburg & Clarendon
Stream: Lake Marion
Road: I-95
Region: Coastal Plain

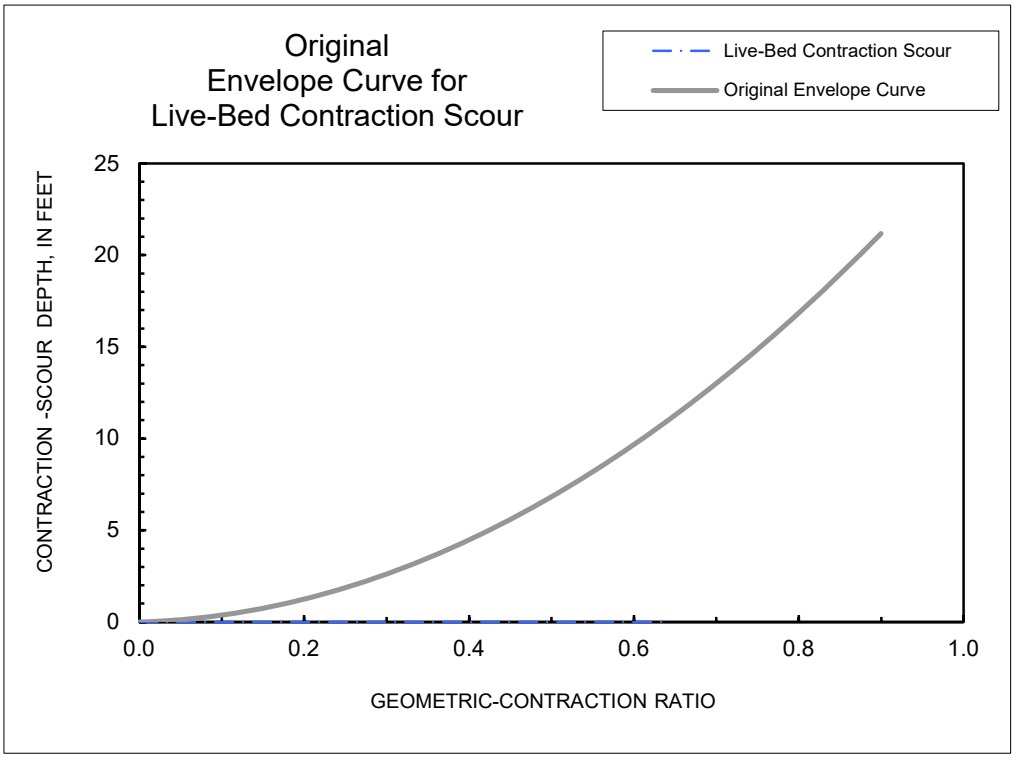
Modified Clear-Water Abutment-Scour Envelope Curves (Benedict and others, 2016; Benedict and Caldwell, 2012)



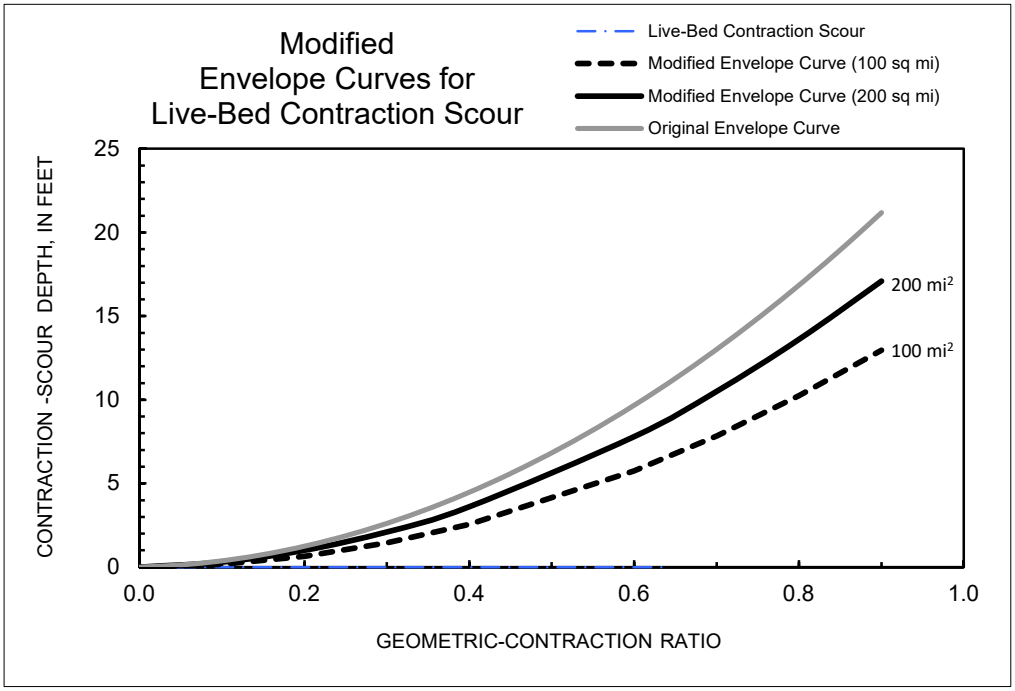


Bridge Number: 05249 & 05258 **4**
County: Orangeburg & Clarendon
Stream: Lake Marion
Road: I-95
Region: Coastal Plain

Original Live-Bed Channel Contraction-Scour Envelope Curve (Benedict and others, 2016; Benedict and Caldwell, 2009)

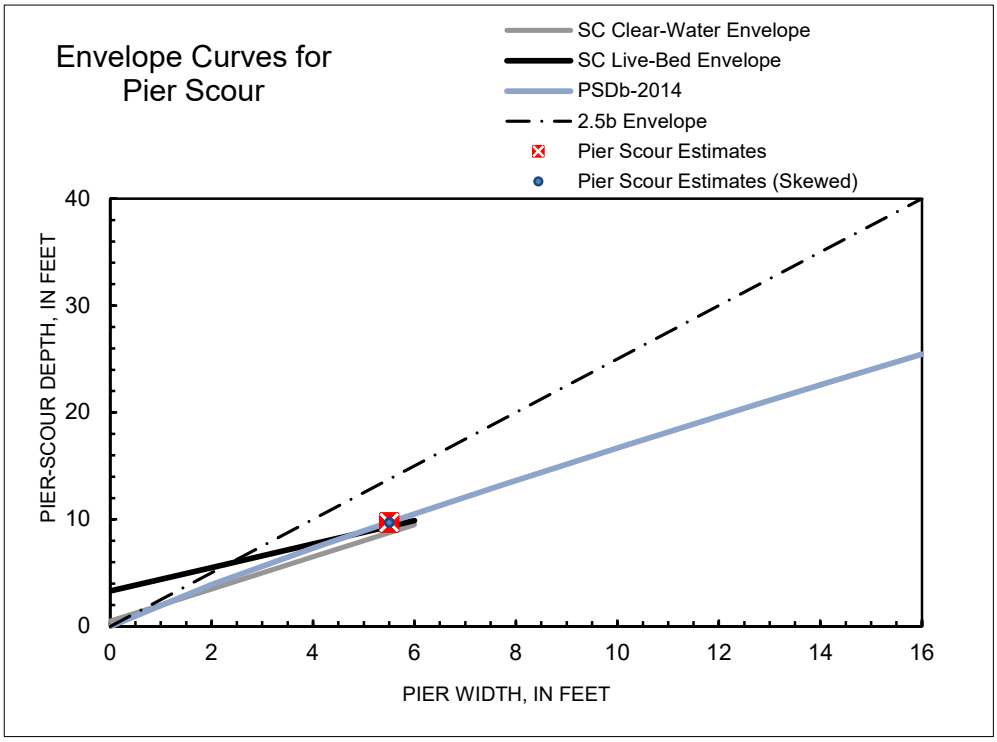


Modified Live-Bed Channel Contraction-Scour Envelope Curves (Benedict and others, 2016; Benedict and Caldwell, 2012)

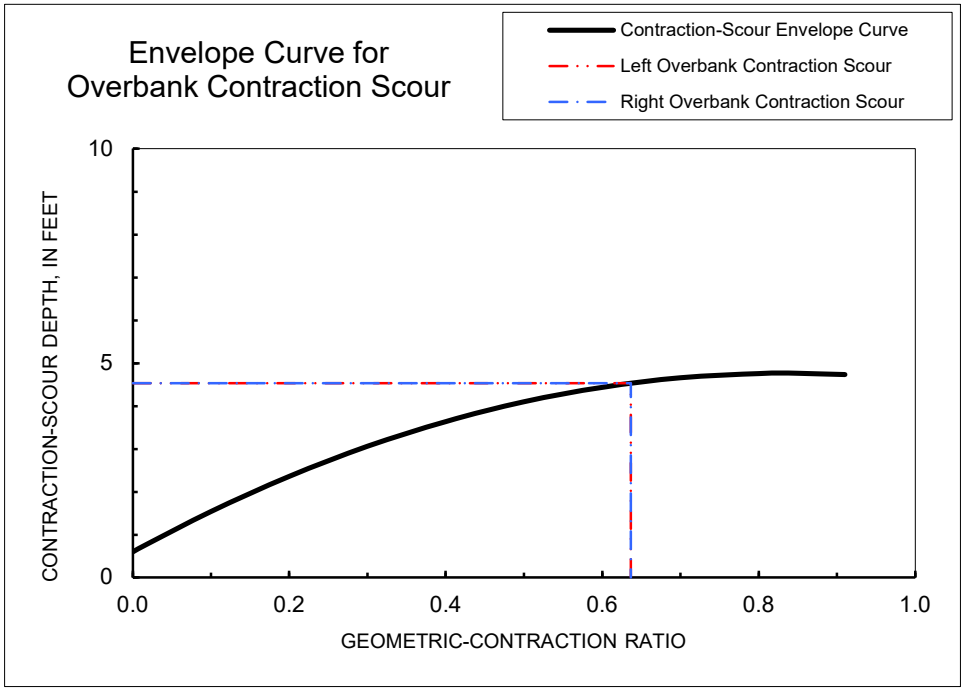


Bridge Number: 05249 & 05258 **5**
County: Orangeburg & Clarendon
Stream: Lake Marion
Road: I-95
Region: Coastal Plain

Pier-Scour Envelope Curves (Benedict and others, 2016; Benedict and Caldwell, 2006; 2009)

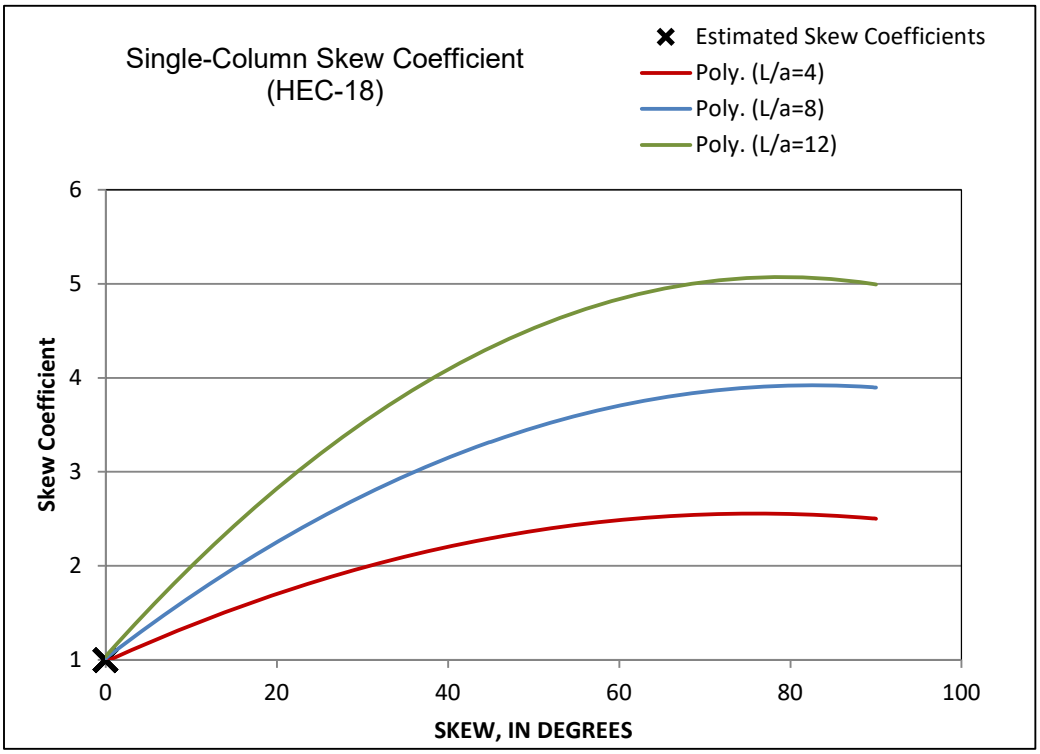


Clear-Water Overbank Contraction-Scour Envelope Curve (Benedict and others, 2016; Benedict and Caldwell, 2006)



Bridge Number: 05249 & 05258 **6**
County: Orangeburg & Clarendon
Stream: Lake Marion
Road: I-95
Region: Coastal Plain

Pier-Scour Skew Coefficients



Data for Graphs

Estimate of Abutment-Scour -- Original Abutment-Scour Envelope Curves (Benedict and others, 2016; Benedict, 2003)

Use the following envelope curve: **Coastal Plain** **Coastal Plain**

Abutment Scour by Embankment Length

Left Abutment

Embankment Length (ft)	Scour Depth (ft)
0	18.7
3700	18.7
3700	0

Right Abutment

Embankment Length (ft)	Scour Depth (ft)
0	14.6
570	14.6
570	0

5 ft break line

Embankment Length (ft)	Scour Depth (ft)
0	5
194	5

Abutment Scour by m

Left Abutment

m	Scour Depth (ft)
0	7.0
0.64	7.0
0.64	0

Right Abutment

m	Scour Depth (ft)
0	7.0
0.64	7.0
0.64	0

5 ft break line

m	Scour Depth (ft)
0	5
0.37	5

Estimate of Abutment-Scour -- Modified Abutment-Scour Envelope Curves (Benedict and others, 2016; Benedict and Caldwell, 2012)

Piedmont

By Category

Left Abutment

m	Scour Depth (ft)
0	0.0
0.00	0.0
0.00	0

Right Abutment

m	Scour Depth (ft)
0	0.0
0.00	0.0
0.00	0

By Interpolation

m	Scour Depth (ft)
0	0.0
0.00	0.0
0.00	0

m	Scour Depth (ft)
0	0.0
0.00	0.0
0.00	0

Coastal Plain

By Category

Left Abutment

m	Scour Depth (ft)
0	N/A
0.64	N/A
0.64	0

Right Abutment

m	Scour Depth (ft)
0	N/A
0.64	N/A
0.64	0

By Interpolation

m	Scour Depth (ft)
0	N/A
0.64	N/A
0.64	0

m	Scour Depth (ft)
0	N/A
0.64	N/A
0.64	0

Coastal Plain and Piedmont Clear-Water Overbank Contraction-Scour Envelope Curve by m (Benedict and others, 2016; Benedict and Caldwell, 2006)

Left Overbank

m	Scour Depth (ft)
0	4.5
0.64	4.5
0.64	0

Right Overbank

m	Scour Depth (ft)
0	4.5
0.64	4.5
0.64	0

Coastal Plain and Piedmont Live-Bed Channel Contraction-Scour Envelope Curve by m

Original Live-Bed Channel Contraction Scour (Benedict and Caldwell, 2009)

m	Scour Depth (ft)
0	N/A
0.64	N/A
0.64	0.0

Modified Live-Bed Channel Contraction Scour (Benedict and Caldwell, 2012)

m	Scour Depth (ft)
0	N/A
0.64	N/A
0.64	0.0

Abutment-Scour Hole Topwidths (Benedict and others, 2016; Benedict, 2003)

Use the following envelope curve: **Long Bridge** **Long Bridge**

Left Abutment

Scour Depth (ft)	Scour Topwidth (ft)
0	70.0
18.7	70.0
18.7	0

Right Abutment

Scour Depth (ft)	Scour Topwidth (ft)
0	70.0
14.6	70.0
14.6	0

Envelope Curve Data

Abutment-Scour Depth by Embankment Length Original Curve (Benedict, 2003)

Coastal Plain

Abut Length (ft)	Scour Depth (ft)
0	0
426.5	14.4
7440.6	23.6

Piedmont

Abut Length (ft)	Scour Depth (ft)
0	0
18.4	0.6
112.3	3.1
181.4	4.6
408.5	9.7
571.8	12.9
606.4	13.7
675	14.2
952.9	18

Envelope Curve Data

Pier Scour Envelopes (Benedict and Caldwell, 2006; 2009)

Pier Width (ft)	SC Clear-Water Scour Depth (ft)	SC Live-Bed Scour Depth (ft)	National Scour Depth (ft)	2.5b Scour Depth (ft)	PSDb-2014 Scour Depth (ft)
0	0.5	3.3	4.1	0.0	0.0
2	3.5	5.5	7.1	5.0	3.9
4	6.5	7.7	10.1	10.1	7.3
6	9.5	9.9	13.1	15.0	10.5
8			16.1	20.0	13.6
10			19.1	25.0	16.7
12			22.1	30.0	19.7
14			25.1	35	22.6
16				40.0	25.5

Envelope Curve Data

Abutment-Scour Depth by Contraction Ratio
Original Curve (Benedict, 2003)

Coastal Plain

m	Scour Depth (ft)
0	0
0.32	1.69
0.67	8.18
0.77	11.75
0.81	13.55
0.82	14.03
0.98	23.53

Piedmont Sands

m	Scour Depth (ft)
0	0
0.022	0.6
0.372	4.6
0.668	13.7
0.817	18

Envelope Curve Data

Abutment-Scour Hole Topwidth
Original Curve (Benedict, 2003)

Long Bridges

Scour Depth (ft)	Scour Topwidth (ft)
0	0
0	6
0.4	20
1.2	40
2.6	60
5.2	65
13.2	70
18	70

Small Swampy Bridges

Scour Depth (ft)	Scour Topwidth (ft)
0	0
0	6
0.4	20
1.2	40
2.6	60
13.7	100
23.6	130

Skew Coefficients from HEC-18

Correction Factor, K_2, for Angle of Attack, θ, of the Flow.

Angle	L/a=4	L/a=8	L/a=12
0	1.00	1.00	1.00
15	1.50	2.00	2.50
30	2.00	2.75	3.50
45	2.30	3.30	4.30
90	2.50	3.90	5.00

Angle = skew angle of flow, in degrees; L = length of pier, in feet; a = pier width, in feet

Envelope Curve Data

Modified Abutment-Scour Envelope Curves (Benedict and others, 2016; Benedict and Caldwell, 2012)

Piedmont

m	Embankment Length Category (ft) 100 Scour Depth (ft)	200 Scour Depth (ft)	300 Scour Depth (ft)	400 Scour Depth (ft)	500 Scour Depth (ft)
0.130	1.20				
0.25	1.21	2.84			
0.34	1.29	2.92	4.42		
0.42	1.40	3.08	4.60	6.12	
0.5	1.55	3.31	4.89	6.43	8.04
0.6	1.80	3.72	5.40	7.02	8.65
0.7	2.11	4.25	6.08	7.84	9.57
0.8	2.49	4.91	6.92	8.89	10.79
0.85	2.70	5.28	7.41	9.50	11.52

Coastal Plain

m	Embankment Length Category (ft) 100 Scour Depth (ft)	200 Scour Depth (ft)	300 Scour Depth (ft)	400 Scour Depth (ft)	500 Scour Depth (ft)
0.25	1.22				
0.49	1.57	3.84			
0.65	2.10	4.62	7.40		
0.76	2.60	5.42	8.39	11.24	
0.84	3.03	6.14	9.30	12.42	14.94
0.90	3.40	6.76	10.10	13.50	16.30

Envelope Curve Data

Coastal Plain and Piedmont
Clear-Water Overbank Contraction Scour
(Benedict and Caldwell, 2006)

m	Scour Depth (ft)
0	0.60
0.02	0.80
0.1	1.54
0.2	2.36
0.3	3.06
0.4	3.64
0.5	4.10
0.6	4.44
0.7	4.66
0.8	4.76
0.85	4.77
0.91	4.73

Envelope Curve Data

Coastal Plain and Piedmont
Original Live-Bed Channel Contraction Scour
(Benedict and Caldwell, 2009)

m	Scour Depth (ft)
0	0.0
0.02	0.04
0.1	0.38
0.2	1.25
0.3	2.61
0.4	4.47
0.5	6.83
0.6	9.67
0.7	13.01
0.8	16.85
0.85	18.95
0.9	21.18

Envelope Curve Data

Coastal Plain and Piedmont
Modified Live-Bed Channel Contraction Scour

(Benedict and Caldwell, 2012)

m	Drainage Area (sq mi) 100 Scour Depth (ft)	200 Scour Depth (ft)
0.000	0.00	0.00
0.1	0.16	0.30
0.2	0.64	1.00
0.3	1.44	2.10
0.4	2.56	3.60
0.6	5.76	7.80
0.7	7.84	10.50
0.8	10.24	13.60
0.9	12.96	17.10

ABUTMENT-SCOUR DATA

SCDOT Bridge Number	County	Road	Stream	Latitude (DMS)	Longitude (DMS)	Analysis date	Physiographic Province	Multiple bridge?	Relief bridge?	Swampy, Poorly Defined Channel?	Bridge length (feet)	Drainage area (sq mi)	Drainage area check (original envelope)	Drainage area check (modified envelope)	Quality of SCDOT Plan Data
05249 & 05258	rangeburg & Clarenc	I-95	Lake Marion	33:30:15.83	80:27:14.98	6/7/2023	Coastal Plain	Yes	No	Yes	4523.67	14400	DA OUTSIDE RANGE (Above)	DA OUTSIDE RANGE (Above)	No Data

CLEAR-WATER CONTRACTION-SCOUR DATA

SCDOT Bridge Number	County	Road	Stream	Latitude (DMS)	Longitude (DMS)	Analysis date	Physiographic Province	Multiple bridge?	Relief bridge?	Swampy, Poorly Defined Channel?	Bridge length (feet)	Drainage area (sq mi)	Drainage area check	Plan m	Topo m
05249 & 05258	rangeburg & Clarenc	I-95	Lake Marion	33:30:15.83	80:27:14.98	6/7/2023	Coastal Plain	Yes	No	Yes	4523.67	14400	DA OUTSIDE RANGE (Above)	No Data	0.64

LIVE-BED CONTRACTION-SCOUR DATA

SCDOT Bridge Number	County	Road	Stream	Latitude (DMS)	Longitude (DMS)	Analysis date	Physiographic Province	Multiple bridge?	Relief bridge?	Swampy, Poorly Defined Channel?	Bridge length (feet)	Drainage area (sq mi)	Drainage area check (original curve)	Drainage area check (modified curve)	Plan m
05249 & 05258	rangeburg & Clarenc	I-95	Lake Marion	33:30:15.83	80:27:14.98	6/7/2023	Coastal Plain	Yes	No	Yes	4523.67	14400	DA OUTSIDE RANGE (Above)	DA OUTSIDE RANGE (Above)	No Data

PIER-SCOUR DATA

SCDOT Bridge Number	County	Road	Stream	Latitude (DMS)	Longitude (DMS)	Analysis date	Physiographic Province	Multiple bridge?	Relief bridge?	Swampy, Poorly Defined Channel?	Bridge length (feet)	Drainage area (sq mi)	Location of pier	Pier or bent type	Envelope curve used
05249 & 05258	rangeburg & Clarenc	I-95	Lake Marion	33:30:15.83	80:27:14.98	6/7/2023	Coastal Plain	Yes	No	Yes	4523.67	14400	LABUT	Multiple Column Pier	Automatic Calculation
05249 & 05258	rangeburg & Clarenc	I-95	Lake Marion	33:30:15.83	80:27:14.98	6/7/2023	Coastal Plain	Yes	No	Yes	4523.67	14400	LOB	Multiple Column Pier	Automatic Calculation
05249 & 05258	rangeburg & Clarenc	I-95	Lake Marion	33:30:15.83	80:27:14.98	6/7/2023	Coastal Plain	Yes	No	Yes	4523.67	14400	CH	Multiple Column Pier	Automatic Calculation
05249 & 05258	rangeburg & Clarenc	I-95	Lake Marion	33:30:15.83	80:27:14.98	6/7/2023	Coastal Plain	Yes	No	Yes	4523.67	14400	ROB	Multiple Column Pier	Automatic Calculation
05249 & 05258	rangeburg & Clarenc	I-95	Lake Marion	33:30:15.83	80:27:14.98	6/7/2023	Coastal Plain	Yes	No	Yes	4523.67	14400	RABUT	Multiple Column Pier	Automatic Calculation

Quality of Topo Map Data	Quality of FEMA/Other Map Data	Plan m	Topo m	FEMA/Other m	Used m	m check (original envelope)	m check (modified envelope)	Plan (left abutment length) (feet)	Topo (left abutment length) (feet)	FEMA/Other (left abutment length) (feet)	Used (left abutment length) (feet)	Left abutment length check (original envelope)	Left abutment length check (modified envelope)	Plan (right abutment length) (feet)	Topo (right abutment length) (feet)
Good	Good	No Data	0.64	0.64	0.64	OK	OK	No Data	3700	3700	3700	CAUTION	OUTSIDE RANGE	No Data	570

FEMA/Other m	Used m	m check	Left overbank scour depth (feet)	Right overbank scour depth (feet)	Selected left overbank scour depth (feet)	Selected right overbank scour depth (feet)
0.64	0.64	OK	4.5	4.5	4.5	4.5

Topo m	FEMA/Other m	Used m	m check (original curve)	m check (modified curve)	Original channel scour depth (feet)	Modified channel scour depth (feet)	Selected channel scour depth (feet)
0.64	0.64	0.64	OK	OK	N/A	N/A	N/A

PENETRATION TABLE

Pier width (feet)	Pier length (feet)	Angle of attack (degrees)	Multiple column bent?	Minimum spacing between columns (feet)	Column spacing to width ratio	Skew coefficient (single pier - HEC 18)		Skew coefficient used	Envelope curve used in pier scour estimate	Pier scour from envelope (feet) (no adjustment)	Pier scour adjusted for skew (feet)	Use abutment scour at pier?	Clear-water abutment scour from USGS curves (feet)	Use overbank contraction scour at pier?	Clear-water overbank contraction scour from USGS curves (feet)
5.5	33	0	Yes	14.5	2.64	1.00		1.00	PSDb-2014	9.7	9.7	Yes	18.7	No	0.0
5.5	33	0	Yes	14.5	2.64	1.00		1.00	PSDb-2014	9.7	9.7	No	0.0	Yes	4.5
5.5	33	0	Yes	14.5	2.64	1.00		1.00	PSDb-2014	9.7	9.7	No	0.0	No	0.0
5.5	33	0	Yes	14.5	2.64	1.00		1.00	PSDb-2014	9.7	9.7	No	0.0	Yes	4.5
5.5	33	0	Yes	14.5	2.64	1.00		1.00	PSDb-2014	9.7	9.7	Yes	14.6	No	0.0

FEMA/Other (right abutment length) (feet)	Used (right abutment length) (feet)	Right abutment length check (original envelope)	Right abutment length check (modified envelope)	Original left abutment depth by m (feet)	Original right abutment depth by m (feet)	Original left abutment depth by length (feet)	Original right abutment depth by length (feet)	Modified left abutment depth by Category (feet)	Modified right abutment depth by Category (feet)	Modified left abutment depth by Interpolation (feet)	Modified right abutment depth by Interpolation (feet)	Left abutment depth selected (feet)	Right abutment depth selected (feet)	Left abutment hole width (feet)	Right abutment hole width (feet)
570	570	OK	OUTSIDE RANGE	7.04	7.04	18.69	14.59	N/A	N/A	N/A	N/A	18.69	14.59	70.00	70.00

Use live-bed channel contraction scour at pier?	Live-bed contraction scour from USGS curves (feet)	Use pier scour?	Pier scour (feet)	Total scour at bent (feet)	Computed embedment of pile from consultant (feet)	Remaining pile penetration (feet)	Embedment below thalweg from consultant (feet)	Remaining pile penetration (at thalweg) (feet)
No	0.0	No	0.0	18.69	0.00	-18.69	0.00	-18.69
No	0.0	Yes	9.7	14.27	0.00	-14.27	0.00	-14.27
No	0.0	No	0.0	N/A	0.00	N/A	0.00	N/A
No	0.0	Yes	9.7	14.27	0.00	-14.27	0.00	-14.27
No	0.0	No	0.0	14.59	0.00	-14.59	0.00	-14.59

The South Carolina
Bridge-Scour Envelope Curve Template
2016

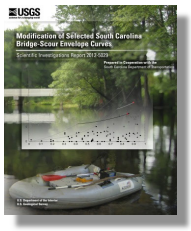
The South Carolina Bridge-Scour Envelope Curve Template was designed to provide a consistent procedure to apply the South Carolina bridge-scour envelope curves. The template was tested with a limited number of bridges and corrections were made as necessary.

The development of the South Carolina bridge-scour envelope curves is documented in a series of five reports published over a period from 2003 to 2014 (reports listed below with website links). Benedict and others (2016; website link below) provides a summary of those five previous reports and the 2016 report should be used as the primary source for guidance in applying the envelope curves and understanding their limitations. However, the earlier five reports provide important background information, and users of this template should be familiar with their content. The South Carolina bridge-scour envelope curves are useful supplementary tools for assessing scour potential at bridges in South Carolina. However, there are limitations associated with these empirical methods that must be considered in their application. The reports listed below (with website links) describe these limitations, and users of this template should be familiar with their content.

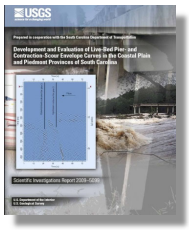
Although much effort was expended in the development and review of this template, no warranty, expressed or implied, is made by the U.S. Geological Survey as to the accuracy and functioning of the template and related template materials.

Benedict, S.T., Feaster, T.D., and Caldwell, A.W., 2016, The South Carolina bridge-scour envelope curves: U.S. Geological Survey Scientific Investigations Report 2016-5121, 96 p.
https://pubs.er.usgs.gov/publication/sir20165121

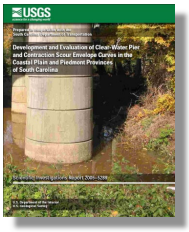
Benedict, S.T., and Caldwell, A.W., 2014, A pier-scour database 2,427 field and laboratory measurements of pier scour: U.S. Geological Survey Data Series 845, 22 p.
http://pubs.usgs.gov/ds/0845/



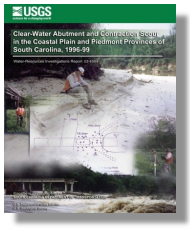
Benedict, S.T., and Caldwell, A.W., 2012, Modification of selected South Carolina bridge-scour envelope curves:U.S. Geological Survey Scientific Investigations Report 2012-5029, 37 p.
http://pubs.usgs.gov/sir/2012/5029/



Benedict, S.T., and Caldwell, A.W., 2009, Development and evaluation of live-bed pier and contraction scour envelope curves in the Coastal Plain and Piedmont Provinces of South Carolina, U.S. Geological Survey Scientific Investigations Report 2009 5099, 108 p.
http://pubs.usgs.gov/sir/2009/5099/



Benedict, S.T., and Caldwell, A.W., 2006, Development and evaluation of clear-water pier and contraction scour envelope curves in the Coastal Plain and Piedmont Provinces of South Carolina: U.S. Geological Survey Scientific Investigations Report 2005 5289, 98 p.
http://pubs.usgs.gov/sir/2005/5289/



Benedict, S.T., 2003, Clear-water abutment and contraction scour in the Coastal Plain and Piedmont Provinces of South Carolina, 1996 99: U.S. Geological Survey Water-Resources Investigations Report 03 4064, 137 p.

http://pubs.usgs.gov/wri/wri034064/

A Note to Template Users:

Throughout this workbook there are several locations where users are asked to fill in bridge-site information and where users have the option to select their preferred bridge-scour envelope curve. The authors recommend that a blank template be used when starting a new bridge-scour assessment to avoid mistakes possible when back-tracking through a previously populated template.

Abbreviations Used in the Template

#	number
CH	channel
D/S	downstream
DA	drainage area
DMS	degrees-minutes-seconds
FEMA	Federal Emergency Management Agency
ft	feet
HEC-18	Hydraulic Engineering Circular No. 18 (Arneson and others, 2012)
HWM	high water mark
LABUT	left abutment
LEW	left edge of water
LTB	left top bank
LOB	left overbank
m	geometric-contraction ratio
N/A	not applicable
RABUT	right abutment
REW	right edge of water
ROB	right overbank
RTB	right top bank
SCDOT	South Carolina Department of Transportation
sq mi	square mile
topo	topographic
USGS	U.S. Geological Survey
WSEL	water-surface elevation

References Used in the Template

Arneson, L.A., Zevenbergen, L.W., Lagasse, P.F., and Clopper, P.E., 2012, Evaluating scour at bridges (5th ed.): Federal Highway Administration Hydraulic Engineering Circular No. 18, Publication No. FHWA-HIF-12-003, 340 p.

Benedict, S.T., 2003, Clear-water abutment and contraction scour in the Coastal Plain and Piedmont Provinces of South Carolina, 1996 99: U.S. Geological Survey Water-Resources Investigations Report 03 4064, 137 p.

Benedict, S.T., and Caldwell, A.W., 2006, Development and evaluation of clear-water pier and contraction scour envelope curves in the Coastal Plain and Piedmont Provinces of South Carolina: U.S. Geological Survey Scientific Investigations Report 2005 5289, 98 p.

Benedict, S.T., and Caldwell, A.W., 2009, Development and evaluation of live-bed pier and contraction scour envelope curves in the Coastal Plain and Piedmont Provinces of South Carolina, U.S. Geological Survey Scientific Investigations Report 2009 5099, 108 p.

Benedict, S.T., and Caldwell, A.W., 2012, Modification of selected South Carolina bridge-scour envelope curves: U.S. Geological Survey Scientific Investigations Report 2012-5029, 37 p.

Benedict, S.T., and Caldwell, A.W., 2014, A pier-scour database 2,427 field and laboratory measurements of pier scour: U.S. Geological Survey Data Series 845, 22 p.

Benedict, S.T., Feaster, T.D., and Caldwell, A.W., 2016, The South Carolina bridge-scour envelope curves: U.S. Geological Survey Scientific Investigations Report 2016-5121, 96 p.

Site Information

Use a blank template when starting new assessments

(Fill in gray shaded cells; leave blank if data not available.)

Bridge Number:	05250 & 05259	Stream:	Lake Marion Relief	Date of Analysis:	6/7/2023
County:	Clarendon	Road:	I-95		
Physiographic Region (for scour):	Coastal Plain	Multiple Bridge?	Yes	Bridge Length:	375 ft
		Relief Bridge?	Yes		
Latitude:	33:31:05.87 DMS	Swampy, Poorly Defined Channel?	Yes	Drainage Area:	14400 sq mi
Longitude:	80:26:09.83 DMS				

Hydraulic Model Data (Stations for bridge cross section are based on unconstricted approach section station with bridge projected on to approach)

Data Available?	No
Quality of Model Data:	

LEW station at unconstricted approach cross section; OR left stagnation point for multiple bridge (if no data, leave cell empty):		ft
REW station at unconstricted approach cross section; OR right stagnation point for multiple bridge (if no data, leave cell empty):		ft
Unconstricted cross-section topwidth from model data (approach before cross-section):	No Data	ft

CHECK (Single bridge data):

Do embankment lengths and toe-to-toe distance equal unconstricted cross-section topwidth? (approach before cross-section)	N/A

LEW station at bridge (based on approach):		ft
REW station at bridge (based on approach):		ft
Left abutment toe station (based on approach):		ft
Right abutment toe station (based on approach):		ft
LTB station at bridge (if relief bridge or swampy, poorly defined channel, leave cell empty):		ft
RTB station at bridge (if relief bridge or swampy, poorly defined channel, leave cell empty):		ft
Channel topwidth (model):	0	ft
Distance from toe to toe (model):	No Data	ft
Left embankment length (model):	No Data	ft
Right embankment length (model):	No Data	ft
m (model):	No Data	

SCDOT Plan Data (Be sure to check for tie equalities)

Data Available?	No
Quality of Plan Data:	

SCDOT Road Plan number:		
Use HWM or average flood-plain flow depth for WSEL?**		
WSEL on SCDOT datum:		ft
LEW station at unconstricted cross section from plans (if no data, leave cell empty):		ft
REW station at unconstricted cross section from plans (if no data, leave cell empty):		ft
Unconstricted cross-section topwidth from plans:	No Data	ft

CHECK (Single bridge data):

Do embankment lengths and toe-to-toe distance equal unconstricted cross-section topwidth?	N/A

LEW station at bridge:		ft
REW station at bridge:		ft
Left abutment toe station:		ft
Right abutment toe station:		ft
LTB station at bridge (if relief bridge or swampy, poorly defined channel, leave cell empty):		ft
RTB station at bridge (if relief bridge or swampy, poorly defined channel, leave cell empty):		ft
Channel topwidth (plans):	0	ft
Distance from toe to toe (plans):	No Data	ft
Left embankment length (plans):	No Data	ft
Right embankment length (plans):	No Data	ft
m (plans):	No Data	

**NOTE: Average flood-plain flow depth in Coastal Plain and Piedmont is approximately 7 ft.

Topographic Map Data

Data Available?	Yes
Quality of Map Data:	Good

Does topo indicate wide, flat floodplain?	Yes	
Does topo indicate severe meander just upstream?	No	
Bridge length as provided by SCDOT (verify with topo map if possible):	4899	ft

CHECK (Single bridge data):

Does sum of embankment and bridge lengths	N/A

Approach flood-plain topwidth (topo map):**	13475	ft	**equal approach flood-plain topwidth?**	N/A
Left embankment length (topo map):	3346	ft		
Right embankment length (topo map):	960	ft		
m (topo map):	0.64			

****NOTE:** The approach cross section should represent the unconstricted natural cross section located approximately one bridge-width upstream of the bridge of interest.
****NOTE:** The HWM from the SCDOT plans, HWM from flood documentation, or the average flood-plain flow depth should be used to approximate the flood-plain topwidth.

FEMA/Other Map Data

Data Available?	Yes
Quality of Map Data:	Good
If "Other Map," describe:	

Bridge length as provided by SCDOT (verify with FEMA/Other map if possible):	4899	ft		
Approach flood-plain topwidth (FEMA/Other map):**	13475	ft	**CHECK (Single bridge data):**	
Left embankment length (FEMA/Other map):	3346	ft	**Does sum of embankment and bridge lengths equal approach flood-plain topwidth?**	**N/A**
Right embankment length (FEMA/Other map):	960	ft		
m (FEMA/Other map):	0.64			

****NOTE:** The approach cross section should represent the unconstricted natural cross section located approximately one bridge-length upstream of the bridge of interest.
****NOTE:** The inundated areas on the FEMA/Other map should be used to approximate the flood-plain topwidth.

Comparison of Geometric-Contraction Ratios [m]

Select Source for m: Source Used: Topo Map

	m Value	Quality of Source Data
m from model:	No Data	No Data
m from road plans:	No Data	No Data
m from topographic map:	0.64	Good
m from FEMA/Other map:	0.64	Good
USE m:	0.64	

****NOTE: The "USE m" value is automatically selected, but can be overridden by typing in another value. If the originally selected value of m is overridden, justification should be provided in the comments below.**

**NOTE: In most cases, the model data should provide a reasonable estimate of m and should be given strong consideration in the selection of the final m. The other sources of data (road plans and maps) should be used to confirm the m estimate based on the model data. The road plans are based on an actual survey, likely providing a better data source for confirming the m determined from the model data. The details associated with the topographic and FEMA/Other maps will often be limited, causing discrepancies in the estimate of m. When significant discrepancies in the estimate of m exist between the four data sources, the user should determine the reason for the discrepancy and then select a reasonable, but conservative estimate of m. As a general rule, the selected m and embankment lengths should come from the same data source.

Comparison of Embankment Lengths

Select Source for Embankment Length: Source Used: Topo Map

	Left		Right	
	Embankment Length (ft)	Quality of Source Data	Embankment Length (ft)	Quality of Source Data
Embankment length from model:	No Data	No Data	No Data	No Data
Embankment length from road plans:	No Data	No Data	No Data	No Data
Embankment length from topographic map:	3346	Good	960	Good
Embankment length from FEMA/Other map:	3346	Good	960	Good
USE embankment length:	3346 **ft**		960 **ft**	

CHECK:

Is this a relief or swampy bridge with a poorly defined channel and a bridge length less than or equal to 240 ft?	**No**
If so, use the maximum embankment length from the selected "Source Used" for left and right embankment length.	

****NOTE:** The "USE embankment length" value is automatically selected, but can be overridden by typing in another value. If the originally selected value of embankment length is overridden, justification should be provided in the comments below.

**NOTE: In most cases, the model data should provide a reasonable estimate of embankment lengths and should be given strong consideration in the selection of the final embankment lengths. The other sources of data (road plans and maps) should be used to confirm the embankment length estimates baed on the model data. The road plans are based on an actual survey, likely providing a better data source for confirming the embankment lengths determined from the model data. The details associated with the topographic and FEMA/Other maps will often be limited, causing discrepancies in the estimate of embankment length. When significant discrepancies in the estimate of embankmnent lengths exist between the four data sources, the user should determine the reason for the discrepancy and then select a reasonable, but conservative estimate of embankment length. As a general rule, the selected m and embankment lengths should come from the same data source.

Comparison of Overbank Widths underneath Bridge

Select Source for Overbank Width: Source Used: SCDOT Plans

	Left Overbank Width (Left abutment toe to left top of bank)**	Right Overbank Width (Right top of bank to right abutment toe)**
Overbank width (Old SCDOT plans if available):	No Data **ft**	No Data **ft**
Overbank width (Hydraulic Model):	No Data **ft**	No Data **ft**
USE overbank width:	No Data **ft**	No Data **ft**
CHECK: **Is overbank width greater than or equal to 10 feet?++**	No Data	No Data

****NOTE:** The overbank width information is compared with the topwidth of the abutment-scour hole to determine how much of the overbank width will be covered by the abutment-scour hole and how much will remain for overbank scour.
****NOTE:** If the site is a relief bridge or has a swampy, poorly defined channel, then the overbank width will be determined by splitting the toe-to-toe width between the left and right overbanks.
++NOTE: The SCDOT Requirements Manual recommends for new and replacement bridges that there be a minimum 10 foot setback distance from the top of bank to the abutment toe (written commun., S.T. Benedict, South Carolina Department of Transportation, September 12, 2016).

Comments:

1	These and other limitations should be kept in mind when using the envelope curves to assess scour potential. The envelope curves are empirical methods that are based on limited field samples; it is possible that scour could exceed the envelope curves; therefore, application of a safety factor may be prudent. Application of the envelope curves is constrained to the range of data and site characteristics used to develop the envelope curves. The uncertainty associated with the envelope curves increases near the limits of the data range. The live-bed scour data have the largest uncertainty.
2	The envelope curves do not account for unusual site conditions such as: debris; channel bank failures; pressure flow; unusual flow patterns created by unique site conditions; unusual pier geometries; and washout of approach road embankments.
3	The field data generally represent scour associated with flows approaching the 100-year flow magnitude but should not be considered a definitive estimate of the scour depth associated with the 100-year flow. Similarly, the 500-year flow adjustment coefficients can be used to provide perspective on the relative increase in theoretical scour associated with the 100- to 500-year flow condition, but should not be considered a definitive estimate of the scour depth associated with the 500-year flow.
4	Subsurface soils can impede or promote scour. Therefore, assessing the potential effect of subsurface soils on scour is important.
5	
6	

Clear-Water Abutment-Scour Estimate

(occurs in the abutment region)

(Option to fill in/modify gray shaded cells. Other cells are selected/calculated automatically.)

Bridge Number:	05250 & 05259	**Stream:**	Lake Marion Relief	**Date of Analysis:**	6/7/2023
County:	Clarendon	**Road:**	I-95		
Physiographic Region:	Coastal Plain	**Multiple Bridge?**	Yes	**Bridge Length:**	375 ft
		Relief Bridge?	Yes		
		Swampy, Poorly Defined Channel?	Yes	**Drainage Area:**	14400 sq mi
Latitude:	33:31:05.87 DMS				
Longitude:	80:26:09.83 DMS				

Drainage Area Check -- Original Curve (Benedict and others, 2016; Benedict, 2003): **DA OUTSIDE RANGE (Above)**

Drainage Area Check -- Modified Curve (Benedict and others, 2016; Benedict and Caldwell, 2012): **DA OUTSIDE RANGE (Above)**

Comparison of Geometric-Contraction Ratios [m]

	m Value	Quality of Source
m from model:	No Data	No Data
m from road plans:	No Data	No Data
m from topographic map:	0.64	Good
m from FEMA/Other map:	0.64	Good
USE m: (from "Site Info" Sheet)	0.64	

m range check -- Original Curve (Benedict and others, 2016; Benedict, 2003):	**OK**
m range check -- Modified Curve (Benedict and others, 2016; Benedict and Caldwell, 2012):	**OK**

****NOTE: The "USE m" value is automatically pulled from the Site Info Sheet.**

Guidance:

Original Clear-Water Abutment-Scour Curves

(Benedict and others, 2016; Benedict, 2003)

Limits:
1) For Piedmont sites the maximum m =0.82, but 0.86 could be justified with caution.
2) For Coastal Plain sites the maximum m =0.98, but use caution when greater than 0.9.
3) Drainage area should fall within range of measured data and caution should be used as drainage area approaches limits of data.

Modified Clear-Water Abutment-Scour Curve

(Benedict and others, 2016; Benedict and Caldwell, 2012)

Limits:
1) For Piedmont sites the maximum m =0.85.
2) For Coastal Plain sites the maximum m =0.9.
3) Drainage area should fall within the range of measured data and caution should be used as drainage area approaches limits of data.

Comparison of Embankment Lengths

	Left		Right	
	Embankment Length (ft)	Quality of Source Data	Embankment Length (ft)	Quality of Source Data
Embankment length from model:	No Data	No Data	No Data	No Data
Embankment length from road plans:	No Data	No Data	No Data	No Data
Embankment length from topographic map:	3346	Good	960	Good
Embankment length from FEMA/Other map:	3346	Good	960	Good
USE embankment length *(from Site Info Sheet)*:	**3346**		**960**	
Embankment length range check -- Original Curve (Benedict and others, 2016; Benedict, 2003): *(from "EQUATIONS" Sheet)*	CAUTION		OK	
Embankment length range check -- Modified Curve (Benedict and others, 2016; Benedict and Caldwell, 2012): *(from "EQUATIONS" Sheet)*	OUTSIDE RANGE		OUTSIDE RANGE	

****NOTE:** The "USE embankment length" value is automatically pulled from the Site Info Sheet.

CHECK:

Is this a relief or swampy bridge with a length less than or equal to 240 ft?	No
If so, use the maximum embankment length from the selected "Source Used" (see "Site Info" Sheet) for left and right embankment lengths.	

Guidance:

Original Clear-Water Abutment-Scour Curves
(Benedict and others, 2016; Benedict, 2003)

Limits:
1) If the bridge is a relief or swampy bridge with a length of 240 ft or less, the longest embankment length for the left or right embankments should be used at both abutments.
2) For Piedmont sites the maximum embankment length = 950 ft.
3) For Coastal Plain sites the maximum embankment length = 7,440 ft, but most of the data is for lengths of about 2,000 ft or less. Caution must be used when values exceed 2,000 ft.
4) Drainage area should fall within the range of measured data and caution should be used as drainage area approaches limits of data.

Modified Clear-Water Abutment-Scour Curve
(Benedict and others, 2016; Benedict and Caldwell, 2012)

Limits:
1) If the bridge is a relief or swampy bridge with a length of 240 ft or less, the longest embankment length for the left or right embankments should be used at both abutments.
2) For Piedmont and Coastal Plain sites, the maximum embankment length = 500 ft.
3) Drainage area should fall within the range of measured data and caution should be used as drainage area approaches limits of data.

Clear-Water Abutment-Scour Depth from Envelope Curves

	Left Abutment		Right Abutment	
Original Clear-Water Abutment-Scour Curves (Benedict and others, 2016; Benedict, 2003):				
Abutment-scour depth by embankment length:	18.2	ft	15.1	ft
Abutment-scour depth by geometric-contraction ratio m:	7.0	ft	7.0	ft
Original abutment-scour curve selection:	**Automatic Calculation**		**Automatic Calculation**	
Selected original abutment-scour depth:	**18.2**	ft	**15.1**	ft
Modified Clear-Water Abutment-Scour Curve (Benedict and others, 2016; Benedict and Caldwell, 2012):				
Abutment-scour depth by embankment-length category:	N/A	ft	N/A	ft
Abutment-scour depth by interpolation:	N/A	ft	N/A	ft
Modified abutment-scour curve selection:	**Automatic Calculation**		**Automatic Calculation**	
Selected modified abutment-scour depth:	**N/A**	ft	**N/A**	ft
Final Selected Clear-Water Abutment-Scour Depth:				
Final abutment-scour curve selection:	**Automatic Selection**		**Automatic Selection**	
Final selected clear water abutment-scour depth:	**18.2**	ft	**15.1**	ft
Relative Increase in Theoretical Clear-Water Abutment-Scour from the 100- to 500-Year Flows (Benedict and others, 2016):				
500-yr flow coefficient:	1.21		1.21	
Abutment-scour by 500-year flow coefficient:	**22.1**	ft	**18.3**	ft

Guidance:

Original Clear-Water Abutment-Scour Curves
(Benedict and others, 2016; Benedict, 2003)

1) If the bridge is a relief or swampy bridge with a length of 240 ft or less, the scour depth determined by embankment length for the left and right abutments should be based on the longest embankment length. NOTE: The "Use embankment length" from above should reflect the maximum embankment length from the left or right embankment if the bridge meets the criteria in item 1. Check to verify.
2) For single bridge, the spreadsheet will use the embankment-length envelope curves. However, there are cases when it may be appropriate to use the geometric-contraction ratio envelope curve if a more conservative estimate is deemed appropriate. Refer to Benedict and others (2016) for additional discussion.
3) For multiple bridge in Piedmont, use m envelope curve.
4) For multiple bridge in Coastal Plain, for embankment length < 426 ft use m envelope curve.
5) For multiple bridge in Coastal Plain: for embankment length >= 426 ft, the spreadsheet will use the embankment-length envelope curves. However, there are cases when it may be appropriate to use the geometric-contraction ratio envelope curve if a more conservative estimate is deemed appropriate. Refer to Benedict and others (2016) for additional discussion.
6) If the m and (or) embankment lengths are near the limits or beyond the range of the envelope data a caution or warning message, respectively, will appear in the "m range check" and (or) "Embankment length range check" cells above. For these cases judgment, must be used to assess the best estimate of clear-water abutment scour.

Modified Clear-Water Abutment-Scour Curve
(Benedict and others, 2016; Benedict and Caldwell, 2012)

1) If the bridge is a relief or swampy bridge with a length of 240 ft or less, the scour depth determined by embankment length for the left and right abutments should be based on the longest embankment length. NOTE: The "Use embankment length" from above should reflect the maximum embankment length from the left or right embankment if the bridge meets the criteria in item 1. Check to verify.
2) Use for single bridges only. Use original curve (Benedict and others, 2016; Benedict, 2003) for multiple bridges.
3) If the estimate of scour using the original envelope curves is less than that using the modified curve, then use the scour depth associated with the original curve.
4) If the m and (or) embankment lengths are near the limits or beyond the range of the envelope data a caution or warning message, respectively, will appear in the "m range check" and (or) "Embankment length range check" cells above. For these cases judgment must be used to assess the best estimate of clear-water abutment scour.

Relative Increase in Theoretical Clear-Water Abutment-Scour from the 100- to 500-Year Flows
(Benedict and others, 2016)

1) The 500-year flow adjustment coefficient (K_{500}) is used to calculate the relative abutment scour increase from 100- to 500-year flows.
2) The K_{500} is a helpful tool for gaining perspective on the relative increase of theoretical scour associated with the 100- to 500-year abutment-scour depth. However, the adjusted envelope curve values should not be considered a definitive estimate of the abutment scour associated with the 500-year flow.

Scour-Hole Topwidths

(Benedict and others, 2016; Benedict, 2003)

	Left Abutment		Right Abutment	
Use Abutment Scour-Hole Topwidth Curve (select from 1 or 2 below):	**1**		**1**	
(1) Any length bridge with a well defined channel or any bridge longer than 240 feet				
(2) Flood-plain relief or swampy bridge with length of 240 ft or less				
Abutment scour-hole topwidth:	**70.0**	ft	**70.0**	ft
Is scour depth outside range of graph?	**Yes**		**Yes**	

NOTE: The "Abutment scour-hole topwidth" is automatically calculated. The scour-hole topwidth equations coded in the spreadsheet limit the abutment-scour depth to 25 feet, which is beyond the range of the original graphs. The cell below the scour-hole topwidth will indicate if the abutment-scour depth exceeds the graph range and judgment must be used with regard to utilizing the estimated value.

Comments:

1	These and other limitations should be kept in mind when using the envelope curves to assess scour potential. The envelope curves are empirical methods that are based on limited field samples; it is possible that scour could exceed the envelope curves; therefore, application of a safety factor may be prudent. Application of the envelope curves is constrained to the range of data and site characteristics used to develop the envelope curves. The uncertainty associated with the envelope curves increases near the limits of the data range. The live-bed scour data have the largest uncertainty.
2	The envelope curves do not account for unusual site conditions such as: debris; channel bank failures; pressure flow; unusual flow patterns created by unique site conditions; unusual pier geometries; and washout of approach road embankments.
3	The field data generally represent scour associated with flows approaching the 100-year flow magnitude but should not be considered a definitive estimate of the scour depth associated with the 100-year flow. Similarly, the 500-year flow adjustment coefficients can be used to provide perspective on the relative increase in theoretical scour associated with the 100- to 500-year flow condition, but should not be considered a definitive estimate of the scour depth associated with the 500-year flow.
4	Subsurface soils can impede or promote scour. Therefore, assessing the potential effect of subsurface soils on scour is important.
5	

Clear-Water Contraction-Scour Estimate

(occurs in the overbank region)

(Option to fill in/modify gray shaded cells. Other cells are selected/calculated automatically.)

Bridge Number:	05250 & 05259	**Stream:**	Lake Marion Relief	**Date of Analysis:**	6/7/2023
County:	Clarendon	**Road:**	I-95	**Bridge Length:**	375 ft
Physiographic Region:	Coastal Plain	**Multiple Bridge?**	Yes		
		Relief Bridge?	Yes	**Drainage Area:**	14400 sq mi
Latitude:	33:31:05.87 DMS	**Swampy, Poorly Defined Channel?**	Yes		
Longitude:	80:26:09.83 DMS			**Drainage Area Check:**	DA OUTSIDE RANGE (Above)

Comparison of Geometric-Contraction Ratios [m]

	m Value	Quality of Source Data
m from model:	No Data	No Data
m from road plans:	No Data	No Data
m from topographic map:	0.64	Good
m from FEMA/Other map:	0.64	Good
USE m: (from "Site Info" Sheet)	0.64	
m range check: (from "EQUATIONS" Sheet)	OK	

****NOTES:** If the geometric-contraction ratio is greater than 0.95 message is **OUTSIDE RANGE**.
If the geometric-contraction ratio is between 0 and 0.85 message is **OK**.
If the geometric-contraction ratio is between 0.85 and 0.95 message is **CAUTION**.

**NOTE: The "USE m" value is automatically pulled from the Site Info Sheet.

Guidance:

(Benedict and others, 2016; Benedict and Caldwell, 2006)

1) For the Piedmont data the maximum m for clear-water overbank contraction scour was 0.85.
2) For the Coastal Plain data the maximum m for clear-water overbank contraction scour was 0.95 with data sparse for m greater than 0.9.
3) Caution must be used when m nears or exceeds the upper limits of the data and the "m range check" cell above should be used to help evaluate the final selection of m.

Clear-Water Contraction-Scour Depth from Envelope Curves

	Left Overbank	Right Overbank
Clear-Water Contraction-Scour Curve (Benedict and others, 2016; Benedict and Caldwell, 2006)		
Clear-water contraction-scour depth by geometric-contraction ratio m:	4.5 ft	4.5 ft
Final Selected Clear-Water Contraction-Scour Depth:	**4.5** ft	**4.5** ft
Relative Increase in Theoretical Clear-Water Contraction Scour from the 100- to 500-Year Flows (Benedict and others, 2016):		
500-yr flow coefficient:	1.46	1.46
Clear-water contraction-scour by 500-year flow coefficient:	**6.6** ft	**6.6** ft

****NOTE:** The "Selected clear-water overbank-contraction-scour depth" value is automatically selected, but can be overridden by typing in another value. If the originally selected value of overbank-contraction-scour depth is overridden, justification should be provided in the comments below.

Guidance:

Clear-Water Contraction-Scour Curve

(Benedict and others, 2016; Benedict and Caldwell, 2006)

1) If the m is near the limits or beyond the range of the envelope data a caution or warning message, respectively, will appear in the "m range check" cell above. For these cases judgment must be used to assess the best estimate of clear-water overbank-contraction scour.

Relative Increase in Theoretical Clear-Water Contraction-Scour from the 100- to 500-Year Flows
(Benedict and others, 2016)

1) The 500-year flow adjustment coefficient (K_{500}) is used to calculate the relative clear-water contraction scour increase from 100- to 500-year flows.
2) The K_{500} is a helpful tool for gaining perspective on the relative increase of theoretical scour associated with the 100- to 500-year clear-water contraction-scour depth. However, the adjusted envelope curve values should not be considered a definitive estimate of the scour associated with the 500-year flow.

Comments:

1	These and other limitations should be kept in mind when using the envelope curves to assess scour potential. The envelope curves are empirical methods that are based on limited field samples; it is possible that scour could exceed the envelope curves; therefore, application of a safety factor may be prudent. Application of the envelope curves is constrained to the range of data and site characteristics used to develop the envelope curves. The uncertainty associated with the envelope curves increases near the limits of the data range. The live-bed scour data have the largest uncertainty.
2	The envelope curves do not account for unusual site conditions such as: debris; channel bank failures; pressure flow; unusual flow patterns created by unique site conditions; unusual pier geometries; and washout of approach road embankments.
3	The field data generally represent scour associated with flows approaching the 100-year flow magnitude but should not be considered a definitive estimate of the scour depth associated with the 100-year flow. Similarly, the 500 year flow adjustment coefficients can be used to provide perspective on the relative increase in theoretical scour associated with the 100- to 500-year flow condition, but should not be considered a definitive estimate of the scour depth associated with the 500-year flow.
4	Subsurface soils can impede or promote scour. Therefore, assessing the potential effect of subsurface soils on scour is important.

Live-Bed Contraction-Scour Estimate

(occurs in the channel region)

(Option to fill in/modify gray shaded cells. Other cells are selected/calculated automatically.)

Bridge Number:	05250 & 05259	**Stream:**	Lake Marion Relief	**Date of Analysis:**	6/7/2023
County:	Clarendon	**Road:**	I-95		
				Bridge Length:	375 ft
Physiographic Region:	Coastal Plain	**Multiple Bridge?**	Yes		
		Relief Bridge?	Yes	**Drainage Area:**	14400 sq mi
		Swampy, Poorly Defined Channel?	Yes		
Latitude:	33:31:05.87 DMS				
Longitude:	80:26:09.83 DMS				

Drainage Area Check -- Original Curve (Benedict and others, 2016; Benedict and Caldwell, 2009): DA OUTSIDE RANGE (Above)

Drainage Area Check -- Modified Curve (Benedict and others, 2016; Benedict and Caldwell, 2012): DA OUTSIDE RANGE (Above)

Comparison of Geometric-Contraction Ratios [m]

	m Value	Quality of Source Data
m from model:	No Data	No Data
m from road plans:	No Data	No Data
m from topographic map:	0.64	Good
m from FEMA/Other map:	0.64	Good
USE m: (from "Site Info" Sheet)	0.64	

m range check -- Original Curve (Benedict and Caldwell, 2009) (m <=0.82):	OK
m range check -- Modified Curve (Benedict and Caldwell, 2012) (m <=0.90):	OK

**NOTE: The "USE m" value is automatically pulled from the Site Info Sheet.

Guidance:

Original Live-Bed Contraction-Scour Curve:
(Benedict and others, 2016; Benedict and Caldwell, 2009)

NOTE: Only the field envelope curve for live-bed contraction scour is used in the spreadsheet template. The user may refer to Benedict and others (2016) for application of the dimensionless envelope curve, if deemed appropriate.

Limits:
1) For Piedmont and Coastal Plain sites the maximum m =0.82.
2) Limited clear-water scour data suggests that it may be appropriate to extend the live-bed curve beyond a value of 0.82; however caution and judgment must be used.
3) Drainage area should fall within range of the measured data and caution should be used as drainage area approaches limits of data.
4) Because of uncertainty associated with the live-bed contraction-scour data, caution and judgment must be used in the final estimate of live-bed contraction scour.

Modified Live-Bed Contraction-Scour Curve:
(Benedict and others, 2016; Benedict and Caldwell, 2012)

Limits:
1) For Piedmont and Coastal Plain sites the maximum m =0.9.
2) Drainage area should be 200 square miles or less.
3) Because of uncertainty associated with the live-bed contraction-scour data, caution and judgment must be used in the final estimate of live-bed contraction scour.

Live-Bed Contraction-Scour Depth from Envelope Curves (NOTE: Only the Field Envelope Curves are Used)

	Scour Depth	
Original Field Envelope Curve for Live-Bed Contraction-Scour Curve (Benedict and others, 2016; Benedict and Caldwell, 2009):		
Live-bed contraction-scour depth:	N/A	ft
Modified Field Envelope Curve for Live-Bed Contraction-Scour Curve (Benedict and others, 2016; Benedict and Caldwell, 2012):		
Live-bed contraction-scour depth:	N/A	ft
Final Selected Live-Bed Contraction-Scour Depth:		
Final live-bed contraction-scour curve selection:	**Automatic Selection**	
Final selected live-bed contraction-scour depth:	**N/A**	ft
Relative Increase in Theoretical Live-Bed Contraction Scour from the 100- to 500-Year Flows (Benedict and others, 2016):		
500-yr flow coefficient:	1.32	
Live-bed contraction-scour by 500-year flow coefficient:	**N/A**	ft

Guidance:

Original and Modified Live-Bed Contraction-Scour Curve
(Benedict and others, 2016; Benedict and Caldwell, 2012; Benedict and Caldwell, 2009)

NOTE: Only the field envelope curve for live-bed contraction scour is used in the spreadsheet template. The user may refer to Benedict and others (2016) for application of the dimensionless envelope curve, if deemed appropriate.

1) If drainage area is 200 square miles or less, then use the live-bed contraction-scour estimate based on the modified envelope curve (Benedict and Caldwell, 2012). Otherwise, use the estimate based on the original envelope curve (Benedict and others, 2016; Benedict and Caldwell, 2009).

2) If site is a relief bridge or is swampy with a poorly defined channel, it will be assumed that live-bed contraction scour will not occur and the scour depths in the above cells will be set to "N/A."

Relative Increase in Theoretical Live-Bed Contraction-Scour from the 100- to 500-Year Flows
(Benedict and others, 2016)

1) The 500-year flow adjustment coefficient (K_{500}) is used to calculate the relative abutment scour increase from 100- to 500-year flows.

2) The K_{500} is a helpful tool for gaining perspective on the relative increase of theoretical scour associated with the 100- to 500-year live-bed contraction-scour depth. However, the adjusted envelope curve values should not be considered a definitive estimate of the scour associated with the 500-year flow.

Comments:

1	These and other limitations should be kept in mind when using the envelope curves to assess scour potential. The envelope curves are empirical methods that are based on limited field samples; it is possible that scour could exceed the envelope curves; therefore, application of a safety factor may be prudent. Application of the envelope curves is constrained to the range of data and site characteristics used to develop the envelope curves. The uncertainty associated with the envelope curves increases near the limits of the data range. The live-bed scour data have the largest uncertainty.
2	The envelope curves do not account for unusual site conditions such as: debris; channel bank failures; pressure flow; unusual flow patterns created by unique site conditions; unusual pier geometries; and washout of approach road embankments.
3	The field data generally represent scour associated with flows approaching the 100-year flow magnitude but should not be considered a definitive estimate of the scour depth associated with the 100-year flow. Similarly, the 500-year flow adjustment coefficients can be used to provide perspective on the relative increase in theoretical scour associated with the 100- to 500-year flow condition, but should not be considered a definitive estimate of the scour depth associated with the 500-year flow.
4	Subsurface soils can impede or promote scour. Therefore, assessing the potential effect of subsurface soils on scour is important.

Pier Scour Estimate

(Fill in gray shaded cells. Other cells are selected/calculated automatically.)

Bridge Number:	05250 & 05259		**Stream:**	Lake Marion Relief		**Date of Analysis:**	6/7/2023	
County:	Clarendon		**Road:**	I-95				
Physiographic Region:	Coastal Plain			**Multiple Bridge?**	Yes	**Bridge Length:**	375	ft
				Relief Bridge?	Yes			
Latitude:	33:31:05.87	**DMS**		**Swampy, Poorly**	Yes	**Drainage Area:**	14400	**sq mi**
Longitude:	80:26:09.83	**DMS**		**Defined Channel?**				

Guidance:

Use of Pier Scour Table below
- See cell comments for guidance on using the Pier Scour Table below.

Pier Scour Computations
- If a pier or bent falls anywhere on the overbank, pier scour will be computed for both the abutment and overbank regions.
- If there are piers or bents of varying geometries on the same overbank, use the worst case pier geometry in both the abutment and overbank areas.
- When a pier is on the floodplain, but near the channel bank, the user must decide if the pier should be considered to be a channel pier or not; in addition to the proximity of the pier to the bank, the user should consider other factors such as bends that may increase potential for scour.

Pier Scour Table

(Benedict and others, 2016; Benedict and Caldwell, 2009; Benedict and Caldwell, 2006)

	Left Abutment	**Left Overbank**	**Channel**	**Right Overbank**	**Right Abutment**
Location of pier	LABUT	LOB	CH	ROB	RABUT
Type of pier or bent **(choose from list)**	Multiple Column Pier	Multiple Column Pier	Multiple Column Pier	Multiple Column Pier	Multiple Column Pier
Envelope curve used **(choose from list)**	Automatic Calculation	Automatic Calculation	Automatic Calculation	Automatic Calculation	Automatic Calculation
Pier width (feet)	5.5	5.5	5.5	5.5	5.5
Pier length (feet) **(should not be less than pier width)**	33	33	33	33	33
Angle of attack (degrees) **(should not exceed 90)**	0	0	0	0	0
Multiple column pier or bent? **(choose from list)**	Yes	Yes	Yes	Yes	Yes
Estimate of minimum spacing between columns (feet)	14.5	14.5	14.5	14.5	14.5
Column spacing to width ratio **(should be between 2 and 10)**	2.64	2.6	2.6	2.6	2.6
Skew coefficient [Based on guidance in Benedict and others (2016) and HEC-18]	1.00	1.00	1.00	1.00	1.00
Skew coefficient (selected value; **should not exceed a value of 5**)	1.00	1.00	1.00	1.00	1.00
Envelope curve used in pier scour estimate	PSDb-2014	PSDb-2014	PSDb-2014	PSDb-2014	PSDb-2014
Pier scour from envelope (feet) (no adjustment)	9.7	9.7	9.7	9.7	9.7
Pier scour adjusted for skew (feet)	9.7	9.7	9.74	9.7	9.7
Final selected pier scour depth (feet)	**9.7**	**9.7**	**9.7**	**9.7**	**9.7**
500-year flow coefficient:	1.09	1.09	1.09	1.09	1.09
Relative Increase in Theoretical Pier-Scour from the 100- to 500-Year Flows (Benedict and others, 2016):	**10.6**	**10.6**	**10.6**	**10.6**	**10.6**

****NOTE:** The K_{500} is a helpful tool for gaining perspective on the relative increase of theoretical scour associated with the 100- to 500-year clear-water contraction-scour depth. However, the adjusted envelope curve values should not be considered a definitive estimate of the scour associated with the 500-year flow.

	2
	Comments:
1	These and other limitations should be kept in mind when using the envelope curves to assess scour potential. The envelope curves are empirical methods that are based on limited field samples; it is possible that scour could exceed the envelope curves; therefore, application of a safety factor may be prudent. Application of the envelope curves is constrained to the range of data and site characteristics used to develop the envelope curves. The uncertainty associated with the envelope curves increases near the limits of the data range. The live-bed scour data have the largest uncertainty.
2	The envelope curves do not account for unusual site conditions such as: debris; channel bank failures; pressure flow; unusual flow patterns created by unique site conditions; unusual pier geometries; and washout of approach road embankments.
3	The field data generally represent scour associated with flows approaching the 100-year flow magnitude but should not be considered a definitive estimate of the scour depth associated with the 100-year flow. Similarly, the 500-year flow adjustment coefficients can be used to provide perspective on the relative increase in theoretical scour associated with the 100- to 500-year flow condition, but should not be considered a definitive estimate of the scour depth associated with the 500-year flow.
4	Subsurface soils can impede or promote scour. Therefore, assessing the potential effect of subsurface soils on scour is important.

Pile Penetration Table for Scour Estimates Using Flows Approaching the 100-year Flow

Scour analysis using USGS Bridge-Scour Envelope Curves

(Fill in gray shaded cells. Other cells are selected/calculated automatically.)

Bridge Number:	05250 & 05259	**Stream:**	Lake Marion Relief	**Date of Analysis:**	6/7/2023
County:	Clarendon	**Road:**	I-95		
				Bridge Length:	375 ft
Physiographic Region:	Coastal Plain	**Multiple Bridge?**	Yes		
		Relief Bridge?	Yes	**Drainage Area:**	14400 sq mi
Latitude:	33:31:05.87 DMS	**Swampy, Poorly Defined Channel?**	Yes		
Longitude:	80:26:09.83 DMS				

NOTE: Bents are listed from left to right looking downstream

GUIDANCE FOR LEFT AND RIGHT ABUTMENT SCOUR:

Refer to Benedict and others (2016) and Benedict (2003) for additional guidance.

1) Do not include clear-water overbank scour depth in abutment-scour area.

2) If site is in the Piedmont region and the abutment-scour depth is less than or equal to 5 feet then add pier-scour depth for determining total scour.

3) If the pier in the abutment area is a multiple column bent/pier with minimal skew or a solid, long pier with no skew, and the pier width is less than or equal to 2.3 ft, then do not add pier scour to total scour. (NOTE: The exception to this guidance is for sites in the Piedmont with abutment-scour depths less than or equal to 5 ft as noted in item 2 above.)

4) The spreadsheet assumes that abutment scour will always occur at the left and right abutments. The spreadsheet will automatically make an initial determination regarding the inclusion of pier scour in the total scour estimate. The user should review this initial determination and if appropriate override the automated value by typing "Yes" or "No" (case sensitive) in the "Use pier scour?" column. If the pier is skewed, the user should apply judgment to determine if pier scour should be included in the total scour estimate, especially for long solid piers where a pier skew can cause large scour depths.

5) If the site is a relief or swampy bridge that is 240 ft or less, the abutment-scour depth will be applicable from toe-to-toe; if the relief or swampy bridge is greater than 240 ft, the abutment scour-hole depths will be limited to the abutment scour-hole topwidths and the clear-water overbank contraction scour will be applied to the remaining overbank area. The spreadsheet will automatically determine if there is any overbank area on which overbank contraction scour will occur.

6) If clear-water overbank contraction scour depth (with no adjustment for pier scour) is greater than the abutment scour depth (with no adjustment for pier scour), then the clear-water overbank contraction scour depth will be used as the best representation of the abutment scour depth. The spreadsheet will automatically determine if the clear-water overbank contraction scour depth is to be used in place of the abutment scour depth.

GUIDANCE FOR LEFT AND RIGHT OVERBANK CONTRACTION SCOUR:

Refer to Benedict and others (2016) and Benedict and Caldwell (2006) for additional guidance.

1) If the abutment-scour hole topwidth is greater than the overbank width then it will be assumed that the abutment-scour depth will cover the entire overbank area and there will be no clear-water overbank scour applied to the bridge overbank. However, if the abutment-scour hole topwidth is less than the overbank width then it will be assumed that clear-water overbank scour occurs in the overbank area not affected by the abutment scour hole.

2) The spreadsheet will automatically determine if clear-water overbank scour should be applied or not.

3) If clear-water overbank scour is determined to be applicable to the overbank area, then the spreadsheet will automatically apply the calculated pier scour to the overbank as well.

GUIDANCE FOR LIVE-BED CHANNEL SCOUR:

Refer to Benedict and others (2016) and Benedict and Caldwell (2009) for additional guidance.

1) If the main channel is well defined and considered to be live-bed in nature, it will be assumed that the live-bed contraction scour and channel pier scour will be included in the estimate for total scour in the main channel. The spreadsheet will automatically determine if these scour components are to be included in the estimate of total scour in the main channel.

2) Live-bed contraction scour will not be applied to a relief bridge or to a bridge with a swampy, poorly defined channel; at such bridges, it will be assumed that clear-water scour conditions prevail and the procedures for applying clear-water abutment and contraction scour, as noted previously, will be used. The spreadsheet will automatically determine if live-bed scour should or should not be applied to the channel.

GENERAL GUIDANCE:

1) Drainage area should fall within the range of measured data and caution should be used as drainage area approaches limits of the data or exceeds the data range.

2) If the m and (or) embankment lengths are near the limits or beyond the range of the envelope data caution should be used.

3) User should review automatically determined values to assure that selected values are reasonable.

Scour region	Pier location	Use clear-water abutment scour?	Clear-water abutment scour from USGS curves (feet)	Use clear-water overbank contraction scour?	Clear-water overbank contraction scour from USGS curves (feet)	Use live-bed channel contraction scour?	Live-bed channel contraction scour from USGS curves (feet)	Use pier scour?	Pier scour (feet)	Total scour at bent (feet)	Computed embedment of pile from consultant (feet)	Remaining pile penetration (feet)	Embedment below thalweg from consultant (feet)	Remaining pile penetration (at thalweg) (feet)
Left Abutment	LABUT	Yes	18.23	No	0.00	No	0.00	No	0.00	18.23		-18.23		-18.23
Left Overbank	LOB	No	0.00	Yes	4.53	No	0.00	Yes	9.74	14.27		-14.27		-14.27
Channel	CH	No	0.00	No	0.00	No	0.00	No	0.00	N/A		N/A		N/A
Right Overbank	ROB	No	0.00	Yes	4.53	No	0.00	Yes	9.74	14.27		-14.27		-14.27
Right Abutment	RABUT	Yes	15.10	No	0.00	No	0.00	No	0.00	15.10		-15.10		-15.10

	Comments:	2
1	These and other limitations should be kept in mind when using the envelope curves to assess scour potential. The envelope curves are empirical methods that are based on limited field samples; it is possible that scour could exceed the envelope curves; therefore, application of a safety factor may be prudent. Application of the envelope curves is constrained to the range of data and site characteristics used to develop the envelope curves. The uncertainty associated with the envelope curves increases near the limits of the data range. The live-bed scour data have the largest uncertainty.	
2	The envelope curves do not account for unusual site conditions such as: debris; channel bank failures; pressure flow; unusual flow patterns created by unique site conditions; unusual pier geometries; and washout of approach road embankments.	
3	The field data generally represent scour associated with flows approaching the 100-year flow magnitude but should not be considered a definitive estimate of the scour depth associated with the 100-year flow. Similarly, the 500-year flow adjustment coefficients can be used to provide perspective on the relative increase in theoretical scour associated with the 100- to 500-year flow condition, but should not be considered a definitive estimate of the scour depth associated with the 500-year flow.	
4	Subsurface soils can impede or promote scour. Therefore, assessing the potential effect of subsurface soils on scour is important.	
5		

Pile Penetration Table for Scour Estimates Using Flows Approaching the 100-year Flow and Adjusted by the 500-year Flow Adjustment Coefficient

1

Scour analysis using USGS Bridge-Scour Envelope Curves

(Fill in gray shaded cells. Other cells are selected/calculated automatically.)

Bridge Number:	05250 & 05259	**Stream:**	Lake Marion Relief	**Date of Analysis:**	6/7/2023
County:	Clarendon	**Road:**	I-95		
				Bridge Length:	375 **ft**
Physiographic Region:	Coastal Plain	**Multiple Bridge?**	Yes		
		Relief Bridge?	Yes	**Drainage Area:**	14400 **sq mi**
Latitude:	33:31:05.87 **DMS**	**Swampy, Poorly Defined Channel?**	Yes		
Longitude:	80:26:09.83 **DMS**				

NOTE: Bents are listed from left to right looking downstream

GUIDANCE FOR LEFT AND RIGHT ABUTMENT SCOUR:

Refer to Benedict and others (2016) and Benedict (2003) for additional guidance.

1) Do not include clear-water overbank scour depth in abutment-scour area.

2) If site is in the Piedmont region and the abutment-scour depth is less than or equal to 5 feet then add pier-scour depth for determining total scour.

3) If the pier in the abutment area is a multiple column bent/pier with minimal skew or a solid, long pier with no skew, and the pier width is less than or equal to 2.3 ft, then do not add pier scour to total scour. (NOTE: The exception to this guidance is for sites in the Piedmont with abutment-scour depths less than or equal to 5 ft as noted in item 2 above.)

4) The spreadsheet assumes that abutment scour will always occur at the left and right abutments. The spreadsheet will automatically make an initial determination regarding the inclusion of pier scour in the total scour estimate. The user should review this initial determination and if appropriate override the automated value by typing "Yes" or "No" (case sensitive) in the "Use pier scour?" column. If the pier is skewed, the user should apply judgment to determine if pier scour should be included in the total scour estimate, especially for long solid piers where a pier skew can cause large scour depths.

5) If the site is a relief or swampy bridge that is 240 ft or less, the abutment-scour depth will be applicable from toe-to-toe; if the relief or swampy bridge is greater than 240 ft, the abutment scour-hole depths will be limited to the abutment scour-hole topwidths and the clear-water overbank contraction scour will be applied to the remaining overbank area. The spreadsheet will automatically determine if there is any overbank area on which overbank contraction scour will occur.

6) If clear-water overbank contraction scour depth (with no adjustment for pier scour) is greater than the abutment scour depth (with no adjustment for pier scour), then the clear-water overbank contraction scour depth will be used as the best representation of the abutment scour depth. The spreadsheet will automatically determine if the clear-water overbank contraction scour depth is to be used in place of the abutment scour depth.

GUIDANCE FOR LEFT AND RIGHT OVERBANK CONTRACTION SCOUR:

Refer to Benedict and others (2016) and Benedict and Caldwell (2006) for additional guidance.

1) If the abutment-scour hole topwidth is greater than the overbank width then it will be assumed that the abutment-scour depth will cover the entire overbank area and there will be no clear-water overbank scour applied to the bridge overbank. However, if the abutment-scour hole topwidth is less than the overbank width then it will be assumed that clear-water overbank scour occurs in the overbank area not affected by the abutment scour hole.

2) The spreadsheet will automatically determine if clear-water overbank scour should be applied or not.

3) If clear-water overbank scour is determined to be applicable to the overbank area, then the spreadsheet will automatically apply the calculated pier scour to the overbank as well.

GUIDANCE FOR LIVE-BED CHANNEL SCOUR:

Refer to Benedict and others (2016) and Benedict and Caldwell (2009) for additional guidance.

1) If the main channel is well defined and considered to be live-bed in nature, it will be assumed that the live-bed contraction scour and channel pier scour will be included in the estimate for total scour in the main channel. The spreadsheet will automatically determine if these scour components are to be included in the estimate of total scour in the main channel.

2) Live-bed contraction scour will not be applied to a relief bridge or to a bridge with a swampy, poorly defined channel; at such bridges, it will be assumed that clear-water scour conditions prevail and the procedures for applying clear-water abutment and contraction scour, as noted previously, will be used. The spreadsheet will automatically determine if live-bed scour should or should not be applied to the channel.

GENERAL GUIDANCE:

1) Drainage area should fall within the range of measured data and caution should be used as drainage area approaches limits of the data or exceeds the data range.

2) If the m and (or) embankment lengths are near the limits or beyond the range of the envelope data caution should be used.

3) User should review automatically determined values to assure that selected values are reasonable.

Scour region	Pier location	Use clear-water abutment scour?	Clear-water abutment scour from USGS curves (feet)	Use clear-water overbank contraction scour?	Clear-water overbank contraction scour from USGS curves (feet)	Use live-bed channel contraction scour?	Live-bed channel contraction scour from USGS curves (feet)	Use pier scour?	Pier scour (feet)	Total scour at bent (feet)	Computed embedment of pile from consultant (feet)	Remaining pile penetration (feet)	Embedment below thalweg from consultant (feet)	Remaining pile penetration (at thalweg) (feet)
Left Abutment	LABUT	Yes	22.10	No	0.00	No	0.00	No	0.00	22.10		-22.10		-22.10
Left Overbank	LOB	No	0.00	Yes	6.60	No	0.00	Yes	10.60	17.20		-17.20		-17.20
Channel	CH	No	0.00	No	0.00	No	0.00	No	0.00	N/A		N/A		N/A
Right Overbank	ROB	No	0.00	Yes	6.60	No	0.00	Yes	10.60	17.20		-17.20		-17.20

Right Abutment	RABUT	Yes	18.30	No	0.00	No	0.00	No	0.00	18.30		-18.30		-18.30

	Comments:	2
1	These and other limitations should be kept in mind when using the envelope curves to assess scour potential. The envelope curves are empirical methods that are based on limited field samples; it is possible that scour could exceed the envelope curves; therefore, application of a safety factor may be prudent. Application of the envelope curves is constrained to the range of data and site characteristics used to develop the envelope curves. The uncertainty associated with the envelope curves increases near the limits of the data range. The live-bed scour data have the largest uncertainty.	
2	The envelope curves do not account for unusual site conditions such as: debris; channel bank failures; pressure flow; unusual flow patterns created by unique site conditions; unusual pier geometries; and washout of approach road embankments.	
3	The field data generally represent scour associated with flows approaching the 100-year flow magnitude but should not be considered a definitive estimate of the scour depth associated with the 100-year flow. Similarly, the 500-year flow adjustment coefficients can be used to provide perspective on the relative increase in theoretical scour associated with the 100- to 500-year flow condition, but should not be considered a definitive estimate of the scour depth associated with the 500-year flow.	
4	Subsurface soils can impede or promote scour. Therefore, assessing the potential effect of subsurface soils on scour is important.	
5		

Application of Selected Envelope-Curve Equations

Do not modify this worksheet. This worksheet uses data entered in other worksheets of this workbook and uses the various South Carolina Bridge-Scour Envelope Curves to calculate the upper bound of selected scour parameters.

Estimate of Upper Bound of Clear-Water Abutment-Scour Depth from Envelope Curves

I. Estimate from abutment-length envelope curves -- Original Curves (Benedict and others, 2016; Benedict, 2003)

		Left Abutment		Right Abutment	
Coastal Plain	Scour Depth:	18.2	ft	15.1	ft
	Embankment Length:	3346	ft	960	ft
	Embankment Length Check:	CAUTION		OK	

NOTES:
If embankment length is greater than 7,440 ft it is **OUTSIDE RANGE**.
If embankment length is greater than 2,000 ft but less than 7,440 ft use **CAUTION**.
If embankment length is between 0 and 2,000 ft it is **OK**.

Piedmont	Scour Depth:	-8.4	ft	18.2	ft
	Embankment Length:	3346.0		960.0	
	Embankment Length Check:	OUTSIDE RANGE		OUTSIDE RANGE	

NOTES:
If embankment length is greater than 950 ft it is **OUTSIDE RANGE**.
If embankment length is between 0 and 950 ft it is **OK**.

II. Estimate from the geometric contraction ratio m -- Original Curves (Benedict and others, 2016; Benedict, 2003)

		Left Abutment		Right Abutment	
Coastal Plain	Scour Depth:	7.0	ft	7.0	ft
	Contraction Ratio:	0.64		0.64	
	Contraction Ratio Check:	OK		OK	

NOTES:
If contraction ratio is greater than 0.98 it is **OUTSIDE RANGE.**
If contraction ratio is greater than 0.9 but less than 0.98 use **CAUTION.**
If contraction ratio is between 0 and 0.9 it is **OK.**

Piedmont	Scour Depth:	12.0	ft	12.0	ft
	Contraction Ratio:	0.64		0.64	
	Contraction Ratio Check:	OK		OK	

NOTES:
If contraction ratio is greater than 0.86 it is **OUTSIDE RANGE.**
If contraction ratio is greater than 0.82 but less than 0.86 use **CAUTION.**
If contraction ratio is between 0 and 0.82 it is **OK.**

III. Estimate by embankment-length category -- Modified Curves (Benedict and others, 2016; Benedict and Caldwell, 2012)

Coastal Plain

	Left Abutment		Right Abutment	
Initial Estimate of Scour Depth (by Category):	N/A	ft	N/A	ft
Final Selection of Scour Depth (by Category):	N/A	ft	N/A	ft
Initial Estimate of Scour Depth (by Interpolation):	N/A	ft	N/A	ft
Final Selection of Scour Depth (by Interpolation):	N/A	ft	N/A	ft
Embankment Length:	3346	ft	960	ft
Embankment Length Check:	OUTSIDE RANGE		OUTSIDE RANGE	
Contraction Ratio:	0.64		0.64	
Contraction Ratio Check:	OK		OK	

Interpolation Table

Embankment Length Category (ft)	Lower m Limit	m used in equation	Abutment-Scour Depth (ft)
0	0.00	0.00	0.0
100	0.25	0.64	2.0
200	0.50	0.64	4.5
300	0.65	0.65	7.4
400	0.76	0.76	11.2
500	0.84	0.84	14.9

NOTES:

If embankment length is greater than 500 ft it is **OUTSIDE RANGE**.
If embankment length is between 0 and 500 ft it is **OK**.
If contraction ratio is greater than 0.9 it is **OUTSIDE RANGE.**
If contraction ratio is between 0 and 0.9 it is **OK.**

Piedmont

Initial Estimate of Scour Depth (by Category):	N/A	ft	N/A	ft
Final Selection of Scour Depth (by Category):	N/A	ft	N/A	ft
Initial Estimate of Scour Depth (by Interpolation):	N/A	ft	N/A	ft
Final Selection of Scour Depth (by Interpolation):	N/A	ft	N/A	ft
Embankment Length:	3346	ft	960	ft
Embankment Length Check:	OUTSIDE RANGE		OUTSIDE RANGE	
Contraction Ratio:	0.64		0.64	
Contraction Ratio Check:	OK		OK	

Interpolation Table

Embankment Length Category (ft)	Lower m Limit	m used in equation	Abutment-Scour Depth (ft)
0	0.00	0.00	0.0
100	0.14	0.64	1.9
200	0.25	0.64	3.9
300	0.34	0.64	5.6
400	0.42	0.64	7.3
500	0.50	0.64	8.9

NOTES:

If embankment length is greater than 500 ft it is **OUTSIDE RANGE**.
If embankment length is between 0 and 500 ft it is **OK**.
If contraction ratio is greater than 0.85 it is **OUTSIDE RANGE.**
If contraction ratio is between 0 and 0.85 it is **OK.**

Estimate of Clear-Water Abutment-Scour Hole Topwidth from Envelope Curve (Benedict and others, 2016; Benedict, 2003)

Using "final selected abutment-scour depth"

	Left Abutment		Right Abutment	
Any length bridge with well defined channel	70.0	ft	70.0	ft
Is scour depth greater than 18 feet and therefore outside range of graph?	Yes		Yes	
Relief or swampy bridge with length of 240 ft or less	113.7	ft	104.2	ft
Is scour depth greater than 23.6 feet and therefore outside range of graph?	No		No	

NOTES:

If scour depth is outside the range of the graph then cell is highlighted in **red.**

If scour depth is within the range of the graph then cell is highlighted in **green.**

Estimate of Clear-Water Overbank Contraction-Scour Depth from Envelope Curves (Benedict and others, 2016; Benedict and Caldwell, 2006)

	Left Overbank		Right Overbank	
Scour Depth:	4.5	ft	4.5	ft
Contraction Ratio:	0.64		0.64	
Contraction Ratio Check:	OK		OK	

NOTES:

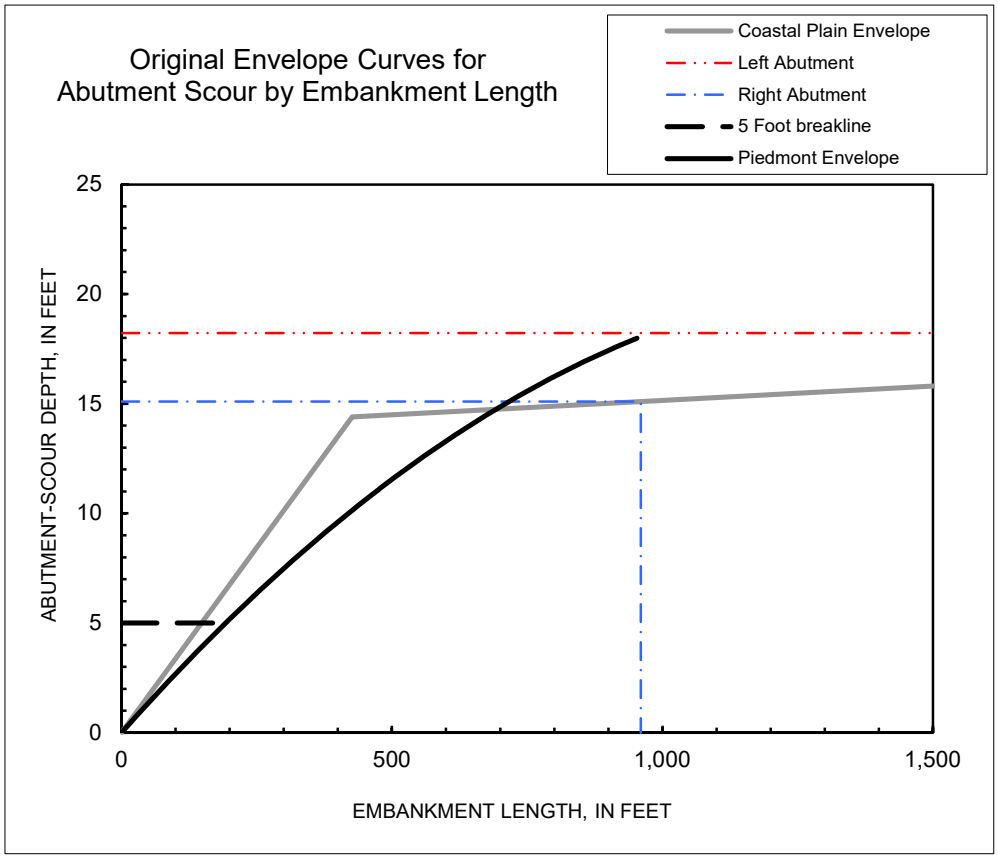
If contraction ratio is greater than 0.95 it is **OUTSIDE RANGE.**

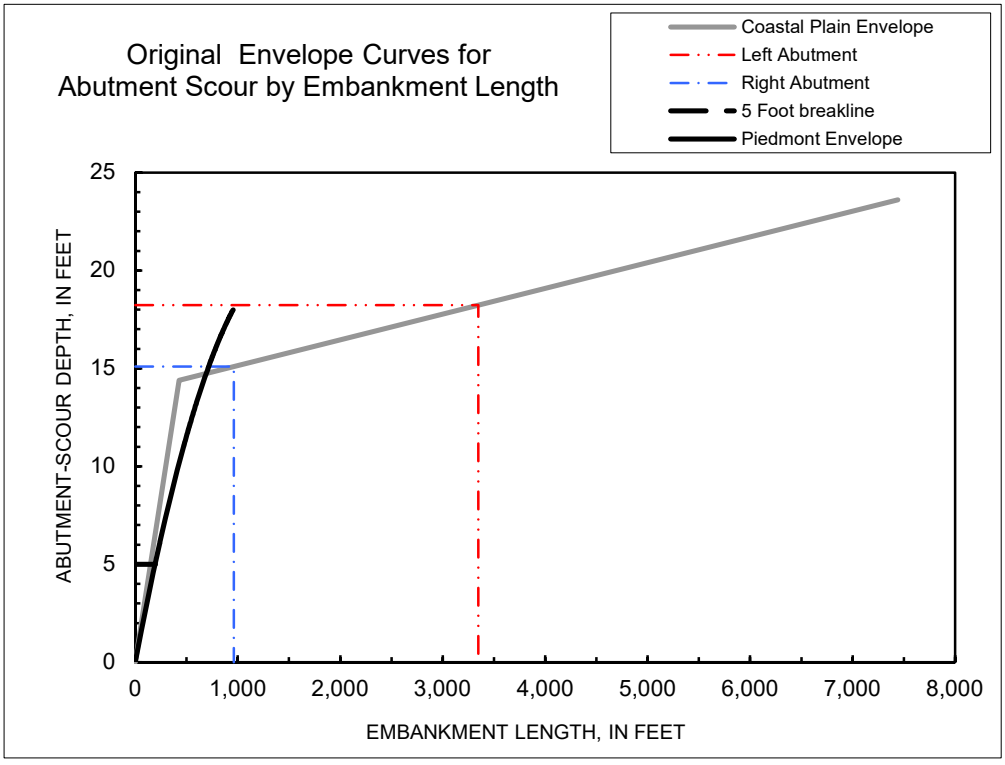
If contraction ratio is greater than 0.85 but less than 0.95 use **CAUTION.**

If contraction ratio is between 0 and 0.85 it is **OK.**

Bridge Number: 05250 & 05259 **1**
County: Clarendon
Stream: Lake Marion Relief
Road: I-95
Region: Coastal Plain

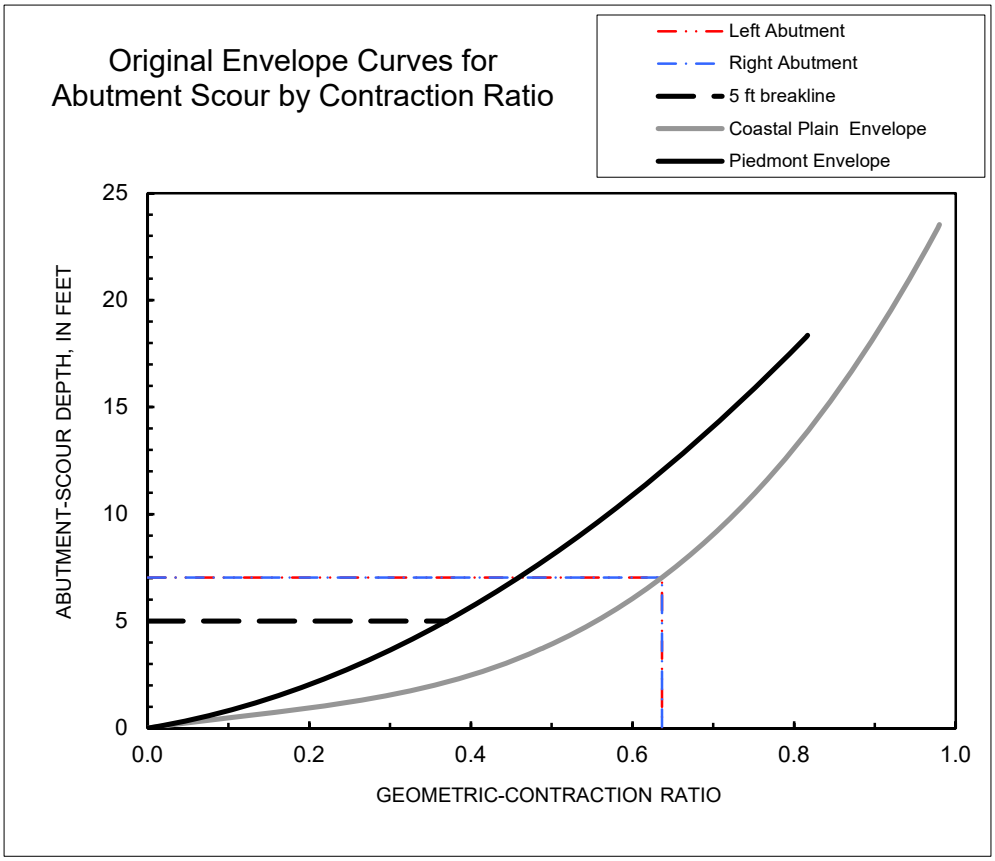
Original Clear-Water Abutment-Scour Envelope Curves (Benedict and others, 2016; Benedict, 2003)

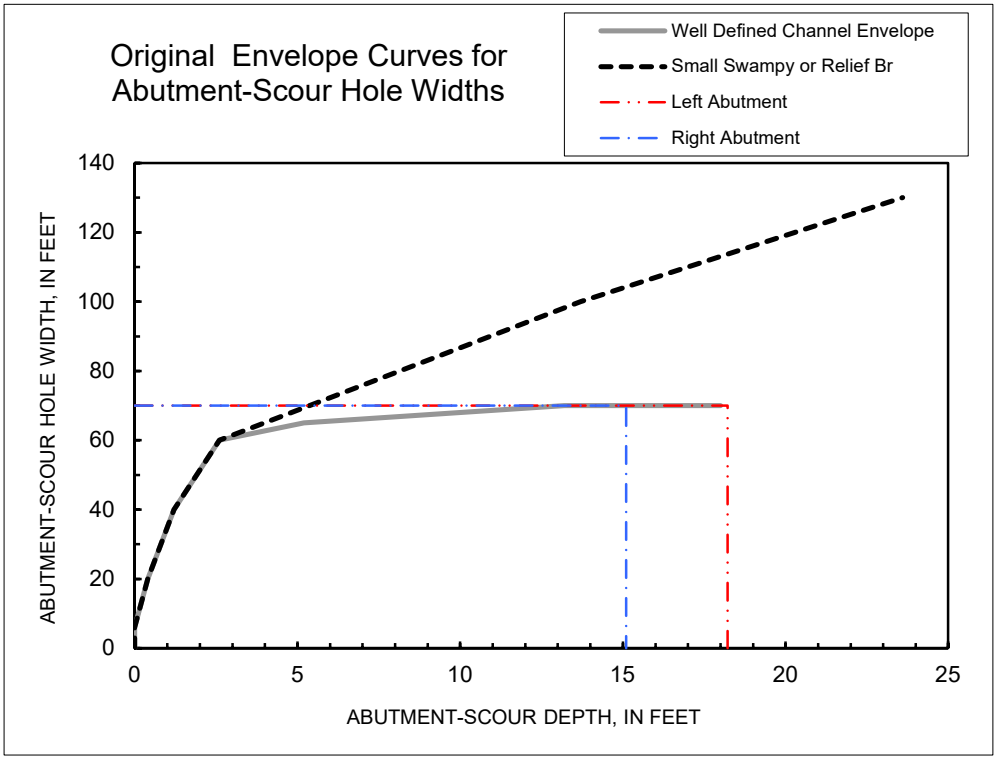




Bridge Number: 05250 & 05259 **2**
County: Clarendon
Stream: Lake Marion Relief
Road: I-95
Region: Coastal Plain

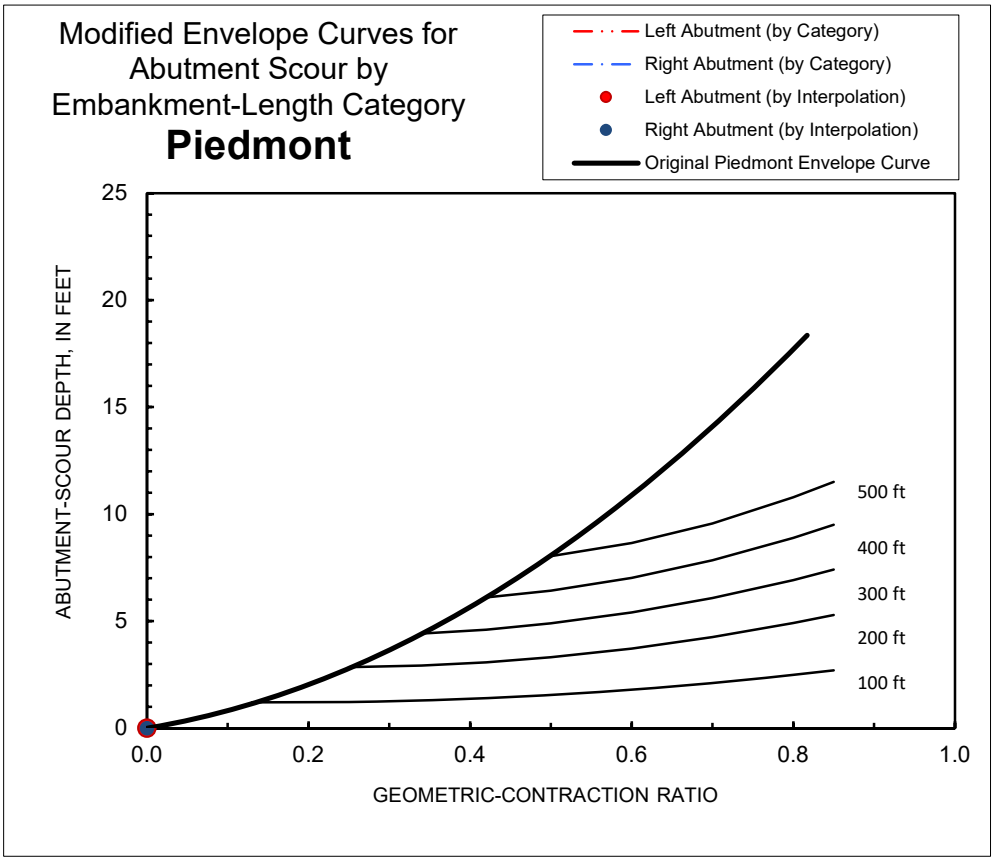
Original Clear-Water Abutment-Scour Envelope Curves (Benedict and others, 2016; Benedict, 2003)

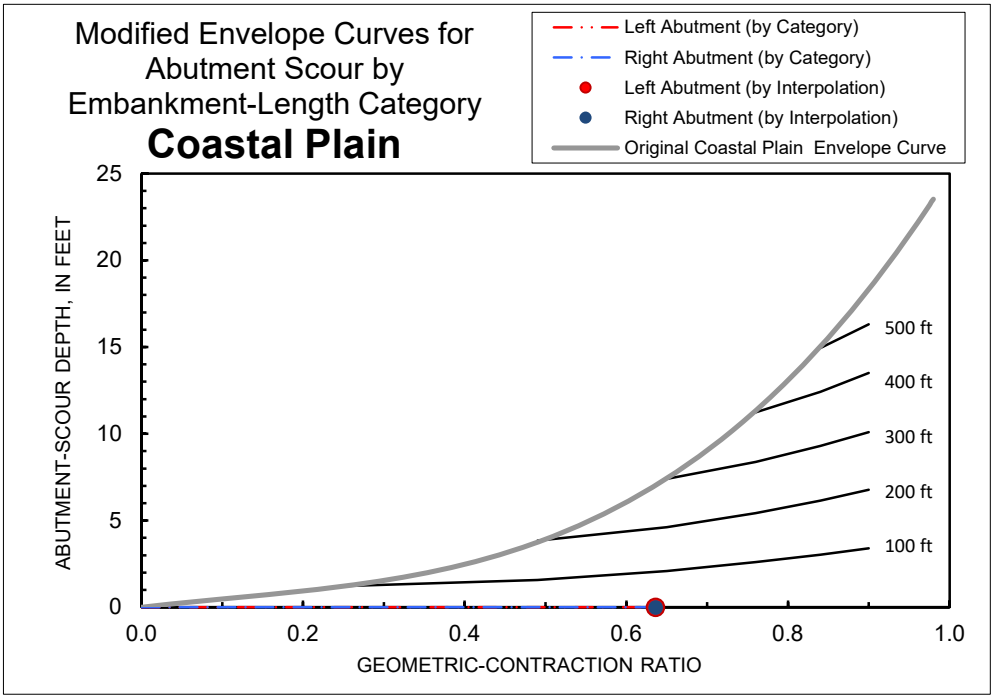




Bridge Number: 05250 & 05259 **3**
County: Clarendon
Stream: Lake Marion Relief
Road: I-95
Region: Coastal Plain

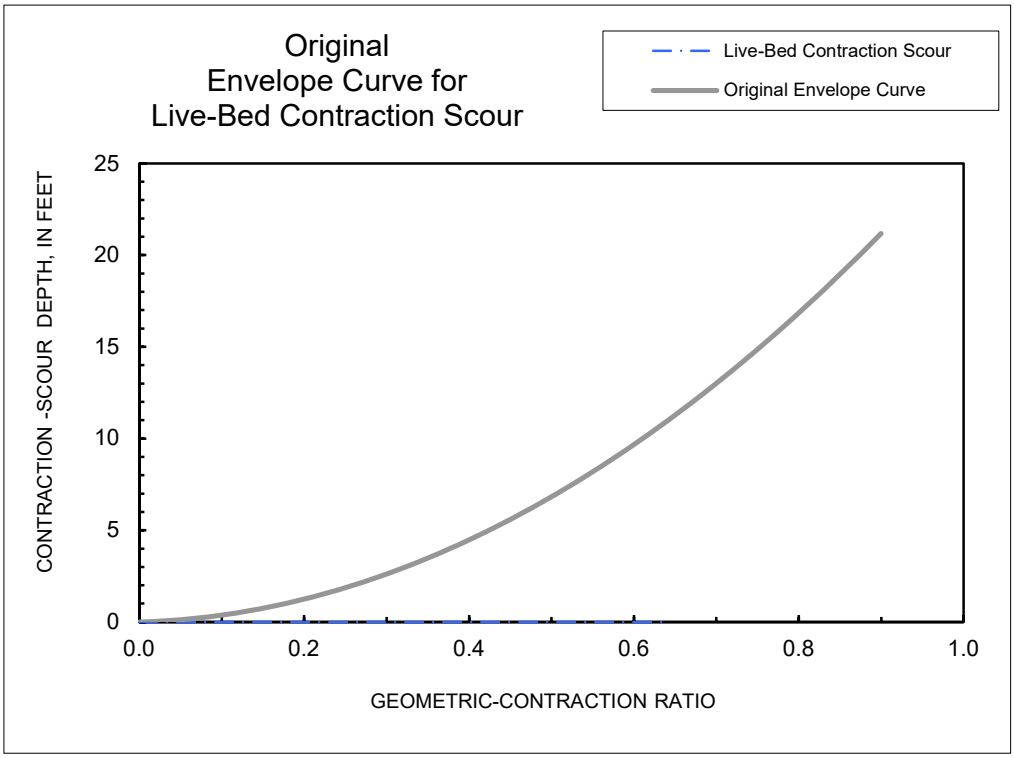
Modified Clear-Water Abutment-Scour Envelope Curves (Benedict and others, 2016; Benedict and Caldwell, 2012)



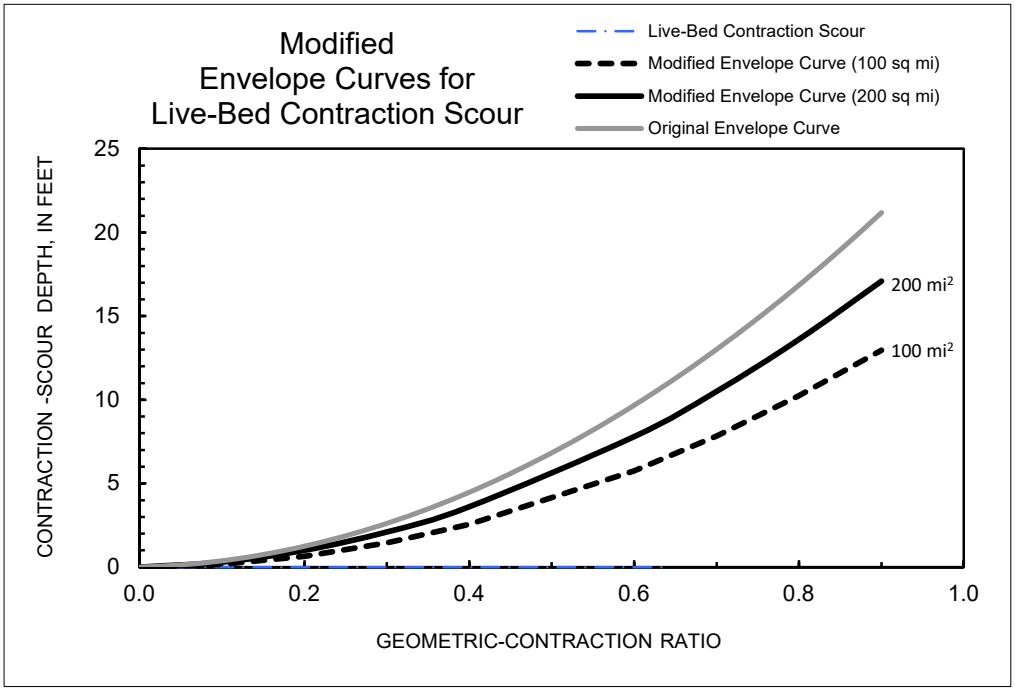


Bridge Number: 05250 & 05259 **4**
County: Clarendon
Stream: Lake Marion Relief
Road: I-95
Region: Coastal Plain

Original Live-Bed Channel Contraction-Scour Envelope Curve (Benedict and others, 2016; Benedict and Caldwell, 2009)

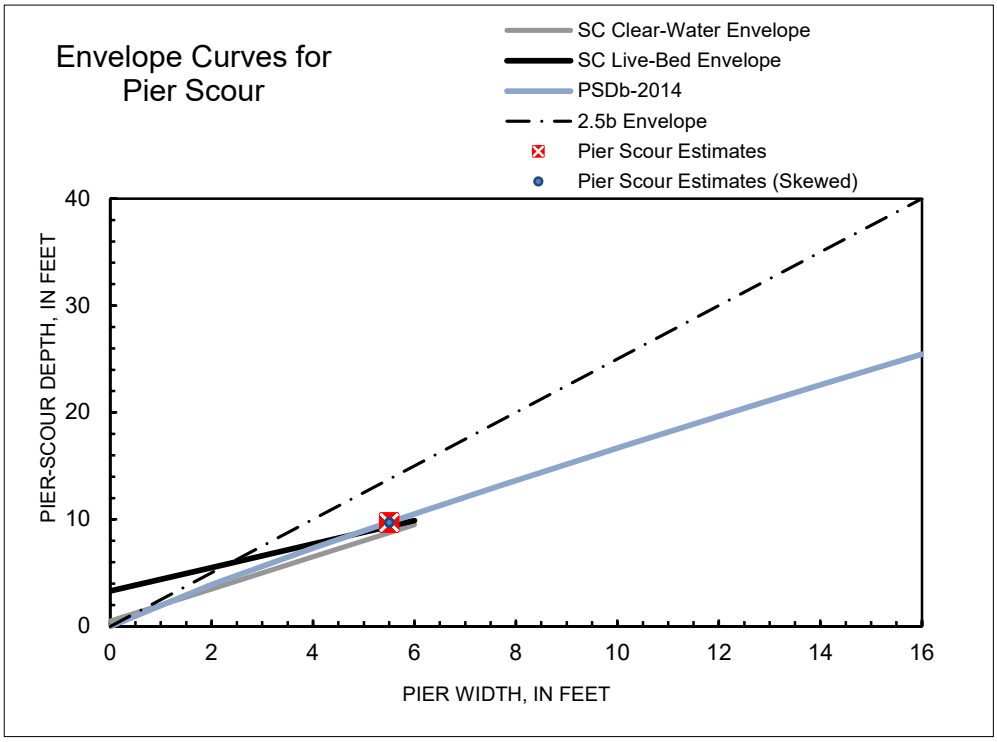


Modified Live-Bed Channel Contraction-Scour Envelope Curves (Benedict and others, 2016; Benedict and Caldwell, 2012)

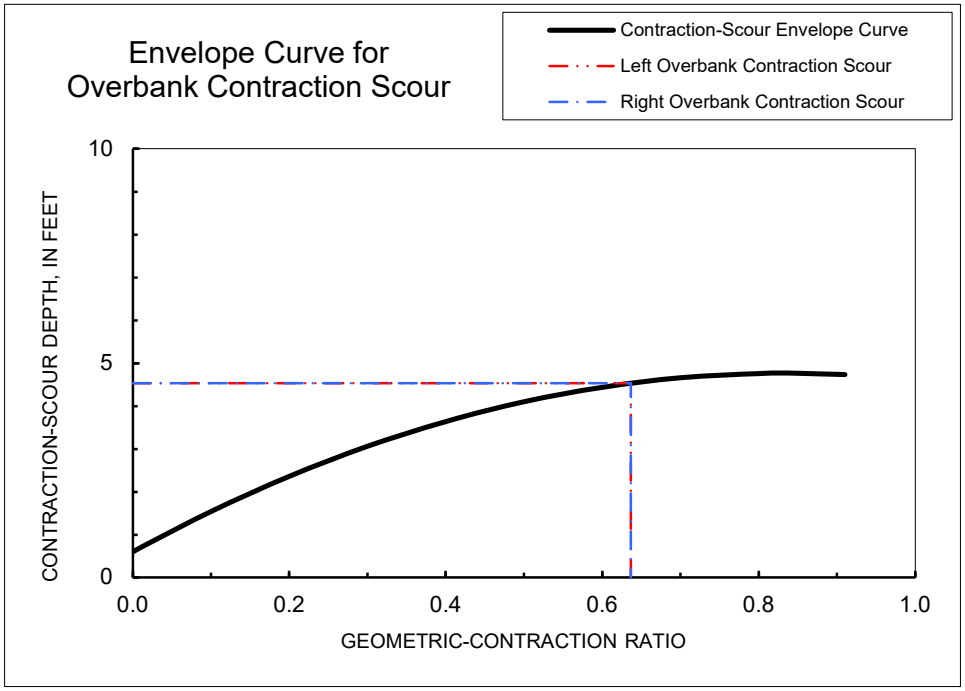


Bridge Number: 05250 & 05259 **5**
County: Clarendon
Stream: Lake Marion Relief
Road: I-95
Region: Coastal Plain

Pier-Scour Envelope Curves (Benedict and others, 2016; Benedict and Caldwell, 2006; 2009)

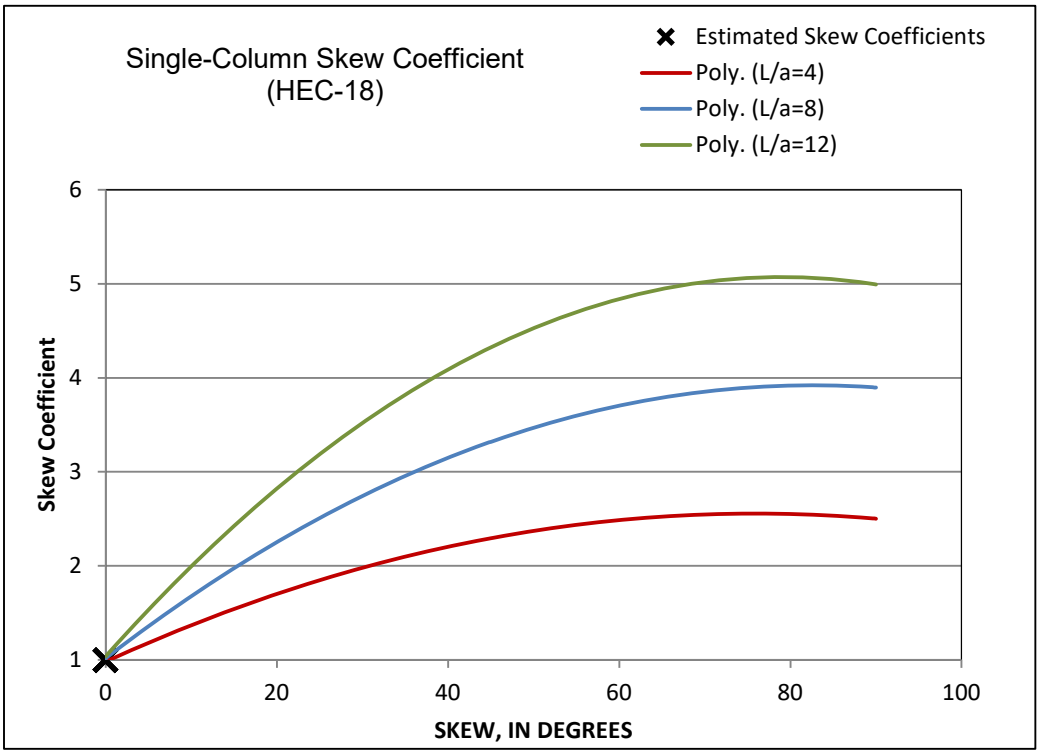


Clear-Water Overbank Contraction-Scour Envelope Curve (Benedict and others, 2016; Benedict and Caldwell, 2006)



Bridge Number: 05250 & 05259 **6**
County: Clarendon
Stream: Lake Marion Relief
Road: I-95
Region: Coastal Plain

Pier-Scour Skew Coefficients



Data for Graphs

Estimate of Abutment-Scour -- Original Abutment-Scour Envelope Curves (Benedict and others, 2016; Benedict, 2003)

Use the following envelope curve: **Coastal Plain** **Coastal Plain**

Abutment Scour by Embankment Length

Left Abutment

Embankment Length (ft)	Scour Depth (ft)
0	18.2
3346	18.2
3346	0

Right Abutment

Embankment Length (ft)	Scour Depth (ft)
0	15.1
960	15.1
960	0

5 ft break line

Embankment Length (ft)	Scour Depth (ft)
0	5
194	5

Abutment Scour by m

Left Abutment

m	Scour Depth (ft)
0	7.0
0.64	7.0
0.64	0

Right Abutment

m	Scour Depth (ft)
0	7.0
0.64	7.0
0.64	0

5 ft break line

m	Scour Depth (ft)
0	5
0.37	5

Estimate of Abutment-Scour -- Modified Abutment-Scour Envelope Curves (Benedict and others, 2016; Benedict and Caldwell, 2012)

Piedmont

By Category

Left Abutment

m	Scour Depth (ft)
0	0.0
0.00	0.0
0.00	0

Right Abutment

m	Scour Depth (ft)
0	0.0
0.00	0.0
0.00	0

By Interpolation

m	Scour Depth (ft)
0	0.0
0.00	0.0
0.00	0

m	Scour Depth (ft)
0	0.0
0.00	0.0
0.00	0

Coastal Plain

By Category

Left Abutment

m	Scour Depth (ft)
0	N/A
0.64	N/A
0.64	0

Right Abutment

m	Scour Depth (ft)
0	N/A
0.64	N/A
0.64	0

By Interpolation

m	Scour Depth (ft)
0	N/A
0.64	N/A
0.64	0

m	Scour Depth (ft)
0	N/A
0.64	N/A
0.64	0

Coastal Plain and Piedmont Clear-Water Overbank Contraction-Scour Envelope Curve by m (Benedict and others, 2016; Benedict and Caldwell, 2006)

Left Overbank

m	Scour Depth (ft)
0	4.5
0.64	4.5
0.64	0

Right Overbank

m	Scour Depth (ft)
0	4.5
0.64	4.5
0.64	0

Coastal Plain and Piedmont Live-Bed Channel Contraction-Scour Envelope Curve by m

Original Live-Bed Channel Contraction Scour (Benedict and Caldwell, 2009)

m	Scour Depth (ft)
0	N/A
0.64	N/A
0.64	0.0

Modified Live-Bed Channel Contraction Scour (Benedict and Caldwell, 2012)

m	Scour Depth (ft)
0	N/A
0.64	N/A
0.64	0.0

Abutment-Scour Hole Topwidths (Benedict and others, 2016; Benedict, 2003)

Use the following envelope curve: **Long Bridge** **Long Bridge**

Left Abutment

Scour Depth (ft)	Scour Topwidth (ft)
0	70.0
18.2	70.0
18.2	0

Right Abutment

Scour Depth (ft)	Scour Topwidth (ft)
0	70.0
15.1	70.0
15.1	0

Envelope Curve Data

Abutment-Scour Depth by Embankment Length Original Curve (Benedict, 2003)

Coastal Plain

Abut Length (ft)	Scour Depth (ft)
0	0
426.5	14.4
7440.6	23.6

Piedmont

Abut Length (ft)	Scour Depth (ft)
0	0
18.4	0.6
112.3	3.1
181.4	4.6
408.5	9.7
571.8	12.9
606.4	13.7
675	14.2
952.9	18

Envelope Curve Data

Pier Scour Envelopes (Benedict and Caldwell, 2006; 2009)

Pier Width (ft)	SC Clear-Water Scour Depth (ft)	SC Live-Bed Scour Depth (ft)	National Scour Depth (ft)	2.5b Scour Depth (ft)	PSDb-2014 Scour Depth (ft)
0	0.5	3.3	4.1	0.0	0.0
2	3.5	5.5	7.1	5.0	3.9
4	6.5	7.7	10.1	10.0	7.3
6	9.5	9.9	13.1	15.0	10.5
8			16.1	20.0	13.6
10			19.1	25.0	16.7
12			22.1	30.0	19.7
14			25.1	35	22.6
16				40.0	25.5

Envelope Curve Data

Abutment-Scour Depth by Contraction Ratio
Original Curve (Benedict, 2003)

Coastal Plain

m	Scour Depth (ft)
0	0
0.32	1.69
0.67	8.18
0.77	11.75
0.81	13.55
0.82	14.03
0.98	23.53

Piedmont Sands

m	Scour Depth (ft)
0	0
0.022	0.6
0.372	4.6
0.668	13.7
0.817	18

Envelope Curve Data

Abutment-Scour Hole Topwidth
Original Curve (Benedict, 2003)

Long Bridges

Scour Depth (ft)	Scour Topwidth (ft)
0	0
0	6
0.4	20
1.2	40
2.6	60
5.2	65
13.2	70
18	70

Small Swampy Bridges

Scour Depth (ft)	Scour Topwidth (ft)
0	0
0	6
0.4	20
1.2	40
2.6	60
13.7	100
23.6	130

Skew Coefficients from HEC-18

Correction Factor, K_2, for Angle of Attack, θ, of the Flow.

Angle	L/a=4	L/a=8	L/a=12
0	1.00	1.00	1.00
15	1.50	2.00	2.50
30	2.00	2.75	3.50
45	2.30	3.30	4.30
90	2.50	3.90	5.00

Angle = skew angle of flow, in degrees; L = length of pier, in feet; a = pier width, in feet

Envelope Curve Data

Modified Abutment-Scour Envelope Curves (Benedict and others, 2016; Benedict and Caldwell, 2012)

Piedmont

m	Embankment Length Category (ft) 100 Scour Depth (ft)	200 Scour Depth (ft)	300 Scour Depth (ft)	400 Scour Depth (ft)	500 Scour Depth (ft)
0.130	1.20				
0.25	1.21	2.84			
0.34	1.29	2.92	4.42		
0.42	1.40	3.08	4.60	6.12	
0.5	1.55	3.31	4.89	6.43	8.04
0.6	1.80	3.72	5.40	7.02	8.65
0.7	2.11	4.25	6.08	7.84	9.57
0.8	2.49	4.91	6.92	8.89	10.79
0.85	2.70	5.28	7.41	9.50	11.52

Coastal Plain

m	Embankment Length Category (ft) 100 Scour Depth (ft)	200 Scour Depth (ft)	300 Scour Depth (ft)	400 Scour Depth (ft)	500 Scour Depth (ft)
0.25	1.22				
0.49	1.57	3.84			
0.65	2.10	4.62	7.40		
0.76	2.60	5.42	8.39	11.24	
0.84	3.03	6.14	9.30	12.42	14.94
0.90	3.40	6.76	10.10	13.50	16.30

Envelope Curve Data

Coastal Plain and Piedmont
Clear-Water Overbank Contraction Scour
(Benedict and Caldwell, 2006)

m	Scour Depth (ft)
0	0.60
0.02	0.80
0.1	1.54
0.2	2.36
0.3	3.06
0.4	3.64
0.5	4.10
0.6	4.44
0.7	4.66
0.8	4.76
0.85	4.77
0.91	4.73

Envelope Curve Data

Coastal Plain and Piedmont
Original Live-Bed Channel Contraction Scour
(Benedict and Caldwell, 2009)

m	Scour Depth (ft)
0	0.0
0.02	0.04
0.1	0.38
0.2	1.25
0.3	2.61
0.4	4.47
0.5	6.83
0.6	9.67
0.7	13.01
0.8	16.85
0.85	18.95
0.9	21.18

Envelope Curve Data

Coastal Plain and Piedmont
Modified Live-Bed Channel Contraction Scour

(Benedict and Caldwell, 2012)

m	Drainage Area (sq mi) 100 Scour Depth (ft)	200 Scour Depth (ft)
0.000	0.00	0.00
0.1	0.16	0.30
0.2	0.64	1.00
0.3	1.44	2.10
0.4	2.56	3.60
0.6	5.76	7.80
0.7	7.84	10.50
0.8	10.24	13.60
0.9	12.96	17.10

ABUTMENT-SCOUR DATA

SCDOT Bridge Number	County	Road	Stream	Latitude (DMS)	Longitude (DMS)	Analysis date	Physiographic Province	Multiple bridge?	Relief bridge?	Swampy, Poorly Defined Channel?	Bridge length (feet)	Drainage area (sq mi)	Drainage area check (original envelope)	Drainage area check (modified envelope)	Quality of SCDOT Plan Data
05250 & 05259	Clarendon	I-95	Lake Marion Relief	33:31:05.87	80:26:09.83	6/7/2023	Coastal Plain	Yes	Yes	Yes	375	14400	DA OUTSIDE RANGE (Above)	DA OUTSIDE RANGE (Above)	No Data

CLEAR-WATER CONTRACTION-SCOUR DATA

SCDOT Bridge Number	County	Road	Stream	Latitude (DMS)	Longitude (DMS)	Analysis date	Physiographic Province	Multiple bridge?	Relief bridge?	Swampy, Poorly Defined Channel?	Bridge length (feet)	Drainage area (sq mi)	Drainage area check	Plan m	Topo m
05250 & 05259	Clarendon	I-95	Lake Marion Relief	33:31:05.87	80:26:09.83	6/7/2023	Coastal Plain	Yes	Yes	Yes	375	14400	DA OUTSIDE RANGE (Above)	No Data	0.64

LIVE-BED CONTRACTION-SCOUR DATA

SCDOT Bridge Number	County	Road	Stream	Latitude (DMS)	Longitude (DMS)	Analysis date	Physiographic Province	Multiple bridge?	Relief bridge?	Swampy, Poorly Defined Channel?	Bridge length (feet)	Drainage area (sq mi)	Drainage area check (original curve)	Drainage area check (modified curve)	Plan m
05250 & 05259	Clarendon	I-95	Lake Marion Relief	33:31:05.87	80:26:09.83	6/7/2023	Coastal Plain	Yes	Yes	Yes	375	14400	DA OUTSIDE RANGE (Above)	DA OUTSIDE RANGE (Above)	No Data

PIER-SCOUR DATA

SCDOT Bridge Number	County	Road	Stream	Latitude (DMS)	Longitude (DMS)	Analysis date	Physiographic Province	Multiple bridge?	Relief bridge?	Swampy, Poorly Defined Channel?	Bridge length (feet)	Drainage area (sq mi)	Location of pier	Pier or bent type	Envelope curve used
05250 & 05259	Clarendon	I-95	Lake Marion Relief	33:31:05.87	80:26:09.83	6/7/2023	Coastal Plain	Yes	Yes	Yes	375	14400	LABUT	Multiple Column Pier	Automatic Calculation
05250 & 05259	Clarendon	I-95	Lake Marion Relief	33:31:05.87	80:26:09.83	6/7/2023	Coastal Plain	Yes	Yes	Yes	375	14400	LOB	Multiple Column Pier	Automatic Calculation
05250 & 05259	Clarendon	I-95	Lake Marion Relief	33:31:05.87	80:26:09.83	6/7/2023	Coastal Plain	Yes	Yes	Yes	375	14400	CH	Multiple Column Pier	Automatic Calculation
05250 & 05259	Clarendon	I-95	Lake Marion Relief	33:31:05.87	80:26:09.83	6/7/2023	Coastal Plain	Yes	Yes	Yes	375	14400	ROB	Multiple Column Pier	Automatic Calculation
05250 & 05259	Clarendon	I-95	Lake Marion Relief	33:31:05.87	80:26:09.83	6/7/2023	Coastal Plain	Yes	Yes	Yes	375	14400	RABUT	Multiple Column Pier	Automatic Calculation

Quality of Topo Map Data	Quality of FEMA/Other Map Data	Plan m	Topo m	FEMA/Other m	Used m	m check (original envelope)	m check (modified envelope)	Plan (left abutment length) (feet)	Topo (left abutment length) (feet)	FEMA/Other (left abutment length) (feet)	Used (left abutment length) (feet)	Left abutment length check (original envelope)	Left abutment length check (modified envelope)	Plan (right abutment length) (feet)	Topo (right abutment length) (feet)
Good	Good	No Data	0.64	0.64	0.64	OK	OK	No Data	3346	3346	3346	CAUTION	OUTSIDE RANGE	No Data	960

FEMA/Other m	Used m	m check	Left overbank scour depth (feet)	Right overbank scour depth (feet)	Selected left overbank scour depth (feet)	Selected right overbank scour depth (feet)
0.64	0.64	OK	4.5	4.5	4.5	4.5

Topo m	FEMA/Other m	Used m	m check (original curve)	m check (modified curve)	Original channel scour depth (feet)	Modified channel scour depth (feet)	Selected channel scour depth (feet)
0.64	0.64	0.64	OK	OK	N/A	N/A	N/A

PENETRATION TABLE

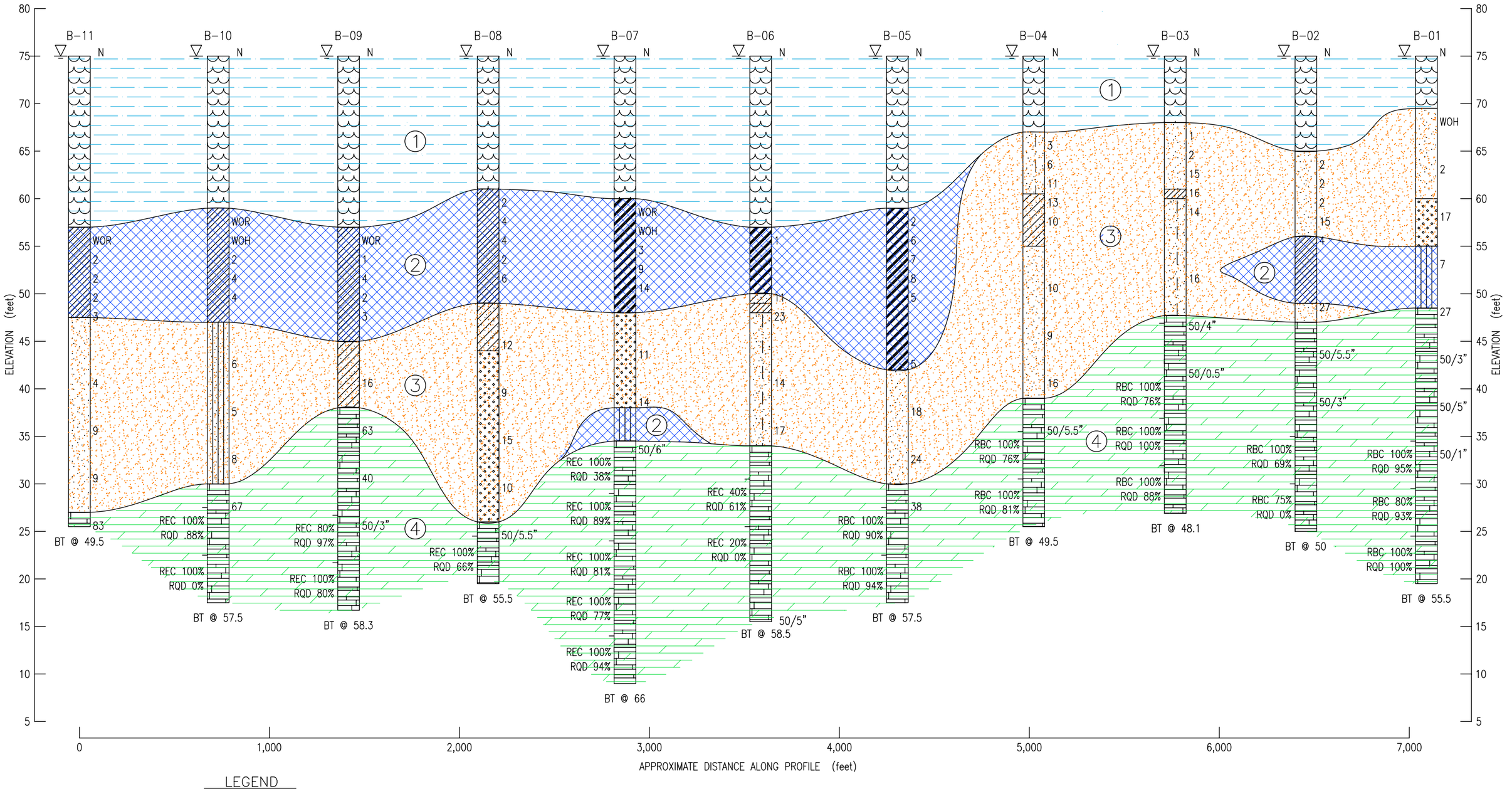
Pier width (feet)	Pier length (feet)	Angle of attack (degrees)	Multiple column bent?	Minimum spacing between columns (feet)	Column spacing to width ratio	Skew coefficient (single pier - HEC 18)		Skew coefficient used	Envelope curve used in pier scour estimate	Pier scour from envelope (feet) (no adjustment)	Pier scour adjusted for skew (feet)	Use abutment scour at pier?	Clear-water abutment scour from USGS curves (feet)	Use overbank contraction scour at pier?	Clear-water overbank contraction scour from USGS curves (feet)
5.5	33	0	Yes	14.5	2.64	1.00		1.00	PSDb-2014	9.7	9.7	Yes	18.2	No	0.0
5.5	33	0	Yes	14.5	2.64	1.00		1.00	PSDb-2014	9.7	9.7	No	0.0	Yes	4.5
5.5	33	0	Yes	14.5	2.64	1.00		1.00	PSDb-2014	9.7	9.7	No	0.0	No	0.0
5.5	33	0	Yes	14.5	2.64	1.00		1.00	PSDb-2014	9.7	9.7	No	0.0	Yes	4.5
5.5	33	0	Yes	14.5	2.64	1.00		1.00	PSDb-2014	9.7	9.7	Yes	15.1	No	0.0

FEMA/Other (right abutment length) (feet)	Used (right abutment length) (feet)	Right abutment length check (original envelope)	Right abutment length check (modified envelope)	Original left abutment depth by m (feet)	Original right abutment depth by m (feet)	Original left abutment depth by length (feet)	Original right abutment depth by length (feet)	Modified left abutment depth by Category (feet)	Modified right abutment depth by Category (feet)	Modified left abutment depth by Interpolation (feet)	Modified right abutment depth by Interpolation (feet)	Left abutment depth selected (feet)	Right abutment depth selected (feet)	Left abutment hole width (feet)	Right abutment hole width (feet)
960	960	OK	OUTSIDE RANGE	7.04	7.04	18.23	15.10	N/A	N/A	N/A	N/A	18.23	15.10	70.00	70.00

Use live-bed channel contraction scour at pier?	Live-bed contraction scour from USGS curves (feet)	Use pier scour?	Pier scour (feet)	Total scour at bent (feet)	Computed embedment of pile from consultant (feet)	Remaining pile penetration (feet)	Embedment below thalweg from consultant (feet)	Remaining pile penetration (at thalweg) (feet)
No	0.0	No	0.0	18.23	0.00	-18.23	0.00	-18.23
No	0.0	Yes	9.7	14.27	0.00	-14.27	0.00	-14.27
No	0.0	No	0.0	N/A	0.00	N/A	0.00	N/A
No	0.0	Yes	9.7	14.27	0.00	-14.27	0.00	-14.27
No	0.0	No	0.0	15.10	0.00	-15.10	0.00	-15.10

FHWA Hydraulic Toolbox/ HEC-18 Approach

TRANSYSTEMS



LEGEND

① WATER

② VERY SOFT TO STIFF CLAYS AND SILTS

③ VERY LOOSE TO MEDIUM DENSE SAND

④ LIMESTONE

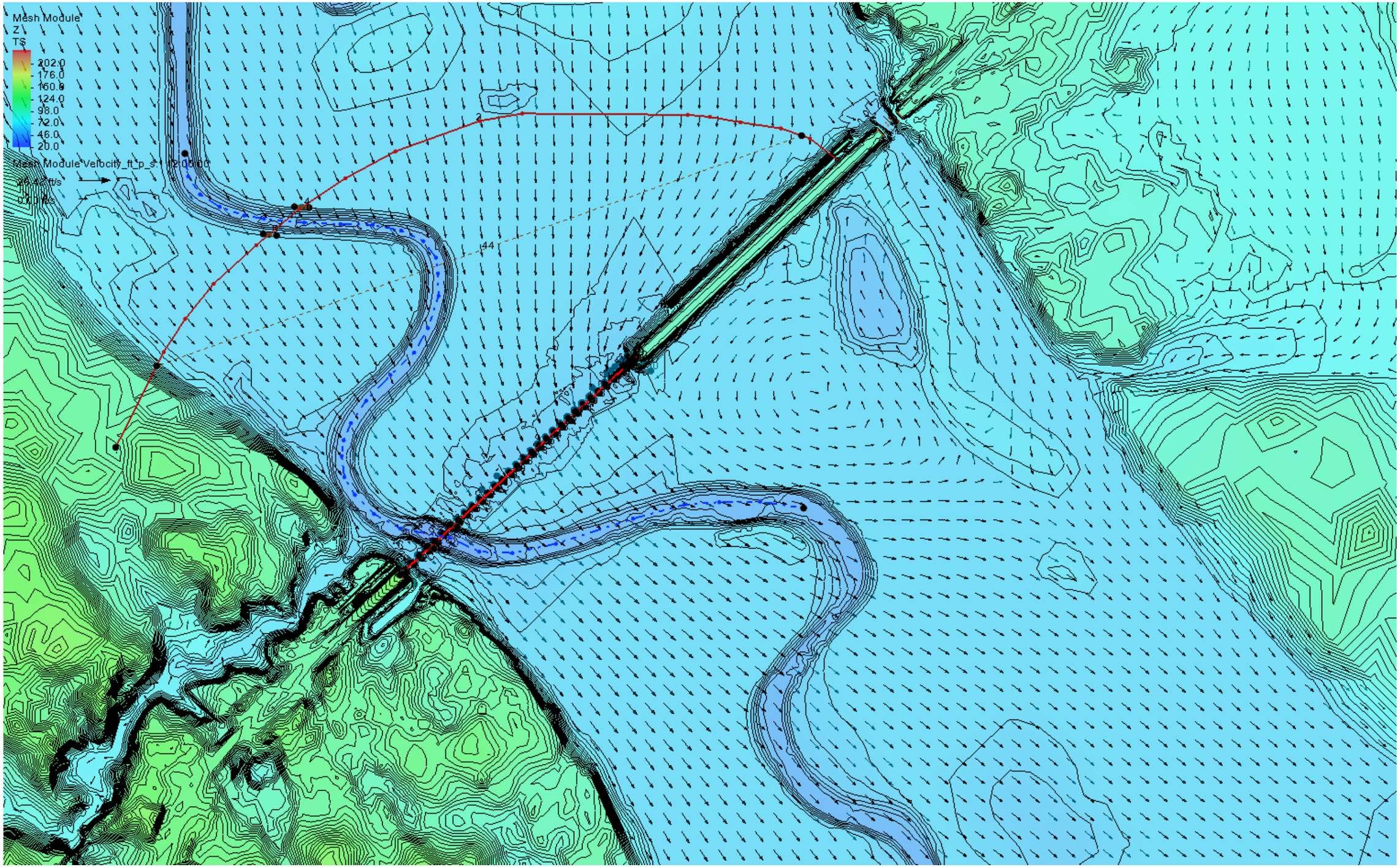
N = Standard Penetration Test resistance value (blows per foot).
The depicted stratigraphy is shown for illustrative purposes only.
The actual subsurface conditions will vary between boring locations.
Elevation determined from SCDNR website (no datum referenced).

S&ME

ENGINEERING · TESTING · ENVIRONMENTAL SERVICES

SUBSURFACE FENCE DIAGRAM
GEOTECHNICAL EXPLORATION
LAKE MARION CROSSING REBUILD
SANTEE, SOUTH CAROLINA

SCALE: AS SHOWN	DRAWN BY: LAJ	APPROVED BY:
PROJECT NO. 1131-10-294	DATE: 8-12-10	FIGURE C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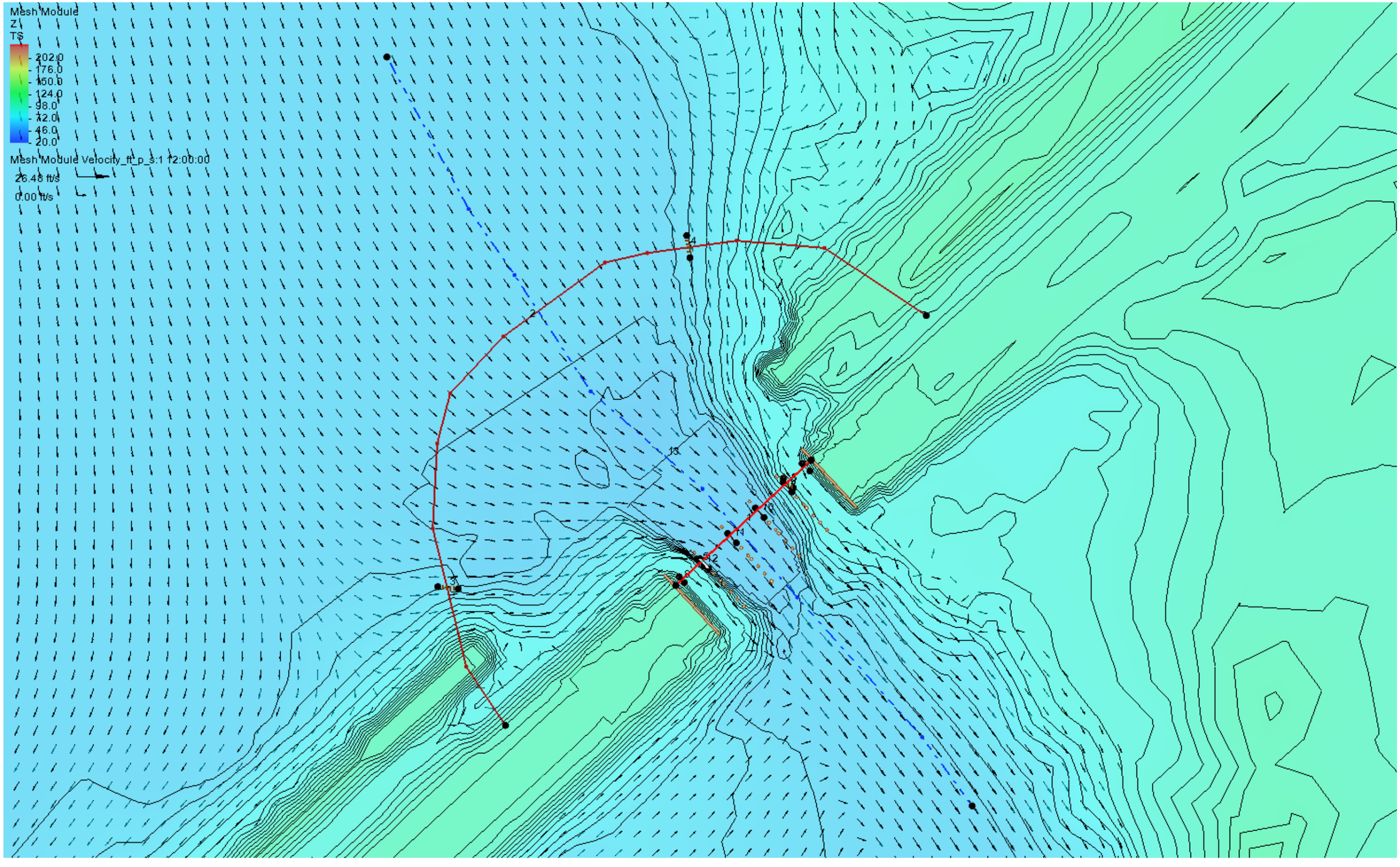
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Bridge scour Summary Table

Bridge Scour Summary Table

Parameter	Scour_Pro...	Scour_Pro...	Units	Notes	Plot
Scenario	☑	☑			
Bridge Geometry					☑
Bridge Cross-Section					☑
WSE	☑	☑			☑
Contraction Scour	☑	☑			☑
Applied Contraction Scour Depth	**16.66**	10.36	ft		
Clear Water Contraction Scour Depth	0.00	0.00	ft		
Live Bed Contraction Scour Depth	**16.66**	10.36	ft		
Applied Contraction Scour Elevation with LTD	**22.68**	28.98	ft		
Approach Cross-Section					☐
Local Scour at Piers					☑
Plot Pier Scour	☑	☑			☑
Piers					
Pier Name	Pier 1	Pier 1			
Pier Scour Depth	6.48	**7.35**	ft	Computation Method: Pier 1Scour_Pr...	
Total Scour at Pier	6.48	**7.35**	ft		
Total Scour Elevation at Pier	**45.71**	64.39	ft		
Piers					
Pier Name	Pier 2	Pier 2			
Pier Scour Depth	**30.27**	20.23	ft	Computation Method: Pier 2Scour_Pr...	
Total Scour at Pier	**30.27**	20.23	ft		
Total Scour Elevation at Pier	**11.25**	40.85	ft		
Piers					
Pier Name	Pier 3	Pier 3			
Pier Scour Depth	**35.89**	32.75	ft	Computation Method: Pier 3Scour_Pr...	
Total Scour at Pier	**35.89**	32.75	ft		
Total Scour Elevation at Pier	**0.22**	22.92	ft		
Piers					
Pier Name	Pier 4	Pier 4			
Pier Scour Depth	**38.79**	35.11	ft	Computation Method: Pier 4Scour_Pr...	
Total Scour at Pier	**38.79**	35.11	ft		
Total Scour Elevation at Pier	**-2.20**	21.05	ft		
Piers					
Pier Name	Pier 5	Pier 5			
Pier Scour Depth	**38.81**	34.51	ft	Computation Method: Pier 5Scour_Pr...	
Total Scour at Pier	**38.81**	34.51	ft		
Total Scour Elevation at Pier	**-2.51**	21.36	ft		
Piers					
Pier Name	Pier 6	Pier 6			
Pier Scour Depth	**41.95**	38.41	ft	Computation Method: Pier 6Scour_Pr...	
Total Scour at Pier	**41.95**	38.41	ft		
Total Scour Elevation at Pier	**-4.92**	18.19	ft		
Piers					
Pier Name	Pier 7	Pier 7			
Pier Scour Depth	**40.23**	33.56	ft	Computation Method: Pier 7Scour_Pr...	
Total Scour at Pier	**40.23**	33.56	ft		
Total Scour Elevation at Pier	**-1.72**	24.50	ft		

Bridge scour Summary Table (continued)

Parameter	Scour_Pro...	Scour_Pro...	Units	Notes	Plot
Piers					
Pier Name	Pier 8	Pier 8			
Pier Scour Depth	**34.40**	32.85	ft	Computation Method: Pier 8Scour_Pr...	
Total Scour at Pier	**34.40**	32.85	ft		
Total Scour Elevation at Pier	**3.38**	24.49	ft		
Piers					
Pier Name	Pier 9	Pier 9			
Pier Scour Depth	**33.16**	29.72	ft	Computation Method: Pier 9Scour_Pr...	
Total Scour at Pier	**33.16**	29.72	ft		
Total Scour Elevation at Pier	**3.99**	27.00	ft		
Piers					
Pier Name	Pier 10	Pier 10			
Pier Scour Depth	16.07	**28.23**	ft	Computation Method: Pier 10Scour_P...	
Total Scour at Pier	16.07	**28.23**	ft		
Total Scour Elevation at Pier	**21.99**	29.39	ft		
Piers					
Pier Name	Pier 11	Pier 11			
Pier Scour Depth	**32.16**	26.77	ft	Computation Method: Pier 11Scour_P...	
Total Scour at Pier	**32.16**	26.77	ft		
Total Scour Elevation at Pier	**5.08**	30.03	ft		
Piers					
Pier Name	Pier 12	Pier 12			
Pier Scour Depth	**31.81**	26.32	ft	Computation Method: Pier 12Scour_P...	
Total Scour at Pier	**31.81**	26.32	ft		
Total Scour Elevation at Pier	**5.30**	30.35	ft		
Piers					
Pier Name	Pier 13	Pier 13			
Pier Scour Depth	15.19	**24.88**	ft	Computation Method: Pier 13Scour_P...	
Total Scour at Pier	15.19	**24.88**	ft		
Total Scour Elevation at Pier	**21.96**	31.83	ft		
Piers					
Pier Name	Pier 14	Pier 14			
Pier Scour Depth	**28.99**	24.26	ft	Computation Method: Pier 14Scour_P...	
Total Scour at Pier	**28.99**	24.26	ft		
Total Scour Elevation at Pier	**7.90**	32.18	ft		
Piers					
Pier Name	Pier 15	Pier 15			
Pier Scour Depth	**27.08**	22.48	ft	Computation Method: Pier 15Scour_P...	
Total Scour at Pier	**27.08**	22.48	ft		
Total Scour Elevation at Pier	**9.88**	34.04	ft		
Piers					
Pier Name	Pier 16	Pier 16			
Pier Scour Depth	**26.48**	21.55	ft	Computation Method: Pier 16Scour_P...	
Total Scour at Pier	**26.48**	21.55	ft		
Total Scour Elevation at Pier	**9.86**	34.36	ft		

Bridge scour Summary Table (continued)

Parameter	Scour_Pro...	Scour_Pro...	Units	Notes	Plot
Piers					
Pier Name	Pier 17	Pier 17			
Pier Scour Depth	**24.17**	19.62	ft	Computation Method: Pier 17Scour_P...	
Total Scour at Pier	**24.17**	19.62	ft		
Total Scour Elevation at Pier	**12.81**	36.91	ft		
Piers					
Pier Name	Pier 18	Pier 18			
Pier Scour Depth	**23.75**	19.31	ft	Computation Method: Pier 18Scour_P...	
Total Scour at Pier	**23.75**	19.31	ft		
Total Scour Elevation at Pier	**13.19**	37.19	ft		
Piers					
Pier Name	Pier 19	Pier 19			
Pier Scour Depth	**21.65**	17.26	ft	Computation Method: Pier 19Scour_P...	
Total Scour at Pier	**21.65**	17.26	ft		
Total Scour Elevation at Pier	**15.61**	39.56	ft		
Piers					
Pier Name	Pier 20	Pier 20			
Pier Scour Depth	**21.98**	17.71	ft	Computation Method: Pier 20Scour_P...	
Total Scour at Pier	**21.98**	17.71	ft		
Total Scour Elevation at Pier	**16.35**	40.19	ft		
Piers					
Pier Name	Pier 21	Pier 21			
Pier Scour Depth	**19.88**	17.38	ft	Computation Method: Pier 21Scour_P...	
Total Scour at Pier	**19.88**	17.38	ft		
Total Scour Elevation at Pier	**17.23**	39.28	ft		
Piers					
Pier Name	Pier 22	Pier 22			
Pier Scour Depth	**17.20**	14.69	ft	Computation Method: Pier 22Scour_P...	
Total Scour at Pier	**17.20**	14.69	ft		
Total Scour Elevation at Pier	**19.95**	42.03	ft		
Piers					
Pier Name	Pier 23	Pier 23			
Pier Scour Depth	**17.68**	15.83	ft	Computation Method: Pier 23Scour_P...	
Total Scour at Pier	**17.68**	15.83	ft		
Total Scour Elevation at Pier	**19.83**	41.24	ft		
Piers					
Pier Name	Pier 24	Pier 24			
Pier Scour Depth	**16.52**	14.94	ft	Computation Method: Pier 24Scour_P...	
Total Scour at Pier	**16.52**	14.94	ft		
Total Scour Elevation at Pier	**22.43**	43.57	ft		
Piers					
Pier Name	Pier 25	Pier 25			
Pier Scour Depth	**15.72**	14.18	ft	Computation Method: Pier 25Scour_P...	
Total Scour at Pier	**15.72**	14.18	ft		
Total Scour Elevation at Pier	**22.77**	43.87	ft		

Bridge scour Summary Table (continued)

Parameter	Scour_Pro...	Scour_Pro...	Units	Notes	Plot
Piers					
Pier Name	Pier 26	Pier 26			
Pier Scour Depth	12.53	**13.36**	ft	Computation Method: Pier 26Scour_P...	
Total Scour at Pier	12.53	**13.36**	ft		
Total Scour Elevation at Pier	**25.01**	43.75	ft		
Piers					
Pier Name	Pier 27	Pier 27			
Pier Scour Depth	**13.32**	12.70	ft	Computation Method: Pier 27Scour_P...	
Total Scour at Pier	**13.32**	12.70	ft		
Total Scour Elevation at Pier	**26.09**	46.26	ft		
Piers					
Pier Name	Pier 28	Pier 28			
Pier Scour Depth	**22.51**	20.09	ft	Computation Method: Pier 28Scour_P...	
Total Scour at Pier	**22.51**	20.09	ft		
Total Scour Elevation at Pier	**0.17**	8.89	ft		
Piers					
Pier Name	Pier 29	Pier 29			
Pier Scour Depth	**27.90**	25.99	ft	Computation Method: Pier 29Scour_P...	
Total Scour at Pier	**27.90**	25.99	ft		
Total Scour Elevation at Pier	**-5.21**	2.99	ft		
Piers					
Pier Name	Pier 30	Pier 30			
Pier Scour Depth	**30.48**	28.40	ft	Computation Method: Pier 30Scour_P...	
Total Scour at Pier	**30.48**	28.40	ft		
Total Scour Elevation at Pier	**-7.80**	0.58	ft		
Piers					
Pier Name	Pier 31	Pier 31			
Pier Scour Depth	**27.14**	25.07	ft	Computation Method: Pier 31Scour_P...	
Total Scour at Pier	**27.14**	25.07	ft		
Total Scour Elevation at Pier	**-4.46**	3.91	ft		
Piers					
Pier Name	Pier 32	Pier 32			
Pier Scour Depth	**23.91**	21.05	ft	Computation Method: Pier 32Scour_P...	
Total Scour at Pier	**23.91**	21.05	ft		
Total Scour Elevation at Pier	**31.45**	34.63	ft		
Piers					
Pier Name	Pier 33	Pier 33			
Pier Scour Depth	**22.18**	18.43	ft	Computation Method: Pier 33Scour_P...	
Total Scour at Pier	**22.18**	18.43	ft		
Total Scour Elevation at Pier	**37.06**	41.13	ft		
Piers					
Pier Name	Pier 34	Pier 34			
Pier Scour Depth	**5.46**	4.73	ft	Computation Method: Pier 34Scour_P...	
Total Scour at Pier	**5.46**	4.73	ft		
Total Scour Elevation at Pier	**68.34**	69.39	ft		

500-year: Channel Scour – Live Bed Contraction

Contraction Scour

Computation Method: Clear-Water and Live-Bed Scour

Parameter	Value	Units	Notes
Input Parameters			
Average Depth Upstream of Contraction	29.85	ft	
D50	0.200000	mm	0.2 mm is the lower limit for ...
Average Velocity Upstream	4.19	ft/s	
Results of Scour Condition			
Critical velocity above which bed material of size D and s...	1.71	ft/s	
Contraction Scour Condition	Live Bed		
Live Bed & Clear Water Input Parameters			
Temperature of Water	60.00	°F	
Slope of Energy Grade Line at Approach Section	0.000246	ft/ft	
Discharge in Contracted Section	114830.00	cfs	
Discharge Upstream that is Transporting Sediment	74946.50	cfs	
Width in Contracted Section	387.10	ft	Remove widths occupied by ...
Width Upstream that is Transporting Sediment	599.64	ft	
Depth Prior to Scour in Contracted Section	41.54	ft	
Unit Weight of Water	62.40	lb/ft^3	
Unit Weight of Sediment	165.00	lb/ft^3	
Results of Clear Water Method			
Diameter of the smallest nontransportable particle in the b...	0.250000	mm	
Average Depth in Contracted Section after Scour	124.45	ft	
Scour Depth	82.91	ft	Negative values imply 'zero' ...
Results of Live Bed Method			
k1	0.690000		
Shear Velocity	0.49	ft/s	
Fall Velocity	0.08	ft/s	
Average Depth in Contracted Section after Scour	58.20	ft	
Scour Depth	16.66	ft	Negative values imply 'zero' ...
Shear Applied to Bed by Live-Bed Scour	0.2858	lb/ft^2	
Shear Required for Movement of D50 Particle	0.0026	lb/ft^2	
Recommendations			
Recommended Scour Depth	16.66	ft	Negative values imply 'zero' ...

500-year: Left Overbank Scour – Live Bed Contraction

Contraction Scour

Computation Method: Clear-Water and Live-Bed Scour

Parameter	Value	Units	Notes
Input Parameters			
Average Depth Upstream of Contraction	22.52	ft	
D50	0.200000	mm	0.2 mm is the lower limit for ...
Average Velocity Upstream	3.57	ft/s	
Results of Scour Condition			
Critical velocity above which bed material of size D and s...	1.63	ft/s	
Contraction Scour Condition	Live Bed		
Live Bed & Clear Water Input Parameters			
Temperature of Water	60.00	°F	
Slope of Energy Grade Line at Approach Section	0.000246	ft/ft	
Discharge in Contracted Section	691091.00	cfs	
Discharge Upstream that is Transporting Sediment	639741.00	cfs	
Width in Contracted Section	3479.70	ft	Remove widths occupied by ...
Width Upstream that is Transporting Sediment	7952.48	ft	
Depth Prior to Scour in Contracted Section	23.00	ft	
Unit Weight of Water	62.40	lb/ft^3	
Unit Weight of Sediment	165.00	lb/ft^3	
Results of Clear Water Method			
Diameter of the smallest nontransportable particle in the b...	0.250000	mm	
Average Depth in Contracted Section after Scour	88.24	ft	
Scour Depth	65.24	ft	Negative values imply 'zero' ...
Results of Live Bed Method			
k1	0.690000		
Shear Velocity	0.42	ft/s	
Fall Velocity	0.08	ft/s	
Average Depth in Contracted Section after Scour	42.56	ft	
Scour Depth	19.56	ft	Negative values imply 'zero' ...
Shear Applied to Bed by Live-Bed Scour	0.2158	lb/ft^2	
Shear Required for Movement of D50 Particle	0.0026	lb/ft^2	
Recommendations			
Recommended Scour Depth	19.56	ft	Negative values imply 'zero' ...

500-year: Right Overbank Scour – Live Bed Contraction

Contraction Scour

Computation Method: Clear-Water and Live-Bed Scour

Parameter	Value	Units	Notes
Input Parameters			
Average Depth Upstream of Contraction	21.10	ft	
D50	0.200000	mm	0.2 mm is the lower limit for ...
Average Velocity Upstream	4.06	ft/s	
Results of Scour Condition			
Critical velocity above which bed material of size D and s...	1.61	ft/s	
Contraction Scour Condition	Live Bed		
Live Bed & Clear Water Input Parameters			
Temperature of Water	60.00	°F	
Slope of Energy Grade Line at Approach Section	0.000246	ft/ft	
Discharge in Contracted Section	59555.80	cfs	
Discharge Upstream that is Transporting Sediment	231746.00	cfs	
Width in Contracted Section	503.66	ft	Remove widths occupied by ...
Width Upstream that is Transporting Sediment	2704.75	ft	
Depth Prior to Scour in Contracted Section	20.68	ft	
Unit Weight of Water	62.40	lb/ft^3	
Unit Weight of Sediment	165.00	lb/ft^3	
Results of Clear Water Method			
Diameter of the smallest nontransportable particle in the b...	0.250000	mm	
Average Depth in Contracted Section after Scour	56.57	ft	
Scour Depth	35.90	ft	Negative values imply 'zero' ...
Results of Live Bed Method			
k1	0.690000		
Shear Velocity	0.41	ft/s	
Fall Velocity	0.08	ft/s	
Average Depth in Contracted Section after Scour	21.00	ft	
Scour Depth	0.32	ft	Negative values imply 'zero' ...
Shear Applied to Bed by Live-Bed Scour	0.2483	lb/ft^2	
Shear Required for Movement of D50 Particle	0.0026	lb/ft^2	
Recommendations			
Recommended Scour Depth	0.32	ft	Negative values imply 'zero' ...

500-year: Right Abutment Scour

Abutment Scour

Computation Method: NCHRP

Parameter	Value	Units	Notes
Input Parameters			
Scour Condition	Compute		
Scour Condition Location	Type a (Main Channel)		
Abutment Type	Spill-through abutment		
Unit Discharge, Upstream in Main Channel (q1)	124.98	cfs/ft	
Unit Discharge in Constricted Area (q2)	296.64	cfs/ft	
D50	0.200000	mm	0.2 mm is the lower limit for coh...
Upstream Flow Depth	29.85	ft	
Define Shear Stress of Floodplain	☐		
Flow Depth prior to Scour	7.76	ft	Depth at Abutment Toe
Results			
q2 / q1	2.37		
Average Velocity Upstream	4.19	ft/s	
Critical Velocity above which Bed Materal of Size D and Sm...	1.71	ft/s	
Scour Condition	Live Bed		
Scour Condition	a (Main Channel)		
Amplification Factor	1.14		
Flow Depth including Contraction Scour	62.62	ft	
Scour depth from Long-Term Degradation calculations	0.00	ft	
Maximum Flow Depth including Abutment Scour	71.17	ft	Including the long-term scour de...
Scour Hole Depth	63.41	ft	Negative values imply 'zero' sco...
Scour Hole			
Angle of Repose	44.00	degrees	
Ratio of Bottom Width of Scour Hole to Scour Hole Depth	0.00		1.0 means the bottom width will ...
Scour Hole Bottom Width	0.00	ft	
Scour Hole Top Width	65.67	ft	

100-year: Channel Scour – Live Bed Contraction

Contraction Scour

Computation Method: Clear-Water and Live-Bed Scour

Parameter	Value	Units	Notes
Input Parameters			
Average Depth Upstream of Contraction	23.53	ft	
D50	0.200000	mm	0.2 mm is the lower limit for ...
Average Velocity Upstream	3.46	ft/s	
Results of Scour Condition			
Critical velocity above which bed material of size D and s...	1.64	ft/s	
Contraction Scour Condition	Live Bed		
Live Bed & Clear Water Input Parameters			
Temperature of Water	60.00	°F	
Slope of Energy Grade Line at Approach Section	0.000227	ft/ft	
Discharge in Contracted Section	73558.00	cfs	
Discharge Upstream that is Transporting Sediment	48832.30	cfs	
Width in Contracted Section	381.47	ft	Remove widths occupied by ...
Width Upstream that is Transporting Sediment	599.64	ft	
Depth Prior to Scour in Contracted Section	35.31	ft	
Unit Weight of Water	62.40	lb/ft^3	
Unit Weight of Sediment	165.00	lb/ft^3	
Results of Clear Water Method			
Diameter of the smallest nontransportable particle in the b...	0.250000	mm	
Average Depth in Contracted Section after Scour	86.03	ft	
Scour Depth	50.72	ft	Negative values imply 'zero' ...
Results of Live Bed Method			
k1	0.690000		
Shear Velocity	0.41	ft/s	
Fall Velocity	0.08	ft/s	
Average Depth in Contracted Section after Scour	45.67	ft	
Scour Depth	10.36	ft	Negative values imply 'zero' ...
Shear Applied to Bed by Live-Bed Scour	0.1809	lb/ft^2	
Shear Required for Movement of D50 Particle	0.0026	lb/ft^2	
Recommendations			
Recommended Scour Depth	10.36	ft	Negative values imply 'zero' ...

100-year: Left Overbank Scour – Live Bed Contraction

Contraction Scour

Computation Method: Clear-Water and Live-Bed Scour

Parameter	Value	Units	Notes
Input Parameters			
Average Depth Upstream of Contraction	16.56	ft	
D50	0.200000	mm	0.2 mm is the lower limit for ...
Average Velocity Upstream	3.03	ft/s	
Results of Scour Condition			
Critical velocity above which bed material of size D and s...	1.55	ft/s	
Contraction Scour Condition	Live Bed		
Live Bed & Clear Water Input Parameters			
Temperature of Water	60.00	°F	
Slope of Energy Grade Line at Approach Section	0.000227	ft/ft	
Discharge in Contracted Section	425378.00	cfs	
Discharge Upstream that is Transporting Sediment	390578.00	cfs	
Width in Contracted Section	3466.85	ft	Remove widths occupied by ...
Width Upstream that is Transporting Sediment	7795.49	ft	
Depth Prior to Scour in Contracted Section	17.65	ft	
Unit Weight of Water	62.40	lb/ft^3	
Unit Weight of Sediment	165.00	lb/ft^3	
Results of Clear Water Method			
Diameter of the smallest nontransportable particle in the b...	0.250000	mm	
Average Depth in Contracted Section after Scour	58.40	ft	
Scour Depth	40.75	ft	Negative values imply 'zero' ...
Results of Live Bed Method			
k1	0.690000		
Shear Velocity	0.35	ft/s	
Fall Velocity	0.08	ft/s	
Average Depth in Contracted Section after Scour	31.17	ft	
Scour Depth	13.52	ft	Negative values imply 'zero' ...
Shear Applied to Bed by Live-Bed Scour	0.1385	lb/ft^2	
Shear Required for Movement of D50 Particle	0.0026	lb/ft^2	
Recommendations			
Recommended Scour Depth	13.52	ft	Negative values imply 'zero' ...

100-year: Right Overbank Scour – Live Bed Contraction

Contraction Scour

Computation Method: Clear-Water and Live-Bed Scour

Parameter	Value	Units	Notes
Input Parameters			
Average Depth Upstream of Contraction	15.07	ft	
D50	0.200000	mm	0.2 mm is the lower limit for ...
Average Velocity Upstream	3.52	ft/s	
Results of Scour Condition			
Critical velocity above which bed material of size D and s...	1.53	ft/s	
Contraction Scour Condition	Live Bed		
Live Bed & Clear Water Input Parameters			
Temperature of Water	60.00	°F	
Slope of Energy Grade Line at Approach Section	0.000227	ft/ft	
Discharge in Contracted Section	33602.60	cfs	
Discharge Upstream that is Transporting Sediment	143331.00	cfs	
Width in Contracted Section	493.60	ft	Remove widths occupied by ...
Width Upstream that is Transporting Sediment	2704.75	ft	
Depth Prior to Scour in Contracted Section	15.25	ft	
Unit Weight of Water	62.40	lb/ft^3	
Unit Weight of Sediment	165.00	lb/ft^3	
Results of Clear Water Method			
Diameter of the smallest nontransportable particle in the b...	0.250000	mm	
Average Depth in Contracted Section after Scour	35.24	ft	
Scour Depth	19.99	ft	Negative values imply 'zero' ...
Results of Live Bed Method			
k1	0.690000		
Shear Velocity	0.33	ft/s	
Fall Velocity	0.08	ft/s	
Average Depth in Contracted Section after Scour	14.05	ft	
Scour Depth	-1.20	ft	Negative values imply 'zero' ...
Shear Applied to Bed by Live-Bed Scour	0.1607	lb/ft^2	
Shear Required for Movement of D50 Particle	0.0026	lb/ft^2	
Recommendations			
Recommended Scour Depth	-1.20	ft	Negative values imply 'zero' ...

100-year: Right Abutment Scour

Abutment Scour

Computation Method: NCHRP

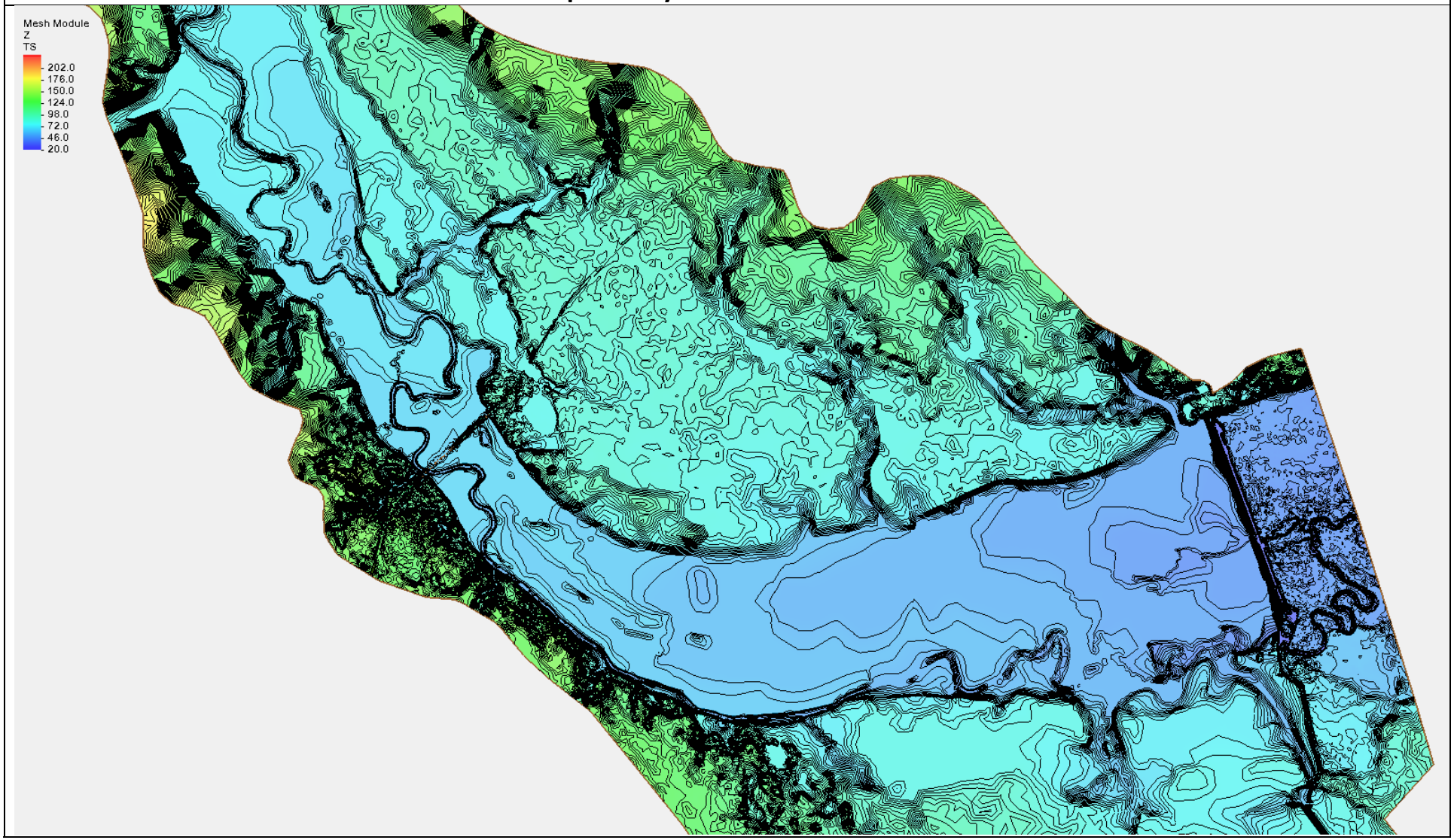
Parameter	Value	Units	Notes
Input Parameters			
Scour Condition	Compute		
Scour Condition Location	Type a (Main Channel)		
Abutment Type	Spill-through abutment		
Unit Discharge, Upstream in Main Channel (q1)	81.44	cfs/ft	
Unit Discharge in Constricted Area (q2)	192.83	cfs/ft	
D50	0.200000	mm	0.2 mm is the lower limit for coh...
Upstream Flow Depth	23.53	ft	
Define Shear Stress of Floodplain	☐		
Flow Depth prior to Scour	1.71	ft	Depth at Abutment Toe
Results			
q2 / q1	2.37		
Average Velocity Upstream	3.46	ft/s	
Critical Velocity above which Bed Materal of Size D and Sm...	1.64	ft/s	
Scour Condition	Live Bed		
Scour Condition	a (Main Channel)		
Amplification Factor	1.14		
Flow Depth including Contraction Scour	49.26	ft	
Scour depth from Long-Term Degradation calculations	0.00	ft	
Maximum Flow Depth including Abutment Scour	56.01	ft	Including the long-term scour de...
Scour Hole Depth	54.30	ft	Negative values imply 'zero' sco...
Scour Hole			
Angle of Repose	44.00	degrees	
Ratio of Bottom Width of Scour Hole to Scour Hole Depth	0.00		1.0 means the bottom width will ...
Scour Hole Bottom Width	0.00	ft	
Scour Hole Top Width	56.23	ft	

Differences in discharge captured in upstream section and contraction section combined with the lack of a defined channel and assumed lower limit for non-cohesive soils D50 resulted in inaccurate HEC-18 method contraction scour results. The results were based on the hydraulic data extracted using SMS s Bridge Scour Coverage and FHWA s Hydraulic Toolbox and were determined to not be applicable for comparison to USGS Bridge-Scour Envelope Curve Results at I-95 over Lake Marion Relief.

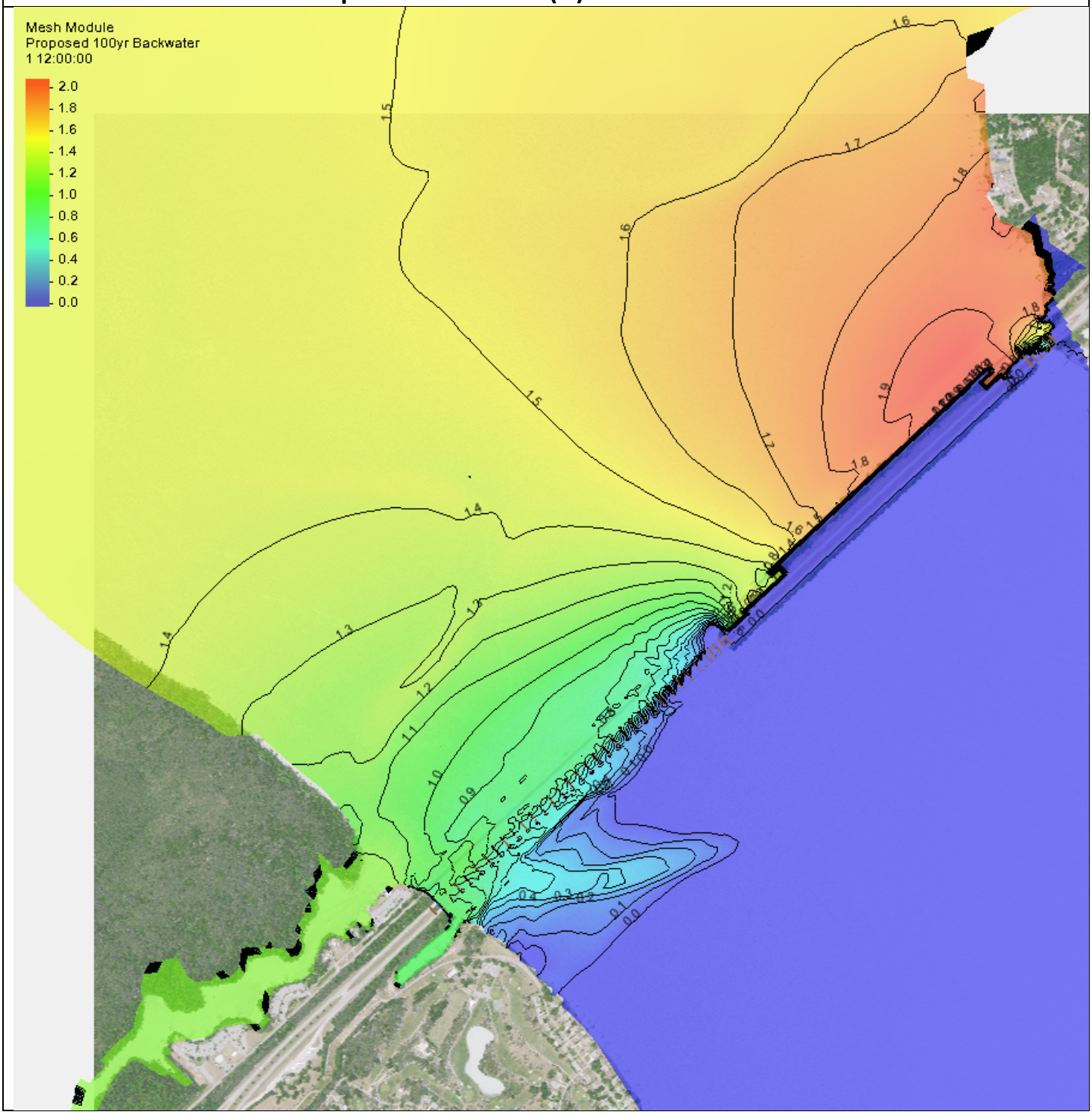
Appendix IV:
Hydraulic Model Output

TRANSYSTEMS

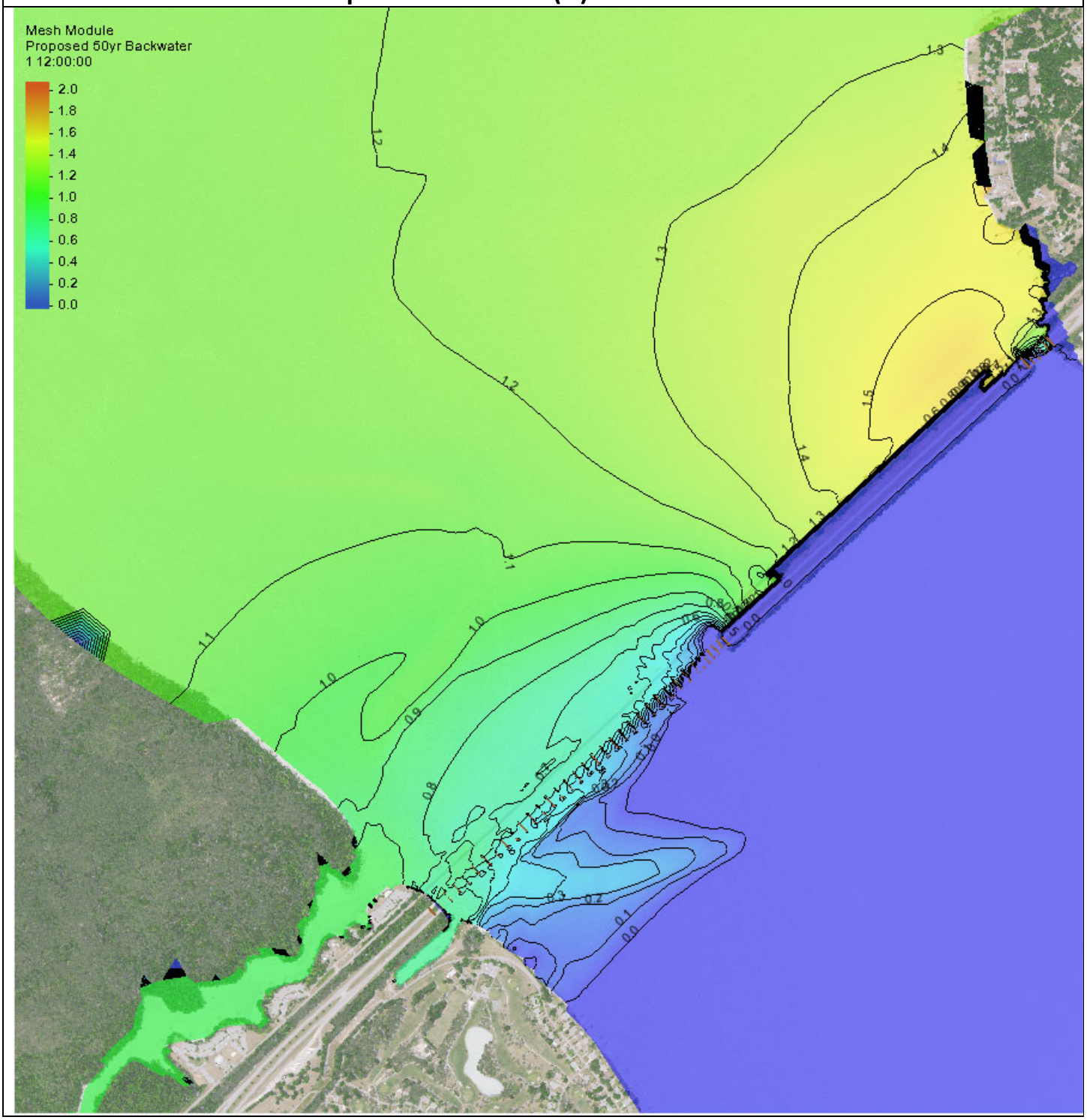
Proposed Hydraulic Model Terrain



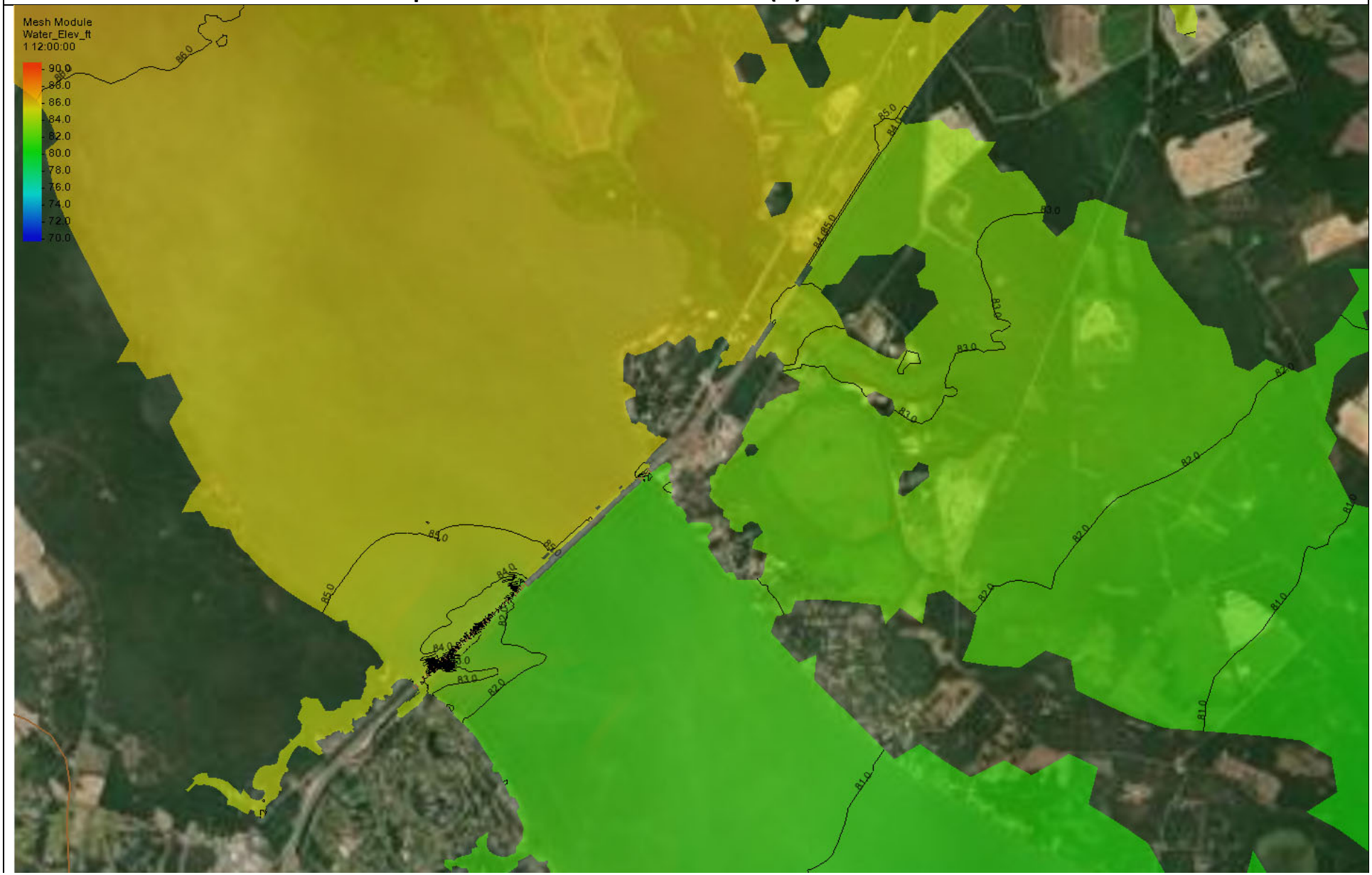
Proposed Backwater (ft) – 100 Year Storm



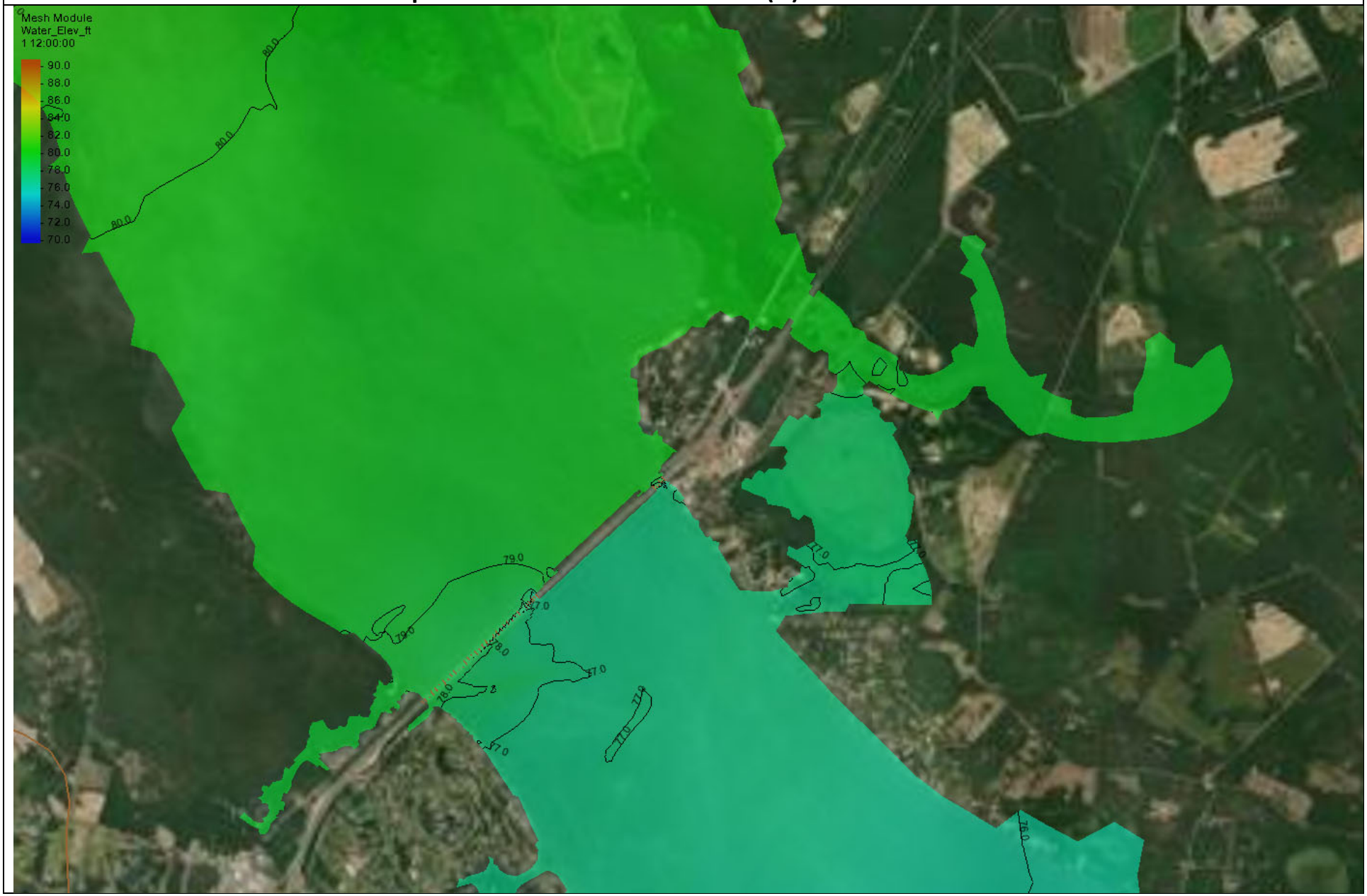
Proposed Backwater (ft) – 50 Year Storm



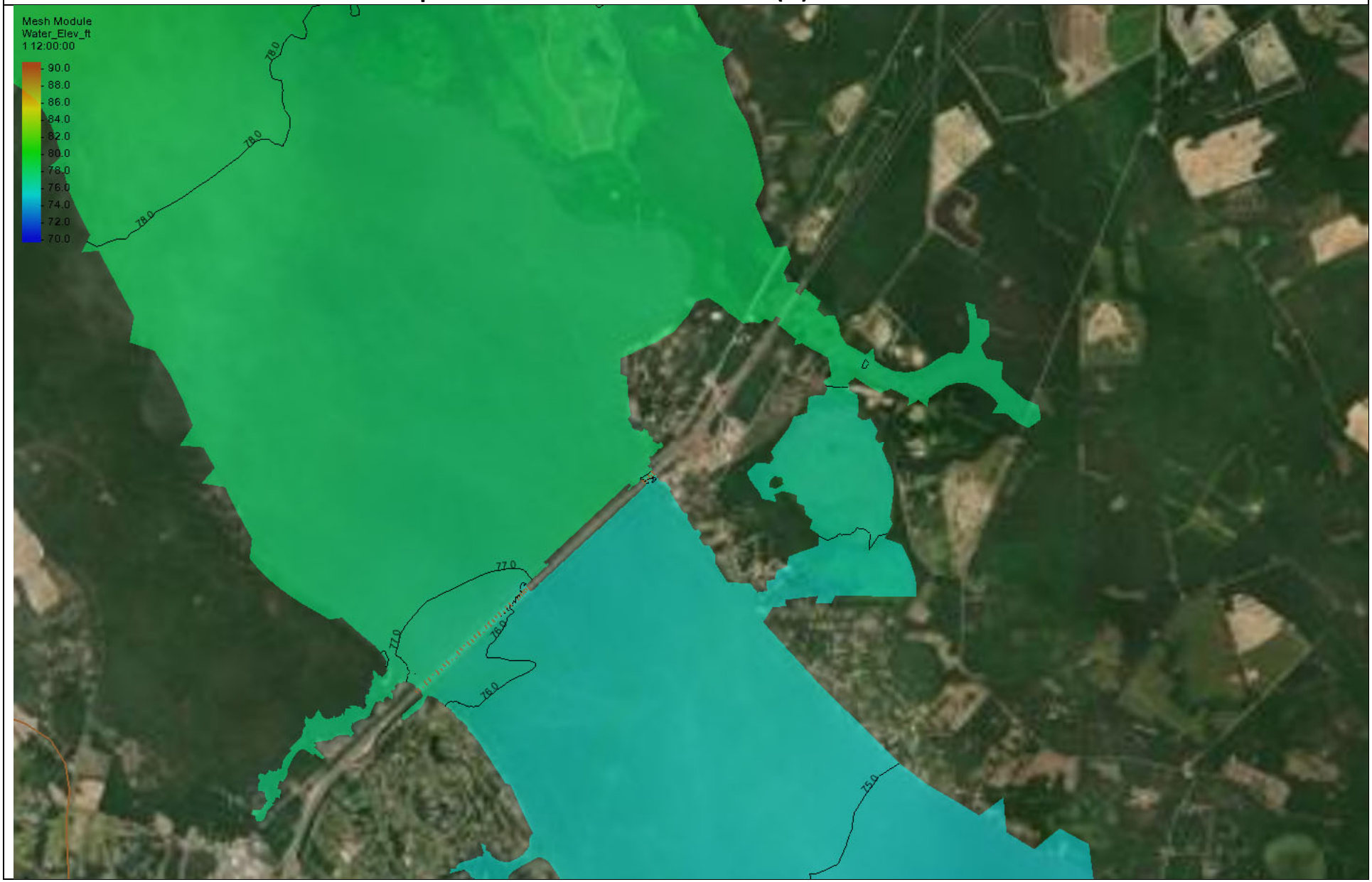
Proposed Water Surface Elevations (ft) – 500 Year Storm



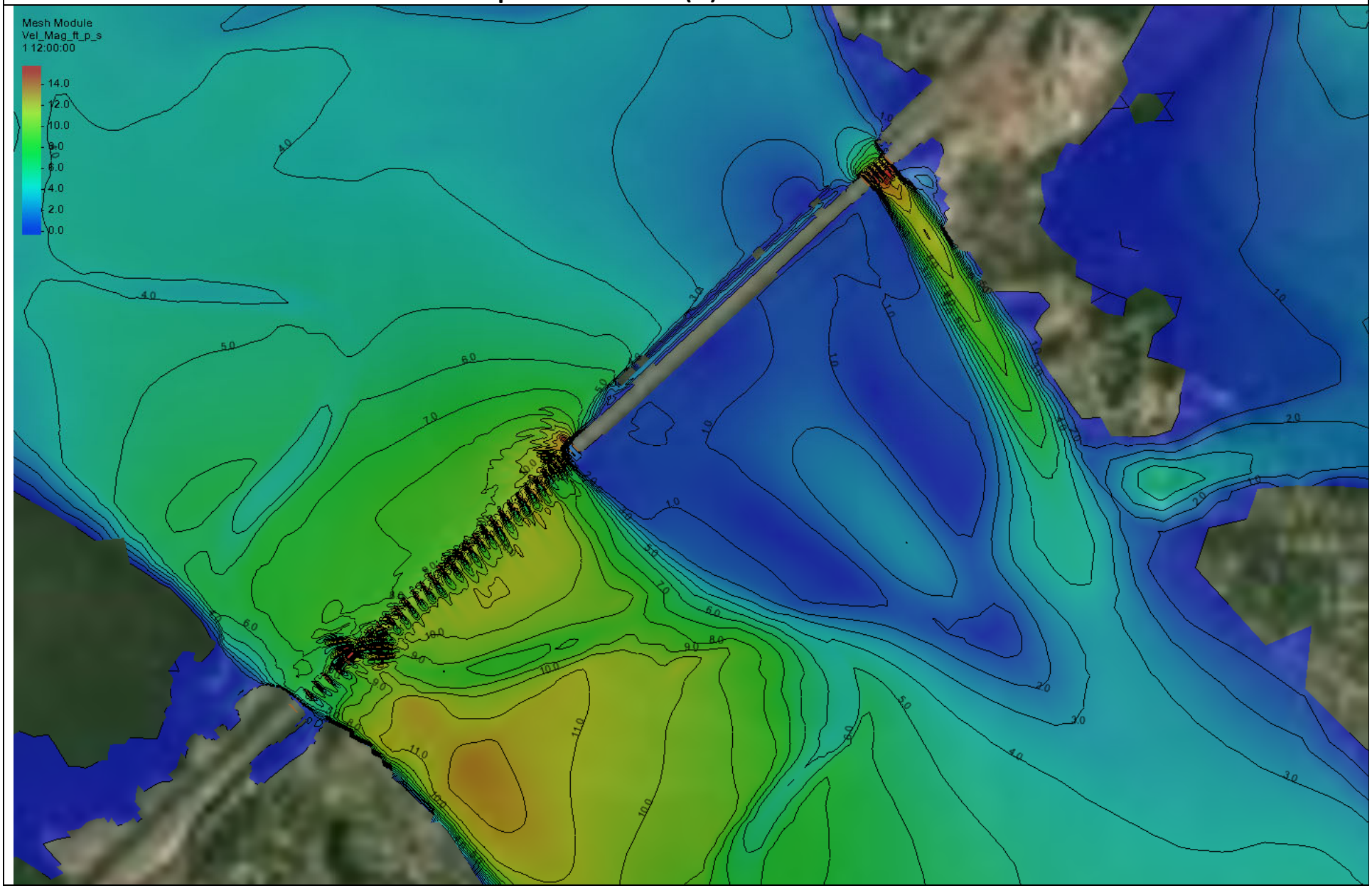
Proposed Water Surface Elevations (ft) – 100 Year Storm



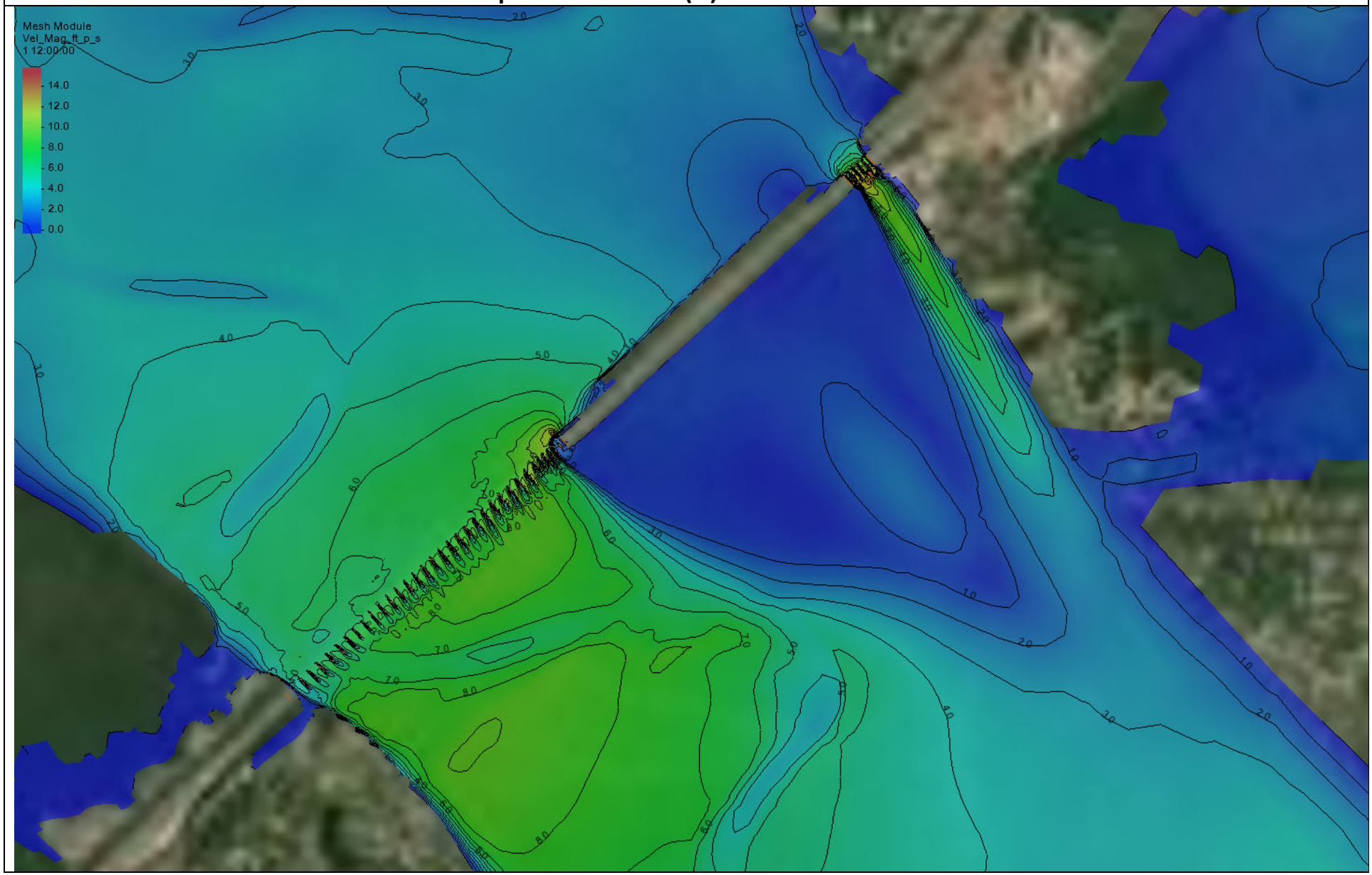
Proposed Water Surface Elevations (ft) – 50 Year Storm



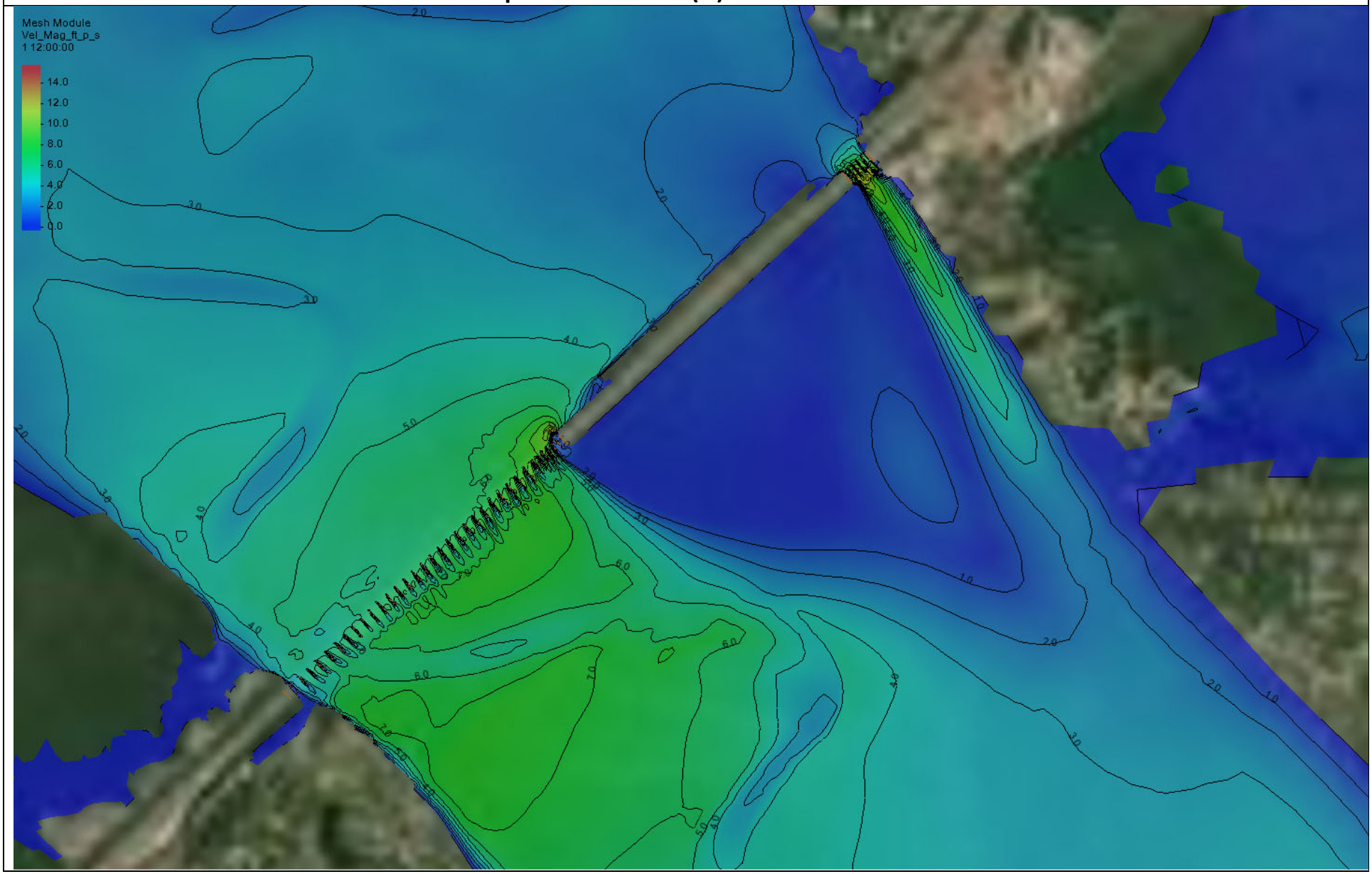
Proposed Velocities (ft) – 500 Year Storm



Proposed Velocities (ft) – 100 Year Storm



Proposed Velocities (ft) – 50 Year Storm



Lake Marion Approach Section Values 500-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	82.951	84.516	26.999	23.264	24.907	-33.078	4.211	5.0322	-52.291	0.0853	0.1194	-57.022	0.1545	0.1794	-56.96
MAX	83.182	84.679	84.781	34.258	35.792	35.901	4.5539	6.2005	6.1653	0.1011	0.1992	0.1972	0.1707	0.2938	0.32

Lake Marion Approach Section Values 100-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	77.784	78.933	79.03	18.097	19.333	19.218	3.3421	4.0695	3.9999	0.0585	0.0855	0.083	0.1394	0.1655	0.1625
MAX	77.956	79.053	79.154	29.072	30.199	30.298	3.6103	5.0981	5.0781	0.0694	0.1398	0.1387	0.1546	0.3085	0.3054

Lake Marion Approach Section Values 50-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	76.177	77.21	77.196	16.49	17.693	17.447	2.9016	3.5237	3.4879	0.0455	0.066	0.0652	0.1269	0.1494	0.1485
MAX	76.316	77.319	77.293	27.449	28.474	28.453	3.1255	4.4475	4.4554	0.0538	0.1079	0.1086	0.1406	0.2184	0.2189

Lake Marion Approach Section Values 25-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	75.237	75.638	75.843	15.55	16.038	16.094	2.3669	2.9778	2.9132	0.0309	0.0489	0.0468	0.1067	0.1339	0.1293
MAX	75.332	75.716	75.916	26.489	26.886	27.087	2.5806	3.7786	3.6962	0.0374	0.0804	0.0773	0.1195	0.2716	0.1945

Lake Marion Approach Section Values 10-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	74.474	74.598	74.628	14.787	14.95	14.816	1.6837	2.0641	2.1216	0.0158	0.0242	0.0256	0.0779	0.096	0.0986
MAX	74.523	74.668	74.667	25.701	25.844	25.852	1.8532	2.5984	2.6706	0.0196	0.039	0.0422	0.0882	0.156	0.162

Lake Marion Approach Section Values 5-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	73.773	73.574	73.852	14.086	13.927	14.04	1.2692	1.6604	1.6174	0.0092	0.0161	0.0152	0.0602	0.0802	0.0773
MAX	73.8	73.614	73.878	24.989	24.793	25.066	1.411	2.0888	2.0256	0.0116	0.0251	0.0243	0.069	0.1319	0.1283

Lake Marion Approach Section Values 2-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	74.142	74.221	74.186	14.456	14.574	14.374	0.4467	0.8084	0.5642	0.0011	0.0038	0.0018	0.0209	0.0381	0.0266
MAX	74.148	74.251	74.191	25.344	25.429	25.39	0.5114	1.0452	0.6962	0.0015	0.0068	0.0029	0.0247	0.0669	0.0435

Lake Marion Upstream Face Section Values 500-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	82.76	82.965	83.145	24.534	26.172	26.102	4.4169	9.5832	9.0758	0.0915	0.4258	0.4011	0.1588	0.327	0.3179
MAX	82.823	84.162	85.59	41.931	42.885	42.958	4.5736	14.068	13.669	0.0996	2.3038	1.146	0.1783	0.8185	0.7305

Lake Marion Upstream Face Section Values 100-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	77.627	77.899	78.045	19.496	21.151	21.094	3.4492	7.0499	6.9294	0.0603	0.2641	0.2545	0.1401	0.2787	0.2726
MAX	77.674	78.375	78.61	36.783	37.556	37.593	3.5616	11.326	11.176	0.0655	1.6341	0.9663	0.1897	1.0111	0.8482

Lake Marion Upstream Face Section Values 50-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	76.047	76.442	76.44	17.916	19.694	19.489	2.9542	5.8873	5.8523	0.0456	0.1886	0.1881	0.1254	0.2423	0.2408
MAX	76.081	76.801	76.857	35.192	35.987	35.865	3.0877	9.2676	9.721	0.0497	1.0665	0.8239	0.1654	0.9808	0.8734

Lake Marion Upstream Face Section Values 25-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	75.146	75.059	75.317	17.077	18.708	18.425	2.3908	4.9303	4.7327	0.0303	0.1353	0.1264	0.1039	0.2097	0.2014
MAX	75.17	75.34	75.6	34.281	34.531	34.622	2.5206	7.5217	8.0302	0.0331	0.8041	0.6162	0.1345	1.1108	0.8294

Lake Marion Upstream Face Section Values 10-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	74.424	74.318	74.351	16.355	16.94	17.65	1.6804	3.6104	3.3594	0.0152	0.0743	0.0646	0.0747	0.1603	0.1472
MAX	74.439	74.403	74.499	33.551	20.183	33.53	1.7851	5.1457	5.5394	0.0167	0.3939	0.3199	0.0983	0.838	0.6687

Lake Marion Upstream Face Section Values 5-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	73.742	73.394	73.689	15.673	17.042	16.846	1.258	2.6043	2.4871	0.0087	0.039	0.0363	0.0575	0.1169	0.1123
MAX	73.749	73.477	74.062	32.862	32.68	32.81	1.3602	4.1535	4.0119	0.0094	0.1733	0.1771	0.0978	0.703	0.5721

Lake Marion Upstream Face Section Values 2-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	74.137	74.12	74.166	16.069	17.769	17.274	0.437	1.3351	0.8641	0.001	0.0107	0.0043	0.0197	0.0593	0.0383
MAX	74.14	74.154	74.177	33.253	33.362	33.218	0.4661	2.75	1.4312	0.0011	0.1194	0.0215	0.0363	0.4436	0.1725

Lake Marion Relief Approach Section Values 500-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	82.771	84.955	85.064	16.811	19.391	20.217	3.4836	1.3397	1.337	0.0774	0.0136	0.012	0.1437	0.0578	0.051
MAX	82.808	85.042	85.147	23.785	24.216	24.326	5.0974	2.7667	2.5985	0.1269	0.0663	0.0319	0.1917	0.2421	0.0931

Lake Marion Relief Approach Section Values 100-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	77.654	79.27	79.349	16.471	15.082	15.502	3.4499	1.1106	1.1101	0.0678	0.0089	0.0092	0.1484	0.0499	0.0483
MAX	77.68	79.309	79.402	18.66	18.496	18.59	4.0365	2.0291	2.1468	0.087	0.0213	0.0238	0.1733	0.0833	0.0879

Lake Marion Relief Approach Section Values 50-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	76.071	77.474	77.453	15.432	13.711	13.97	3.0546	1.0018	0.9767	0.053	0.0075	0.0073	0.1366	0.0472	0.045
MAX	76.096	77.502	77.49	17.072	16.693	16.682	3.4678	1.8107	1.8719	0.0663	0.0176	0.0188	0.1564	0.0782	0.0809

Lake Marion Relief Approach Section Values 25-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	75.164	75.826	76.031	14.856	12.973	13.672	2.5427	0.8842	0.874	0.0364	0.0059	0.0057	0.1165	0.0426	0.0411
MAX	75.178	75.846	76.055	16.167	15.04	15.249	2.8205	1.5656	1.5471	0.0448	0.0136	0.0132	0.1312	0.0712	0.0699

Lake Marion Relief Approach Section Values 10-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	74.435	74.722	74.732	13.91	11.869	12.32	1.7473	0.6392	0.6311	0.0179	0.0032	0.0031	0.0824	0.0329	0.0313
MAX	74.444	74.771	74.745	15.434	13.956	13.942	1.9929	1.1237	1.1318	0.0228	0.0072	0.0073	0.0951	0.0532	0.0535

Lake Marion Relief Approach Section Values 5-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	73.75	73.64	73.92	13.11	10.86	11.40	1.29	0.52	0.48	0.01	0.00	0.00	0.06	0.03	0.02
MAX	73.75	73.65	73.92	14.74	12.85	13.12	1.50	0.94	0.87	0.01	0.01	0.00	0.07	0.05	0.04

Lake Marion Relief Approach Section Values 2-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	74.14	74.26	74.19	13.37	11.29	11.68	0.44	0.29	0.17	0.00	0.00	0.00	0.02	0.02	0.01
MAX	74.15	74.27	74.19	15.15	13.47	13.39	0.52	0.51	0.31	0.00	0.00	0.00	0.03	0.03	0.02

Lake Marion Relief Upstream Section Values 500-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	82.754	83.648	83.778	23.417	18.925	19.793	4.2812	8.2792	8.5075	0.088	0.8752	0.3849	0.1559	0.3573	0.3502
MAX	82.764	84.255	84.297	24.753	25.807	25.96	4.6164	10.531	10.501	0.1015	5.0847	0.6302	0.167	0.6706	0.5617

Lake Marion Relief Upstream Section Values 100-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	77.631	78.437	78.574	18.294	13.714	14.59	3.3724	5.8945	6.5137	0.0594	0.4573	0.2644	0.1389	0.3353	0.3297
MAX	77.637	78.897	78.969	19.63	20.557	20.801	3.6462	7.9174	8.4094	0.0686	2.8043	0.5637	0.1489	0.7704	0.697

Lake Marion Relief Upstream Section Values 50-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	76.049	76.819	76.88	16.712	14.448	12.896	2.8763	5.5684	5.4345	0.0445	0.2895	0.1998	0.124	0.3039	0.3063
MAX	76.054	77.107	77.18	18.049	18.941	19.065	3.1151	6.754	7.2936	0.0516	1.8116	0.4673	0.133	0.6347	0.7698

Lake Marion Relief Upstream Section Values 25-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	75.151	75.405	75.613	15.918	14.727	14.166	2.325	4.7399	4.7423	0.0295	0.1309	0.1394	0.1026	0.2344	0.2474
MAX	75.154	75.571	75.862	17.151	17.473	17.776	2.5123	5.5497	6.0171	0.0342	0.2244	0.278	0.1102	0.4537	0.6828

Lake Marion Relief Upstream Section Values 10-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	74.427	74.517	74.513	15.193	14.194	14.039	1.6235	3.4191	3.4126	0.0146	0.0698	0.0706	0.0733	0.1747	0.1693
MAX	74.429	74.59	74.634	16.427	16.553	16.599	1.7639	3.9783	4.3634	0.0171	0.147	0.1174	0.0792	0.4312	0.4013

Lake Marion Relief Upstream Section Values 5-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	73.741	73.488	73.79	14.562	14.106	13.658	1.2157	2.7047	2.5394	0.0083	0.0428	0.0394	0.0561	0.1319	0.1248
MAX	73.742	73.537	73.858	15.741	15.512	15.84	1.3183	3.1249	3.2883	0.0097	0.0597	0.0592	0.0605	0.2313	0.1941

Lake Marion Relief Upstream Section Values 2-Year

	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop	Uncon	Exist	Prop
	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Elev_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Water_Depth_ft"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Vel_Mag_ft_p_s"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Strs_lb_p_ft2"	"Froude"	"Froude"	"Froude"
AVG	74.143	74.15	74.176	14.91	13.828	14.045	0.4099	2.098	0.8991	0.0009	0.0271	0.0049	0.0187	0.1133	0.0446
MAX	74.144	74.18	74.185	16.143	16.165	16.182	0.4552	2.4317	1.156	0.0011	0.0646	0.0072	0.0206	0.3105	0.0902

Appendix V:
Bridge Layout and Roadway Plans (Conceptual)

TRANSYSTEMS

Title.dgn

BRIDGE PLANS ID	SHEET NO.
P041130-B01	1

SCDOT

South Carolina Department of Transportation

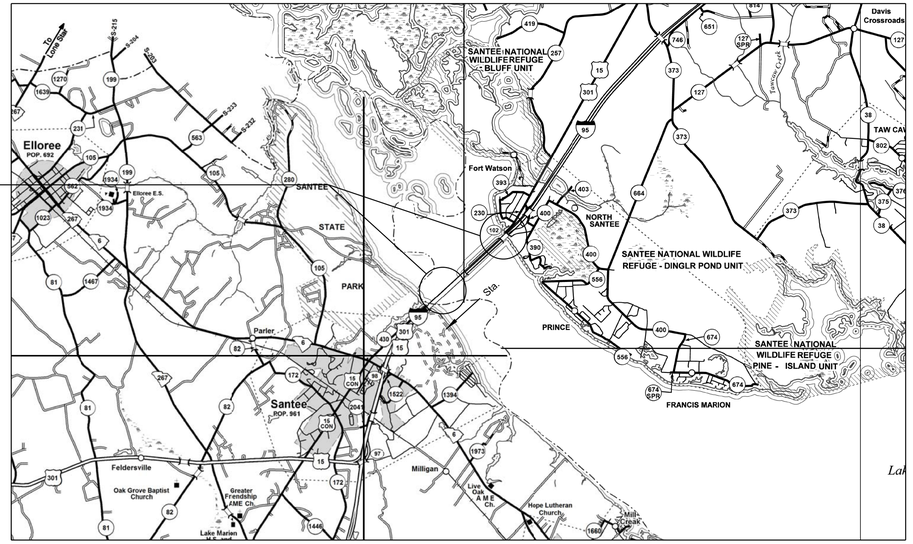
INDEX OF SHEETS

1. Title Sheet
2. Relief Bridge Plan and Profile
3. Main Bridge Plan and Profile (1 of 7)
4. Main Bridge Plan and Profile (2 of 7)
5. Main Bridge Plan and Profile (3 of 7)
6. Main Bridge Plan and Profile (4 of 7)
7. Main Bridge Plan and Profile (5 of 7)
8. Main Bridge Plan and Profile (6 of 7)
9. Main Bridge Plan and Profile (7 of 7)
10. Stages of Construction Relief (1 of 2)
11. Stages of Construction Relief (2 of 2)
12. Stages of Construction Main (1 of 2)
13. Stages of Construction Main (2 of 2)
14. Substructure Typical Sections Relief Bridge
15. Substructure Typical Sections Main Bridge

CONCEPTUAL PLANS FOR

ORANGEBURG/CLARENDON COUNTY
PROJECT ID P041130
ROUTE I-95
REPLACE BRIDGES OVER LAKE MARION

SITE LOCATIONS



-N-

LAYOUT

Approximate Location of Bridge is	
Main Bridge	
Latitude	33°- 30' - 19"
Longitude	80°- 27' - 09"
Relief Bridge	
Latitude	33°- 31' - 05"
Longitude	80°- 26' - 08"

3 DAYS BEFORE DIGGING IN SOUTH CAROLINA

CALL 811

SOUTH CAROLINA 811 (SC811)
WWW.SC811.COM
ALL UTILITIES MAY NOT BE A MEMBER OF SC811

ASSET ID (I-95 SB MAIN)	TBD Formerly 05258
ASSET ID (I-95 NB MAIN)	TBD Formerly 05249
ASSET ID (I-95 SB RELIEF)	TBD Formerly 05259
ASSET ID (I-95 NB RELIEF)	TBD Formerly 05250

NET LENGTH OF ROADWAY	0.000	MILES
NET LENGTH OF BRIDGES	0.927	MILES
NET LENGTH OF PROJECT	0.927	MILES
LENGTH OF EXCEPTIONS	0.000	MILES
GROSS LENGTH OF PROJECT	0.927	MILES

CONCEPTUAL PLANS
NOT FOR CONSTRUCTION

TRAFFIC DATA

2025 ADT 41,000 V.P.D.

2045 ADT 55,000 V.P.D.

TRUCKS 22 %

NOTE: EXCEPT AS MAY OTHERWISE BE SPECIFIED ON THE PLANS OR IN THE SPECIAL PROVISIONS, ALL MATERIALS AND WORKMANSHIP ON THIS PROJECT SHALL CONFORM TO THE SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION (2007 EDITION) AND THE STANDARD DRAWINGS FOR ROAD CONSTRUCTION IN EFFECT AT THE TIME OF LETTING.

ENGINEER OF RECORD

FOR CONSTRUCTION : _____ _____ DATE

REVIEWED			
DR.	XXX	XXX	XX-XX
	BY	CHK	DATE

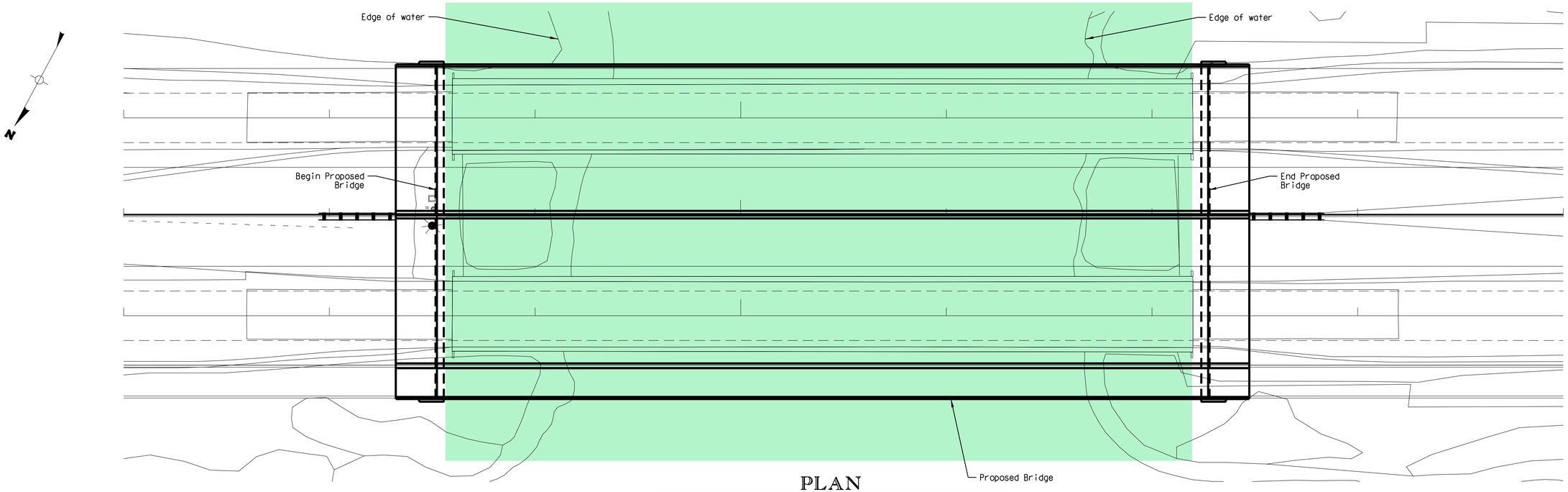
$$user$$
$$date$$

DRAWING NO. 700-01

PlanandProfile.dgn

BRIDGE PLANS ID	SHEET NO.
P041130-B01	2

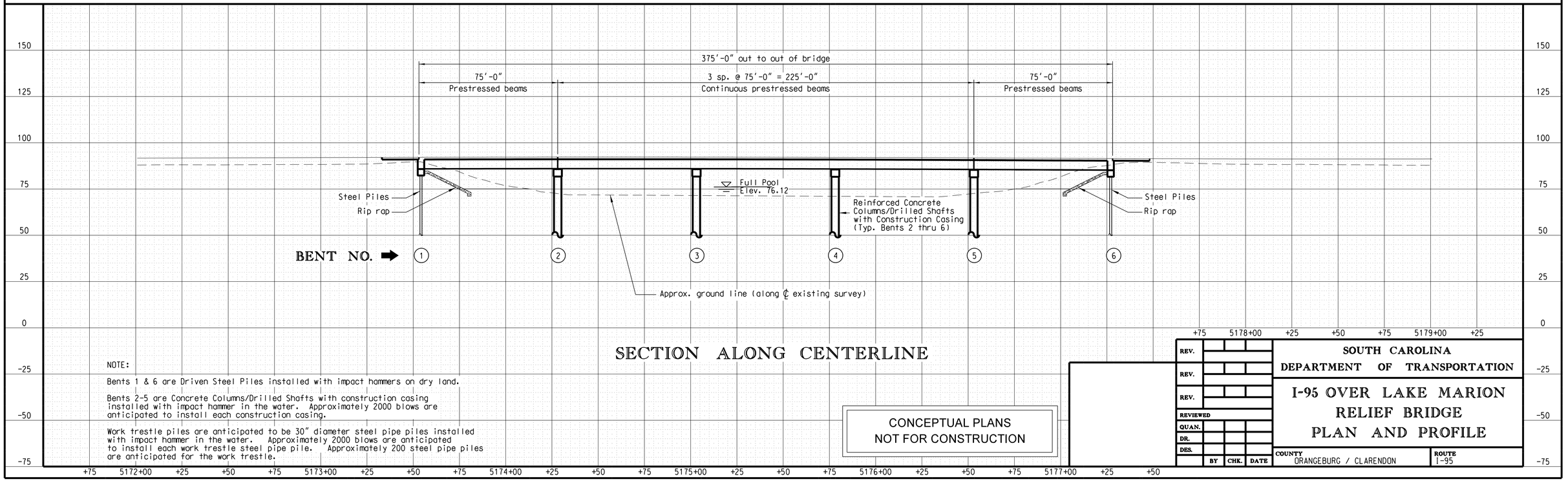
5172+00 5173+00 5174+00 5175+00 5176+00 5177+00 5178+00 5179+00



PLAN

Proposed temporary work trestle area

1"=25' 0 25' 50' 75'



SECTION ALONG CENTERLINE

NOTE:

Bents 1 & 6 are Driven Steel Piles installed with impact hammers on dry land.

Bents 2-5 are Concrete Columns/Drilled Shafts with construction casing installed with impact hammer in the water. Approximately 2000 blows are anticipated to install each construction casing.

Work trestle piles are anticipated to be 30" diameter steel pipe piles installed with impact hammer in the water. Approximately 2000 blows are anticipated to install each work trestle steel pipe pile. Approximately 200 steel pipe piles are anticipated for the work trestle.

CONCEPTUAL PLANS
NOT FOR CONSTRUCTION

	BY	CHK.	DATE
REV.			
REV.			
REV.			
REVIEWED			
QUAN.			
DR.			
DES.			

SOUTH CAROLINA
DEPARTMENT OF TRANSPORTATION

I-95 OVER LAKE MARION
RELIEF BRIDGE
PLAN AND PROFILE

COUNTY ORANGEBURG / CLARENDON

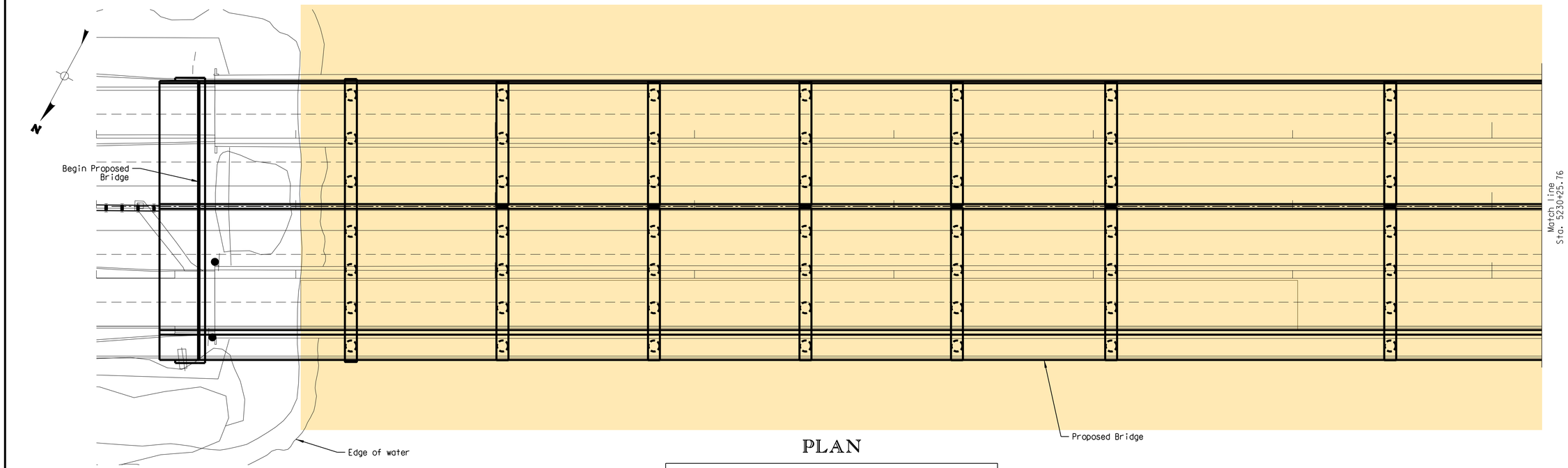
ROUTE I-95

DRAWING NO. 700-06

$$DATE$$
Border Sheet 6/08

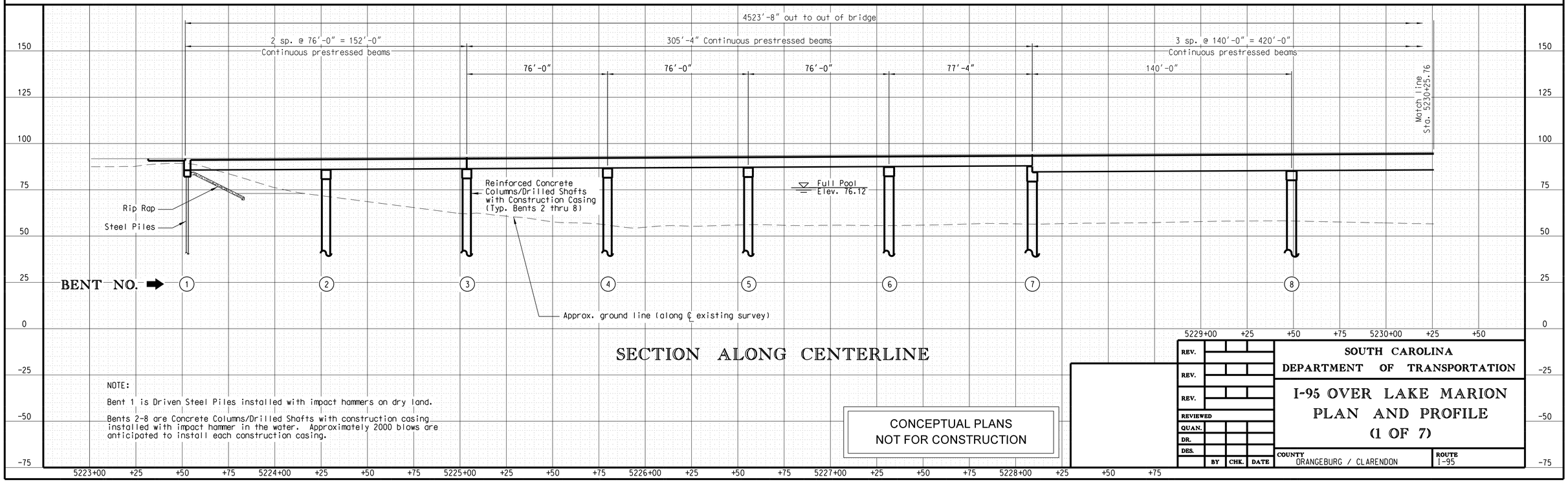
PlanandProfile.dgn

BRIDGE PLANS ID	SHEET NO.
P041130-B01	3



PLAN

Proposed temporary barge construction access area



SECTION ALONG CENTERLINE

NOTE:

Bent 1 is Driven Steel Piles installed with impact hammers on dry land.

Bents 2-8 are Concrete Columns/Drilled Shafts with construction casing installed with impact hammer in the water. Approximately 2000 blows are anticipated to install each construction casing.

CONCEPTUAL PLANS
NOT FOR CONSTRUCTION

REV.	BY	CHK.	DATE
REV.			
REV.			
REVIEWED			
QUAN.			
DR.			
DES.			

SOUTH CAROLINA
DEPARTMENT OF TRANSPORTATION

I-95 OVER LAKE MARION
PLAN AND PROFILE
(1 OF 7)

COUNTY: ORANGEBURG / CLARENDON

ROUTE: I-95

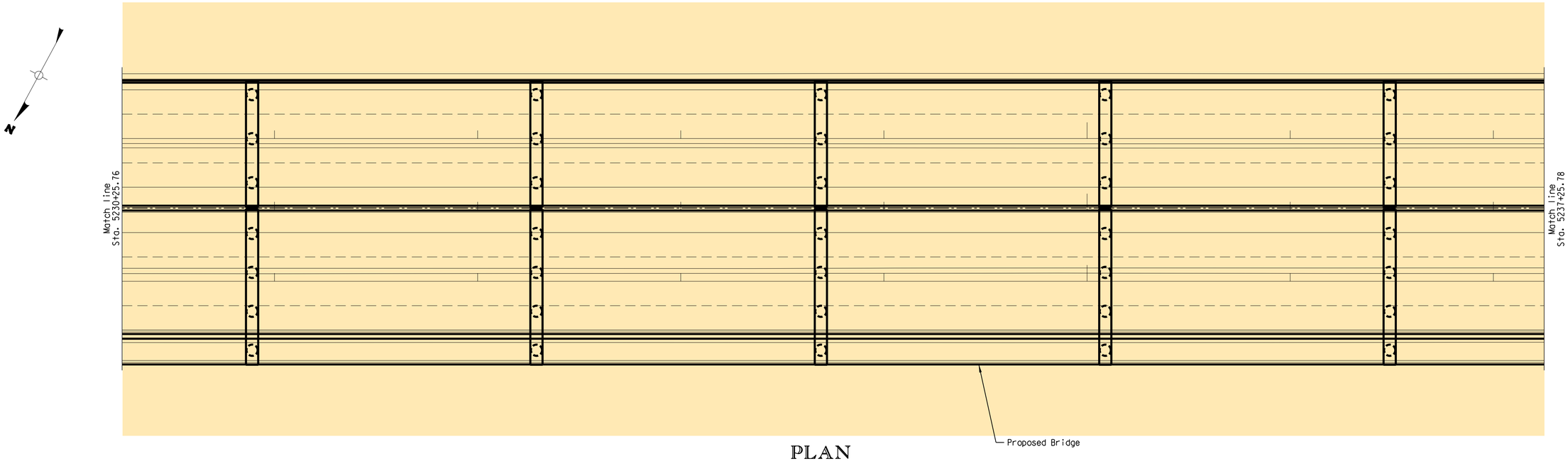
DRAWING NO. 700-06

$$DATE$$
Border Sheet 6/08

PlanandProfile.dgn

BRIDGE PLANS ID	SHEET NO.
P041130-B01	4

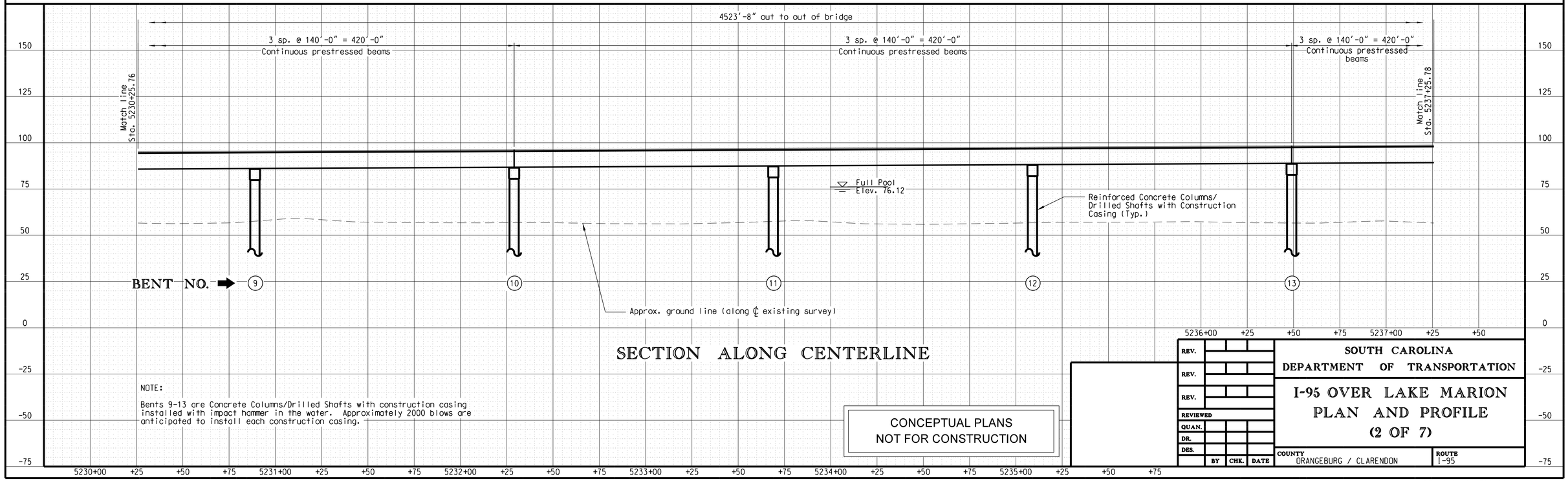
5230+00 5231+00 5232+00 5233+00 5234+00 5235+00 5236+00 5237+00



PLAN

Proposed temporary barge construction access area

1"=25' 0 25' 50' 75'



SECTION ALONG CENTERLINE

NOTE:

Bents 9-13 are Concrete Columns/Drilled Shafts with construction casing installed with impact hammer in the water. Approximately 2000 blows are anticipated to install each construction casing.

CONCEPTUAL PLANS
NOT FOR CONSTRUCTION

REV.	BY	CHK.	DATE
REV.			
REV.			
REVIEWED			
QUAN.			
DR.			
DES.			

SOUTH CAROLINA
DEPARTMENT OF TRANSPORTATION

I-95 OVER LAKE MARION
PLAN AND PROFILE
(2 OF 7)

COUNTY ORANGEBURG / CLARENDON

ROUTE I-95

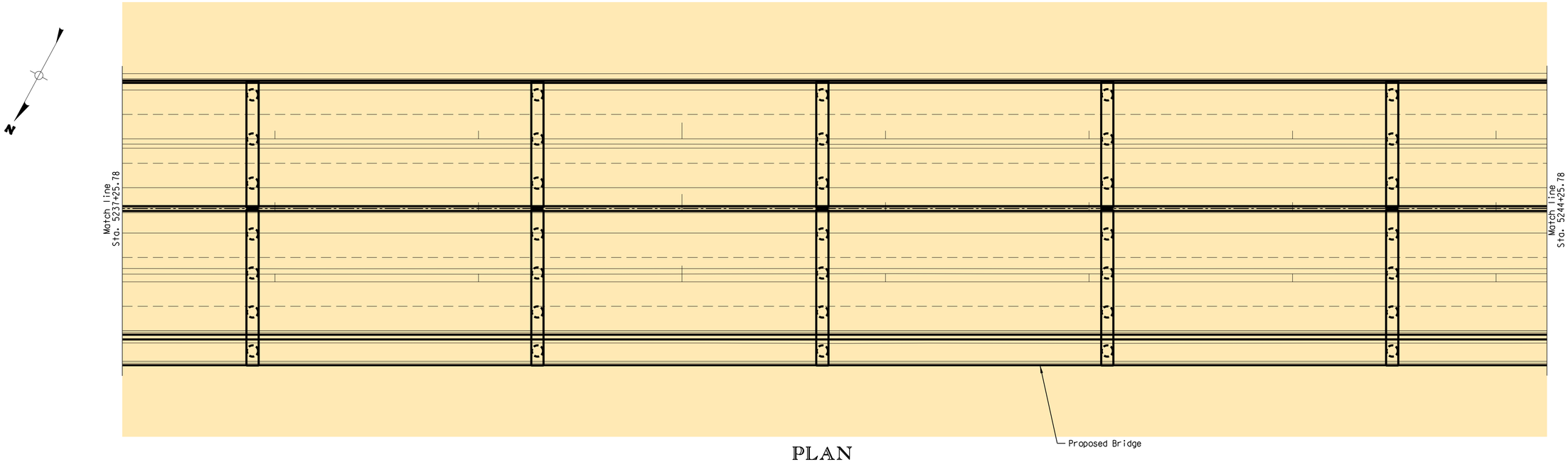
DRAWING NO. 700-06

$$DATE$$
Border Sheet 6/08

PlanandProfile.dgn

BRIDGE PLANS ID	SHEET NO.
P041130-B01	5

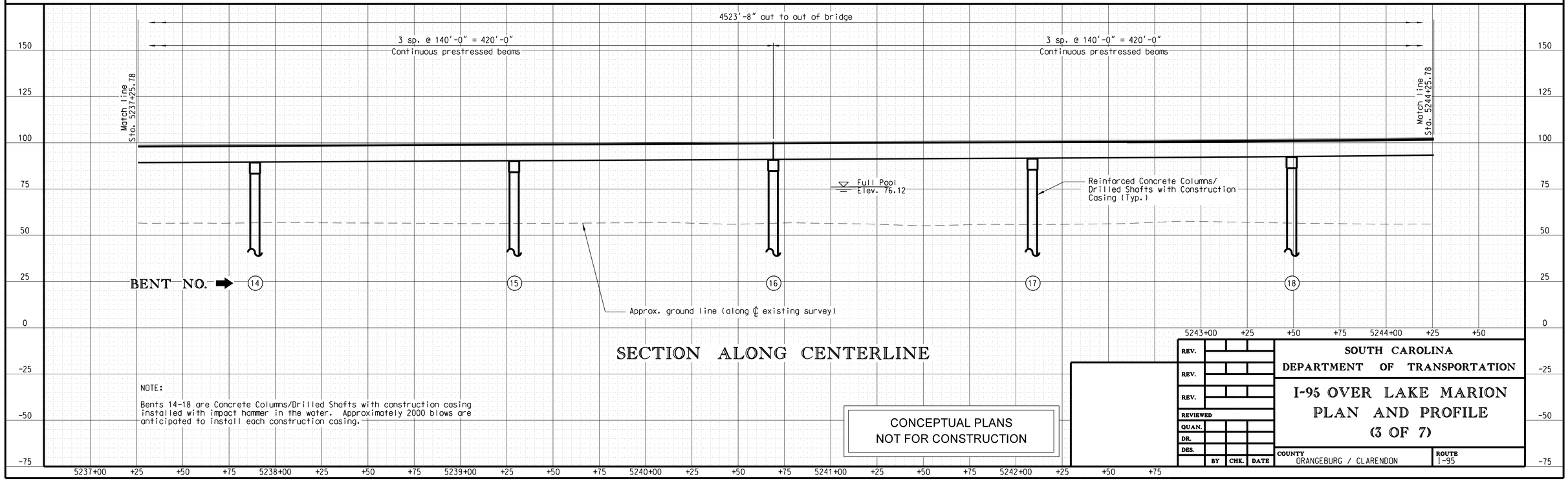
5237+00 5238+00 5239+00 5240+00 5241+00 5242+00 5243+00 5244+00



PLAN

Proposed temporary barge construction access area

1"=25' 0 25' 50' 75'



SECTION ALONG CENTERLINE

NOTE:

Bents 14-18 are Concrete Columns/Drilled Shafts with construction casing installed with impact hammer in the water. Approximately 2000 blows are anticipated to install each construction casing.

CONCEPTUAL PLANS
NOT FOR CONSTRUCTION

	BY	CHK.	DATE
REV.			
REV.			
REV.			
REVIEWED			
QUAN.			
DR.			
DES.			

SOUTH CAROLINA
DEPARTMENT OF TRANSPORTATION

I-95 OVER LAKE MARION
PLAN AND PROFILE
(3 OF 7)

COUNTY ORANGEBURG / CLARENDON

ROUTE I-95

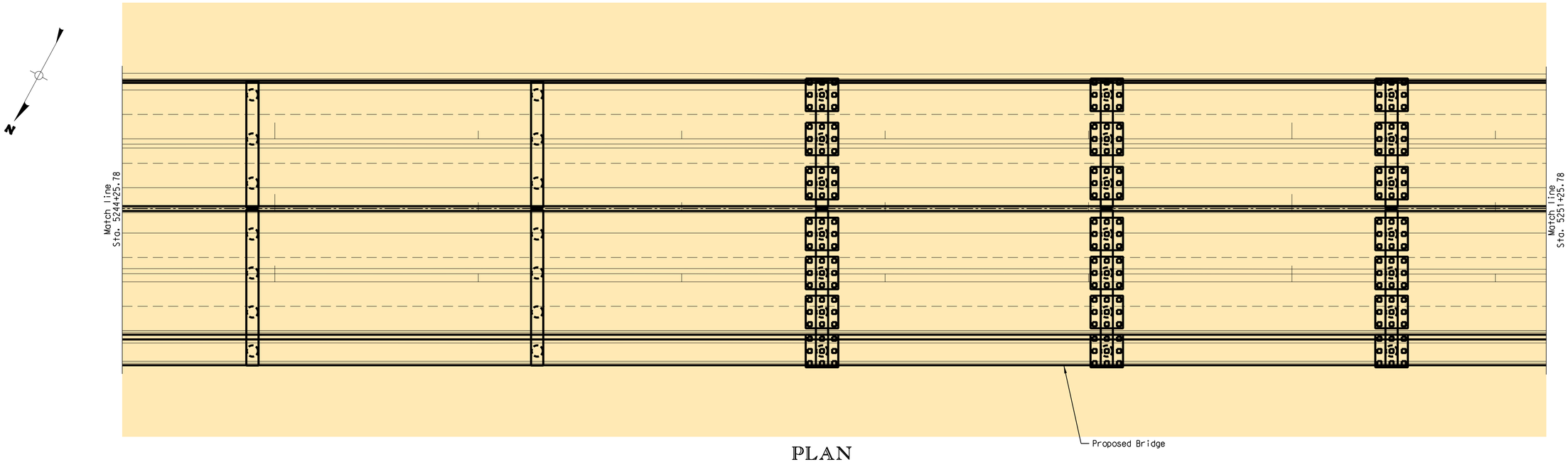
DRAWING NO. 700-06

$$DATE$$
Border Sheet 6/08

PlanandProfile.dgn

BRIDGE PLANS ID	SHEET NO.
P041130-B01	6

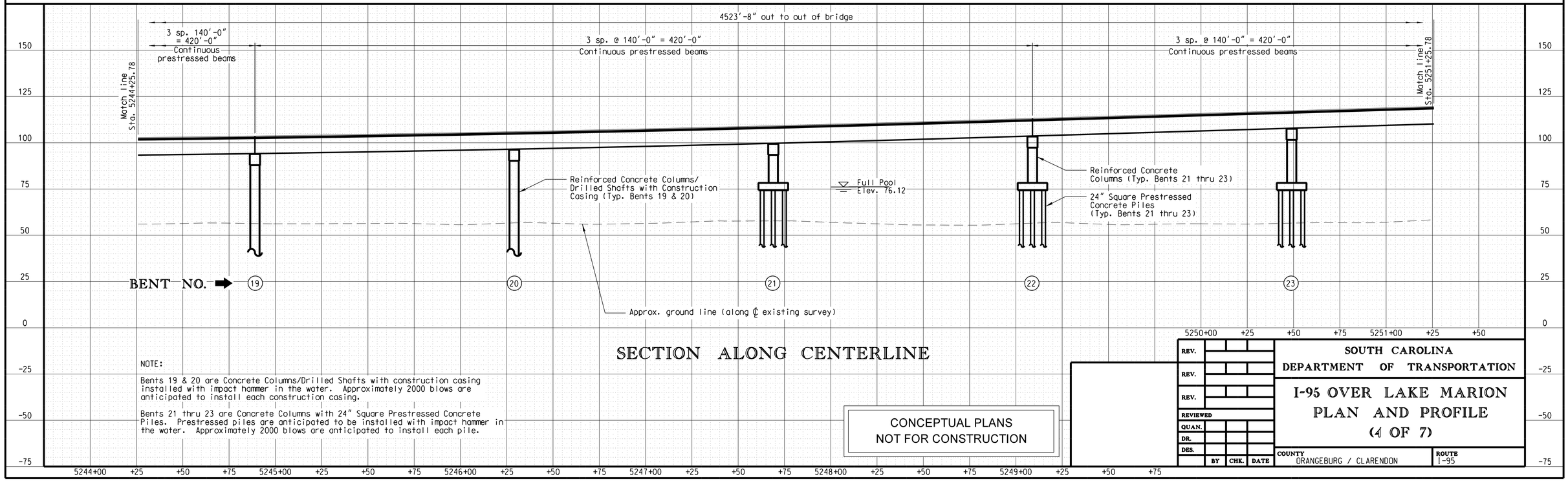
5244+00 5245+00 5246+00 5247+00 5248+00 5249+00 5250+00 5251+00



PLAN

Proposed temporary barge construction access area

1"=25' 0 25' 50' 75'



SECTION ALONG CENTERLINE

NOTE:

Bents 19 & 20 are Concrete Columns/Drilled Shafts with construction casing installed with impact hammer in the water. Approximately 2000 blows are anticipated to install each construction casing.

Bents 21 thru 23 are Concrete Columns with 24" Square Prestressed Concrete Piles. Prestressed piles are anticipated to be installed with impact hammer in the water. Approximately 2000 blows are anticipated to install each pile.

CONCEPTUAL PLANS
NOT FOR CONSTRUCTION

REV.	BY	CHK.	DATE
REV.			
REV.			
REVIEWED			
QUAN.			
DR.			
DES.			

SOUTH CAROLINA
DEPARTMENT OF TRANSPORTATION

I-95 OVER LAKE MARION
PLAN AND PROFILE
(4 OF 7)

COUNTY ORANGEBURG / CLARENDON

ROUTE I-95

DRAWING NO. 700-06

$$DATE$$
Border Sheet 6/08

PlanandProfile.dgn

BRIDGE PLANS ID	SHEET NO.
P041130-B01	7

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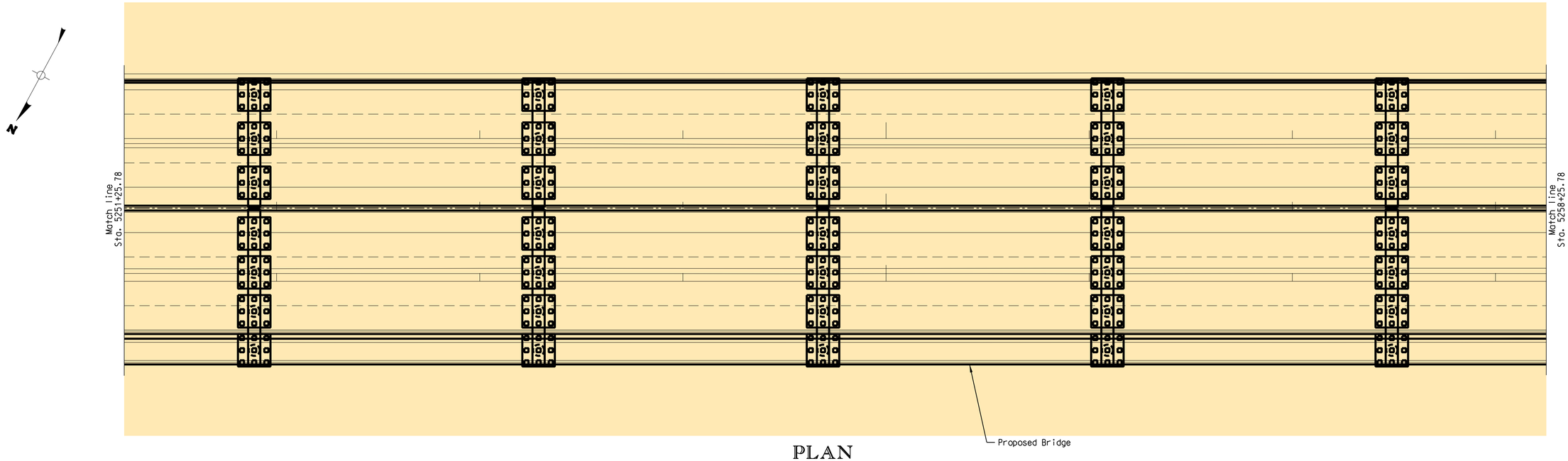
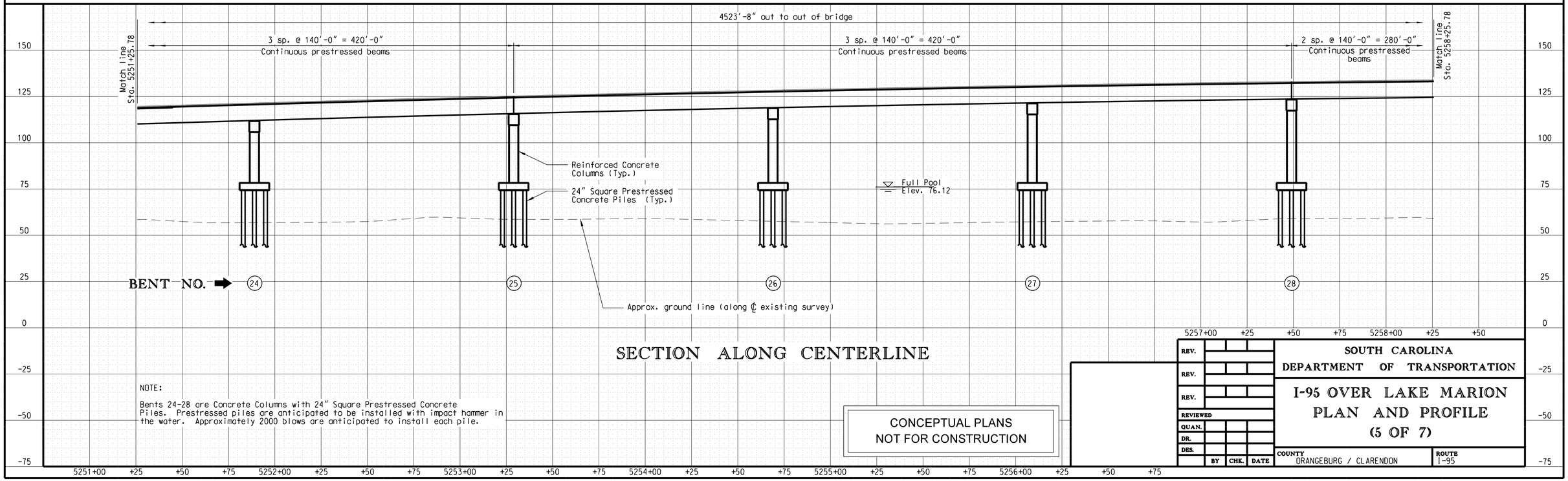


PLAN

Proposed temporary barge construction access area

1"=25' 0 25' 50' 75'



SECTION ALONG CENTERLINE

NOTE:

Bents 24-28 are Concrete Columns with 24" Square Prestressed Concrete Piles. Prestressed piles are anticipated to be installed with impact hammer in the water. Approximately 2000 blows are anticipated to install each pile.

CONCEPTUAL PLANS
NOT FOR CONSTRUCTION

REV.	BY	CHK.	DATE
REV.			
REV.			
REVIEWED			
QUAN.			
DR.			
DES.			

SOUTH CAROLINA
DEPARTMENT OF TRANSPORTATION

I-95 OVER LAKE MARION
PLAN AND PROFILE
(5 OF 7)

COUNTY ORANGEBURG / CLARENDON

ROUTE I-95

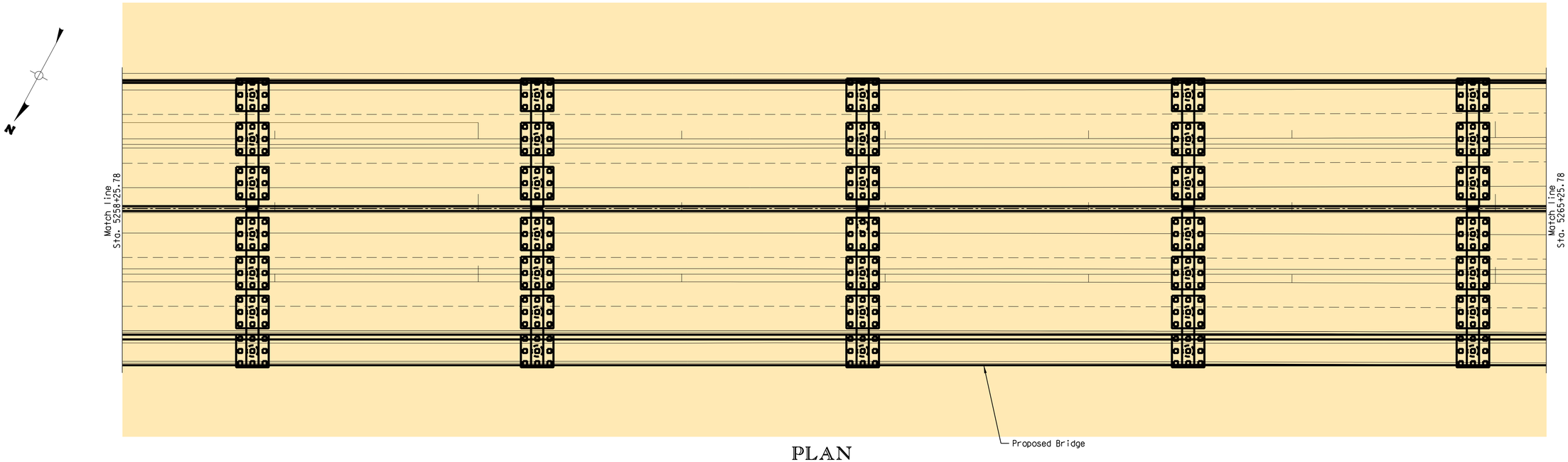
DRAWING NO. 700-06

$$DATE$$
Border Sheet 6/08

PlanandProfile.dgn

BRIDGE PLANS ID	SHEET NO.
P041130-B01	8

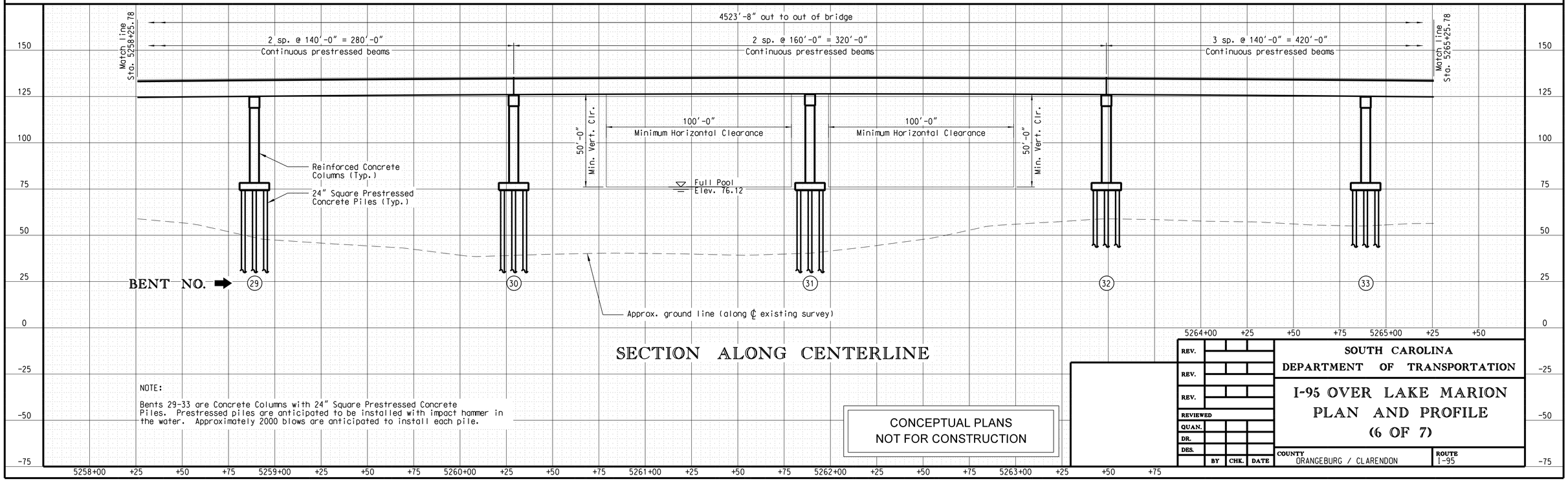
5258+00 5259+00 5260+00 5261+00 5262+00 5263+00 5264+00 5265+00



PLAN

Proposed temporary barge construction access area

1"=25' 0 25' 50' 75'



SECTION ALONG CENTERLINE

NOTE:

Bents 29-33 are Concrete Columns with 24" Square Prestressed Concrete Piles. Prestressed piles are anticipated to be installed with impact hammer in the water. Approximately 2000 blows are anticipated to install each pile.

CONCEPTUAL PLANS
NOT FOR CONSTRUCTION

REV.	BY	CHK.	DATE
REV.			
REV.			
REVIEWED			
QUAN.			
DR.			
DES.			

SOUTH CAROLINA
DEPARTMENT OF TRANSPORTATION

I-95 OVER LAKE MARION
PLAN AND PROFILE
(6 OF 7)

COUNTY ORANGEBURG / CLARENDON

ROUTE I-95

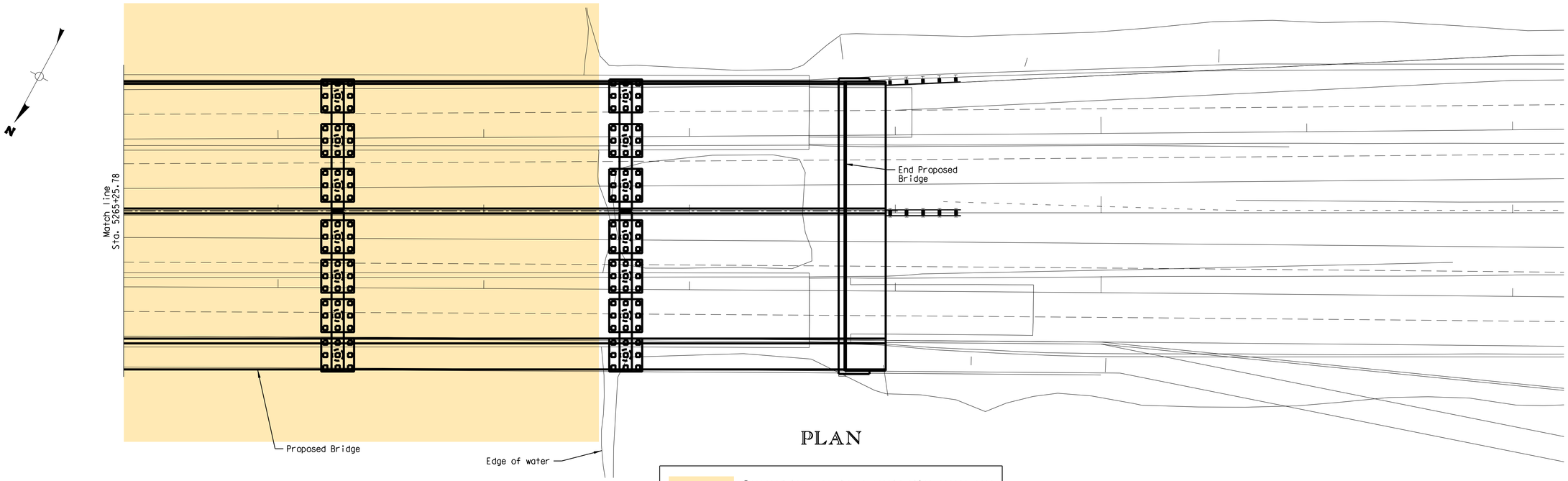
DRAWING NO. 700-06

$$DATE$$
Border Sheet 6/08

PlanandProfile.dgn

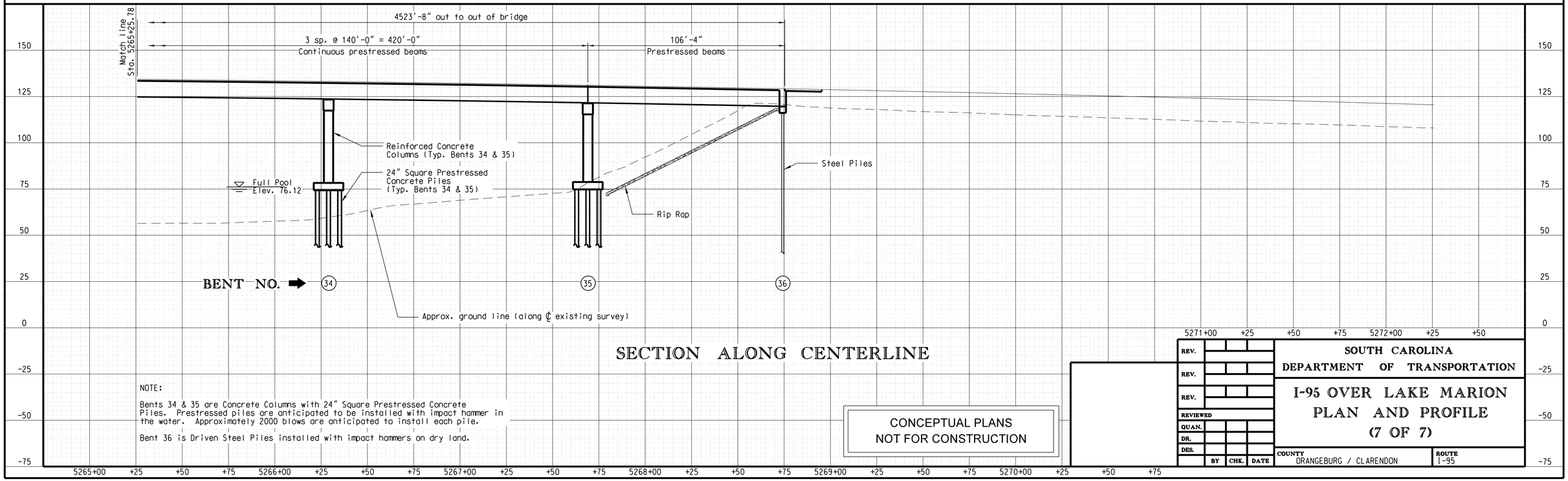
BRIDGE PLANS ID	SHEET NO.
P041130-B01	9

5265+00 5266+00 5267+00 5268+00 5269+00 5270+00 5271+00 5272+00



PLAN

1"=25' 0 25' 50' 75'



SECTION ALONG CENTERLINE

NOTE:

Bents 34 & 35 are Concrete Columns with 24" Square Prestressed Concrete Piles. Prestressed piles are anticipated to be installed with impact hammer in the water. Approximately 2000 blows are anticipated to install each pile.

Bent 36 is Driven Steel Piles installed with impact hammers on dry land.

CONCEPTUAL PLANS
NOT FOR CONSTRUCTION

	BY	CHK.	DATE
REV.			
REV.			
REV.			
REVIEWED			
QUAN.			
DR.			
DES.			

SOUTH CAROLINA
DEPARTMENT OF TRANSPORTATION

I-95 OVER LAKE MARION
PLAN AND PROFILE
(7 OF 7)

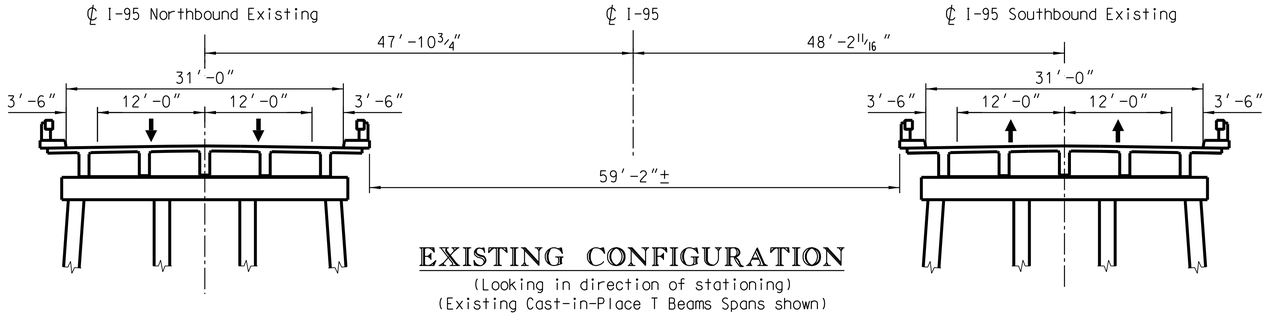
COUNTY ORANGEBURG / CLARENDON

ROUTE I-95

DRAWING NO. 700-06

$$DATE$$
Border Sheet 6/08

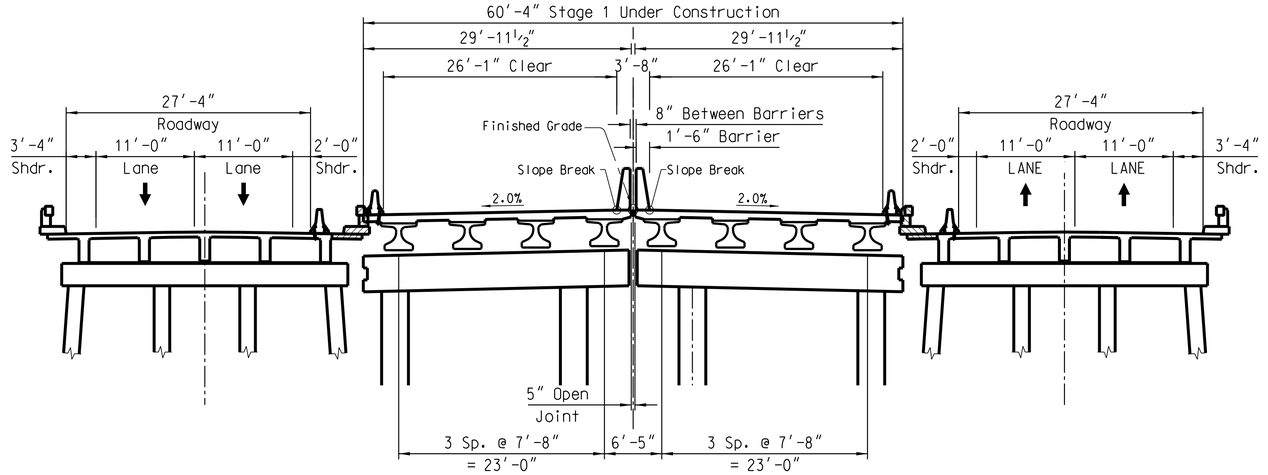
BRIDGE PLANS ID	SHEET NO.
P041130-B01	10



EXISTING CONFIGURATION

(Looking in direction of stationing)
(Existing Cast-in-Place T Beams Spans shown)

Note:
Guardrails on existing bridges not shown.

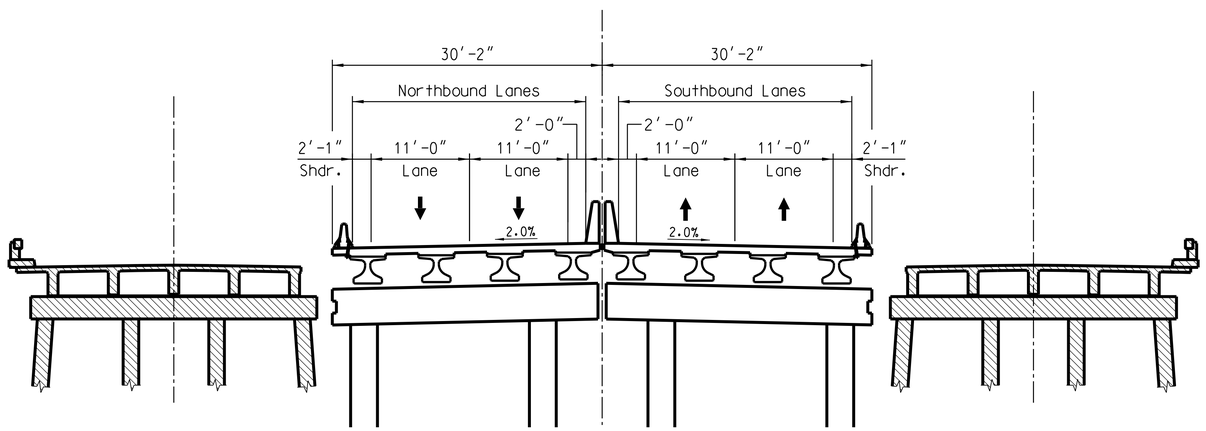


STAGE 1 CONSTRUCTION

(Looking in direction of stationing)

Stage 1 Notes:

1. Shift Existing Traffic, demolish designated portions of existing I-95 bridges and Construct Stage I Portion of new bridge.



STAGE 2A CONSTRUCTION

(Looking in direction of stationing)

Stage 2A Notes:

1. Shift Existing Traffic to newly constructed bridge.
2. Demolish Existing I-95 bridges.

CONCEPTUAL PLANS
NOT FOR CONSTRUCTION

= Existing Bridge Removal

REV.			
REV.			
REV.			
REVIEWED			
QUAN.			
DR.			
DES.			
	BY	CHK.	DATE

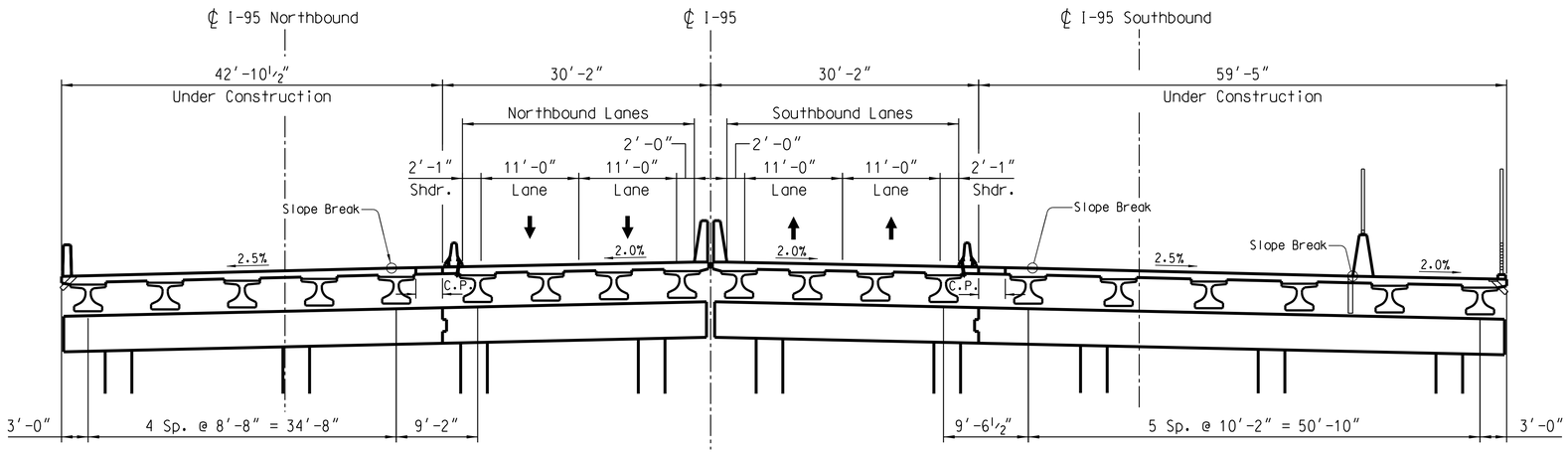
SOUTH CAROLINA
DEPARTMENT OF TRANSPORTATION

I-95 OVER LAKE MARION
STAGES OF CONSTRUCTION
RELIEF BRIDGE 1 OF 2

COUNTY	ROUTE
ORANGEBURG / CLARENDON	I-95

$$DATE$$

BRIDGE PLANS ID	SHEET NO.
P041130-B01	11

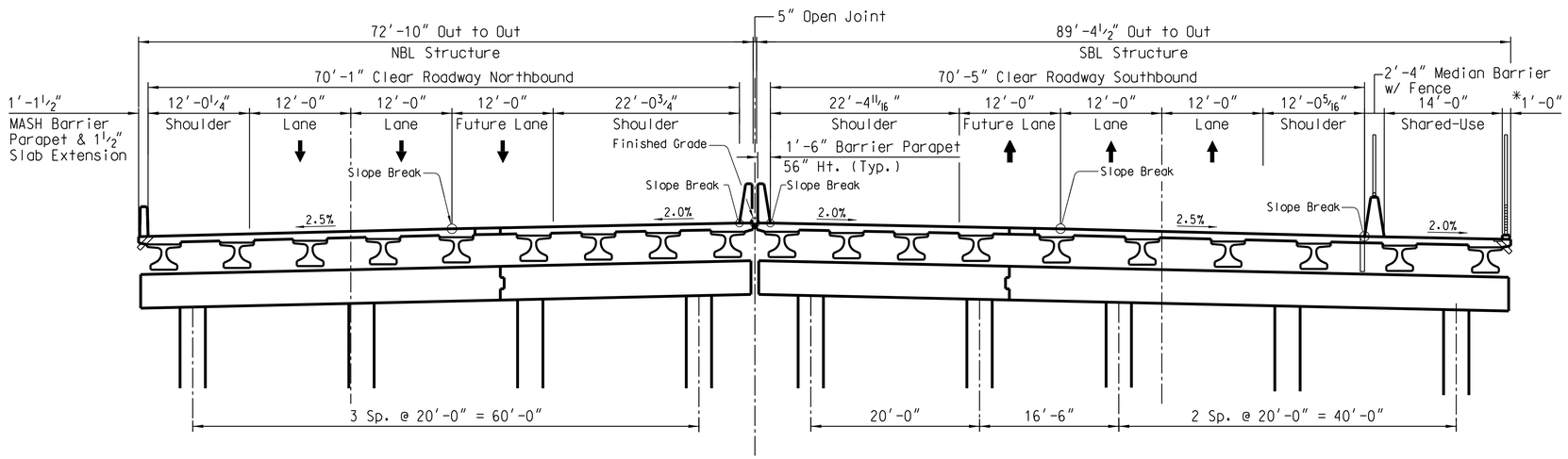


STAGE 2B CONSTRUCTION

(Looking in direction of stationing)

Stage 2B Notes:

1. Costruct remaining portions of NBL and SBL bridges. Remove temporary barriers and shift traffic to final configuration.



FINISHED BRIDGE

(Looking in direction of stationing)

= Existing Bridge Removal

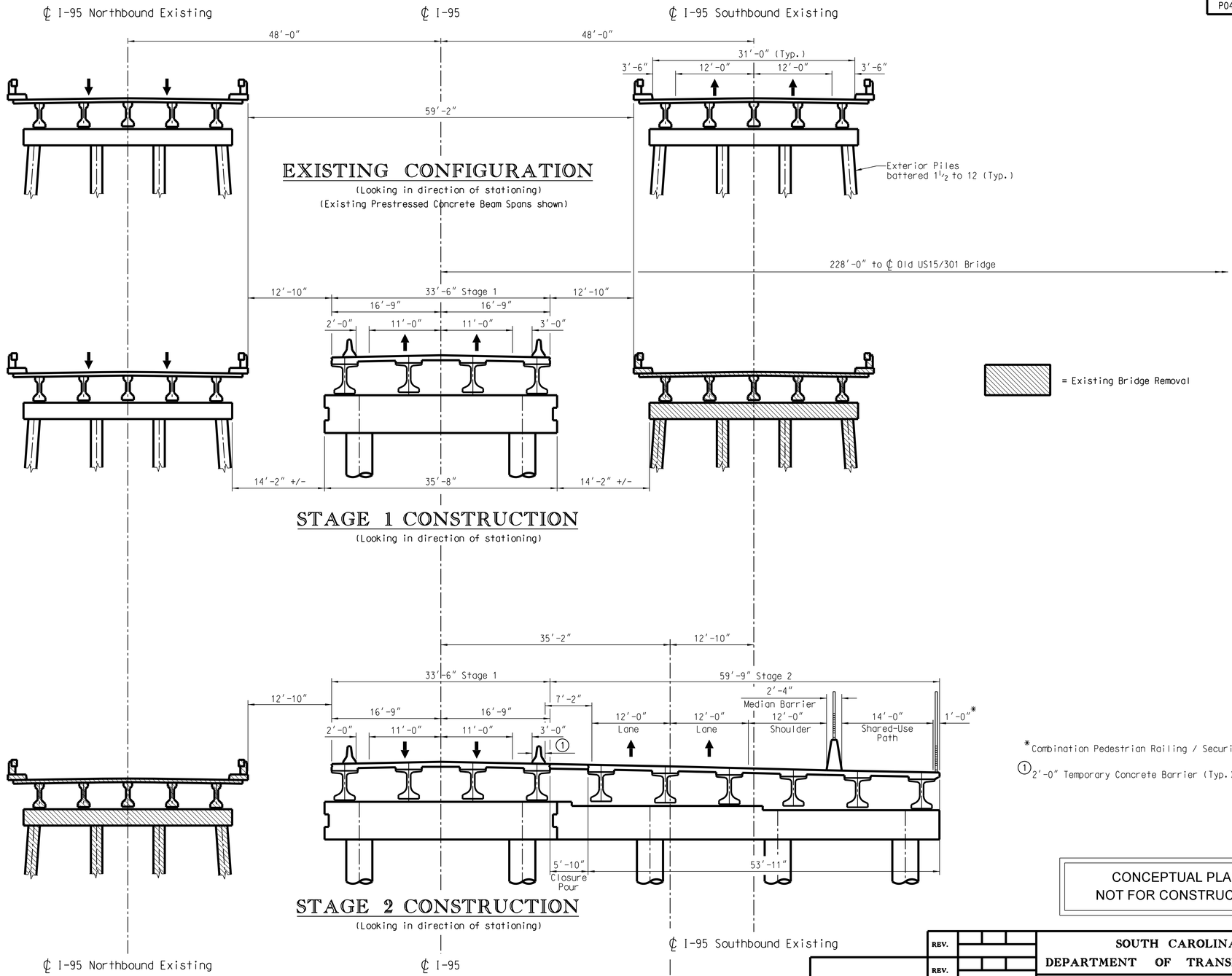
*Combination Pedestrian Railing / Security Fence

CONCEPTUAL PLANS
NOT FOR CONSTRUCTION

REV.				SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
REV.				I-95 OVER LAKE MARION
REV.				STAGES OF CONSTRUCTION
REVIEWED				RELIEF BRIDGE 2 OF 2
QUAN.				
DR.				
DES.				
	BY	CHK.	DATE	COUNTY: ORANGEBURG / CLARENDON — ROUTE: I-95

$$DATE$$

BRIDGE PLANS ID	SHEET NO.
P041130-B01	12



EXISTING CONFIGURATION

(Looking in direction of stationing)
(Existing Prestressed Concrete Beam Spans shown)

STAGE 1 CONSTRUCTION

(Looking in direction of stationing)

Stage 1 Notes:

1. Construct Stage 1 portion of new bridge & shift Southbound traffic.
2. Demolish Existing Southbound bridge.

STAGE 2 CONSTRUCTION

(Looking in direction of stationing)

Stage 2 Notes:

1. Construct Stage 2 portion of new bridge & place closure pour.
2. Shift Southbound lanes to final configuration on Stage 2 deck.
3. Shift Northbound lanes to Stage 1 lane configuration as shown.
4. Demolish Existing Northbound bridge.

*Combination Pedestrian Railing / Security Fence

①2′-0″ Temporary Concrete Barrier (Typ.)

CONCEPTUAL PLANS
NOT FOR CONSTRUCTION

REV.			
REV.			
REV.			
REVIEWED			
QUAN.			
DR.			
DES.			
	BY	CHK.	DATE

SOUTH CAROLINA
DEPARTMENT OF TRANSPORTATION

I-95 OVER LAKE MARION
STAGES OF CONSTRUCTION
(1 OF 2)

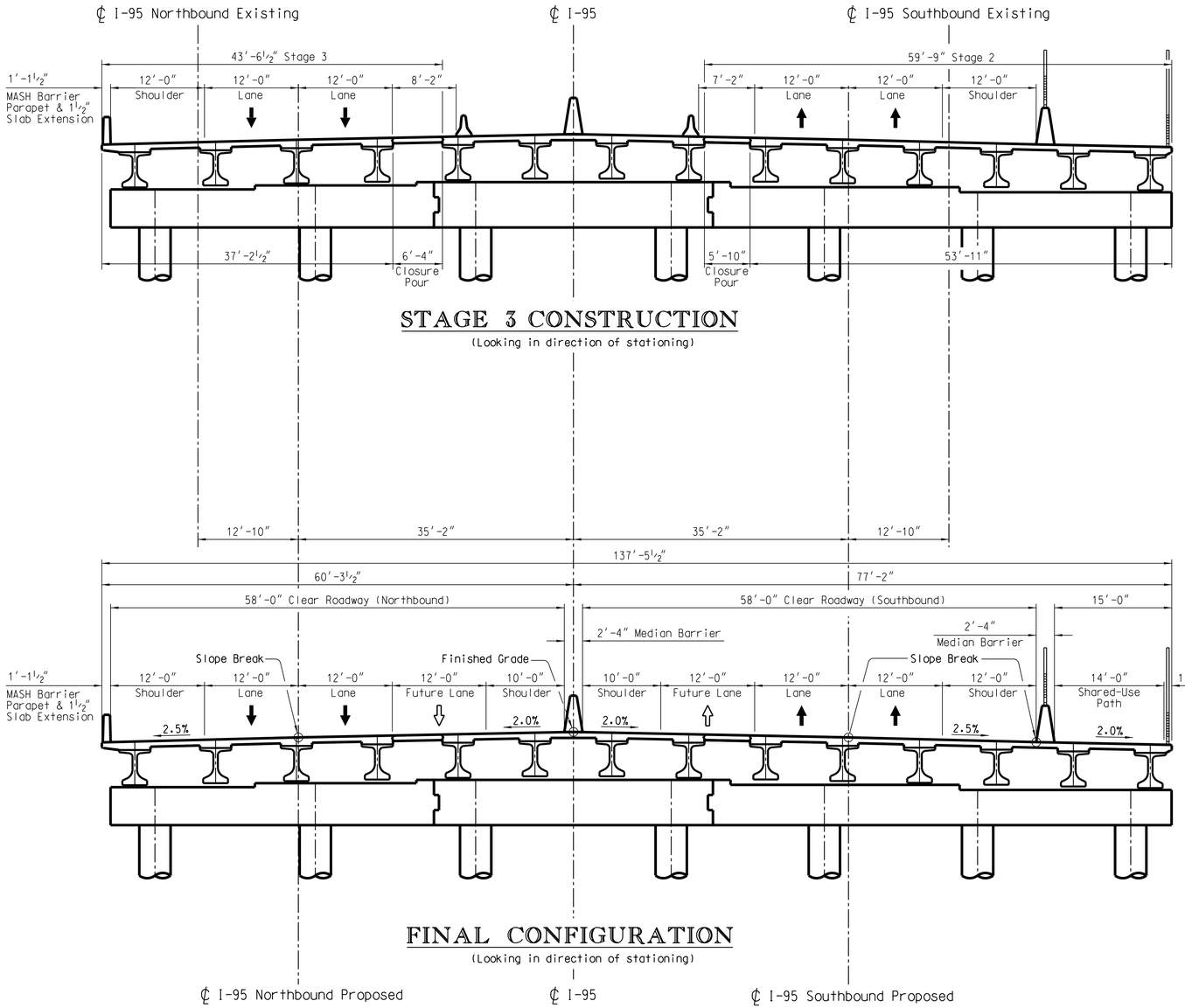
COUNTY	ROUTE
ORANGEBURG / CLARENDON	I-95

$$DATE$$

BRIDGE PLANS ID	SHEET NO.
P041130-B01	13

Stage 3 Notes:

1. Construct Stage 3 portion of new bridge & place closure pour.
2. Shift Northbound lanes to final configuration on Stage 3 deck.
3. Place Median Barrier.
4. Remove temporary barriers.



STAGE 3 CONSTRUCTION

(Looking in direction of stationing)

FINAL CONFIGURATION

(Looking in direction of stationing)

*Combination Pedestrian Railing / Security Fence

CONCEPTUAL PLANS
NOT FOR CONSTRUCTION

REV.			
REV.			
REV.			
REVIEWED			
QUAN.			
DR.			
DES.			
	BY	CHK.	DATE

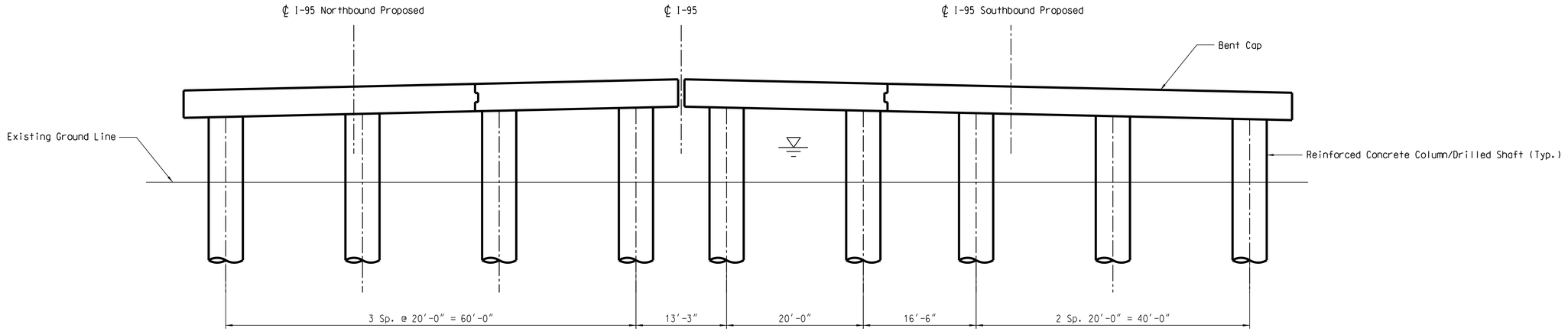
SOUTH CAROLINA
DEPARTMENT OF TRANSPORTATION

I-95 OVER LAKE MARION
STAGES OF CONSTRUCTION
(2 OF 2)

COUNTY	ROUTE
ORANGEBURG / CLARENDON	I-95

$$DATE$$

BRIDGE PLANS ID	SHEET NO.
P041130-B01	14



SUBSTRUCTURE TYPICAL SECTION
I-95 OVER LAKE MARION RELIEF
(Looking in direction of stationing)

CONCEPTUAL PLANS
NOT FOR CONSTRUCTION

REV.			
REV.			
REV.			
REVIEWED			
QUAN.			
DR.			
DES.			
	BY	CHK.	DATE

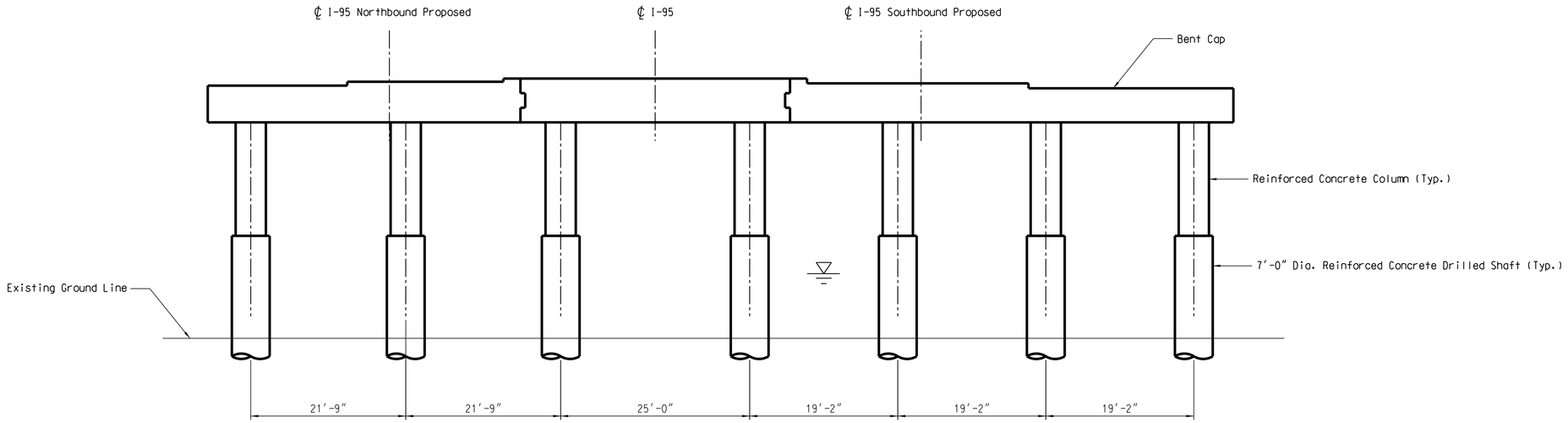
SOUTH CAROLINA
DEPARTMENT OF TRANSPORTATION

SUBSTRUCTURE
TYPICAL SECTIONS
RELIEF BRIDGE

COUNTY	ROUTE
ORANGEBURG / CLARENDON	I-95

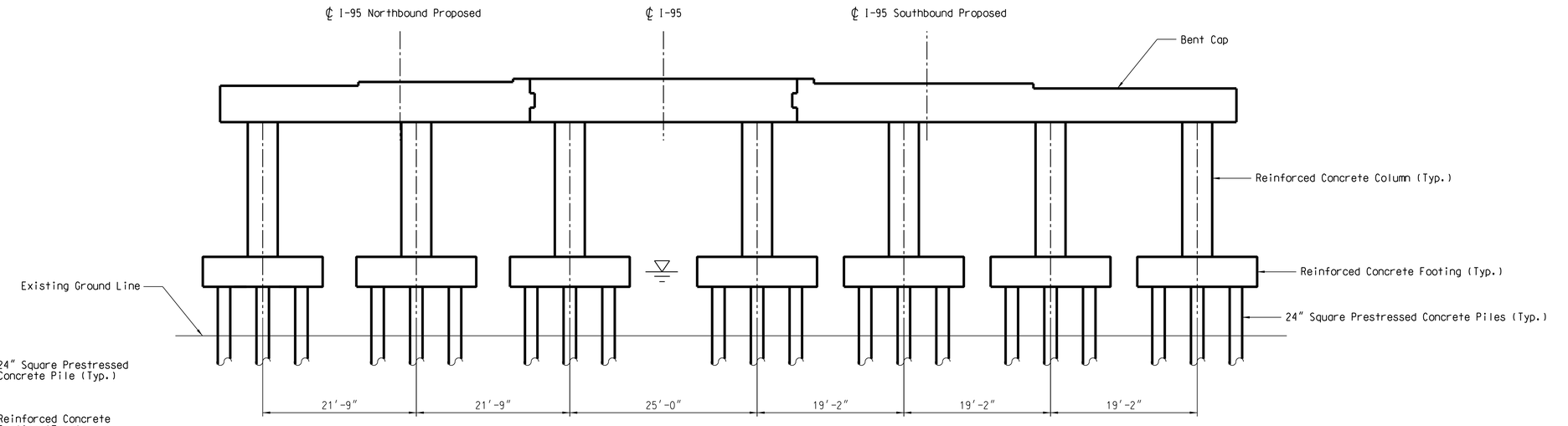
$$DATE$$

BRIDGE PLANS ID	SHEET NO.
P041130-B01	15



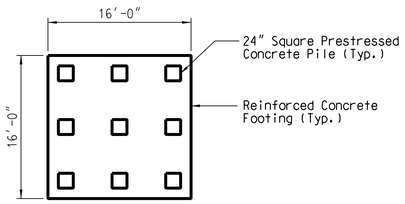
SUBSTRUCTURE TYPICAL SECTION
INTERIOR BENTS 2-20
I-95 OVER LAKE MARION

(Looking in direction of stationing)



SUBSTRUCTURE TYPICAL SECTION
INTERIOR BENTS 21-35
I-95 OVER LAKE MARION

(Looking in direction of stationing)



PILE FOOTING PLAN

CONCEPTUAL PLANS
NOT FOR CONSTRUCTION

REV.			
REV.			
REV.			
REVIEWED			
QUAN.			
DR.			
DES.			
	BY	CHK.	DATE

SOUTH CAROLINA
DEPARTMENT OF TRANSPORTATION

SUBSTRUCTURE
TYPICAL SECTIONS
MAIN BRIDGE

COUNTY	ROUTE
ORANGEBURG / CLARENDON	I-95

$$DATE$$

Appendix VI:
Hydraulic and NEPA Forms

TRANSYSTEMS

1.5.4 Hydrology Data Sheet for Bridges

MEMORANDUM TO:

Submittal Date: 06/22/2023

Supersedes Submittal Date: N/A

RPG ROAD DESIGN TEAM LEADER: Walker Roberts, P.E.

RPG STRUCTURAL ENGINEER: Matthew Rekers, P.E.

From: Hydraulic Design Squad / Engineer Jacob Law, P.E.

Subject: Hydrology Data for Bridge over Lake Marion

County: CLARENDON & ORANGEBURG **Rd/Rte:** I-95 NB/SB

Structure No: 1410009510100 & 141009530100 **Const. Pin:** 041130

Bridge Data:

Bridge Length: 4523.67 ft. Bridge Width: 137.46 ft.

Beg. Station: 5223+51.00 Ending Station: 5268+74.67

Pier/Pile Type: Concrete Column Pier/Pipe Width: 5.5 ft.

Skew Angle: 0 °

Bridge Span Configuration: 5@76'-0" - 77'-4" - 23@140'-0" - 2@160'-0" - 3@140'-0" - 106'-4"

Bridge Span Type: Continuous Prestressed Beams & Prestressed Beams (160'-4" Span)

Min. F.G. Elev.: Navigational Channel: 135.62 ft. Approach Spans: 90.37 ft. Min. Low Steel Elev.: Navigational Channel: 126.12 ft. Approach Spans: 84.12 ft.

Min. Bottom Interior Bent Cap Elev. (For Tidal Bridges Only) N/A ft.

Br. End Fill Slope: 2:1 Riprap Req'd: Yes ☑ No ☐ To Elevation: 74.12 ft.

Comments: The existing navigation channel is maintained and existing bridge foundation elements are avoided with the proposed bridge configuration. The proposed bridge will combine the NB and SB lanes into one bridge, provide a future lane in each direction, and provide a shared-use path. The proposed bridge is hydraulically sufficient.

Historic High Water Information:

Elevation of High Water: 66.19 (NAVD88) ft. Discharge: (if available) 374,000 ft.

Date of occurrence: 07/21/1916 Source of Data: USGS Gage 02170000

Design High Water and Backwater Information: (Show high water elevations including backwater on plans)

If 'Secondary Road' provide 25-yr high water elevation including backwater: N/A ft.

If 'Primary Road' provide 50-yr high water elevation including backwater: 76.86 ft.

For all roads provide 100-yr high water elevation including backwater: 78.75 ft.

Hydrology Data for Tidal Bridges: (Only complete this section if tidal flow is the dominant flow) (show on plans)

Mean Higher high tide elevation = N/A ft.

Mean Lower low tide elevation = N/A ft.

10-year tidal surge height = N/A ft. (includes wave height)

100-year stillwater height = N/A ft.

500-year stillwater height = N/A ft.

Maximum vel. within bridge = 100-yr. tidal surge velocity: N/A fps 500-yr. tidal surge velocity: N/A fps

Hydrology Data for Riverine Bridges: (Only complete this section if riverine flow is the dominant flow) (show on plans)

D.A. = 14,400 sq. mi. (or acres)

Q_{Design} = 480,400 cfs

Vel. $_{Design}$ = 9.72 ft./sec.

Design Headwater Elevation = 76.86 ft.

Including 0.97 ft. backwater

Q_{100} = 616,900 cfs

Vel_{100} = 11.18 ft/sec

100 Year Headwater Elev. = 78.75 ft.

Including 1.47 ft. backwater

Overtopping Flood:

Q = > 1,046,000 cfs Probability = < 0.2 %

cc: Environmental Engineer TBD

Note: Probability may be determined by plotting the 2-, 10-, 25-, 50-, 100-, and 500-year discharges on Gumble paper and reading the probability corresponding to the overtopping discharge. For discharges greater than 500-year, the probability should be stated as less than (<) 0.002.Profiles of the computed scour for the 100-year and 500-year floods should be shown on the bridge plan and profile sheet. The shape of these profiles should be based on the methods described in the HEC-18. A plot of the 100- and 500-year scour lines on a bridge plan and profile sheet must be provided. Revised 3/16/09

1.5.4 Hydrology Data Sheet for Bridges

MEMORANDUM TO:

Submittal Date: 06/22/2023

Supersedes Submittal Date: N/A

RPG ROAD DESIGN TEAM LEADER: Walker Roberts, P.E.

RPG STRUCTURAL ENGINEER: Matt Rekers, P.E.

From: Hydraulic Design Squad / Engineer Jacob Law, P.E.

Subject: Hydrology Data for Bridge over Lake Marion Relief

County: CLARENDON & ORANGEBURG **Rd/Rte:** I-95 NB/SB

Structure No: 1410009510200 & 141009530200 **Const. Pin:** 1041130

Bridge Data:

Bridge Length: 375 ft. Bridge Width: 162.625 ft.

Beg. Station: 5173+53 Ending Station: 5177+28

Pier/Pile Type: Concrete Column Pier/Pipe Width: 505 ft.

Skew Angle: 0 °

Bridge Span Configuration: 75-75-75-75-75

Bridge Span Type: Continuous Prestressed Beams and Prestressed Beams

Min. F.G. Elev.: 90.37 ft. Min. Low Steel Elev. 84.12 ft.

Min. Bottom Interior Bent Cap Elev. (For Tidal Bridges Only) ft.

Br. End Fill Slope: 2:1 Riprap Req'd: Yes ☑ No ☐ To Elevation: 74.12 ft.

Comments: Existing bridge foundation elements are avoided with the proposed bridge configuration. The proposed bridge will combine the NB and SB lanes into one bridge, provide a future lane in each direction, and provide a shared-use path. The proposed bridge is hydraulically sufficient.

Historic High Water Information:

Elevation of High Water: 66.19 ft. Discharge: (if available) 374,000 ft.

Date of occurrence: 07/21/1916 Source of Data: USGS Gage 02170000

Design High Water and Backwater Information: (Show high water elevations including backwater on plans)

If 'Secondary Road' provide 25-yr high water elevation including backwater: N/A ft.

If 'Primary Road' provide 50-yr high water elevation including backwater: 77.18 ft.

For all roads provide 100-yr high water elevation including backwater: 79.12 ft.

Hydrology Data for Tidal Bridges: (Only complete this section if tidal flow is the dominant flow) (show on plans)

Mean Higher high tide elevation = N/A ft.

Mean Lower low tide elevation = N/A ft.

10-year tidal surge height = N/A ft. (includes wave height)

100-year stillwater height = N/A ft.

500-year stillwater height = N/A ft.

Maximum vel. within bridge = 100-yr. tidal surge velocity: N/A fps 500-yr. tidal surge velocity: N/A fps

Hydrology Data for Riverine Bridges: (Only complete this section if riverine flow is the dominant flow) (show on plans)

D.A. = 14,400 sq. mi. (or acres)

Q_{Design} = 480,400 cfs

Vel. $_{Design}$ = 7.29 ft./sec.

Design Headwater Elevation = 77.18 ft.

Including 1.39 ft. backwater

Q_{100} = 616,900 cfs

Vel_{100} = 8.41 ft/sec

100 Year Headwater Elev. = 78.97 ft.

Including 3.30 ft. backwater

Overtopping Flood:

Q = >1,046,000 cfs Probability = < 0.2 %

cc: Environmental Engineer TBD

Note: Probability may be determined by plotting the 2-, 10-, 25-, 50-, 100-, and 500-year discharges on Gumble paper and reading the probability corresponding to the overtopping discharge. For discharges greater than 500-year, the probability should be stated as less than (<) 0.002.Profiles of the computed scour for the 100-year and 500-year floods should be shown on the bridge plan and profile sheet. The shape of these profiles should be based on the methods described in the HEC-18. A plot of the 100- and 500-year scour lines on a bridge plan and profile sheet must be provided. Revised 3/16/09

1.6.1 Title Sheet

HYDRAULIC DESIGN AND RISK ASSESSMENT FOR

BRIDGE / BRIDGE REPLACEMENT OVER

(Lake Marion and Lake Marion Relief)

ROUTE / ROAD NUMBER: I-95 (NB & SB)

FILE NO.: N/A

PROJECT NO.: P041130

PIN: P041130

COUNTY NAME: Clarendon and Orangeburg

DATE: 6 / 22 / 2023

PREPARED BY: Jacob A. Law, PE

CHECKED BY: John K. McWhorter, PE

Hydraulic Design Reference for this study is the :

2009

Edition of SCDOT's "Requirements for Hydraulic Design Studies."

Signed and Sealed

1.6.2 Comparative Data Sheet

COMPARATIVE DATA

PROJECT DESCRIPTION

County:	Clarendon/ Orangeburg	Rt. / Rd. No.:	I-95 (NB & SB)
Stream:	Lake Marion & Lake Marion Relief	File No:	P0040308
Project No:	P306220028	PIN:	P0040308
Charge Code:	N/A	Road Squad:	N/A
Project Engineer:	Jacob Law, PE		

By:	Jacob Law, PE	Date:	6 / 22 / 2023
Checked By:	John McWhorter, PE	Date:	6 / 22 / 2023

	ROUTE/ROAD NO.'s				
	US 601 (Congaree River)	I-95 (SB & NB)	US 52 (Santee River)		
DISTANCE FROM NEW BR. (mi.)	20.5	New Bridge	31 mi.		
DRAINAGE AREA (sq. mi.)	8,520	14,400	400*		
ZONE	A	AE	A		
Q_{10} (cfs)	Information Not Comparable				
Q_{25} (cfs)	Information Not Comparable				
Q_{50} (cfs)	Information Not Comparable				
Q_{100} (cfs)	Information Not Comparable				
Q_{500} (cfs)	Information Not Comparable				
BRIDGE LENGTH (ft.)	1,760	4,523.67	1,655		
AVG. FINISHED GRADE (ft.)	Information Not Comparable				
OPENING FURNISHED (sq.ft.)	Information Not Comparable				
VELOCITY (ft./sec)	Information Not Comparable				
HIGHWATER ELEV. (ft.)	Information Not Comparable				
HIGHWATER DATE	N/A	1916	N/A		
HIGHWATER DEPTH (ft.)	N/A	N/A	N/A		
OBSERVED WATER ELEV. (ft.)	N/A	N/A	N/A		
OBSERVED WATER DATE	N/A	N/A	N/A		
OBSERVED WATER DEPTH (ft.)	N/A	N/A	N/A		
FILE/DOCKET/PROJECT NO.	0940.1001B	P306220028	N/A		
DATUM/DATUM TIE	N/A	N/A	N/A		

**Drainage Area downstream of Santee Dam and upstream of crossing.*

1.6.3 Site Inspection Form

SITE INSPECTION FORM

PROJECT DESCRIPTION

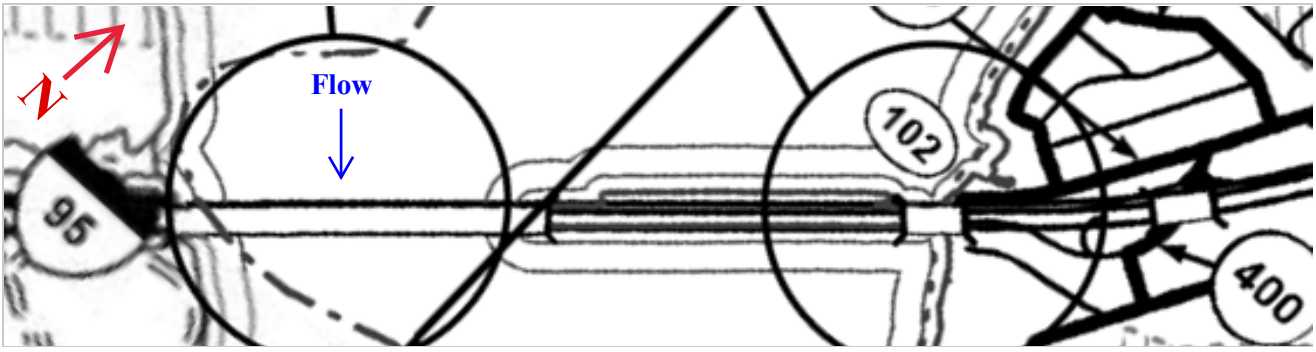
County: Clarendon/ Orangeburg
Rt. / Rd. No.: I-95 (NB & SB)
Stream: Lake Marion
File No: N/A
Project No: P306220028
PIN: P0040308
By: Jacob Law, PE
Date: 2 / 9 / 2023

Note: All references to left and right are looking in the direction of flow.

EXISTING BRIDGE

Length: 4,500.00 ft. Width: 35.1 ft. Max. Span Length: 140 ft.
Alignment: Tangent [x] Curved [ ]
Bridge skewed? Yes [ ] No [x] Angle:
End Abutment Type: Spill-through.
Riprap on Fills? Yes [x] No [ ] Condition: Fair on NBL fill and None on SBL.
Superstructure Type: PSC Concrete Beam and Steel Open Girder/ Beam
Substructure Type: R/C Caps with two 36"x36" columns and R/C Caps with four 1'-9" columns.
Utilities Present? Yes [x] No [ ] Describe: Electrical lines running parallel to and 300 ft downstream of I-95. SCDOT signal beam across lake.
Debris Accumulations on Bridge: Percent Blocked (Horizontal): 0 %
Percent Blocked (Vertical): 0 %
Hydraulic Problems? Yes [ ] No [x] Describe:
Bridge deck is approximately 50 ft above normal water level.

Draw Sketch of Bridge and Stream Below: (Show north arrow and direction of flow)



1.6.3.1 Site Characteristics Form

SITE CHARACTERISTICS FORM

General Topography Flat

Stream Type (circle one)

Straight Braided Anabranched Meandering

Are channel banks stable? Yes [x] No [ ]

If No, describe: N/A

Soil Type USCS Soil Types: SP, SW-SM, SM/ SC. Clayey - Fine to Medium Sand.
(based on nearby US 301 over Four Hole Swamp soil analysis - Geotechnical analysis ongoing)

Exposed Rock? Yes [ ] No [x]

If Yes, give description and location: N/A

Describe potential for debris: Potential for debris accumulation in and around intermediate pile bents.

Give description and location of any structures or other property that could be damaged by backwater: No structures located in upstream floodplain.

Describe any other features that might affect or be affected by the hydraulic performance of the proposed bridge: The Lake Marion and Lake Marion Relif bridges are dependent on the performance of each other. The hydraulic performace of both bridges will be affected by the downstream Santee Dam. The Cantey Bay crossing may affect flood results.

1.6.3.2 Manning's "n" Values – for Channels

MANNING'S "n" VALUES – FOR CHANNELS

$$n = [(n_b+n_1+ n_2 +n_3+n_4)\ m]$$

Channel	n_b -- *Base n for soil*
Earth	.020
Rock Cut	.025
Fine Gravel	.024
Course Gravel	.028

Channel	n_1 -- *Degree of Irregularity*
Smooth	.000
Minor	.001-.005
Moderate	.006-.010
Severe	.011-.020

	n_2 -- *Variations of Channel Cross Sections*
Gradual	.000
Alternating Occasionally	.001-.005
Frequently	.010-.015

	n_3 -- *Relative Effect of Obstructions*
Negligible	.000-.004
Minor	.010-.015
Appreciable	.020-.030
Severe	.040-.060

	n_4 -- *Vegetation*
Low	.002-.010
Medium	.010-.025
High	.025-.050
Very High	.050-.100

	m -- *Degree of Meandering*
Minor	1.00
Appreciable	1.15
Severe	1.30

SITE OBSERVATIONS FOR CHANNELS

Channel Depth	n_b	n_1	n_2	n_3	n_4	m	***Computed n***
~ 35 feet	0.020	0.000	0.000	0.000	0.000	1.00	0.020

Note: No visible defined channel at Lake Marion - USGS Bathymetric Data Includes Channel Definition.

1.6.4 Risk Assessment

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION FLOODPLAIN AND RISK ASSESSMENT

Regulation 23 CFR 650 shall apply to all encroachment and to all actions which affect base floodplains, except for repairs made with emergency funds. (See HEC-17) Note: These studies shall be summarized in the environmental review document prepared pursuant to 23 CFR 771.

Project Description: The bridge replacement project will replace the existing 4,500 ft 85 Span concrete and steel girder bridges at I-95 NB SB over Lake Marion and the existing 360 ft 9 span concrete girder bridges at I-95 NB and I-95 SB over Lake Marion Relief (4 bridges) with a 4,526.67-foot 35 span and 375-foot 5 span concrete girder bridge at I-95 over Lake Marion and Relief, respectively.

A. Narrative Describing Purpose and Need for Project:

a. Relevant Project History: The purpose of the project is to maintain connectivity and a safe interstate facility for the traveling public along I-95 over Lake Marion. Portions of the I-95 bridges will soon be in poor conditions and do not meet current design standards for vehicle loads.

b. Project Location (attach Location and Project Map):

The project is located on I-95, 7 miles south of Summerton, SC and over Lake Marion.

c. Major Issues and Concerns: Proposed project will maintain navigation channel under main bridge. Proposed bridge will adhere to allowable environmental impact limits.

B. Are there any floodplain(s) regulated by FEMA located in the project area?

Yes [x] **No** [ ]

C. Will fill be placed within a 100-year floodplain?

Yes [x] **No** [ ]

Page 1 of 5

D. Will the existing profile grade be raised within the floodplain?

Yes [x] **No** [ ]

E. If applicable, please discuss the practicability of alternatives to any longitudinal encroachments.

N/A

F. Please include a discussion of the following: commensurate with the significance of the risk or environmental impact for all alternatives containing encroachments and those actions which would support base floodplain development:

i. What are the flood-related risks associated with implementation of the action?

The action will decrease flood-related risks.

ii. What are the impacts on the natural and beneficial floodplain values?

There will be no deleterious consequences to this action.

iii. Will the bridge entice people to build in floodplains?

No, the reduction in WSEs are insignificant to entice people to build in the floodplain. Additionally, the floodplain is a lake and not enticing to build in.

iv. What measures were used to minimize floodplain impacts associated with the action?

The proposed bridge will be longer than the existing bridge and the profile will be increased, increasing the hydraulic opening of the proposed bridge.

v. Were any measures used to restore and preserve the natural and beneficial floodplain values impacted by the action?

The proposed action will not cause negative effects.

G. Please discuss the practicability of alternatives to any significant encroachments or to support of incompatible floodplain development.

N/A

H. List local, state, and federal water resources and floodplain management agencies consulted to determine if the proposed highway action is consistent with existing watershed and floodplain management programs. Describe any information obtained on development and proposed actions in the affected area. Please include agency documentation.

SCDOT.

I. BACKWATER DAMAGE FORM

Major flood damage applies to shopping centers, hospitals, industrial facilities, residential areas, schools, farming operations, etc.

1. *Does the maximum flood cause major damage to upstream property?*

Yes - (Go to 2.) (No - (Go to 3.))

2. *Would this damage occur if the road were not there?*

Yes - (Go to 3.)

No - (Perform a limited Least Total Expected Cost (LTEC) (HEC-17) analysis to see if the bridge opening should be increased and/or grades raised to minimize the damage potential. Go to II.)

3. *Was this a bridge replacement? If so, was the bridge opening increased enough to increase the discharge passed through the bridge?*

(Yes - (Go to 4.)) No - (Go to II.)

4. *Does the increased flow cause major damage downstream?*

Yes - (Perform a limited LTEC analysis to determine if the bridge opening should be reduced, the floodway redefined, and flood easements purchased upstream or if flood easements should be purchased downstream. Go to II.)

No - (Go to II)

II. TRAFFIC RELATED LOSSES

1. *Is the overtopping flood greater than the 100-year flood?*

Yes - (Go to III.) No - (Go to 2.)

2. *Does the ADT exceed 50 vehicles per day?*

Yes - (Go to 3.) No - (Go to III.)

3. *Does the duration of road closure in days, multiplied by the difference in length, in miles between the normal route and the detour, exceed 20?*

Yes - (Go to 4.) No - (Go to III.)

4. *Does the annual risk cost for traffic related costs exceed 10% of the estimated annual capital costs?*

Yes - (Perform a limited LTEC analysis to compare the cost to raise the grades and if necessary increase the bridge length with the traffic related costs. Go to III.)

No - (Go to III.)

III. ROADWAY AND/OR STRUCTURE REPAIR COST

1. *Is the overtopping flood less than the 100-year flood?*

Yes - (Go to 2) No - (Go to 3)

2. *Is the overtopping flood less than 0.5 foot over the low point on the roadway and duration no more than 1.0 hour?*

Yes - (Go to 3)

No - (perform a limited LTEC analysis to determine if the grades should be raised and/or the bridge opening increased or that the repair cost for embankment erosion are less significant. Traffic cost should be included in this evaluation.)

3. *Is the proposed bridge or culvert structure subject to potential damage due to debris?*

Yes - (Go to 4) No - (Go to 5)

4. *Perform a limited LTEC analysis to determine if the structure should be modified. (Go to 5.)*

5. *The risk assessment has determined the most economical design for the crossing within the design constraints.*

Revised 3/16/09

Figure 1: Level 1: Qualitative Analyses Flow Chart

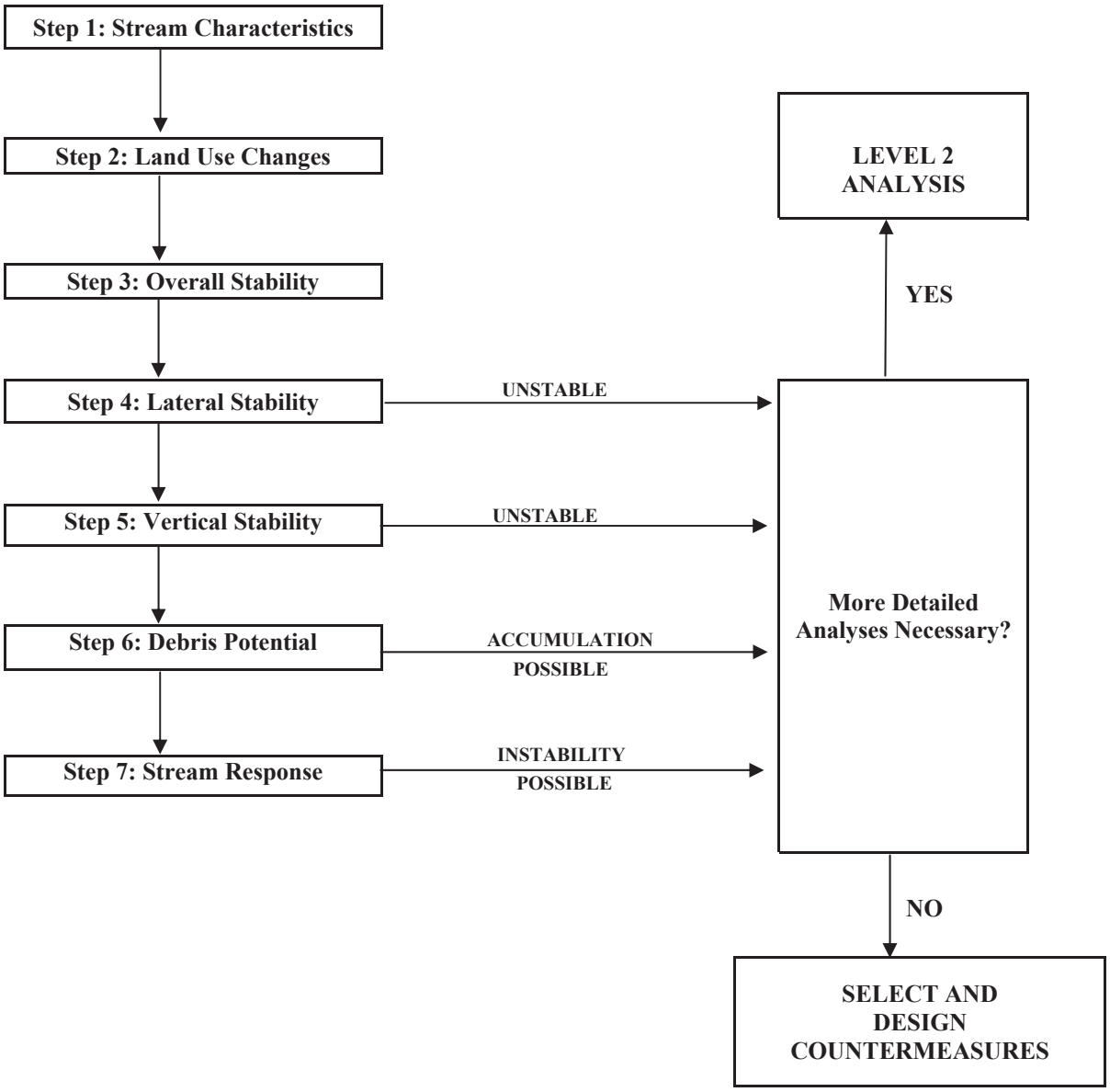


Figure 2: Level 2: Basic Engineering Analysis Flow Chart

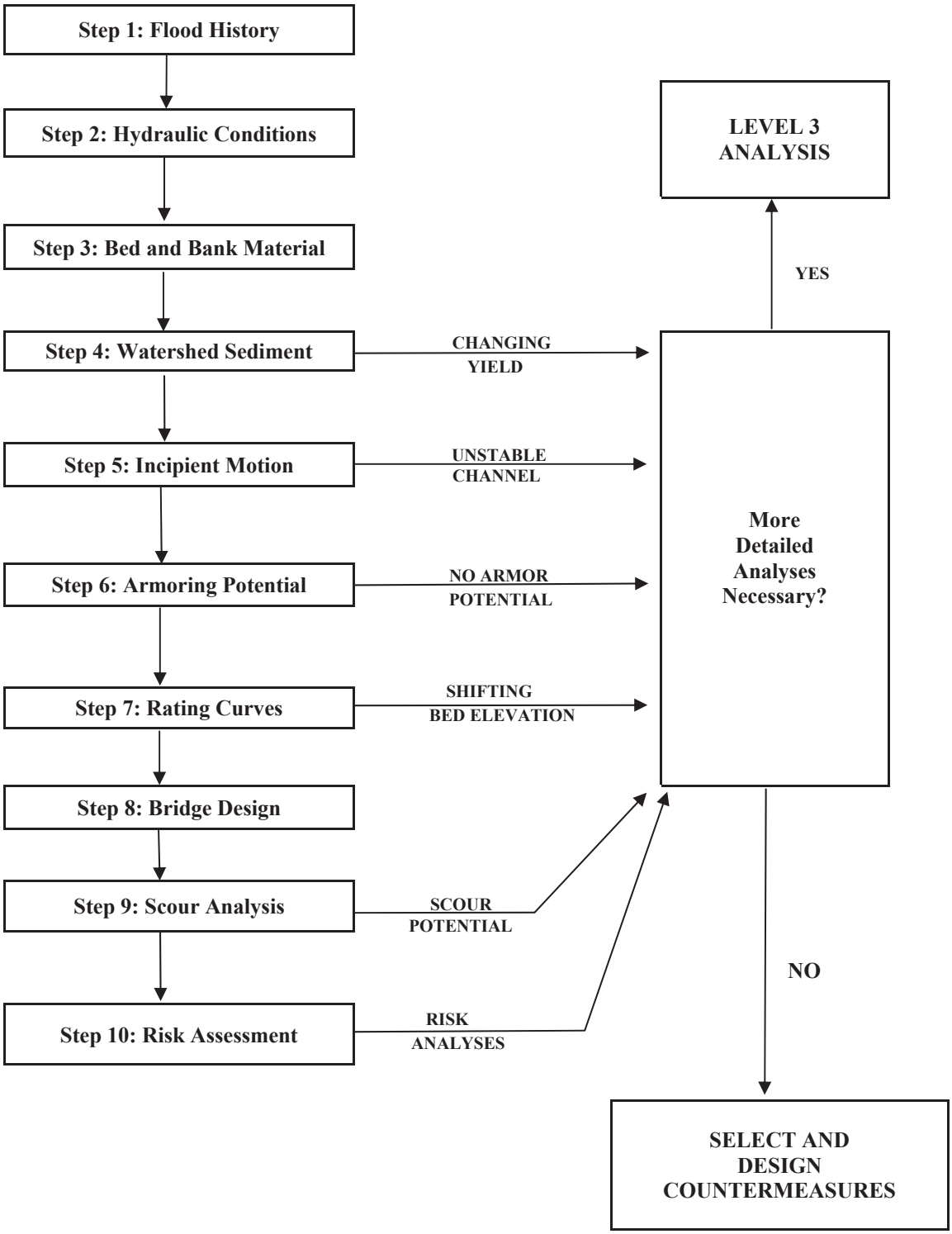
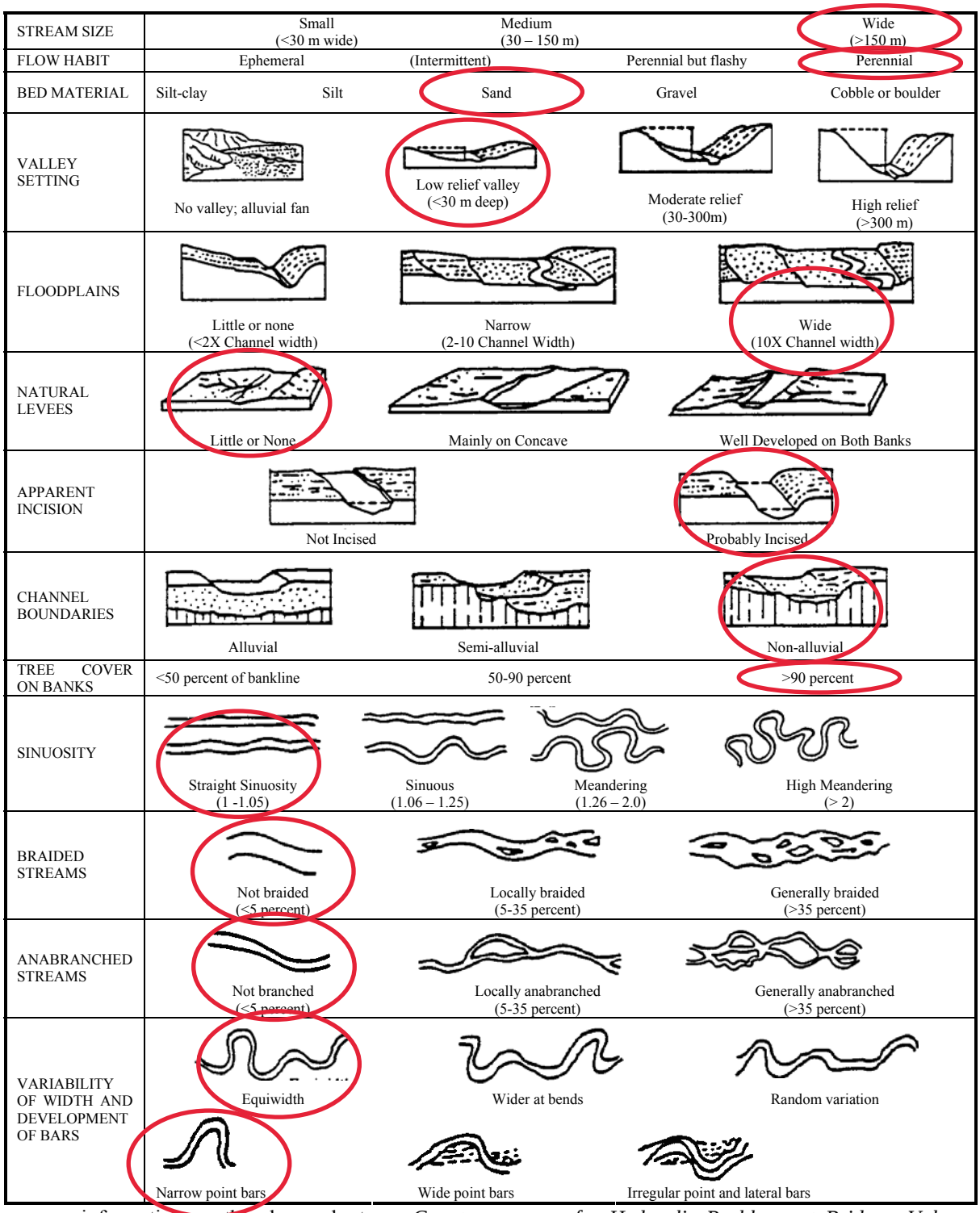


Figure 3: Geomorphic Factors Chart



For more information on the above chart see *Countermeasures for Hydraulic Problems at Bridges, Volume 1 Analysis and Assessment* (FHWA) (HEC 23).

BRIDGE REPLACEMENT SCOPING TRIP RISK ASSESSMENT FORM

COUNTY: Orangeburg/ Clarendon DATE: 06/22/2023

ROAD #: I-95 NB/SB STREAM CROSSING: Lake Marion and Lake Marion Relief

Purpose & Need for the Project:

The purpose of the project is to correct structural and functional deficiencies of the existing bridge and to maintain connectivity of a safe interstate for the traveling public along I-95 over Lake Marion..

I. FEMA Acknowledgement

Is this project located in a regulated FEMA Floodway? ☐ Yes ☒ No

Panel Number: 45027C0365C & 45075C0265C Effective Date: 08/19/2013 & 01/16/2014 (See Attached)

II. FEMA Floodmap Investigation

FEMA Flood Profile Sheet Number N/A illustrates the existing 100 year flood:

☐ Passes under the existing low chord elevation.
☐ Is in contact with the existing low chord elevation.
☐ Overtops the existing bridge finished grade elevation.

III. No Rise/CLOMR Preliminary Determination

☑ Preliminary assessment indicates this project may be constructed to meet the "No-Rise" requirements. A detailed hydraulic analysis will be performed to verify this assessment.

Justification: The low chord is being raised and the bridge length is being increased resulting in a proposed hydraulic opening larger the existing hydraulic opening.

☐ Preliminary assessmnet indicates this project may require a CLOMR/LOMR. Impacts will be determined by a detailed hydraulic analysis.

Justification: N/A

BRIDGE REPLACEMENT SCOPING TRIP RISK ASSESSMENT FORM

IV. Preliminary Bridge Assessment

A. Locate Existing Plans

a. Bridge Plans ☑ Yes ☐ No File No. 1438.315.1 Sheet No. 10 (See Attached)

b. Road Plans ☑ Yes ☐ No File No. 1438.315.1 Sheet No. 8-9 (See Attached)

B. Historical Highwater Data

a. USGS Gage ☑ Yes ☐ No Gage No. 02170000 Results: 66.19 ft (374,000 cfs) on 7/21/1916

b. SCDOT/USGS Documented Highwater Elevations

☑ Yes ☐ No Results: 66.19 ft on 7/21/19 (Before completion of Lake Marion)

c. Existing Plans ☑ Yes ☐ No See Above

Length: 4,500.00 ft. Width: 35.20 ft. Max. span Length: 140 ft.

Alignment: ☑ Tangent ☐ Curved

Bridge Skewed: ☐ Yes ☑ No Angle: 0

End Abutment Type: R/C Caps with concrete piles.

Riprap on End Fills: ☑ Yes ☐ No Condition: Fair on NBL fill and None on SBL.

Superstructure Type:

Substructure Type: R/C Caps with concrete piles.

Utilities Present: ☑ Yes ☐ No

Describe: Electrical lines running parallel to and 300 ft downstream of I-95. SCDOT signal beam across lake.

Debris Accumulation on Bridge: Percent Blocked Horizontally: 0

Percent Blocked Vertically: 0

Hydraulic Problems: ☑ Yes ☐ No

Describe: Existing and proposed conditions backwater exceeds 1-foot increase from natural conditions.

V. Field Review (cont.)

B. Hydraulic Features

a. Scour Present: ☑ Yes ☐ No Location: End Bent front slopes

b. Distance from F.G. to Normal Water Elevation: N/A ft.
c. Distance from Low Steel to Normal Water Elev.: N/A ft.
d. Distance from F.G. to High Water Elevation: N/A ft.
e. Distance from Low Steel to High Water Elev.: N/A ft.

f. Channel Banks Stable: ☑ Yes ☐ No
Describe: Heavy vegetation maintaining floodplain and floodplain bank stability. No defined channel visible (38 ft below lake surface).

g. Soil Type: Sandy loam (based on nearby US 301 over Four Hole Swamp analysis).

h. Exposed Rock: ☐ Yes ☑ No Location: N/A

i. Give Description and Location of any structures or other property that could be damaged due to additional backwater.

Residential and commercial properties line the Lake Marion banks in the vicinity of I-95. Resorts, country club, marinas, restaurant, residential structures and national wildlife refuge present.

C. Existing Roadway Geometry

a. Can the existing roadway be closed for an On-Alignment Bridge Replacement
☐ Yes ☑ No
Describe:

Staged construction is required to maintain current interstate/ evacuation route volume of traffic.

If "yes", does the existing vertical and horizontal curves meet the proposed design speed criteria?

N/A

If "No", will the proposed bridge be:
☑ Staged Constructed
☐ Replaced on New Alignment

VI. Field Review (cont.)

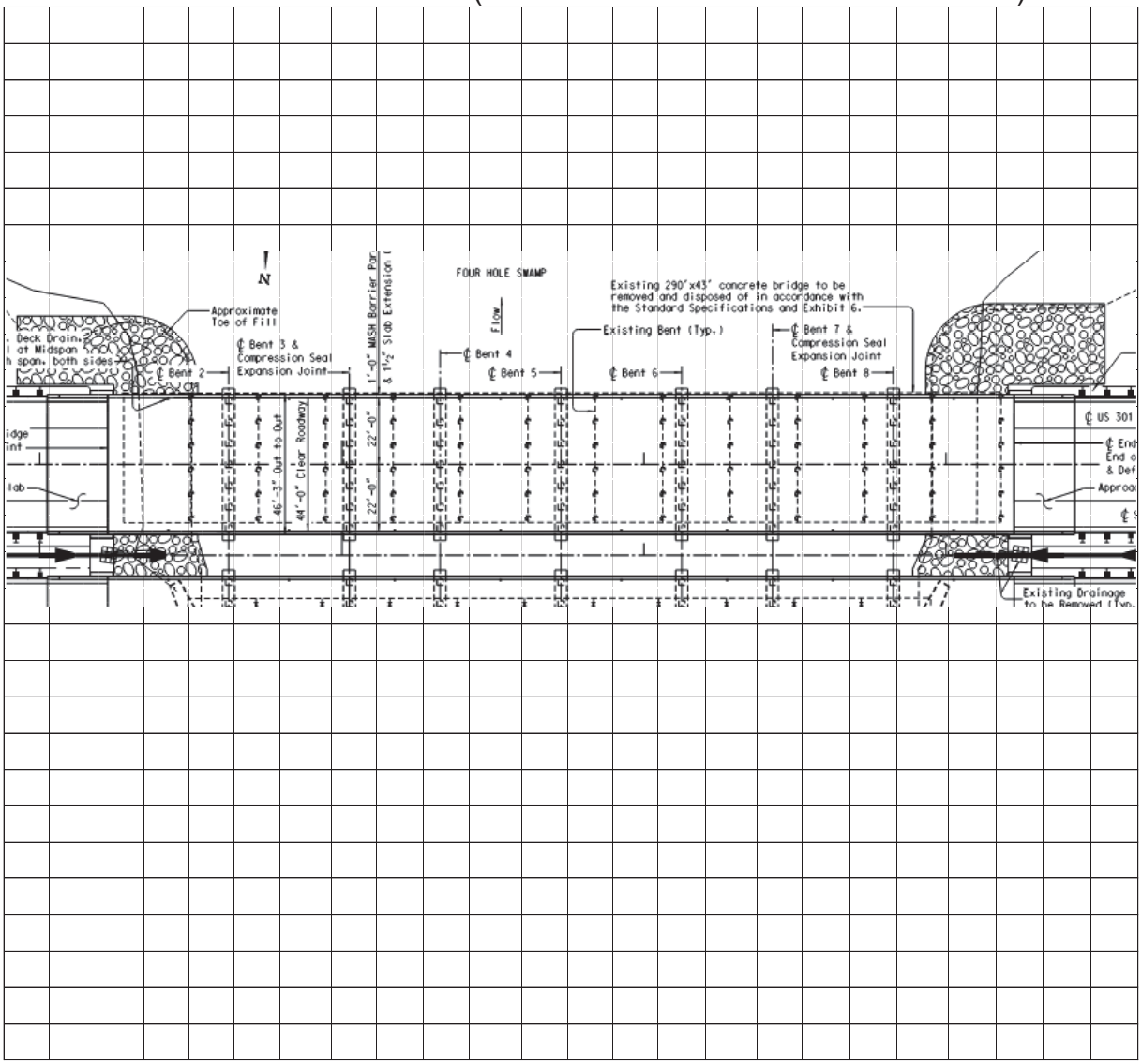
A. Proposed Bridge Recommendation:

Length: 300 ft. Width: 46.25 ft. Elevation: 122.875 ft.

Span Arangement: 8 Span Flat Slab

Notes: 300' Flat Slab bridge with the 3 Continuous Units.
Unit 1 - 80' (40-40).
Unit 2 - 140' (30-40-40-30).
Unit 3 - 80' (40-40).
NB and SB Bridges will be identical structures.

BRIDGE SITE DIAGRAM: (Show North Arrow and Direction of Flow)



Performed By: Jacob A. Law, PE

Title: Hydraulic Engineer

Correspondence

Jacob A. Law

From: John McWhorter III
Sent: Friday, March 10, 2023 1:36 PM
To: Feaster, Toby D
Cc: Jacob A. Law; Gotvald, Anthony J
Subject: Re: [EXTERNAL] Santee River (Lake Marion), South Carolina

Thank you guys very much for taking the time to respond with so much info. I'm out of the office today but we will definitely put this to use.

Have a great weekend!

John

Get Outlook for iOS

From: Feaster, Toby D <tfeaster@usgs.gov>
Sent: Friday, March 10, 2023 9:53:56 AM
To: John McWhorter III <jkmcwhorter@transystems.com>
Cc: Jacob A. Law <jalaw@transystems.com>; Gotvald, Anthony J <agotvald@usgs.gov>
Subject: Re: [EXTERNAL] Santee River (Lake Marion), South Carolina

John,

Tony is correct that we have a report coming out later this spring that will include regression equations for regulated basins that drain 75 percent or more from above the Fall Line. However, the upper limit of the drainage area of basins used to develop those equations was 8,480 square miles and therefore, it would not be recommended that you use them for a drainage basin of 14,400 square miles. That is also true of the current rural regression equations for SC in StreamStats, which has an upper limit of 9,000 square miles.

We have a report that was recently approved updating the rural flood-frequency statistics and regression equations for GA, SC, and NC that will be released soon. In it, we generated maximum probable curves based on the maximum peak flows measured in our study area. For the drainage area at the I-95 location crossing at Lake Marion, that estimate is 642,000 cubic feet per second. Of course, that is a worst-case scenario and would not seem reasonable for a bridge design.

We do have historic peak flows that were measured downstream of I-95 at station 02170000 Santee River at Ferguson, SC. [nwis.waterdata.usgs.gov] The peak flows are from 1908 to 1941. The peak of record occurred in 1916 and was 374,000 cubic feet per second. At our upstream station 02148000 Wateree River near Camden, SC [nwis.waterdata.usgs.gov], 1916 was also the peak of record (400,000 cfs) and was the largest peak measured going back to at least 1886. Thus, one option you might consider is doing a flood-frequency analysis for station 02170000 using peaks from 1908 to 1940. Lake Marion was completed in 1941 and the 1941 peak flow is noted as having been affected by backwater so you would want to exclude it. Because the record would be considered regulated, you should use the station skew option in PeakFQ [water.usgs.gov] [water.usgs.gov]and not the weighted skew option (I'm assuming you are familiar with the USGS software package PeakFQ that is used to compute flood-frequency statistics). That will at least give you results that would be represent conditions prior to the construction of Lake Marion.

Hope this is helpful,
Toby

Toby D. Feaster, P.E.
Hydrologist
USGS South Atlantic Water Science Center
North Carolina-South Carolina-Georgia

864-508-0215 (cell/office)

From: Gotvald, Anthony J <agotvald@usgs.gov>
Sent: Friday, March 10, 2023 7:21 AM
To: John McWhorter III <jkmcwhorter@transystems.com>
Cc: Jacob A. Law <jalaw@transystems.com>; Feaster, Toby D <tfeaster@usgs.gov>
Subject: Re: [EXTERNAL] Santee River (Lake Marion), South Carolina

Hey John,

Yeah, I am still with the USGS and doing well. Since this site is regulated, the rural flood frequency values from StreamStats do not apply for this site. The good news is that my colleague, Toby Feaster, has developed regression equations for regulated streams in GA, NC, and SC. The report is in the final stages of being approved. I have included Toby on this email. He may be able to provide further information on these equations.

Tony

From: John McWhorter III <jkmcwhorter@transystems.com>
Sent: Thursday, March 9, 2023 11:25 AM
To: Gotvald, Anthony J <agotvald@usgs.gov>
Cc: Jacob A. Law <jalaw@transystems.com>
Subject: [EXTERNAL] Santee River (Lake Marion), South Carolina

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

Hey Tony,

I hope this message finds you well, and still with the USGS! We are working on a project that will replace the I-95 bridges over the Santee River, which is also Lake Marion in South Carolina. As you know, this is a heavily regulated basin so discharges are tough to come by. I have been coordinating with Santee Cooper and they have provided some discharge information but they seem really high (ex. 100-year = 550,200 cfs). This is based on the PMF information, which always seems to be on a different scale in order of magnitude. As a reference, the Streamstats number for the 100-year is 227,000 cfs (attached).

So, we are hoping that you will be able to provide some guidance on the appropriate discharges to use for design. We will then have to determine the best way toto tie those to an elevation at the spillway. We do have a few data points from Santee Cooper so we may be able to create a rating curve to address that part.

Anyway, hope you are doing well and thanks in advance for any input can provide.

Thanks!

John

John K. McWhorter III, PE, SE, CFM
Vice President

c: 770-639-9103 | d: 678-244-9732 | o: 678-244-9730
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www.transystems.com [gcc02.safelinks.protection.outlook.com]

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FEMA Model Request Correspondence

Jacob A. Law

From: John McWhorter III
Sent: Monday, June 19, 2023 11:09 AM
To: Jacob A. Law
Subject: FW: Case Number : B2304279 - Clarendon County and Orangeburg County ; Lake Marion

John K. McWhorter III, PE, SE, CFM
Vice President

c: 770-639-9103 | d: 678-244-9732 | o: 678-244-9730
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From: FEMA-EngineeringLibrary <fema-engineeringlibrary@fema.dhs.gov>
Sent: Friday, June 2, 2023 11:04 AM
To: John McWhorter III <jkmcwhorter@transystems.com>
Cc: FEMA-EngineeringLibrary <fema-engineeringlibrary@fema.dhs.gov>
Subject: Case Number : B2304279 - Clarendon County and Orangeburg County ; Lake Marion

June 2, 2023,

Case Number: B2304279 - Clarendon County and Orangeburg County ; Lake Marion

We received your request for technical support data related to a Federal Emergency Management Agency (FEMA) Flood Insurance Study. Your submittal seems to include all the necessary information for us to process your request. If we find that we need any additional information while conducting our research, we will contact you.

Requests are typically completed in 3 to 4 weeks, once we have all the required information and fees.

Your request has been placed in a que for processing and will be processed in the order it was received. You may also contact the FEMA Engineering Library at fema-engineeringlibrary@fema.dhs.gov with any additional questions. **Please make sure to reference the case number above on all correspondence.**

Please contact the Fee Administrator at fema-mappingfees@fema.dhs.gov should you have any questions regarding fee processing or to request a receipt.

FEMA Engineering Library Team