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U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

LEVEL II BRIDGE SCOUR ANALYSIS FOR STRUCTURES 121007710700/30700 ON INTERSTATE 77, CROSSING FISHING CREEK IN CHESTER COUNTY, SOUTH CAROLINA

By Toby D. Feaster and Stephen T. Benedict

Prepared in cooperation with the
SOUTH CAROLINA DEPARTMENT
OF TRANSPORTATION

Columbia, South Carolina

1994

UNIT ABBREVIATIONS

cubic foot per second	ft^3/s
feet per second	ft/s
foot	ft
mile	mi
millimeter	mm
square foot	ft^2
square mile	mi^2
meter	m

OTHER ABBREVIATIONS

North	N
South	S
downstream	D/S
upstream	U/S
flood plain	f/p
median diameter of bed material	D_{50}
South Carolina Department of Transportation	SCDOT

In this report, the words "right" and "left" refer to directions that would be reported by an observer facing downstream.

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929-- a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Level II bridge scour analysis for structures 121007710700/30700 on Interstate 77, crossing Fishing Creek in Chester County, South Carolina

by Toby D. Feaster and Stephen T. Benedict

This report provides the results of the detailed Level II analysis of scour potential at structures 121007710700/30700 on Interstate 77, crossing Fishing Creek in Chester County, South Carolina (figure 1 in pocket; figures 7-10). The site is located in the high flow region of the Piedmont physiographic province near the town of Richburg in the eastern part of Chester County. The drainage area for the site is 134 mi^2, and is a predominately rural drainage basin with little development in recent years. In the vicinity of the study site, the land is covered by moderate to dense hardwoods with a small-grain field covering part of the upstream left flood plain.

In the study area, Fishing Creek has a meandering channel with a slope of approximately 0.0012 ft/ft (6.3 ft/mi), an average channel top width of 78 ft and an average channel depth of 11 ft. The predominant channel bed material is sand (D_{50} is 0.48 mm), and the channel banks consist of a silty clayey sand (D_{50} is 0.48 mm). In general, the banks have moderate woody vegetative cover. During the Level I site visit on July 9, 1990, the upstream banks were noted to be relatively stable. However, the downstream banks were experiencing mass wasting.

The Interstate 77 crossing of Fishing Creek consists of twin 400-ft-long, two-lane bridges having eight 50-ft concrete spans, supported by steel H-pile bents with spill through abutments. Structure 121007730700 is the upstream bridge located on the south bound lanes and structure 121007710700 is the downstream bridge located on the north bound lanes. The left and right abutments for both bridges are protected by 12- to 18-inch granite. In this report, the words "right" and "left" refer to directions that would be reported by an observer facing downstream. Additional details describing conditions at the site are included in the Scour Report Summary.

Scour depths were computed using engineering judgement and the general guidelines described in Hydraulic Engineering Circular 18 (Richardson and others, 1993) and the Transportation Research Board Draft Paper, "Evaluating scour at bridges using WSPRO" (Arneson and others, 1992). Scour depths were calculated assuming an infinite depth of erosive material and a homogeneous particle-size distribution. The results of the scour analysis are presented in tables 1 through 8 and graphs of the scour depths are presented in figures 2 and 4 for the Interstate 77 south and north bound bridges, respectively.

Scour depth calculations indicate that maximum pile tip exposure will occur at bent 6 for structure 121007730700 and bent 3 for structure 121007710700. At structure 121007730700, scour caused by the 100- and 500-year discharges will cause the pile tips at bent 6 to be exposed by 47.3 and 64.8 ft, respectively. Additionally, at structure 121007710700, scour caused by the 100- and 500-year discharges will cause the pile tips at bent 3 to be exposed by 46.4 and 63.9 ft, respectively. However, it should be noted that the SCDOT bridge plans (file number 12.477.4) show subsurface rock that could limit the scour depths. For additional information, refer to the SCDOT bridge plans located in the pocket at the back of this report.

Table 1. *--Remaining pile/footing penetration at piers/bents for the 100-year discharge at structure 121007730700 (south bound bridge) on Interstate 77, crossing Fishing Creek in Chester County, South Carolina*

Pier/bent [1] number	Station from [2] left end of bridge (feet)	Pile tip/[3] footing elevation, SCDOT datum (feet)	Pile tip/ footing elevation, USGS datum (feet)	Ground elevation at pier/bent, USGS datum (feet)	Total [4] scour depth (feet)	Elevation of scour, USGS datum (feet)	Remaining[5] pile/footing penetration (feet)
100-year discharge is 16,800 cubic feet per second							
8	50	451.4	56.5	75.3	9.2	66.1	9.6
7	100	452.4	57.5	69.7	54.3	15.4	-42.1
6	150	453.9	59.0	66.0	54.3	11.7	-47.3
5	200	456.0	61.1	74.0	54.3	19.7	-41.4
4	250	455.7	60.8	75.4	6.6	68.8	8.0
3	300	457.2	62.3	75.8	6.6	69.2	6.9
2	350	459.9	65.0	78.8	6.3	72.5	7.5

[1] Pier/bent number corresponds to South Carolina Department of Transportation bridge plans.

[2] Stations are determined from left to right looking downstream.

[3] Pile tip/footing elevations obtained from SCDOT bridge plans. The maximum elevation at each pier bent is used.

[4] Total scour depth is the sum of the contraction and pier/bent scour depths.

[5] A negative number signifies undermining of pile tip/footing.

NOTE: SCDOT bridge plan borings (file number 12.477.4) show subsurface rock that could limit the total scour depths. For more information, see the SCDOT bridge plans in the pocket at the back of this report.

Table 2. *--Remaining pile/footing penetration at piers/bents for the 500-year discharge at structure 121007730700 (south bound bridge) on Interstate 77, crossing Fishing Creek in Chester County, South Carolina*

Pier/bent [1] number	Station from [2] left end of bridge (feet)	Pile tip/[3] footing elevation, SCDOT datum (feet)	Pile tip/ footing elevation, USGS datum (feet)	Ground elevation at pier/bent, USGS datum (feet)	Total [4] scour depth (feet)	Elevation of scour, USGS datum (feet)	Remaining[5] pile/footing penetration (feet)
500-year discharge is 24,600 cubic feet per second							
8	50	451.4	56.5	75.3	8.8	66.5	10.0
7	100	452.4	57.5	69.7	71.8	-2.1	-59.6
6	150	453.9	59.0	66.0	71.8	-5.8	-64.8
5	200	456.0	61.1	74.0	71.8	2.2	-58.9
4	250	455.7	60.8	75.4	9.2	66.2	5.4
3	300	457.2	62.3	75.8	9.1	66.7	4.4
2	350	459.9	65.0	78.8	9.0	69.8	4.8

[1] Pier/bent number corresponds to South Carolina Department of Transportation bridge plans.

[2] Stations are determined from left to right looking downstream.

[3] Pile tip/footing elevations obtained from SCDOT bridge plans. The maximum elevation at each pier bent is used.

[4] Total scour depth is the sum of the contraction and pier/bent scour depths.

[5] A negative number signifies undermining of pile tip/footing.

NOTE: SCDOT bridge plan borings (file number 12.477.4) show subsurface rock that could limit the total scour depths. For more information, see the SCDOT bridge plans in the pocket at the back of this report.

Table 3. *--Remaining pile/footing penetration at piers/bents for the 100-year discharge at structure 121007710700 (north bound bridge) on Interstate 77, crossing Fishing Creek in Chester County, South Carolina*

Pier/bent [1] number	Station from[2] left end of bridge (feet)	Pile tip/[3] footing elevation, SCDOT datum (feet)	Pile tip/ footing elevation, USGS datum (feet)	Ground elevation at pier/bent, USGS datum (feet)	Total [4] scour depth (feet)	Elevation of scour, USGS datum (feet)	Remaining[5] pile/footing penetration (feet)
100-year discharge is 16,800 cubic feet per second							
8	50	453.3	58.4	75.1	9.2	65.9	7.5
7	100	455.1	60.2	75.7	9.2	66.5	6.3
6	150	453.7	58.8	74.2	54.3	19.9	-38.9
5	200	453.3	58.4	66.5	54.3	12.2	-46.2
4	250	451.6	56.7	66.1	54.3	11.8	-44.9
3	300	456.7	61.8	69.7	54.3	15.4	-46.4
2	350	456.0	61.1	76.4	6.3	70.1	9.0

[1] Pier/bent number corresponds to South Carolina Department of Transportation bridge plans.

[2] Stations are determined from left to right looking downstream.

[3] Pile tip/footing elevations obtained from SCDOT bridge plans. The maximum elevation at each pier bent is used.

[4] Total scour depth is the sum of the contraction and pier/bent scour depths.

[5] A negative number signifies undermining of pile tip/footing.

NOTE: SCDOT bridge plan borings (file number 12.477.4) show subsurface rock that could limit the total scour depths. For more information, see the SCDOT bridge plans in the pocket at the back of this report.

Table 4. *--Remaining pile/footing penetration at piers/bents for the 500-year discharge at structure 121007710700 (north bound bridge) on Interstate 77, crossing Fishing Creek in Chester County, South Carolina*

Pier/bent [1] number	Station from [2] left end of bridge (feet)	Pile tip/[3] footing elevation, SCDOT datum (feet)	Pile tip/ footing elevation, USGS datum (feet)	Ground elevation at pier/bent, USGS datum (feet)	Total [4] scour depth (feet)	Elevation of scour, USGS datum (feet)	Remaining[5] pile/footing penetration (feet)
500-year discharge is 24,600 cubic feet per second							
8	50	453.3	58.4	75.1	8.8	66.3	7.9
7	100	455.1	60.2	75.7	8.8	66.9	6.7
6	150	453.7	58.8	74.2	71.8	2.4	-56.4
5	200	453.3	58.4	66.5	71.8	-5.3	-63.7
4	250	451.6	56.7	66.1	71.8	-5.7	-62.4
3	300	456.7	61.8	69.7	71.8	-2.1	-63.9
2	350	456.0	61.1	76.4	9.0	67.4	6.3

[1] Pier/bent number corresponds to South Carolina Department of Transportation bridge plans.

[2] Stations are determined from left to right looking downstream.

[3] Pile tip/footing elevations obtained from SCDOT bridge plans. The maximum elevation at each pier bent is used.

[4] Total scour depth is the sum of the contraction and pier/bent scour depths.

[5] A negative number signifies undermining of pile tip/footing.

NOTE: SCDOT bridge plan borings (file number 12.477.4) show subsurface rock that could limit the total scour depths. For more information, see the SCDOT bridge plans in the pocket at the back of this report.

Table 5. --*Cumulative scour depths at piers/bents for the 100-year discharge at structure 121007730700 (south bound bridge) on Interstate 77, crossing Fishing Creek in Chester County, South Carolina*

Pier/bent [1] number	Station from [2] left end of bridge (feet)	Contraction scour depth (feet)	Pier/bent scour depth **without** debris (feet)	Total [3] scour depth **without** debris (feet)
100-year discharge is 16,800 cubic feet per second				
8	50	2.6	6.6	9.2
7	100	45.8	8.5	54.3
6	150	45.8	8.5	54.3
5	200	45.8	8.5	54.3
4	250	0.0[4]	6.6	6.6
3	300	0.0[4]	6.6	6.6
2	350	0.0[4]	6.3	6.3

[1] Pier/bent number corresponds to South Carolina Department of Transportation bridge plans.

[2] Stations are determined from left to right looking downstream.

[3] Total scour depth is the sum of the contraction and pier/bent scour depths.

[4] The calculated contraction scour is a negative value, but was set equal to zero to reflect a more reasonable estimate of scour during peak flood conditions.

NOTE: SCDOT bridge plan borings (file number 12.477.4) show subsurface rock that could limit the total scour depths. For more information, see the SCDOT bridge plans in the pocket at the back of this report.

NOTE: The pier and contraction scour equations used in this scour analysis were those recommended in Hydraulic Engineering Circular 18 (Richardson and others, 1993). Scour depths were calculated assuming an infinite depth of erosive material and a homogeneous particle-size distribution.

Table 6. *--Cumulative scour depths at piers/bents for the 500-year discharge at structure 121007730700 (south bound bridge) on Interstate 77, crossing Fishing Creek in Chester County, South Carolina*

Pier/bent [1] number	Station from [2] left end of bridge (feet)	Contraction scour depth (feet)	Pier/bent scour depth **without** debris (feet)	Total [3] scour depth **without** debris (feet)
500-year discharge is 24,600 cubic feet per second				
8	50	0.6	8.2	8.8
7	100	62.4	9.4	71.8
6	150	62.4	9.4	71.8
5	200	62.4	9.4	71.8
4	250	2.8	6.4	9.2
3	300	2.8	6.3	9.1
2	350	2.8	6.2	9.0

[1] Pier/bent number corresponds to South Carolina Department of Transportation bridge plans.

[2] Stations are determined from left to right looking downstream.

[3] Total scour depth is the sum of the contraction and pier/bent scour depths.

NOTE: SCDOT bridge plan borings (file number 12.477.4) show subsurface rock that could limit the total scour depths. For more information, see the SCDOT bridge plans in the pocket at the back of this report.

NOTE: The pier and contraction scour equations used in this scour analysis were those recommended in Hydraulic Engineering Circular 18 (Richardson and others, 1993). Scour depths were calculated assuming an infinite depth of erosive material and a homogeneous particle-size distribution.

Table 7. --*Cumulative scour depths at piers/bents for the 100-year discharge at structure 121007710700 (north bound bridge) on Interstate 77, crossing Fishing Creek in Chester County, South Carolina*

Pier/bent [1] number	Station from [2] left end of bridge (feet)	Contraction scour depth (feet)	Pier/bent scour depth **without** debris (feet)	Total [3] scour depth **without** debris (feet)
100-year discharge is 16,800 cubic feet per second				
8	50	2.6	6.6	9.2
7	100	2.6	6.6	9.2
6	150	45.8	8.5	54.3
5	200	45.8	8.5	54.3
4	250	45.8	8.5	54.3
3	300	45.8	8.5	54.3
2	350	0.0[4]	6.3	6.3

[1] Pier/bent number corresponds to South Carolina Department of Transportation bridge plans.

[2] Stations are determined from left to right looking downstream.

[3] Total scour depth is the sum of the contraction and pier/bent scour depths.

[4] The calculated contraction scour is a negative value, but was set equal to zero to reflect a more reasonable estimate of scour during peak flood conditions.

NOTE: SCDOT bridge plan borings (file number 12.477.4) show subsurface rock that could limit the total scour depths. For more information, see the SCDOT bridge plans in the pocket at the back of this report.

NOTE: The pier and contraction scour equations used in this scour analysis were those recommended in Hydraulic Engineering Circular 18 (Richardson and others, 1993). Scour depths were calculated assuming an infinite depth of erosive material and a homogeneous particle-size distribution.

Table 8. --*Cumulative scour depths at piers/bents for the 500-year discharge at structure 121007710700 (north bound bridge) on Interstate 77, crossing Fishing Creek in Chester County, South Carolina*

Pier/bent [1] number	Station from [2] left end of bridge (feet)	Contraction scour depth (feet)	Pier/bent scour depth **without** debris (feet)	Total [3] scour depth **without** debris (feet)
500-year discharge is 24,600 cubic feet per second				
8	50	0.6	8.2	8.8
7	100	0.6	8.2	8.8
6	150	62.4	9.4	71.8
5	200	62.4	9.4	71.8
4	250	62.4	9.4	71.8
3	300	62.4	9.4	71.8
2	350	2.8	6.2	9.0

[1] Pier/bent number corresponds to South Carolina Department of Transportation bridge plans.

[2] Stations are determined from left to right looking downstream.

[3] Total scour depth is the sum of the contraction and pier/bent scour depths.

NOTE: SCDOT bridge plan borings (file number 12.477.4) show subsurface rock that could limit the total scour depths. For more information, see the SCDOT bridge plans in the pocket at the back of this report.

NOTE: The pier and contraction scour equations used in this scour analysis were those recommended in Hydraulic Engineering Circular 18 (Richardson and others, 1993). Scour depths were calculated assuming an infinite depth of erosive material and a homogeneous particle-size distribution.

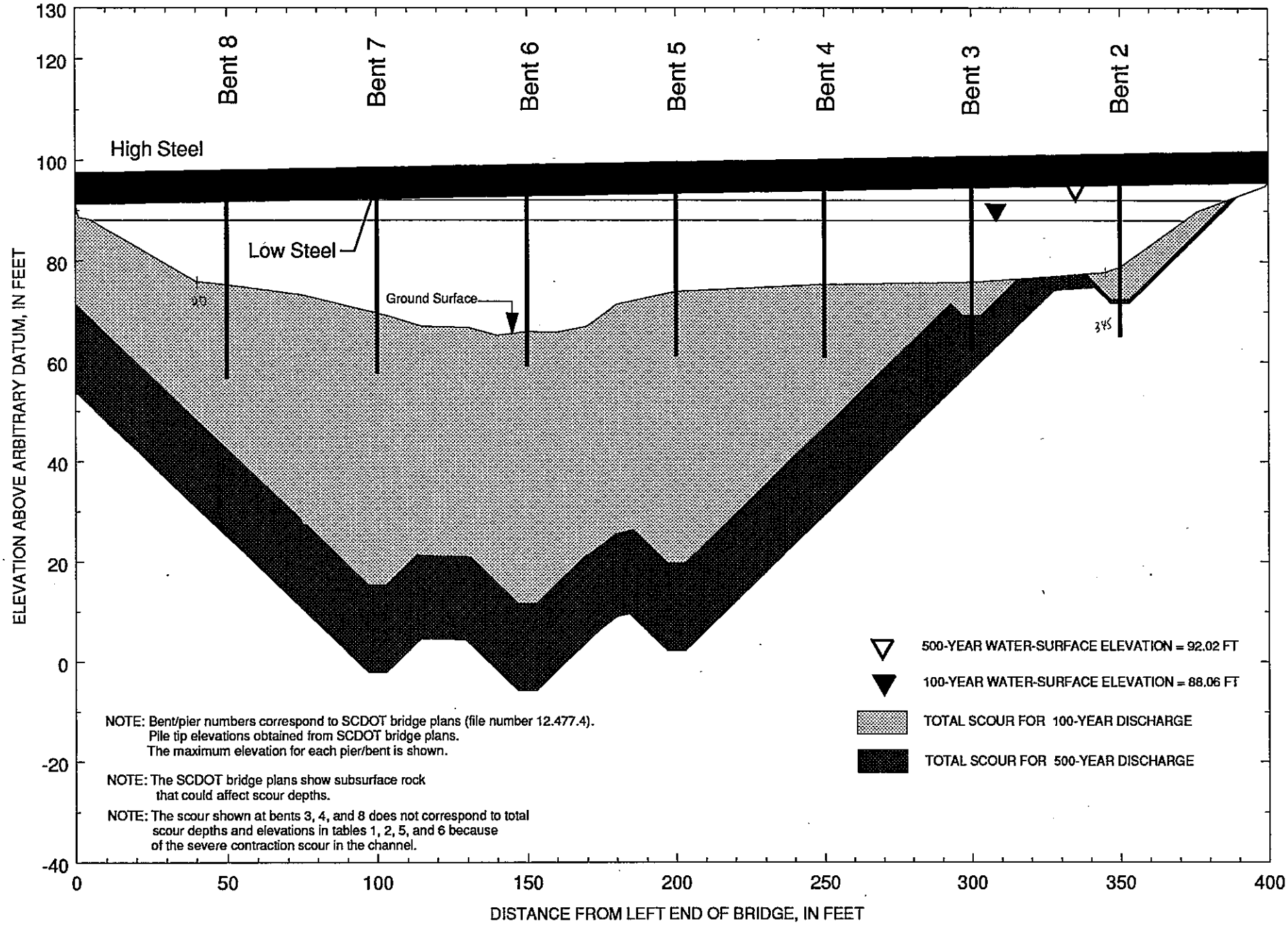

Figure 2.--Total scour depths for the 100- and 500-year discharges on the upstream bridge face at structure 121007730700 (south bound bridge) on Interstate 77, crossing Fishing Creek in Chester County, South Carolina.

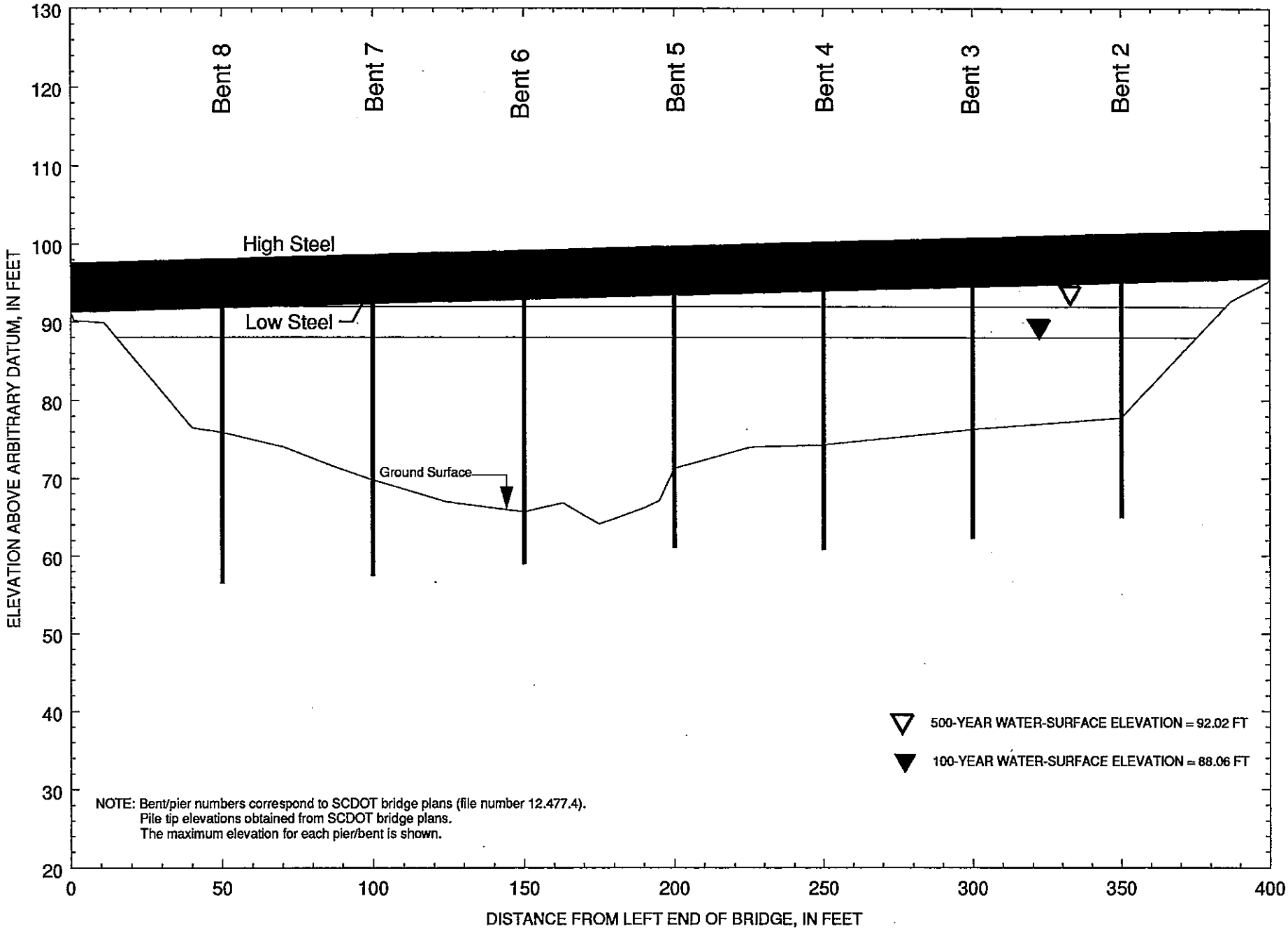

Figure 3.--Downstream face at structure 121007730700 (south bound bridge) on Interstate 77, crossing Fishing Creek in Chester County, South Carolina.

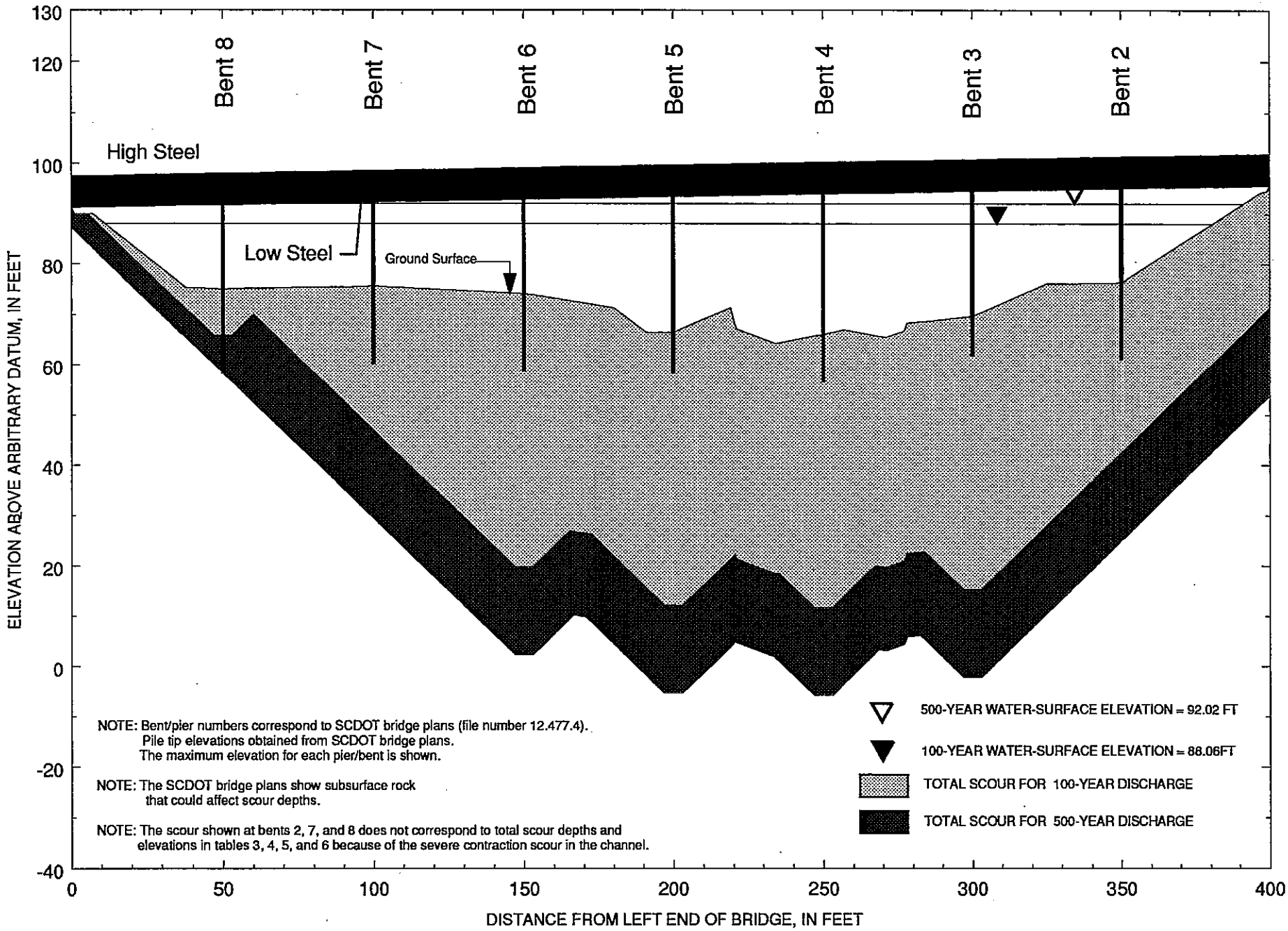

Figure 4.--Total scour depths for the 100- and 500-year discharges on the downstream bridge face at structure 121007710700 (north bound bridge) on Interstate 77, crossing Fishing Creek in Chester County, South Carolina.

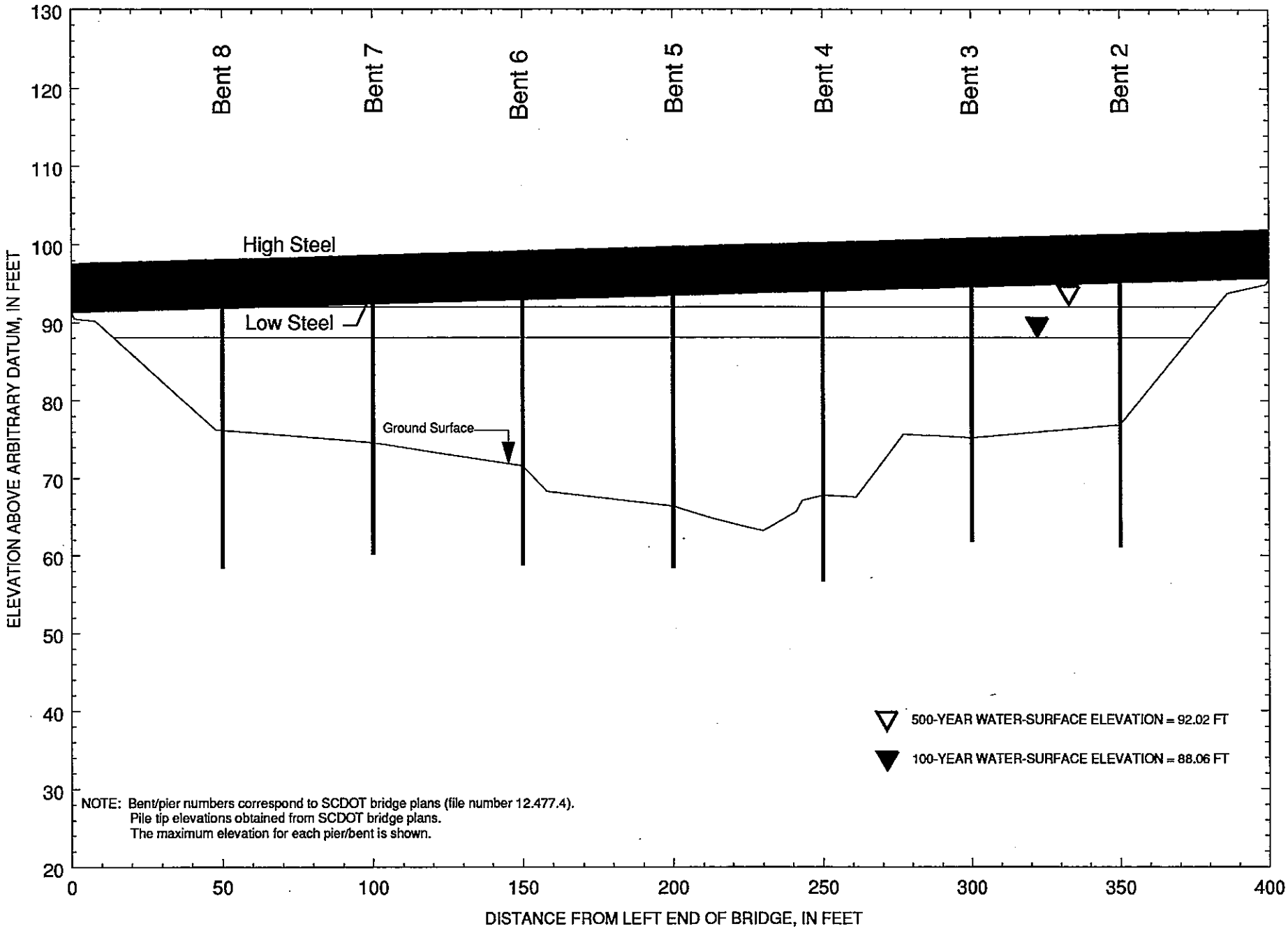

Figure 5.--Upstream face at structure 121007710700 (north bound bridge) on Interstate 77, crossing Fishing Creek in Chester County, South Carolina.

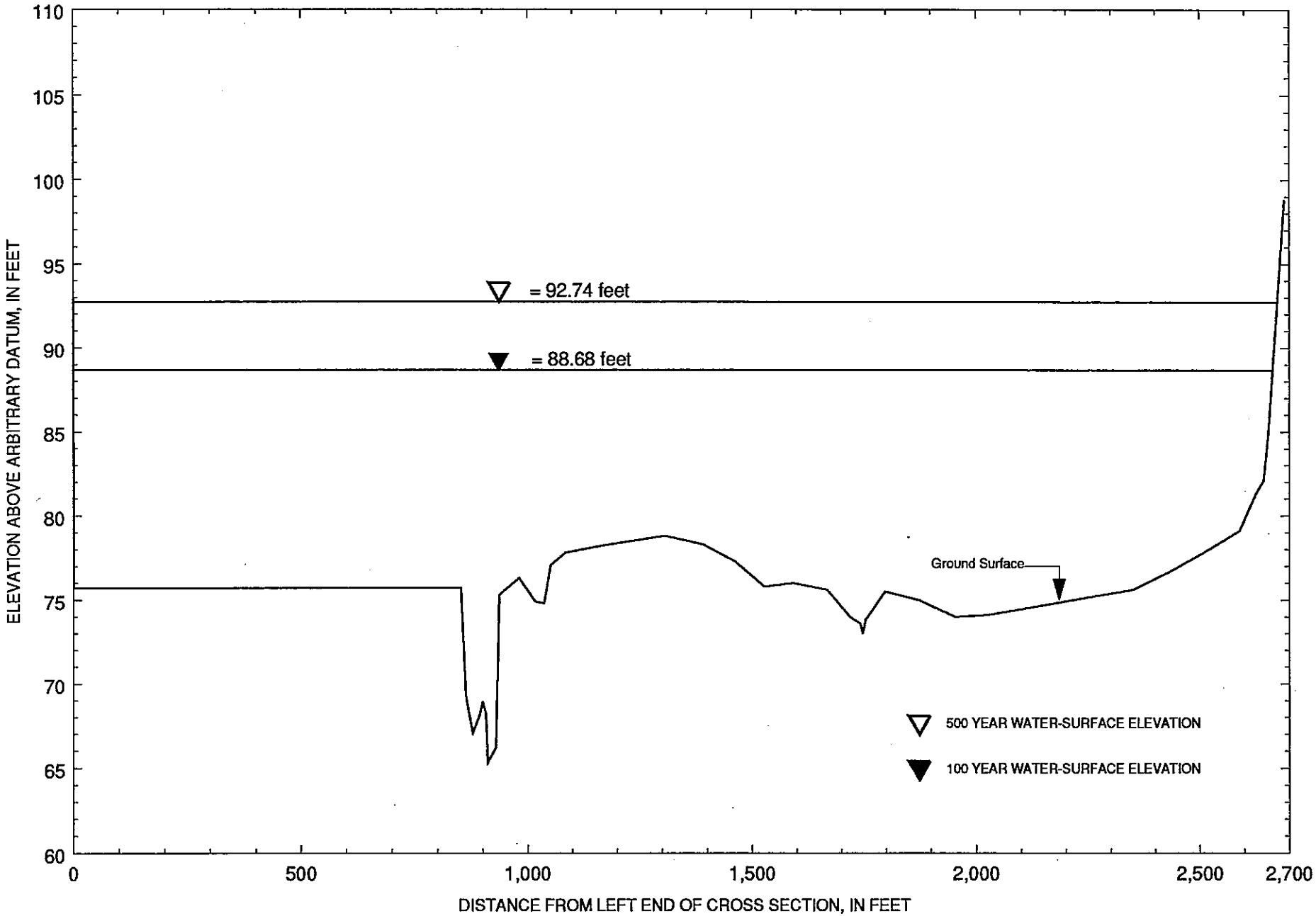

Figure 6.--Approach cross section at structures 121007710700/30700 on Interstate 77, crossing Fishing Creek in Chester County, South Carolina.

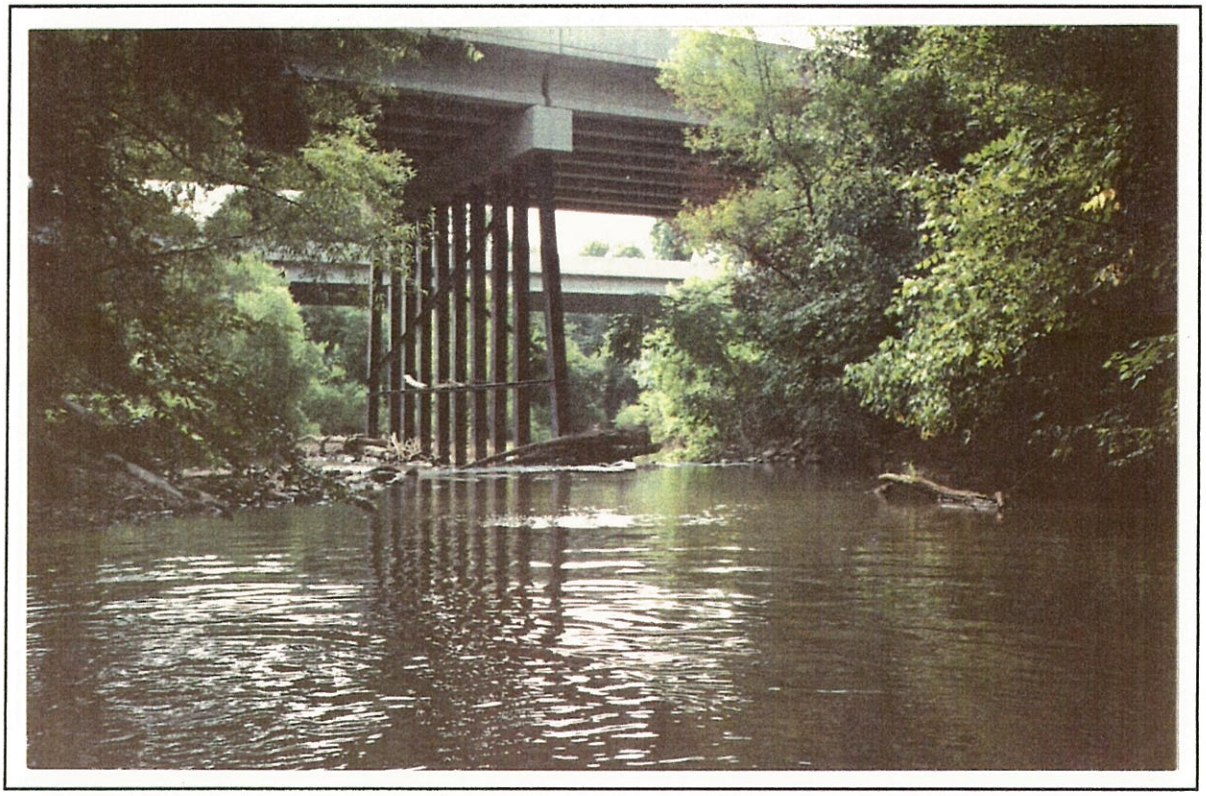

Figure 7.--Structures 121007710700/30700 on Interstate 77, crossing Fishing Creek in Chester County, South Carolina as viewed from the upstream channel (July 9, 1990).

Figure 8.--Structures 121007710700/30700 on Interstate 77, crossing Fishing Creek in Chester County, South Carolina as viewed from the downstream channel (July 9, 1990).

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SCOUR REPORT SUMMARY

Structure Number 121007710700/30700 *Stream* Fishing Creek

County Chester *Road* I-77 *District* 4

Description of Bridge

Bridge length 400 *ft* *Bridge width: each(total)* 45(165) *ft* *Max span length* 50 *ft*

Alignment of bridge to road (on curve or straight) straight

Abutment type spillthrough *Embankment type* sloping

Riprap on abutment? yes *Date of inspection* 7-9-1990

Description of riprap 12- to 18-inch granite on all abutments in good condition

Brief description of piers/pile bents Each bridge is supported by 8 interior pile bents, consisting of 10 steel H-piles (1.0 ft x 1.0 ft).

Is bridge skewed to flood plain according to USGS topo map? yes *Angle* 22

Is bridge located on a bend in channel? yes *If so, describe (mild, moderate, severe)*
Moderate bend with a left bank impact point at 150 ft upstream and a right bank impact point at 150 ft downstream at the time of the Level I site visit on July 9, 1990.

Debris accumulation on bridge at time of Level I or Level II site visit:

	Date of inspection	*Percent of channel blocked horizontally*	*Percent of channel blocked vertically*
Level I	7-9-1990	20	60
Level II	---	---	---

Potential for debris Moderate to high because of bank failure and heavy debris on the flood plains.

Describe any features near or at the bridge that may affect flow (include observation date).
None observed.

Description of Flood Plain

General topography Typical Piedmont topography with rolling hills.

Flood-plain conditions at bridge site: downstream (D/S), upstream (U/S)

Date of inspection 6-29-92

D/S left: Moderately thick hardwoods with moderate to thick undergrowth.

D/S right: Moderately thick hardwoods with moderate to thick undergrowth.

U/S left: Small grain field with moderately thick hardwoods along channel.

U/S right: Moderately thick hardwoods with moderate to thick undergrowth.

Description of Channel

Average top width 78 *ft* *Average depth* 11 *ft*

Predominant bed material sand *Bank material* silt/clay/sand

Stream type (straight, meandering, braided, swampy, channelized) meandering

Vegetative cover on channel banks near bridge: Date of inspection 6-29-1992

D/S left: Fully covered with hardwoods and undergrowth.

D/S right: Fully covered with hardwoods and undergrowth.

U/S left: Fully covered with hardwoods and undergrowth.

U/S right: Fully covered with hardwoods and undergrowth.

Do banks appear stable? no *If not, describe location and type of instability and date of observation.* Upstream banks were noted as stable during Level I site visit on July 9, 1990. However, both downstream banks were noted as having mass wasting.

Describe any obstructions in channel and date of observation. None observed.

Hydrology

Drainage area 134 mi^2

Percentage of drainage area in physiographic provinces:

Physiographic province	*Percent of drainage area*
Piedmont (High Flow)	100

Is drainage area considered rural or urban? rural *Describe any significant urbanization and potential for development.* Moderate potential for development. Basin presently has no significant urbanization but may experience future development due to the commercial and industrial growth near I-77 at Richburg, SC.

Is there a USGS gage on the stream of interest? no

USGS gage description _____

USGS gage number _____

Gage drainage area _____ mi^2

Is there a lake/pond that will significantly affect hydrology/hydraulics? no

If so, describe _____

Calculated Discharges

Q100 16,800 ft^3/s *Q500* 24,600 ft^3/s

Method used to determine discharges The drainage basin is located in the "high flow" area of SC; therefore, the method prescribed by C. L. Sanders (written communication, 11-1993) was used to compute flood discharges. In general, this method uses North Carolina USGS flood discharge equations (WRIR 87-4096) to compute the 100-year discharge, and extrapolates the 500-year discharge from the NC equations using the 2-, 10-, and 100-year floods and methods on page 5-2 of USGS Bulletin 17b.

Brief Description of the Water-Surface Profile Model (WSPRO) Analysis

Datum for WSPRO analysis (USGS survey, sea level, SCDOT plans) USGS survey

Datum tie between USGS survey and SCDOT plans Add 394.92 ft to USGS survey datum to obtain SCDOT plans' datum (file number 12.477.4).

Description of reference marks used to determine USGS datum. RM1 is a chiseled square on the D/S right headwall of I-77 N with an assumed elevation of 100.00 ft. RM 2 is a chiseled square on the D/S left headwall of I-77 N with a surveyed elevation of 95.64 ft. RM 3 is chiseled square on U/S right headwall of I-77 S with a surveyed elevation of 100.04 ft. RM 4 is a chiseled square on the D/S left headwall of I-77 S with a surveyed elevation of 95.72 ft.

Cross-Sections Used in WSPRO Analysis

*Cross-section ID	Section Reference Distance (SRD) in feet	**How cross-section was developed	Comments
TEMP8	-7030	4	Synthesized section
TEMP7	-6280	4	Synthesized section
SYN6	-5280	4	Synthesized section
RTMP1	-4932	2	Synthesized section
RTMP2	-4920	1	Surveyed section
SYN5	-4740	4	Synthesized section
SYN4	-4560	4	Synthesized section
TEMP3	-3810	2 & 3	Synthesized section
TEMP2	-2480	2 & 3	Synthesized section
TEMP1	-1150	1	Surveyed section
EXIT	-400	2 & 3	Exit for I-77
FULV	0	2 & 3	Full Valley for I-77
BRIDG	0	1	Bridge for I-77
APPR	565	1	Approach for I-77

* For location of cross-sections see topographic map included with report (figure 1). For more detail on how cross-sections were developed see WSPRO input file.

** Cross-section development: 1) survey at SRD 2) shift of survey data to SRD 3) modification of survey data based on topographic map 4) synthesized by combining channel survey data and topographic contours 5) other

Description of data and assumptions used in developing WSPRO model.

The WSPRO analysis was done using the data from the most constricted bridge face (U/S face of the U/S bridge) at the I-77 crossing of Fishing Creek. The starting water-surface elevation was obtained by the slope/conveyance method.

The SYN and TEMP templates were synthesized by taking the EXIT section survey data in conjunction with the USGS topographic map contours to determine cross section geometry. This was done by assuming the flood plain was flat from the channel banks to contour 144 m (472 ft) at which point the land starts to rise sharply.

A Seaboard Railway trestle crosses the channel at approximately 4,920 ft downstream and was included in the model to account for the constriction of the flood plain. The slope used to transfer data points downstream of the railroad was 0.0012 ft/ft and was obtained from a USGS topographic map. The slope used to transfer data points from the EXIT section to the railway section was 0.00066 ft/ft and was obtained from channel data taken from the EXIT survey and the railway survey.

SYN1 data was synthesized from the surveyed section taken at 1,150 ft downstream of the bridge and was used to represent the full valley cross section. The flat portion of the flood plain was extended based on USGS topographic map contours using an average flood plain elevation. This section was adjusted by the GT card in WSPRO to represent the EXIT cross section.

An APPROACH section survey was taken at one bridge width upstream. The data were adjusted on the left flood plain to account for the survey data not being taken perpendicular to the flood plain. The left flood plain data was skewed based on an angle taken from the USGS topographic map and truncated where the flood plain intersects the I-77 road embankment. The right flood plain data did not need to be adjusted.

Bridge Hydraulics

Average embankment elevation 97.0 *ft*

Average low steel elevation 93.5 *ft*

100-year discharge 16,800 ft^3/s

Water-surface elevation at D/S bridge face 88.06 *ft*

Area of flow at D/S bridge face 4,668 ft^2

Average velocity in bridge opening 3.60 *ft/s*

Maximum WSPRO tube velocity at bridge 5.99 *ft/s*

Water-surface elevation at Approach section with bridge 88.68 *ft*

Water-surface elevation at Approach section without bridge 88.13 *ft*

Amount of backwater caused by bridge 0.55 *ft*

500-year discharge 24,600 ft^3/s

Water-surface elevation at D/S bridge face 92.02 *ft*

Area of flow at D/S bridge face 6,028 ft^2

Average velocity in bridge opening 4.08 *ft/s*

Maximum WSPRO tube velocity at bridge 7.20 *ft/s*

Water-surface elevation at Approach section with bridge 92.74 *ft*

Water-surface elevation at Approach section without bridge 92.11 *ft*

Amount of backwater caused by bridge 0.63 *ft*

Scour

Describe any special assumptions or considerations made in bridge scour analysis.

Scour depths were computed using engineering judgement and the general guidelines described in Hydraulic Engineering Circular 18 (Richardson and others, 1993) and the Transportation Research Board Draft Paper, "Evaluating scour at bridges using WSPRO" (Arneson and others, 1992). Scour depths were calculated assuming an infinite depth of erosive material and a homogeneous particle-size distribution. The results of the scour analysis are presented in tables 1 through 8 and graphs of the total scour depths are shown in figures 2 and 4. Figures 3 and 5 were included to show how the channel shifts as it progresses from the upstream face of the south bound bridge to the downstream face of the north bound bridge.

The most constricted bridge face cross section (U/S face of U/S bridge) at the Interstate 77 crossing of Fishing Creek was used for the WSPRO and scour analysis. A comparison of the U/S and D/S bridge face cross sections for the Interstate 77 north and south bound bridges showed that the channel geometry for all four cross sections was very similar. Therefore, the most constricted bridge face cross section was representative of the hydraulic and scour conditions at both bridges.

The local pier scour was determined using the Colorado State University pier scour equation (Richardson and others, 1993). Bent 8 is located on the left overbank and was analyzed using the maximum left overbank WSPRO tube velocity and the depth of flow at the bent. Bents 2 through 4 are located on the right overbank and were analyzed using the maximum right overbank WSPRO tube velocity and the depth of flow at each bent. Bents 6 and 7 are channel bents and were analyzed using 90 percent of the maximum WSPRO tube velocity and the maximum depth within the channel to account for possible changes in the thalweg during a flood event. Bent 5 is located near the top of the bank and was analyzed like channel bents 6 and 7 to account for the possibility of a shift in the channel during a flood event.

As previously stated, the channel shifts to the right from the U/S bridge to the D/S bridge. As shown in figure 2 (U/S face of U/S bridge), bents 6 and 7 are located within the channel and bent 5 is at the right top bank. However, in figure 4 (D/S face of D/S bridge), bent 6 is located near the left top bank and bents 3, 4, and 5 are located within the channel. Because of the similarity in cross sections at both bridges, it was assumed that the scour computations developed using the U/S face of the U/S bridge would be applicable to both bridges. Therefore, figure 4 was generated by applying the scour results from the upstream bridge face of the upstream bridge (I-77 S) to the downstream bridge face of the downstream bridge (I-77 N) in the following manner: the left overbank contraction scour and the pier/bent scour from bent 8 of I-77 S were applied to bents 7 and 8 of I-77 N, the live-bed channel scour and pier/bent scour from bents 5 through 7 of I-77 S were applied to bents 3 through 6 of I-77 N, and the right overbank contraction scour and pier/bent scour from bent 2 of I-77 S were applied to bent 2 of I-77 N , respectively. In addition, figures 3 and 5 were included to indicate the location of the channel and the respective channel bents at the other bridge faces.

The left and right overbanks at the bridge were analyzed for contraction scour using Larsen's clear-water contraction scour equation (Richardson and others, 1993). The channel contraction scour was analyzed using Larsen's modified live-bed contraction scour equation (Richardson and others, 1993).

The live-bed scour results indicate an unusually large amount of scour in the channel. There are several factors which would tend to increase the channel scour at this location. This site is located in the "high flow" area of the Piedmont physiographic province where the regional regression equations do not apply. Thus, a method recommended by Curtis L. Sanders (written communication, 11-1993) was used to determine the 100- and 500-year discharges. This resulted in discharges that were approximately 62 and 82 percent higher than the results obtained by using the regular Piedmont regression equations (Guimaraes and Bohman, 1988), respectively. In addition, the approach section has a wide flood plain

(approximately 2,600 ft) that is contracted to a 400 ft opening at the bridges. Furthermore, the overbanks at the bridges are covered by small trees with heavy underbrush which would tend to force more of the flow into the channel at the bridge.

It should be noted that the SCDOT bridge plan borings (file number 12.477.4) show subsurface rock that could limit the scour depths shown in this study. For more information, see the SCDOT bridge plans in the pocket at the back of the report.

The clear-water contraction scour equation indicates the deposition of sediment on the right overbank at the bridge during a 100-year flood event (see negative scour values determined in scour calculations). However, it seems unreasonable to expect deposition at the bridge during peak flood conditions. Therefore, the negative scour values were set equal to zero as reflected in tables 5 and 7 and figure 2.

No abutment scour computations were made because the abutments are protected by riprap.

WSPRO INPUT FILE

```
T1        Structure #: 121007710700/30700   (400 ft Twin Bridge)
T2        Fishing Creek at I-77 N&S  File name: fish.i77
T3        Chester County, South Carolina   TDF 4/21/94
*
*         Q100    Q500
Q         16800   24600
SK        .0012   .0012
*
*         The SYN and TEMP templates were synthesized by taking the EXIT
*         section survey data in conjunction with the USGS topographic map contours
*         to determine cross section geometry. This was done by assuming the
*         144 meter (472 ft) contour was the edge of the flood plain where the land
*         starts to rise sharply. The slope used to transfer data points from the
*         EXIT section to the Railway section was 0.00066 ft/ft and was obtained
*         from the channel survey data at those two locations. The slope
*         below the Railway trestle is 0.0012 ft/ft and was obtained from the
*         USGS topographic map.
*
*
XT   SYN7  -6280  0.0012
GR           0    99.8  100  89.8   180   79.8   240   69.8   270   69.8
GR         273    66.7  277  63.9   280   61.4   287   59.6   293   60.4
GR         304    60.6  319  60.4   336   60.9   345   62.3   350   69.8
GR         420    69.8  720  79.8   890   89.8  1090   99.8
*
XS   TEMP8 -7030
GT
*          "n" values were based on the topography being very similar
*          to the topography at the SURV section where the values were
*          obtained.
*
N          0.17          0.06          0.19
SA                270           350
PX
*
XS   TEMP7 -6280
GT
PX
*
XS   SYN6  -5280
GR           0   101.0  200  91.0   490   81.0   670   71.0   700   71.0
GR         703    67.9  707  65.1   710   62.6   717   60.8   723   61.6
GR         734    61.8  749  61.6   766   62.1   775   63.5   780   71.0
GR         820    71.0  890  81.0   940   91.0   970  101.0
N          0.17          0.06          0.19
SA                700           780
PX
*
*         RAILR data was surveyed at the Seaboard railway trestle at
*         4,920 ft D/S with the distance being determined from the USGS
*         topographic map. Piers were included as part of the cross section.
*         The slope was determined from survey data taken
*         between the Exit section and the Railway crossing.
*
XT   RAILR  -4920
GR           0   102.7   34    87.9    34   102.7   41    102.7   41    90.3
GR          45    85.8   45    82.2    49    80.2   71    72.7    88    76.5
GR          88   102.7   96   102.7    96    77.2  135    69.4   143    64.1
```

```
GR          157    61.6  173    61.3   187   61.6    199   62.9   209   68.1
GR          238    77.8  238   102.9   245  102.9    245   78.9   251   78.9
GR          268   88.9   283    99.0   295  102.9
*
*           Two templates, RTMP1 and RTMP2, were included to model the U/S
*           and D/S face of the Railway cross section.
*
XS   RTMP1  -4932
GT
N           0.054
PX
*
XS   RTMP2  -4920
GT
*
XS   SYN5   -4740
GR            0   102.0  100    92.0   400   82.0    460   71.6   510   71.6
GR          513   68.5   517    65.7   520   63.2    527   61.4   533   62.2
GR          544   62.4   559    62.2   576   62.7    585   64.1   590   71.6
GR          640   71.6   720    82.0   810   92.0    930  102.0
N          0.17           0.06          0.19
SA                 510           590
*         PX
*
XS   SYN4   -4560
GR            0   102.0  200    92.0   480   82.0    630   71.8   680   71.8
GR          683   68.7   687    65.9   690   63.4    697   61.6   703   62.4
GR          714   62.6   729    62.4   746   62.9    755   64.3   760   71.8
GR          810   71.8   910    82.0  1060   92.0   1240  102.0
N         0.17           0.06          0.19
SA                 680           760
PX
*
*           Elevations for SYN3 and SYN2 were taken from the SURV section.
*           Distances were expanded based on ratios of distances between
*           contours at SURV and the respective SYN sections.
*
XT   SYN3   -1150  0.00066
GR            0  100.0    88    96.5   188   92.0    300   88.8   400   87.5
GR          472   85.0   583    81.2   712   78.0    751   75.8   763   74.1
GR          782   73.3   840    73.5   935   73.4    985   74.3  1047   73.6
GR         1102   74.0  1171    74.9  1250   74.6   1253   70.9  1257   68.1
GR         1260   65.6  1267    63.8  1273   64.6   1284   64.8  1299   64.6
GR         1316   65.1  1325    66.5  1330   73.6   1342   73.5  1409   76.1
GR         1467   77.0  1500    77.2  1611   77.7   1684   77.4  1786   77.1
GR         1877   78.7  1899    80.2  1974   86.7   2078   97.1
*
XS   TEMP3  -3810
GT
N         0.17           0.06          0.19
SA                1250          1330
PX
*
*
XT   SYN2   -1150  0.00066
GR            0  100.0    22    96.5    47   92.0     75   88.8   124   85.0
GR          161   81.2   204    78.0   254   74.6    304   74.6   307   70.9
GR          311   68.1   314    65.6   321   63.8    327   64.6   338   64.8
```

```
GR          353   64.6   370   65.1   379    66.5   384   73.6   430   73.5
GR          687   76.1   908   77.0  1034    77.2  1217   77.7  1338   77.4
GR         1506   77.1  1656   78.7  1693    80.2  1787   86.7  1917   97.1
*
XS    TEMP2  -2480
GT
N          0.17         0.06         0.19
SA                304          384
*
*          The FL card was added to account for the difference in the flow
*          length in the channel and the flow length in the flood plain between
*          TEMP2 and TEMP3.
*
FL         800    304    1330    384    1100
PX
*
*          SURV data was taken from the EXIT section survey at a distance
*          of 1,150 ft D/S. The distance was obtained from the topographic map.
*
XT    SURV   -1150  0.0012
GR              0   100.0     22    96.5     47    92.0     75    88.8
GR            124    85.0    161    81.2    204    78.0    232    75.8
GR            241    74.1    255    73.3    297    73.5    366    73.4
GR            402    74.3    447    73.6    487    74.0    537    74.9
GR            569    73.6    615    73.7    664    72.5    678    72.1
GR            684    71.3    704    73.4    762    74.4    767    74.6
GR            770    70.9    774    68.1    777    65.6    784    63.8
GR            790    64.6    801    64.8    816    64.6    833    65.1
GR            842    66.5    847    73.6    861    73.5    940    76.1
GR           1008    77.0   1147    77.7   1213    77.4   1305    77.1
GR           1387    78.7   1477    86.7   1574    97.1
*
XS    TEMP1  -1150
GT
N            0.17           0.06           0.19
SA                   767            847
*
*          The FL card was needed to account for the difference of the
*          flow length in the channel and the flow length in the flood plain
*          between TEMP1 and the SURV section.
*
FL         900    767    1330    847    1100
PX
*
*             SYN1 data was synthesized from the SURV section to represent
*             a cross section at the FULV section. The flat portion
*             of the flood plain was extended based on USGS topographic map
*             contours using an average flood plain elevation. This section was
*             adjusted by the GT scale factor to represent a cross section
*             at the EXIT section.
*
XT    SYN1   -1150  0.0012
GR              0  100.0    22   96.5    47   92.0    75   88.8   124   85.0
GR            161   81.2   204   78.0   232   75.8   241   74.1  1100   74.1
GR           1103   70.9  1107   68.1  1110   65.6  1117   63.8  1123   64.6
GR           1134   64.8  1149   64.6  1166   65.1  1175   66.5  1180   73.6
GR           1194   73.5  1273   76.1  1341   77.0  1480   77.7  1546   77.4
GR           1638   77.1  1720   78.7  1810   86.7  1907   97.1
```

```
*
XS   EXIT    -400
GT        * * * 0.88
N           0.17          0.06          0.19
SA                 968             1038
PX
*
XS   FULV      0
GT
N           0.14          0.051         0.19
SA                 1100          1180
PX
*
*
*          U/S Face of U/S Bridge
*
BR   BRIDG     0      93.5      22
GR            1      91.3      1.1     88.6       5      88.1       40      75.9
GR           50      75.3       75     73.3     100      69.7      115      67.0
GR          130      66.8      140     65.2     150      66.0      160      65.8
GR          170      67.0      180     71.4     200      74.0      250      75.4
GR          300      75.8      345     77.8     350      78.8      376      89.8
GR          398.9    94.9      399     95.7       1      91.3
*
*          The overbank "n" value at the bridge accounts for the thick and
*          high, woody material with underbrush between the bridges.
*
N           0.10           0.051           0.10
SA                   75              200
PW 1        66.0    1.0       69.7    1.0     69.7      2.0      74.0      2.0
PW 1        74.0    3.0       75.4    3.0     75.4      5.0      75.8      5.0
PW 1        75.8    6.0       78.8    6.0     78.8      7.0      91.7      7.0
PW 1        95.0    0.0
CD          3  165  2  97.0
*
*          APPROACH Section was obtained by using the survey data taken at one
*          bridge width U/S in conjunction with the USGS topographic map.
*          The left flood plain data was skewed in order to be placed
*          perpendicular to the flood plain.
*
AS   APPR    565
GR             0     93.0       1     75.7     852      75.7      863      69.3
GR           870     68.2     878     67.1     893      68.1      900      68.9
GR           907     68.2     911     65.3     929      66.2      937      75.3
GR           981     76.3    1017     74.9    1037      74.8     1052      77.1
GR          1085     77.8    1165     78.2    1307      78.8     1391      78.3
GR          1461     77.3    1528     75.8    1592      76.0     1668      75.6
GR          1719     74.0    1742     73.6    1748      73.0     1754      73.8
GR          1798     75.5    1874     75.0    1953      74.0     2026      74.1
GR          2238     75.1    2350     75.6    2435      76.7     2502      77.7
GR          2589     79.1    2626     81.3    2643      82.1     2654      84.9
GR          2689     98.8
N           0.11           0.06           0.19
SA                   852             937
*
*

*          The reference point for the BP card was obtained from
```

```
*           survey data at the bridge and full valley section.
*
BP          752
PX
*
HP 1 BRIDG  88.06   0    88.06
HP 2 BRIDG  88.06   0    88.06    16800
HP 2 BRIDG  88.21   0    88.21    16800
HP 1 APPR   88.71   0    88.71
HP 2 APPR   88.71   0    88.71    16800
*
HP 1 BRIDG  92.01   0    92.01
HP 2 BRIDG  92.01   0    92.01    24600
HP 2 BRIDG  92.18   0    92.18    24600
HP 1 APPR   92.78   0    92.78
HP 2 APPR   92.78   0    92.78    24600
EX
ER
```

WSPRO OUTPUT

```
WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure #: 121007710700/30700   (400 ft Twin Bridge)
        Fishing Creek at I-77 N&S  File name: fish.i77
        Chester County, South Carolina   TDF 4/21/94
           *** RUN DATE & TIME: 04-21-94  14:52
    CROSS-SECTION PROPERTIES:  ISEQ = 13;  SECID = BRIDG;  SRD =       0.

     WSEL  SA#      AREA         K    TOPW    WETP   ALPH     LEW     REW      QCR
             1      631.    41898.    65.     67.                             11177.
             2     2231.   462965.   116.    118.                             55546.
             3     1806.   134532.   159.    162.                             34499.
    88.06          4668.   639395.   340.    347.  1.74       5.    372.     74412.
```

```
WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure #: 121007710700/30700   (400 ft Twin Bridge)
        Fishing Creek at I-77 N&S  File name: fish.i77
        Chester County, South Carolina   TDF 4/21/94
           *** RUN DATE & TIME: 04-21-94  14:52


    VELOCITY DISTRIBUTION:  ISEQ = 13;  SECID = BRIDG;  SRD =       0.

         WSEL      LEW      REW     AREA        K         Q      VEL
        88.19      4.3    372.2   4712.4   647641.   16800.     3.57

X STA.          4.3       66.5       83.7       94.7      104.3      112.4
  A(I)            525.3      239.1      173.1      163.3      151.4
  V(I)             1.60       3.51       4.85       5.14       5.55

X STA.        112.4      119.9      127.2      134.5      141.1      147.8
  A(I)            146.3      144.4      145.2      140.2      140.3
  V(I)             5.74       5.82       5.78       5.99       5.99

X STA.        147.8      154.7      161.5      168.6      177.3      189.2
  A(I)            140.8      141.3      144.5      158.8      182.7
  V(I)             5.96       5.94       5.82       5.29       4.60

X STA.        189.2      206.7      236.5      269.8      305.6      372.2
  A(I)            236.4      375.1      396.6      413.3      554.2
  V(I)             3.55       2.24       2.12       2.03       1.52
```

```
WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V060188             MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

         Structure #: 121007710700/30700    (400 ft Twin Bridge)
         Fishing Creek at I-77 N&S  File name: fish.i77
         Chester County, South Carolina    TDF 4/21/94
            *** RUN DATE & TIME: 04-21-94  14:52
     CROSS-SECTION PROPERTIES:  ISEQ = 14;  SECID = APPR ;  SRD =      565.

      WSEL  SA#      AREA         K    TOPW    WETP  ALPH     LEW     REW      QCR
              1    11051.   818672.    852.    864.                        225874.
              2     1728.   303036.     85.     92.                         44211.
              3    21172.   882372.   1727.   1728.                        420709.
     88.68         33951.  2004081.   2663.   2684.  2.20      0.   2664.  464014.


WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V060188             MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

         Structure #: 121007710700/30700    (400 ft Twin Bridge)
         Fishing Creek at I-77 N&S  File name: fish.i77
         Chester County, South Carolina    TDF 4/21/94
            *** RUN DATE & TIME: 04-21-94  14:52


     VELOCITY DISTRIBUTION:  ISEQ = 14;  SECID = APPR ;  SRD =      565.

          WSEL      LEW      REW     AREA         K         Q     VEL
         88.68      0.2   2663.5  33950.8   2004081.   16800.    0.49

X STA.          0.2      113.3      215.3      317.6      423.1      524.7
  A(I)        1462.6     1324.2     1328.2     1369.2     1318.5
  V(I)          0.57       0.63       0.63       0.61       0.64

X STA.        524.7      628.6      732.1      834.6      878.4      904.7
  A(I)        1348.6     1343.8     1329.8      720.4      542.6
  V(I)          0.62       0.63       0.63       1.17       1.55

X STA.        904.7      928.1     1086.2     1351.5     1569.8     1739.3
  A(I)         527.0     2052.8     2732.5     2514.4     2270.9
  V(I)          1.59       0.41       0.31       0.33       0.37

X STA.       1739.3     1903.1     2050.8     2208.7     2381.8     2663.5
  A(I)        2266.0     2145.5     2225.0     2302.3     2826.2
  V(I)          0.37       0.39       0.38       0.36       0.30
```

WSPRO OUTPUT --Continued

```
WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure #: 121007710700/30700   (400 ft Twin Bridge)
        Fishing Creek at I-77 N&S  File name: fish.i77
        Chester County, South Carolina   TDF 4/21/94
           *** RUN DATE & TIME: 04-21-94  14:52
    CROSS-SECTION PROPERTIES:  ISEQ = 13;  SECID = BRIDG;  SRD =       0.

     WSEL  SA#      AREA         K    TOPW   WETP  ALPH     LEW     REW      QCR
             1      880.    45979.     8.   134.                          51633.
             2      2690.  632347.   116.   118.                          73539.
             3      2459.  213162.   172.   175.                          52699.
    92.02           6029.  891488.   297.   427.  1.88      1.    386.  112465.
```

```
WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure #: 121007710700/30700   (400 ft Twin Bridge)
        Fishing Creek at I-77 N&S  File name: fish.i77
        Chester County, South Carolina   TDF 4/21/94
           *** RUN DATE & TIME: 04-21-94  14:52


    VELOCITY DISTRIBUTION:  ISEQ = 13;  SECID = BRIDG;  SRD =       0.

         WSEL      LEW      REW     AREA         K         Q     VEL
        92.15      1.0    386.6   6066.9   888943.    24600.    4.05

X STA.          1.0       76.7       89.1       99.0      107.9      115.9
  A(I)            909.8      230.1      197.9      191.8      181.9
  V(I)             1.35       5.35       6.22       6.41       6.76

X STA.        115.9      123.5      131.0      138.4      145.3      152.4
  A(I)            176.3      177.5      177.4      170.9      173.2
  V(I)             6.98       6.93       6.93       7.20       7.10

X STA.        152.4      159.6      166.8      175.2      185.9      198.0
  A(I)            175.7      173.7      190.3      209.4      215.9
  V(I)             7.00       7.08       6.46       5.87       5.70

X STA.        198.0      222.8      251.4      280.4      311.5      386.6
  A(I)            410.2      454.3      447.3      470.0      733.2
  V(I)             3.00       2.71       2.75       2.62       1.68
```

WSPRO OUTPUT --Continued

```
WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure #: 121007710700/30700   (400 ft Twin Bridge)
        Fishing Creek at I-77 N&S  File name: fish.i77
        Chester County, South Carolina   TDF 4/21/94
           *** RUN DATE & TIME: 04-21-94  14:52
    CROSS-SECTION PROPERTIES:  ISEQ = 14;  SECID = APPR ;  SRD =     565.

     WSEL  SA#      AREA         K    TOPW   WETP  ALPH    LEW    REW      QCR
             1   14509. 1284818.   852.   868.                        339772.
             2    2073.  410477.    85.    92.                         58096.
             3   28202. 1416955.  1737.  1739.                        644893.
    92.74        44785. 3112250.  2674.  2699.  1.98     0.  2674.  739346.
```

```
WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure #: 121007710700/30700   (400 ft Twin Bridge)
        Fishing Creek at I-77 N&S  File name: fish.i77
        Chester County, South Carolina   TDF 4/21/94
           *** RUN DATE & TIME: 04-21-94  14:52


    VELOCITY DISTRIBUTION:  ISEQ = 14;  SECID = APPR ;  SRD =     565.

         WSEL      LEW      REW     AREA         K         Q     VEL
        92.74      0.0   2673.7 44784.8 3112250.    24600.    0.55

X STA.          0.0      113.6      216.1      316.2      418.1      521.6
  A(I)         1927.4     1746.7     1706.0     1735.5     1763.9
  V(I)           0.64       0.70       0.72       0.71       0.70

X STA.        521.6      621.4      724.7      825.4      878.8      908.8
  A(I)         1701.1     1759.9     1715.7     1066.2      740.5
  V(I)           0.72       0.70       0.72       1.15       1.66

X STA.        908.8      954.0     1149.5     1390.2     1586.0     1750.3
  A(I)         1012.1     3137.7     3428.4     3118.2     2901.0
  V(I)           1.22       0.39       0.36       0.39       0.42

X STA.       1750.3     1915.5     2069.6     2229.6     2404.9     2673.7
  A(I)         2942.4     2867.7     2887.9     3017.8     3608.6
  V(I)           0.42       0.43       0.43       0.41       0.34
```

WSPRO OUTPUT --Continued

```
WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure #: 121007710700/30700   (400 ft Twin Bridge)
        Fishing Creek at I-77 N&S  File name: fish.i77
        Chester County, South Carolina   TDF 4/21/94
           *** RUN DATE & TIME: 04-21-94  14:52

 XSID:CODE    SRDL     LEW      AREA     VHD      HF      EGL      CRWS        Q      WSEL
       SRD    FLEN     REW         K    ALPH      HO      ERR       FR#      VEL

TEMP8:XS    ******    149.     6523.    0.43   *****    83.18    72.50   16800.    82.75
    -7030.  ******    785.   484629.    4.18   ***** *******     0.29     2.58

TEMP7:XS       750.    149.     6530.    0.43    0.90    84.09 *******   16800.    83.66
    -6280.     750.    786.   485147.    4.19    0.00     0.01     0.29     2.57

SYN6 :XS      1000.    377.     5232.    0.58    1.32    85.49 *******   16800.    84.91
    -5280.    1000.    910.   440290.    3.60    0.07     0.00     0.34     3.21

RTMP1:XS       348.     45.     2990.    0.49    0.51    86.00 *******   16800.    85.51
    -4932.     348.    262.   435352.    1.00    0.00     0.00     0.26     5.62

RTMP2:XS        12.     45.     2993.    0.49    0.02    86.02 *******   16800.    85.53
    -4920.      12.    262.   435808.    1.00    0.00     0.01     0.26     5.61

SYN5 :XS       180.    288.     4721.    0.65    0.27    86.38 *******   16800.    85.73
    -4740.     180.    754.   426555.    3.31    0.08     0.00     0.36     3.56

SYN4 :XS       180.    364.     5914.    0.50    0.25    86.63 *******   16800.    86.13
    -4560.     180.    972.   471836.    3.96    0.00     0.00     0.32     2.84

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "TEMP3"     KRATIO =  2.18

TEMP3:XS       750.    303.    18814.    0.05    0.44    87.07 *******   16800.    87.01
    -3810.     750.   1995.  1030487.    4.37    0.00     0.00     0.10     0.89

TEMP2:XS      1330.     83.    19220.    0.05    0.32    87.38 *******   16800.    87.33
    -2480.    1156.   1806.  1002404.    4.59    0.00     0.00     0.10     0.87

TEMP1:XS      1330.     90.    16369.    0.06    0.33    87.72 *******   16800.    87.65
    -1150.    1095.   1486.   935302.    3.88    0.00     0.00     0.10     1.03

EXIT :XS       750.     86.    17189.    0.05    0.24    87.96 *******   16800.    87.91
     -400.     750.   1595.   926258.    3.59    0.00     0.00     0.10     0.98

FULV :FV       400.    103.    18900.    0.05    0.10    88.07 *******   16800.    88.02
        0.     400.   1809.  1172822.    3.84    0.00     0.00     0.09     0.89
          <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "APPR "     KRATIO =  1.59
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APPR :AS      565.      0.   32486.  0.01  0.07   88.14 *******  16800.   88.13
      565.    565.  2662. 1869308.  2.24  0.00    0.00    0.04    0.52
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>


WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure #: 121007710700/30700   (400 ft Twin Bridge)
        Fishing Creek at I-77 N&S  File name: fish.i77
        Chester County, South Carolina   TDF 4/21/94
           *** RUN DATE & TIME: 04-21-94  14:52

              <<<<<RESULTS REFLECTING THE CONSTRICTED FLOW FOLLOW>>>>>

 XSID:CODE    SRDL     LEW      AREA   VHD     HF      EGL     CRWS        Q     WSEL
       SRD    FLEN     REW         K  ALPH     HO      ERR      FR#      VEL

BRIDG:BR       400.      5.    4669.  0.34  0.25   88.40   78.06  16800.   88.06
         0.    400.    372.  639510.  1.68  0.19    0.00    0.22    3.60

     TYPE PPCD FLOW       C     P/A     LSEL   BLEN   XLAB   XRAB
        3.   1.   1.  0.772   0.022    93.50 ****** ****** ******

 XSID:CODE    SRDL     LEW      AREA   VHD     HF      EGL     CRWS        Q     WSEL
       SRD    FLEN     REW         K  ALPH     HO      ERR      FR#      VEL

APPR :AS       400.      0.   33955.  0.01  0.17   88.69   77.70  16800.   88.68
       565.    573.  2664. 2004502.  2.20  0.13    0.00    0.04    0.49

        M(G)   M(K)        KQ   XLKQ   XRKQ    OTEL
       0.862  0.756  488250.    762.   1128.   88.65

                     <<<<<END OF BRIDGE COMPUTATIONS>>>>>


WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure #: 121007710700/30700   (400 ft Twin Bridge)
        Fishing Creek at I-77 N&S  File name: fish.i77
        Chester County, South Carolina   TDF 4/21/94
           *** RUN DATE & TIME: 04-21-94  14:52

 XSID:CODE    SRDL     LEW      AREA   VHD     HF      EGL     CRWS        Q     WSEL
       SRD    FLEN     REW         K  ALPH     HO      ERR      FR#      VEL

TEMP8:XS     ******    118.    9232.  0.49  *****   87.19   75.22  24600.   86.70
    -7030.   ******    853.  710048.  4.40  ***** *******    0.28    2.66

TEMP7:XS       750.    118.    9239.  0.49  0.90   88.10 *******  24600.   87.61
    -6280.     750.    853.  710602.  4.40  0.00    0.01    0.28    2.66

SYN6 :XS      1000.    262.    7599.  0.67  1.34   89.52 *******  24600.   88.85
    -5280.    1000.    929.  637875.  4.11  0.09    0.00    0.34    3.24
```

```
RTMP1:XS      348.     30.     3804.  0.65  0.55   90.08 *******  24600.    89.43
    -4932.    348.    269.   596875.  1.00  0.00    0.00    0.27    6.47

RTMP2:XS       12.     30.     3808.  0.65  0.02   90.11 *******  24600.    89.46
    -4920.     12.    269.   597495.  1.00  0.00    0.01    0.27    6.46

SYN5 :XS      180.    170.     6868.  0.79  0.30   90.48 *******  24600.    89.68
    -4740.    180.    789.   606806.  3.98  0.07    0.00    0.38    3.58

SYN4 :XS      180.    251.     8727.  0.56  0.26   90.75 *******  24600.    90.18
    -4560.    180.   1033.   689704.  4.56  0.00    0.01    0.32    2.82

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "TEMP3"     KRATIO =  2.30

TEMP3:XS      750.    169.    26123.  0.05  0.41   91.16 *******  24600.    91.11
    -3810.    750.   2036.  1589126.  3.88  0.00    0.00    0.09    0.94

TEMP2:XS     1330.     46.    26397.  0.05  0.28   91.44 *******  24600.    91.39
    -2480.   1141.   1857.  1564779.  3.89  0.00    0.00    0.08    0.93

TEMP1:XS     1330.     50.    22144.  0.07  0.29   91.74 *******  24600.    91.67
    -1150.   1083.   1523.  1422434.  3.46  0.01    0.00    0.09    1.11

EXIT :XS      750.     49.    23373.  0.05  0.22   91.96 *******  24600.    91.91
     -400.    750.   1628.  1437230.  3.12  0.00    0.00    0.09    1.05

FULV :FV      400.     59.    25877.  0.05  0.09   92.06 *******  24600.    92.01
        0.    400.   1847.  1827208.  3.36  0.00    0.00    0.08    0.95
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "APPR "     KRATIO =  1.60

APPR :AS      565.      0.    43098.  0.01  0.06   92.12 *******  24600.    92.11
      565.    565.   2672.  2927280.  2.00  0.00    0.00    0.04    0.57
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>


WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure #: 121007710700/30700   (400 ft Twin Bridge)
        Fishing Creek at I-77 N&S  File name: fish.i77
        Chester County, South Carolina   TDF 4/21/94
           *** RUN DATE & TIME: 04-21-94  14:52

             <<<<<RESULTS REFLECTING THE CONSTRICTED FLOW FOLLOW>>>>>

 XSID:CODE    SRDL     LEW      AREA    VHD     HF      EGL     CRWS        Q     WSEL
       SRD    FLEN     REW         K   ALPH     HO      ERR      FR#      VEL

BRIDG:BR      400.      1.     6028.  0.45  0.23   92.46   80.02  24600.    92.02
        0.    400.    386.   891294.  1.73  0.27    0.00    0.24    4.08
```

WSPRO OUTPUT --Continued

```
    TYPE PPCD FLOW       C     P/A    LSEL   BLEN   XLAB   XRAB
       3.   1.   1.  0.760   0.021   93.50 ****** ****** ******

 XSID:CODE    SRDL     LEW      AREA    VHD     HF      EGL     CRWS       Q     WSEL
       SRD    FLEN     REW         K  ALPH     HO      ERR      FR#     VEL

APPR :AS      400.      0.    44791.  0.01   0.16    92.75    78.33  24600.    92.74
      565.    576.   2674. 3112984.  1.98   0.13     0.00     0.03    0.55

       M(G)   M(K)        KQ   XLKQ   XRKQ    OTEL
      0.856  0.768  721536.   758.   1143.    92.72

                    <<<<<END OF BRIDGE COMPUTATIONS>>>>>
 ER


 NORMAL  END  OF  WSPRO  EXECUTION.
```

PIER SCOUR COMPUTATIONS
FOR
FISHING CREEK AT I-77 N&S STR. 121007710700/30700 CHESTER CO., SC
CASE 1 (without debris) Q100 = 16800 cfs 4/29/94 TDF

HYDRAULIC VARIABLES USED IN CSU EQUATION

PIER NUMBER	8	7	6	5	4	3	2
PIER STATION (FT)	50	100	150	200	250	300	350
LOCATION OF PIER	lfp	ltb	mcm	rfp	rfp	rfp	rfp
Y1: DEPTH (FT)	12.9	23.0	23.0	23.0	12.8	12.4	9.4
V1: VEL. (FPS)	3.5	5.4	5.4	5.4	3.5	3.5	3.5
a: PIER WIDTH (FT)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L: PIER LENGTH (FT)	10.0	10.0	10.0	10.0	10.0	10.0	10.0
PIER SHAPE	1	1	1	1	1	1	1
ATTACK ANGLE	22	22	22	22	22	22	22
K1 (SHAPE COEF.)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
K2 (ANGLE COEF.)	2.60	2.60	2.60	2.60	2.60	2.60	2.60
FROUDE NO.	0.17	0.20	0.20	0.20	0.17	0.18	0.20

COMPUTED SCOUR DEPTHS USING CSU EQUATION

SCOUR DEPTH (FT)	5.97	7.77	7.77	7.77	6.00	5.97	5.75
MAX SCOUR DEPTH (FT)	6.57	8.54	8.54	8.54	6.60	6.57	6.33

"MAX SCOUR DEPTH" includes an additional 10 percent of the computed CSU scour depth as recommended in HEC 18

CONTRACTION SCOUR COMPUTATIONS
FOR
FISHING CREEK AT I-77 N&S STR. 121007710700/30700 CHESTER CO., SC
CASE 1 (without debris) Q100 = 16800 cfs 4/29/94 TDF

LIVE-BED SCOUR COMPUTATIONS

	MAIN CHANNEL	CONTRACTED SECTION
DISCHARGE (CFS)	2540.	12200.
BOTTOM WIDTH (FT)	85.0	113.0
MANNINGS n	0.051	0.051
AVERAGE DEPTH (FT)	21.3	

ENERGY SLOPE	0.00051
D50 (FT)	0.0016
FALL VELOCITY (FPS)	0.23
K1 COEF.	0.69
K2 COEF.	0.37

COMPUTED DEPTH AT CONTRACTED SECTION (FT)	=	67.1
DEPTH AT MAIN CHANNEL (FT)	=	21.3
DEPTH OF CONTRACTION SCOUR (FT)	=	45.8

LEFT OVERBANK IN BRIDGE OPENING
CLEAR-WATER CONTRACTION SCOUR COMPUTATIONS

DISCHARGE IN CONTRACTED SECTION (CFS)	=	1100.
WIDTH OF CONTRACTED SECTION (FT)	=	32.5
MEDIAN GRAIN SIZE (FT)	=	0.0020
COMPUTED DEPTH OF CONTRACTED SECTION (FT)	=	15.6
AVERAGE FLOOD PLAIN DEPTH (FT)	=	13.0
DEPTH OF CONTRACTION SCOUR (FT)	=	2.6

RIGHT OVERBANK IN BRIDGE OPENING
CLEAR-WATER CONTRACTION SCOUR COMPUTATIONS

DISCHARGE IN CONTRACTED SECTION (CFS)	=	3530.
WIDTH OF CONTRACTED SECTION (FT)	=	134.0
MEDIAN GRAIN SIZE (FT)	=	0.0020
COMPUTED DEPTH OF CONTRACTED SECTION (FT)	=	12.6
AVERAGE FLOOD PLAIN DEPTH (FT)	=	12.7
DEPTH OF CONTRACTION SCOUR (FT)	=	-0.1

PIER SCOUR COMPUTATIONS
FOR
FISHING CREEK AT I-77 N&S STR. 121007710700/30700 CHESTER CO., SC
CASE 1 (without debris) Q500 = 24600 cfs 4/29/94 TDF

HYDRAULIC VARIABLES USED IN CSU EQUATION

PIER NUMBER	8	7	6	5	4	3	2
PIER STATION (FT)	50	100	150	200	250	300	350
LOCATION OF PIER	lfp	ltb	mcm	rfp	rfp	rfp	rfp
Y1: DEPTH (FT)	16.8	27.0	27.0	27.0	16.8	16.4	13.4
V1: VEL. (FPS)	5.3	6.5	6.5	6.5	3.0	3.0	3.0
a: PIER WIDTH (FT)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
L: PIER LENGTH (FT)	10.0	10.0	10.0	10.0	10.0	10.0	10.0
PIER SHAPE	1	1	1	1	1	1	1
ATTACK ANGLE	22	22	22	22	22	22	22
K1 (SHAPE COEF.)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
K2 (ANGLE COEF.)	2.60	2.60	2.60	2.60	2.60	2.60	2.60
FROUDE NO.	0.23	0.22	0.22	0.22	0.13	0.13	0.14

COMPUTED SCOUR DEPTHS USING CSU EQUATION

SCOUR DEPTH (FT)	7.42	8.59	8.59	8.59	5.79	5.77	5.61
MAX SCOUR DEPTH (FT)	8.16	9.45	9.45	9.45	6.36	6.34	6.17

"MAX SCOUR DEPTH" includes an additional 10 percent of the computed CSU scour depth as recommended in HEC 18

29630

1210077 30700 — 1210077 10

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT NO.	F. A. PROJ. NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S. C.	CHESTER	12.477.4	I-77-1(31)	I-77	1 2	1633

INDEX OF SHEETS

SOUTH CAROLINA
STATE HIGHWAY DEPARTMENT
COLUMBIA

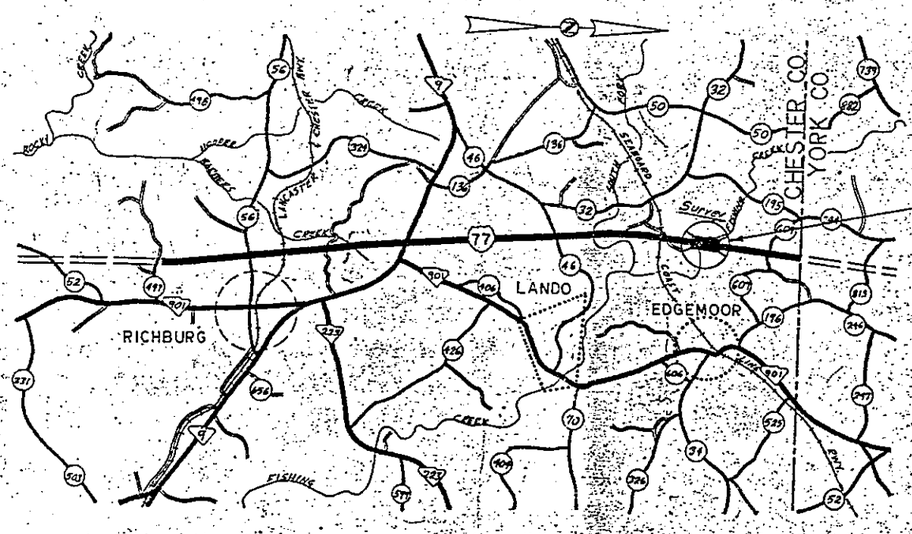
PLAN AND PROFILE OF PROPOSED STATE HIGHWAY

F. A. PROJECT NO. I-77-1(31)
FILE NO. 12.4774
ROUTE I-77
CHESTER COUNTY
TWIN BRIDGES OVER
FISHING CREEK

SUMMARY OF ESTIMATED QUANTITIES

CONCRETE, CLASS "A"	1,526.8 / 1529.6	C.Y.
REINFORCING STEEL	356,142	LBS.
50' PRESTRESSED CONCRETE BEAMS (3'-0")	128	EA.
*STEEL BEARING PILES (HP 12 X 53)	8,740	L.F.
8 IN. PIPE SLOPE DRAIN	85	L.F.
INTAKE SPILLWAY ASSEMBLY	2	EA.
STRUCTURAL STEEL (SWAY BRACES)	19,763	LBS.

*Note: Structural Steel in piles shall contain not less than 0.20% Copper.



LAYOUT

Construct 400'-0" (R.C. & Prestr. Bm. Type II) Twin Bridges From Sta. 3991+25.00 to Sta. 3995+25.00 over Fishing Creek & Constr. 30'-0" Approach Slabs at each end of each Bridge.

Net Length of Roadway	0.000 Miles
Net Length of Bridges	0.075 Miles
Net Length of Project	0.075 Miles
Length of Exceptions	0.000 Miles
Gross Length of Project	0.075 Miles

LEGEND
PROPOSED PROJECT
OTHER ROADS

CONVENTIONAL SIGNS

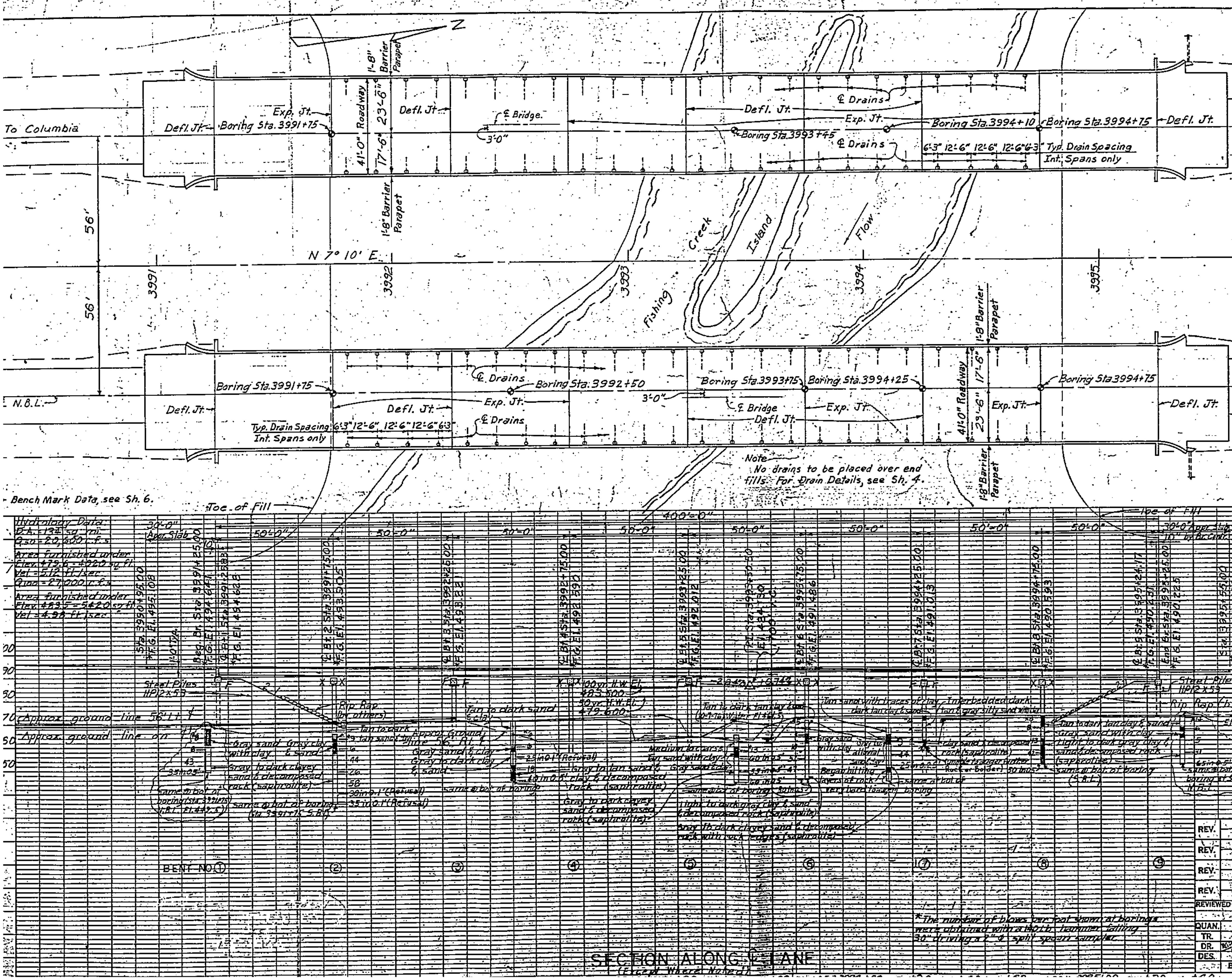
State Line	Trolley Poles
County Line	Power Poles
City or Town Limits	Telephone or Telegraph Poles
Property Line	Marsh
Fence	Trees
Retaining Wall	Brush
Existing Road	Stumps
Old R.O.W. Lines of	Buildings
Proposed Road	Bridge
Railroad	Concrete Box Culvert
Fill or Embankment	Pipe Culvert
Guard Rail	Drop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

RECOMMENDED BY: W. E. Coleman 5/23/77

APPROVED: E. S. Gurley 5/24/77
STATE HIGHWAY ENGINEER — DATE

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

FED. RD. DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	CHESTER	12.477.4	I-77	78	1633



Notes:

For Summary of Quantities see Sh. 4

For Standard Notes see Sh. 3.

Construct Pipe Slope Drains on left side of S.B. Lane and on right side of N.B. Lane at End of Bridges only

*The number of blows per foot shown at borings were obtained with a 140 Lb. hammer falling 30" driving a 2" ⌀ split spoon sampler.

REV.			
REV.			
REV.			
REV.			
REVIEWED	REL		
	IN CHARGE		
QUAN.			
TR.			
DR.	[illegible]	[illegible]	3-75
DES.			
	BY	CHK'D	DATE

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

PLAN AND PROFILE FOR TWIN BRIDGES OVER FISHING CREEK

FILE NO.	COUNTY	ROUTE NO.	DATE
12.477.4	CHESTER	I-77	6-74

APPROVED BY: [signature] ASST. BRIDGE ENGINEER-DESIGN

APPROVED BY: [signature] BRIDGE ENGINEER-DESIGN

PILE RECORD ON FILE NO. 12.477.4 – N.B. BRIDGE

FED. ROAD DIV. NO.	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	Chester	12.477.4	I-77	19	35

WEIGHT OF HAMMER 2850 Lbs. TYPE Kobe 13

BENT NO.	FOOTING	PILE NO.	DIAM. AT BUTT	DIAM. AT TIP	ORIG. LENGTH	BUILD-UP OR SPLICE	TOTAL LENGTH	LENGTH C.O.	NET LENGTH	ELEV. C.O.	ELEV. OF TIP WHEN PLAN BEARING VALUE IS OBTAINED	ELEV. PILE TIP	ELEV. ORIG. GROUND OR BOTTOM OF FOOTING	PEN. IN GROUND OR BELOW FOOTING	PEN. PER BLOW	FALL OF HAMMER	BEARING VALUE	PAY LENGTH	C.O. @ 40 %
North Bound Bridge																			
		1			40.0	0	40.0	6.4	33.6	488.885	456.985	455.285	*487.385	32.1	.25	7.5	44.7	35.6	
		2						7.5	32.5		457.285	456.385		31.0	.2	5.0	47.5	34.5	
		3						6.1	33.9		457.485	454.985		32.4	.225	6.5	49.4	35.9	
		4						5.7	34.3		456.585	454.585		32.8	.25	5.5	44.7	36.3	
		5						5.1	34.9		456.485	453.985		30.4	.2	5.0	47.5	36.9	
		6						6.2	33.8		457.085	455.085		32.3	.25	5.5	44.7	35.8	
		7			40.0		40.0	7.1	32.9	488.885	457.485	455.985	*487.385	31.4	.2	5.0	47.5	34.9	
Sub Total					280.0	0	280.0	44.1	235.9			455.105					47	249.9	
						0		6.3											
		1			40.0	0	40.0	8.4	31.6	487.649	457.049	456.049	470.849	16.8	.05	5.0	*R	33.6	
		2				0	40.0	0	40.0		448.149	447.649	470.749	23.1	.225	5.0	43.8	42.0	
		3				0	40.0	2.7	37.3		450.849	450.349	470.849	20.5	.25	5.0	40.7	39.3	
		4				3.8	43.8	0	43.8		444.849	443.849	470.749	26.9	.25	6.0	48.8	45.8	
		5				0	40.0	0	40.0		447.649	447.649	470.749	23.1	.275	7.0	38.0	42.0	
		6						0	40.0		449.649	447.649	470.749	23.1	.2	7.0	66.5	42.0	
		7						2.7	37.3		450.849	450.349	470.549	20.2	.175	5.0	51.8	39.3	
		8						2.6	37.4		450.749	450.249	471.049	20.8	.25	5.0	40.7	39.4	
		9						2.7	37.3		451.349	450.349	471.049	20.7	.25	5.5	44.7	39.3	
		10			40.0	0	40.0	2.1	37.9	487.649	450.749	449.749	470.749	21.0	.15	6.0	68.4	39.9	
Sub Total					400.0	3.8	403.8	21.2	382.6			444.30					47	402.6	
						0.4		2.1											
		1			40.0	0	40.0	4.7	35.3	486.967	453.167	451.667	470.767	19.1	.25	5.5	44.7	37.3	
		2				0	40.0	5.1	34.9		453.567	452.067	470.767	18.7	.3	6.5	46.3	36.9	
		3				3.2	43.2	2.2	41.0		446.567	445.567	470.867	24.9	.25	6.0	48.8	43.0	
		4				0	40.0	3.2	36.8		451.167	450.167	470.867	20.7	.25	5.0	40.7	38.8	
		5				0	40.0	7.1	32.9		456.067	454.067	470.767	16.7	.2	5.5	52.2	34.9	
		6				0	40.0	0	40.0		448.267	446.967	470.767	23.8	.225	5.5	48.2	42.0	
		7				1.7	41.7	0	41.7		447.767	445.267	470.767	25.5	.25	5.5	44.7	43.7	
		8				0	40.0	9.7	30.3		457.667	456.667	470.767	14.1	.125	6.0	76.0	32.3	
		9				0	40.0	9.1	30.9		457.567	456.067	470.167	14.1	.2	5.0	47.5	32.9	
		10			40.0	0	40.0	1.5	38.5	486.967	450.967	448.467	467.767	19.3	.25	5.5	44.7	40.5	
Sub Total					400.0	4.9	404.9	42.6	362.3			450.737					47	382.3	
						0.5		4.3											
		1			40.0	0	40.0	0.3	39.7	486.337	447.337	446.637	462.407	15.8	.25	5.0	40.7	41.7	
		2				0	40.0	5.3	34.7		452.337	451.637	462.457	10.8	.25	5.0	40.7	36.7	
		3				0	40.0	1.8	38.2		448.937	448.137	462.457	14.3	.225	5.0	43.8	40.2	
		4				1.5	41.5	0	41.5		447.337	444.837	462.457	17.6	.25	5.5	44.7	43.5	
		5				0	40.0	4.3	35.7		452.037	450.637	462.337	11.7	.25	5.0	40.7	37.7	
		6				0	40.0	3.0	37.0		450.037	449.337	462.337	13.0	.2	5.5	52.2	39.0	
		7				0	40.0	4.1	35.9		450.937	450.437	462.307	11.9	.25	5.0	40.7	37.9	
		8				0	40.0	0.2	39.8		450.937	446.937	462.137	15.6	.225	5.5	41.8	41.8	
		9				1.5	41.5	0	41.5		445.737	445.037	461.937	16.9	.225	5.5	48.2	43.5	
		10			40.0	2.2	42.2	0	42.2	486.337	445.137	444.137	461.757	17.6	.25	5.0	40.7	44.2	
Sub Total					400.0	5.0	405.0	19.0	386.0			441.197					47	406.0	
						0.5		1.9											
		1			40.0	0	40.0	5.8	34.2	485.760	459.060	451.560	460.860	9.3	.175	5.5	57.0	36.2	
		2						6.7	33.3		455.060	451.460	461.960	9.5	.15	5.5	62.7	35.3	
		3						4.7	35.3		453.560	450.460	461.960	11.5	.225	5.0	43.8	37.3	
		4						7.5	32.5		456.160	453.260	462.360	9.1	.25	5.5	44.7	34.5	
		5						5.8	34.2		456.260	451.560	460.560	9.0	.25	6.0	48.8	36.2	
		6						3.3	36.7		456.660	449.060	460.360	11.3	.225	5.5	48.2	38.7	
		7						5.0	35.0		452.360	450.760	460.160	9.4	.25	5.0	40.7	37.0	
		8						4.3	35.7		454.760	450.060	460.360	10.3	.225	5.5	48.2	37.7	
		9						4.1	35.9		452.360	449.860	459.960	10.1	.2	5.0	47.5	37.9	
		10			40.0		40.0	7.1	32.9		455.160	452.860	462.760	9.9	.175	5.5	57.0	34.9	
Sub Total					400.0	0	400.0	54.3	345.7	485.760		451.190					50	365.7	
						0		5.4											
					1880.0	13.7	1893.7	181.2	1712.5									1806.5	

DATE	BENT NO.	FOOTING	PILE NO.	DIAM. AT BUTT	DIAM. AT TIP	ORIG. LENGTH	BUILD-UP OR SPLICE	TOTAL LENGTH	LENGTH C.O.	NET LENGTH	ELEV. C.O.	ELEV. OF TIP WHEN PLAN BEARING VALUE IS OBTAINED	ELEV. PILE TIP	ELEV. ORIG. GROUND OR BOTTOM OF FOOTING	PEN. IN GROUND OR BELOW FOOTING	PEN. PER BLOW	FALL OF HAMMER	BEARING VALUE	PAY LENGTH	C.O. @ 40 %
1977																				
	North Bound Bridge																			
8-11	6		1			40.0	0	40.0	2.3	37.7	485.235	449.535	447.535	459.935	12.4	.25	5.0	40.7	39.7	
8-10			2						6.7	33.3		452.685	451.935	460.935	9.0	.175	5.5	57.0	35.3	
8-11			3						8.5	31.5		455.335	453.735	462.835	9.1	.225	5.0	43.8	33.5	
8-11			4						7.4	32.6		453.935	452.635	464.435	11.8	.25	5.5	44.7	34.6	
8-10			5						8.3	31.7		456.335	453.535	465.235	11.7	.225	5.0	43.8	33.7	
8-10			6						4.1	35.9		450.635	449.335	466.035	16.7	.225	5.0	43.8	37.9	
8-11			7						1.8	38.2		448.235	447.035	467.235	20.2	.15	5.5	44.7	40.2	
8-11			8						6.3	33.7		452.735	451.535	468.035	16.5	.225	5.5	48.2	35.7	
8-10			9				0	40.0	2.8	37.2		452.035	448.035	468.935	20.9	.25	5.5	44.7	39.2	
8-11			10			40.0	1.5	41.5	0	41.5	485.235	446.235	443.735	469.735	26.0	.25	5.0	40.7	43.5	
	6	Sub Total				400.0	1.5	401.5	48.2	353.3			449.735					42	373.3	
							0.2		4.8											
8-12	7		1			40.0	0	40.0	9.9	30.1	484.763	456.763	454.663	470.263	15.6	.2	5.5	52.2	32.1	
8-11			2						10.0	30.0		456.363	454.763	470.163	15.4	.25	5.0	40.7	32.0	
8-11			3						10.2	29.8		455.763	454.963	469.963	15.0	.225	5.5	48.2	31.8	
8-12			4						10.3	29.7		456.313	455.063	469.763	14.7	.175	5.0	51.8	31.7	
8-11			5						4.2	35.8		449.863	448.963	469.563	20.6	.25	5.5	44.7	37.8	
8-11			6						7.7	32.3		453.563	452.463	469.763	17.3	.25	5.5	44.7	34.3	
8-12			7						6.4	33.6		452.563	451.163	469.763	18.6	.225	5.0	43.8	35.6	
8-11			8						5.3	34.7		453.163	450.063	470.163	20.1	.225	5.0	43.8	36.7	
8-11			9						4.7	35.3		453.763	449.463	470.463	21.0	.2	5.0	47.5	37.3	
8-12			10			40.0		40.0	6.1	33.9	484.763	452.363	450.863	470.463	19.6	.175	5.0	51.8	35.9	
	7	Sub Total				400.0	0	400.0	74.8	325.2			452.813					47	345.2	
							0		7.5											
8-12	8		1			40.0	0	40.0	6.5	33.5	484.344	451.844	450.844	470.544	19.7	.225	5.0	43.8	35.5	
8-12			2						7.1	32.9		452.544	451.444	470.544	19.1	.225	5.5	48.2	34.9	
8-12			3						6.6	33.4		452.944	450.944	470.544	19.6	.225	5.0	43.8	35.4	
8-12			4						7.0	33.0		453.344	451.344	470.544	19.2	.175	5.0	51.8	35.0	
8-12			5						4.4	35.6		451.044	448.744	470.344	21.6	.225	5.5	48.2	37.6	
8-12			6						4.1	35.9		450.544	448.444	470.544	22.1	.2	5.5	52.2	37.9	
8-12			7						9.0	31.0		456.144	453.344	470.344	17.0	.2	5.5	52.2	33.0	
8-12			8						7.2	32.8		453.444	451.544	470.244	18.7	.2	5.0	47.5	34.8	
8-12			9						8.0	32.0		453.444	452.344	470.144	17.8	.25	5.0	40.7	34.0	
8-12			10			40.0		40.0	7.1	32.9	484.344	453.044	451.444	470.044	18.6	.25	5.5	44.7	34.9	
	8	Sub Total				400.0	0	400.0	67.0	333.0			451.041					46	353.0	
							0		6.7											
8-19	9		1			40.0	0	40.0	10.0	30.0	484.488	455.288	454.488	*482.988	28.5	.2	6.5	61.0	32.0	
8-19			2						5.3	34.7		454.588	453.788		29.2	.2	6.0	57.0	36.7	
8-19			3						9.9	30.1		455.688	454.388		28.6	.15	6.0	68.4	32.1	
8-19			4						8.4	31.6		453.388	452.388		30.1	.15	6.0	68.4	33.6	
8-19			5						8.5	31.5		453.588	452.988		30.0	.175	6.0	62.1	33.5	
8-19			6						8.5	31.5		453.688	452.988		30.0	.15	6.0	68.4	33.5	
8-19			7			40.0		40.0	8.3	31.7	484.488	453.788	452.788	*482.988	30.2	.175	6.0	62.1	33.7	
	9	Sub Total				280.0	0	280.0	62.9	217.1			453.474					64	231.1	
							0		7.0											
*TOTAL						1480.0	1.5	1481.5	252.9	1228.6									1302.6	
*GRAND TOTAL						3360.0	15.2	3375.2	434.1	2941.1									3109.1	

NOTES CONCERNING ANY UNUSUAL FOUNDATION CONDITIONS

BENT NO.	FOOTING	PILE NO.	REMARKS
			* Cap Enlarged to 3'-0" x 3'-0" Therefore Lowering Bottom of Cap 0.5'
			See Sh. No. 22
			‡ R = Refusal
			4½ 11,825
			5½ 13,675
			5 14,250
			6 17,100
			6½ 18,525
			7 19,950

NOTES:

PAY LENGTH SHOULD INCLUDE ALLOWANCE FOR SPLICING STEEL PILES AND ANY OTHER AUTHORIZED ALLOWANCES.

NUMBERING PILES: A SKETCH OF BENT OR FOOTING TO BE DRAWN ON THIS SHEET AND PILES TO BE NUMBERED, ALSO FLOW OF STREAM TO BE SHOWN.

PENETRATION PER BLOW: GIVE THIS INFORMATION IN DECIMALS OF AN INCH.

PILE RECORD — FILE NO. DATA

PILE RECORD ON FILE NO 12.477A - S.B. BRIDGE

FED. ROAD DIV. NO	STATE	COUNTY	FILE NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	CHESTER	12.477A	3277	20	35

WEIGHT OF HAMMER 2850 LBS. TYPE Kobe 13

FOOTING	PILE NO	DIAM. AT BUTT	DIAM. AT TIP	ORIG. LENGTH	BUILD-UP OR SPLICE	TOTAL LENGTH	LENGTH C.O.	NET LENGTH	ELEV. C.O.	ELEV. OF TIP WHEN PLAN BEARING VALUE IS OBTAINED	ELEV. PILE TIP	ELEV. ORIG. GROUND OR BOTTOM OF FOOTING	PEN. IN GROUND OR BELOW FOOTING	PEN. PER BLOW	FALL OF HAMMER	BEARING VALUE	PAY LENGTH	C.O. @ 40 %
North Bound Bridge																		
	1			40.0	0	40.0	9.3	30.7	488.385	459.385	458.185	*487.385	29.2	.175	6.0	62.1	32.7	
	2						5.0	35.0		459.185	459.385		32.5	.25	5.5	44.7	37.0	
	3						8.9	31.1		459.085	457.785		30.6	.2	5.0	47.5	33.1	
	4						8.2	31.8		459.285	457.085		30.3	.25	5.5	44.7	33.8	
	5						10.0	30.0		460.585	458.385		28.5	.175	5.5	57.0	32.0	
	6						9.8	30.2		460.585	458.685		28.7	.2	5.5	52.2	32.2	
	7			40.0		40.0	6.7	33.3	488.885	458.885	455.585	*487.385	31.8	.25	5.5	44.7	35.3	
Sub Total				280.0	0	280.0	57.9	222.1			457.15						236.1	
							6.9									50		
	1			40.0	0	40.0	8.5	31.5	487.649	457.149	456.149	472.449	16.3	.175	5.5	57.0	33.5	
	2			40.0			12.0	28.0		460.649	459.649	472.449	12.8	.1	5.5	78.3	30.0	
	3						11.9	28.1		461.049	459.549	472.449	12.9	.075	5.5	80.5	30.1	
	4						11.6	28.4		460.249	459.249	472.449	13.2	.15	5.0	57.0	30.4	
	5						12.3	27.7		460.949	459.949	471.649	11.7	.125	5.0	68.3	29.7	
	6						11.7	28.3		459.849	459.349	471.249	11.9	.1	5.5	78.3	30.3	
	7						11.0	29.0		459.149	458.649	471.149	12.5	.175	5.0	51.8	31.0	
	8						11.0	29.0		459.149	458.649	470.849	12.2	.2	6.0	57.0	31.0	
	9						9.1	30.9		459.749	459.749	470.849	10.1	.2	5.0	47.5	32.9	
	10			40.0		40.0	11.3	28.7	487.649	459.949	458.949	470.849	11.9	.15	5.0	57.0	30.7	
Sub Total				400.0	0	400.0	104.4	295.6			440.46						313.6	
							10.6									67		
	1			40.0	0	40.0	8.2	31.8	486.561	458.161	455.161	471.861	16.7	.225	5.5	48.2	33.8	
	2						7.2	32.8		459.461	454.161	471.661	17.5	.25	5.0	40.7	34.8	
	3						3.6	36.4		456.061	450.561	471.561	21.0	.225	5.5	48.2	38.4	
	4						4.5	35.5		452.661	451.461	471.461	20.2	.25	5.0	44.7	37.5	
	5						4.0	36.0		451.661	450.961	471.461	20.5	.2	5.5	52.2	38.0	
	6						2.3	37.7		449.961	449.261	471.161	21.9	.225	5.5	48.2	39.7	
	7						7.3	32.7		455.061	454.261	471.161	16.9	.175	5.0	51.8	34.7	
	8						10.2	29.8		458.861	457.161	471.361	14.2	.225	5.0	43.8	31.8	
	9						10.2	29.8		458.961	457.161	471.361	14.2	.225	5.0	43.8	31.8	
	10			40.0		40.0	7.5	32.5	486.961	459.761	454.461	471.361	16.9	.2	4.5	42.7	34.5	
Sub Total				400.0	0	400.0	65.0	335.0			424.47						345.0	
							16.2									41		
	1			40.0	0	40.0	6.7	33.3	486.397	452.097	451.097	470.897	15.8	.225	5.0	44.8	33.9	
	2						4.2	35.8		451.397	450.597	470.597	20.0	.25	6.0	48.8	35.8	
	3						5.5	34.5		452.597	451.897	470.597	18.7	.25	5.5	44.7	34.5	
	4						6.5	33.5		454.897	452.897	470.597	17.7	.25	6.0	48.8	33.5	
	5						5.4	34.6		456.497	455.297	470.497	14.7	.2	5.0	44.9	34.6	
	6						6.3	33.7		457.697	456.297	470.397	13.7	.25	5.0	48.8	33.7	
	7						4.8	35.2		456.897	456.197	470.197	13.0	.25	5.0	48.8	35.2	
	8						7.0	33.0		457.997	457.397	470.197	12.8	.225	5.0	43.8	33.0	
	9						9.5	30.5		460.497	459.897	470.397	10.4	.25	5.0	44.7	30.5	
	10			40.0		40.0	6.0	34.0	486.397	457.797	457.397	470.397	12.8	.25	6.0	48.8	34.0	
Sub Total				400.0	0	400.0	53.5	346.1			451.67						346.1	
							6.4									41		
	1			40.0	0	40.0	10.2	29.8	485.761	456.261	455.961	470.161	14.2	.225	4.5	39.4	31.8	
	2						8.0	32.0		459.761	457.761	469.961	12.2	.15	4.5	51.3	34.0	
	3						5.8	34.2		457.561	457.361	469.961	12.6	.2	5.0	47.5	34.2	
	4						3.8	36.2		456.161	455.961	469.961	13.8	.225	5.5	48.2	36.2	
	5						4.8	35.2		457.361	456.561	469.761	13.2	.25	5.0	40.7	35.2	
	6						4.3	35.7		458.061	457.361	469.761	12.4	.25	5.0	40.7	35.7	
	7						2.6	37.4		459.661	459.161	469.761	10.6	.25	5.0	40.7	37.4	
	8						5.5	34.5		460.761	460.261	469.761	9.5	.2	5.5	47.5	34.5	
	9						6.0	34.0		461.361	460.761	469.761	8.9	.2	5.0	47.5	34.0	
	10			40.0		40.0	3.5	36.5	485.761	460.361	460.761	469.761	9.0	.25	5.0	40.7	36.5	
Sub Total				400.0	0	400.0	58.8	341.2			451.17						341.2	
							5.0									44		
TOTAL				1880.0	+0	1880.0	542.0	1338.0									1338.0	
GRAND TOTAL																		

DATE	BENT NO.	FOOTING	PILE NO.	DIAM. AT BUTT	DIAM. AT TIP	ORIG. LENGTH	BUILD-UP OR SPLICE	TOTAL LENGTH	LENGTH C.O.	NET LENGTH	ELEV. C.O.	ELEV. OF TIP WHEN PLAN BEARING VALUE IS OBTAINED	ELEV. PILE TIP	ELEV. ORIG. GROUND OR BOTTOM OF FOOTING	PEN. IN GROUND OR BELOW FOOTING	PEN. PER BLOW	FALL OF HAMMER	BEARING VALUE	PAY LENGTH	C.O. @ 40 %
1979																				
South Bound Bridge																				
	B-5	6	1			40.0	0	40.0	4.1	35.9	485.235	450.935	449.935	461.735	11.8	.225	5.0	43.8	37.9	
	B-5		2						4.6	35.4		451.335	449.835	460.435	10.6	.25	5.0	40.7	37.4	
	B-5		3						2.0	38.0		448.735	447.235	460.035	12.8	.25	5.5	44.7	40.0	
	B-5		4						0.0	40.0		445.735	445.235	459.635	14.4	.25	6.0	48.8	42.0	
	B-5		5						0.0	40.0		445.735	445.235	460.235	15.0	.325	6.0	57.6	42.0	
	B-5		6						5.8	34.2		453.035	451.035	461.635	10.6	.25	5.0	40.7	36.2	
	B-5		7						8.1	31.9		454.435	453.235	462.235	9.0	.225	5.0	43.8	33.9	
	B-5		8						6.0	34.1		451.235	450.135	461.635	11.5	.25	5.0	40.7	35.1	
	B-5		9						5.2	34.8		451.235	450.535	461.035	10.5	.25	5.0	40.7	36.3	
	B-5		10			40.0		40.0	6.2	33.8	485.235	452.135	451.435	460.635	9.2	.225	5.0	43.8	33.8	
		6	Sub Total			40.0	0	40.0	42.2	357.8			449.45					41	377.8	
									4.2				44.2							
	B-8	7	1			40.0	0	40.0	6.1	33.9	484.763	451.663	450.863	462.563	11.7	.175	5.0	51.8	33.9	
	B-8		2						6.2	33.8		447.563	446.563	462.563	15.6	.225	5.5	48.2	33.8	
	B-8		3						9.2	30.8		450.763	449.763	461.363	11.6	.2	5.0	47.5	30.8	
	B-8		4						5.3	34.7		450.863	450.063	461.363	11.3	.2	5.0	47.5	34.7	
	B-8		5						4.8	35.2		450.463	449.563	461.363	11.8	.225	5.5	48.2	35.2	
	B-8		6						3.8	36.2		449.363	448.563	462.563	14.0	.225	5.0	43.8	36.2	
	B-8		7						3.4	36.6		450.763	450.163	462.563	12.4	.25	5.0	40.7	36.6	
	B-8		8						4.4	35.6		449.763	449.163	462.563	13.4	.2	5.5	51.3	35.6	
	B-8		9						5.2	34.8		451.463	449.963	462.563	12.6	.225	5.5	48.2	34.8	
	B-8		10			40.0		40.0	7.6	32.4	484.763	453.163	452.363	462.563	10.2	.2	5.0	47.5	34.4	
		7	Sub Total			400.0	0	400.0	50.0	350.0			449.76					40	310.0	
									6.0											
	B-16	8	1			40.0	0	40.0	1.0	39.0	486.344	448.844	445.944	470.844	12.5	.225	5.0	43.8	41.0	
	B-16		2						2.2	37.8		447.544	446.944	470.744	14.2	.2	5.0	47.5	39.8	
	B-16		3						3.1	36.9		448.144	447.444	470.444	13.0	.2	5.5	51.3	38.9	
	B-16		4						0.9	39.1		447.944	447.344	470.344	15.0	.2	5.0	47.5	41.1	
	B-16		5						1.0	39.0		446.944	446.344	470.444	15.1	.2	5.0	47.5	41.0	
	B-16		6						7.1	32.9		452.944	451.444	470.444	19.0	.15	5.0	51.0	34.9	
	B-16		7						3.3	36.7		449.144	447.644	470.744	23.1	.225	5.0	43.8	38.7	
	B-16		8						4.8	35.2		451.044	449.144	470.544	21.4	.225	5.0	43.8	37.6	
	B-16		9						1.1	38.9		449.044	446.044	470.744	24.7	.2	5.0	47.5	40.3	
	B-16		10			40.0		40.0	1.3	38.7	484.344	448.644	445.644	471.044	25.4	.225	5.0	43.8	40.7	
		8	Sub Total			400.0	0	400.0	26.4	373.6			450.76					41	333.6	
									7.6											
	B-16	9	1			40.0	0	40.0	0.7	39.3	484.188	447.188	445.088	*492.988	31.8	.175	6.0	45.6	41.3	
	B-16		2						3.3	36.7		451.788	449.788		29.2	.2	5.5	52.2	38.9	
	B-16		3						9.4	30.6		455.188	453.288		25.1	.2	5.0	47.5	32.6	
	B-16		4						9.7	30.3		455.788	454.188		24.3	.125	5.0	63.3	32.5	
	B-16		5						8.5	31.5		455.488	452.788		24.3	.175	5.0	60.3	33.5	
	B-16		6						9.3	30.7		454.588	452.688		24.3	.15	5.0	51.0	32.8	
	B-16		7			40.0		40.0	10.1	29.9	484.588	456.188	454.588	*492.988	29.4	.2	5.0	47.5	31.9	
		9	Sub Total			280.0	0	280.0	49.5	230.1			451.61					41	244.1	
									7.0											
TOTAL				1480.0	+0	1480.0	265	1215											1355.6	
GRAND TOTAL				3360	-0	3360	565	2845.5											3071.6	

NOTES CONCERNING ANY UNUSUAL FOUNDATION CONDITIONS

BENT NO.	FOOTING	PILE NO.	REMARKS
			*Cor Elevs To Bot Of Wreckage Leaving Portion
			of Cap Out. See Sht No 22

NOTES

PAY LENGTH SHOULD INCLUDE ALLOWANCE FOR SPLICING STEEL PILES AND ANY OTHER AUTHORIZED ALLOWANCES.

NUMBERING PILES

A SKETCH OF BENT OR FOOTING TO BE DRAWN ON THIS SHEET AND PILES TO BE NUMBERED. ALSO FLOW OF STREAM TO BE SHOWN.

PENETRATION PER BLOW

GIVE THIS INFORMATION IN DECIMALS OF AN INCH.

PILE RECORD — FILE NO 12.477A

CONSTRUCTION RECORD DATA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EDGEMOOR QUADRANGLE
SOUTH CAROLINA
7.5 MINUTE SERIES (TOPOGRAPHIC)

STUDY AREA

EXPLANATION
EXIT — cross section

PROVISIONAL MAP
Produced from original manuscript drawings. Information shown as of date of field check

PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY
CONTROL BY ..... USGS AND NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1979
FIELD CHECKED ..... 1980 MAP EDITED 1982
PROJECTION ..... LAMBERT CONFORMAL CONIC
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR ..... ZONE 17
10,000-FOOT STATE GRID TICKS .... SOUTH CAROLINA, NORTH ZONE
UTM GRID DECLINATION ..... 0°02' WEST
1982 MAGNETIC NORTH DECLINATION ..... 4° WEST
VERTICAL DATUM ..... NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM ..... 1927 NORTH AMERICAN DATUM
To place on the predicted North American Datum of 1983, move the projection lines as shown by dashed corner ticks (11 meters south and 17 meters west)
There may be private inholdings within the boundaries of any Federal and State Reservations shown on this map

SCALE 1:24 000
1 .5 0 KILOMETERS 1 2
1000 0 METERS 1000 2000
1 .5 0 MILES 1
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10 000 FEET

CONTOUR INTERVAL 3 METERS
CONTROL AND OTHER ELEVATIONS SHOWN TO THE NEAREST 0.1 METER

To convert meters to feet multiply by 3.2808
To convert feet to meters multiply by .3048

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1983

CONTOURS AND ELEVATIONS IN METERS

ROAD LEGEND
Improved Road
Unimproved Road
Trail
Interstate Route U. S. Route State Route

QUADRANGLE LOCATION

1	2	3	1 Tirzah 2 Rock Hill West 3 Rock Hill East 4 Lowrys 5 Catawba 6 Chester 7 Richburg 8 Fort Lawn
4		5	
6	7	8	

ADJOINING 7.5' QUADRANGLE NAMES

EDGEMOOR, S. C.
PROVISIONAL EDITION 1982
34081-G1-TM-024

Figure 1.--Topography of study area and location of cross-sections used in WSPRO analysis for structure 121007710700/30700 on Interstate 77, crossing Fishing Creek in Chester County, South Carolina.