U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

LEVEL II BRIDGE SCOUR ANALYSIS FOR STRUCTURE 132005200200 ON ROUTE US 52, CROSSING JUNIPER CREEK IN CHESTERFIELD COUNTY, SOUTH CAROLINA

By Whitney J. Stringfield and Michael G. Zalants

Prepared in cooperation with the
SOUTH CAROLINA DEPARTMENT
OF TRANSPORTATION

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United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Water Resources Division
Stephenson Center, Suite 129
720 Gracern Road
Columbia, SC 29210-7651

March 27, 1995

William H. Hulbert, P.E.
Hydraulic Engineer
South Carolina Department of Transportation
955 Park Street
Columbia, South Carolina 29202

Dear Mr. Hulbert:

We are pleased to transmit another report of the Level II Bridge Scour Program titled, "Level II bridge scour analysis for structure 132005200200 on Route US 52, crossing Juniper Creek in Chesterfield County, South Carolina", by Whitney J. Stringfield and Michael G. Zalants. The technical aspects of the report have been reviewed by the South Carolina District Surface Water Specialist and the report has been approved by the South Carolina District Hydraulic Section Chief.

If you have any questions concerning this report, please contact me (750-6131) or Michael Zalants (750-6159) and we will be glad to assist you.

Sincerely,

Whitney J. Stringfield

Whitney J. Stringfield
Hydrologist

Enclosure

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

OTHER ABBREVIATIONS

downstream	D/S
upstream	U/S
flood plain	f/p
median diameter of bed material	D_{50}
South Carolina Department of Transportation	SCDOT
Water-Surface Profile computation model	WSPRO

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 structure 132005200200 on Route US 52, crossing Juniper Creek in Chesterfield County, South Carolina

by Whitney J. Stringfield and Michael G. Zalants

This report provides the results of the detailed Level II analysis of scour potential at structure 132005200200 on Route US 52, crossing Juniper Creek in Chesterfield County, South Carolina (figure 1 in pocket; figures 4-6). The site is located in the upper Coastal Plain physiographic province near the town of Cheraw, in the eastern part of Chesterfield County. The drainage area for the site is 64.0 mi^2, and is a predominantly rural drainage basin with little development in recent years. In the vicinity of the study site, the land is covered by moderate to dense woods consisting of hardwoods and pines.

In the study area, Juniper Creek has a meandering channel with a slope of approximately 0.0022 ft/ft (11.6 ft/mi), an average channel top width of 28 ft and an average channel depth of 7.3 ft. The predominant channel bed material is sand (D_{50} is 0.34 mm) and the channel banks consist of a silty sand (D_{50} is 0.19 mm). In general, the banks have moderate woody vegetative cover and were noted to be relatively stable during the Level I and Level II site visits, August 8, 1990, and March 16, 1994, respectively.

The Route US 52 crossing of Juniper Creek is a 250-ft-long, two-lane bridge consisting of ten 25-ft concrete spans, supported by concrete bents with spillthrough abutments. The left and right abutments have sparse riprap protection. 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 5 and a graph of the scour depths is shown on figure 2.

Pile penetration depths were obtained from SCDOT bridge plans (file number 13.427). The minimum remaining pile penetration depth for the 100-year discharge is 0.4 ft. This minimum depth occurs at bent 8. In addition, scour caused by the 500-year discharge will cause the pile tips at bents 7 and 8 to be exposed by 2.6 and 3.8 ft, respectively.

Table 1. *--Remaining pile/footing penetration at piers/bents for the 100-year discharge at structure 132005200200 on Route US 52, crossing Juniper Creek in Chesterfield 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 pile/footing penetration (feet)
100-year discharge is 2,430 cubic feet per second							
2	25	401.1	65.2	81.8	3.1	78.7	13.5
3	50	397.5	61.6	77.1	7.7	69.4	7.8
4	75	393.0	57.1	76.7	7.7	69.0	11.9
5	100	392.7	56.8	75.7	7.9	67.8	11.0
6	125	394.2	58.3	75.2	7.9	67.3	9.0
7	150	396.1	60.2	73.7	11.9	61.8	1.6
8	175	397.0	61.1	73.4	11.9	61.5	0.4
9	200	400.1	64.2	76.6	7.5	69.1	4.9
10	225	398.8	62.9	80.7	6.5	74.2	11.3

[1] Pier/bent number corresponds to the South Carolina Department of Transportation (SCDOT) bridge plans (file number 13.427).

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

[3] Pile tip/footing elevations obtained from the 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.

Table 2. *--Remaining pile/footing penetration at piers/bents for the 500-year discharge at structure 132005200200 on Route US 52, crossing Juniper Creek in Chesterfield 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 3,790 cubic feet per second							
2	25	401.1	65.2	81.8	10.5	71.3	6.1
3	50	397.5	61.6	77.1	11.4	65.7	4.1
4	75	393.0	57.1	76.7	11.4	65.3	8.2
5	100	392.7	56.8	75.7	11.6	64.1	7.3
6	125	394.2	58.3	75.2	11.6	63.6	5.3
7	150	396.1	60.2	73.7	16.1	57.6	-2.6
8	175	397.0	61.1	73.4	16.1	57.3	-3.8
9	200	400.1	64.2	76.6	10.8	65.8	1.6
10	225	398.8	62.9	80.7	10.1	70.6	7.7

[1] Pier/bent number corresponds to the South Carolina Department of Transportation (SCDOT) bridge plans (file number 13.427).

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

[3] Pile tip/footing elevations obtained from the 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.

Table 3. *--Cumulative scour depths at piers/bents for the 100-year discharge at structure 132005200200 on Route US 52, crossing Juniper Creek in Chesterfield 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 2,430 cubic feet per second				
2	25	3.1	0	3.1
3	50	3.1	4.6	7.7
4	75	3.1	4.6	7.7
5	100	3.1	4.8	7.9
6	125	3.1	4.8	7.9
7	150	6.0	5.9	11.9
8	175	6.0	5.9	11.9
9	200	2.5	5.0	7.5
10	225	2.5	4.0	6.5

[1] Pier/bent number corresponds to the South Carolina Department of Transportation bridge plans (file number 13.427).

[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: 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 4. *--Cumulative scour depths at piers/bents for the 500-year discharge at structure 132005200200 on Route US 52, crossing Juniper Creek in Chesterfield 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 3,790 cubic feet per second				
2	25	6.0	4.5	10.5
3	50	6.0	5.4	11.4
4	75	6.0	5.4	11.4
5	100	6.0	5.6	11.6
6	125	6.0	5.6	11.6
7	150	9.7	6.4	16.1
8	175	9.7	6.4	16.1
9	200	5.4	5.4	10.8
10	225	5.4	4.7	10.1

[1] Pier/bent number corresponds to the South Carolina Department of Transportation bridge plans (file number 13.427).

[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: 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 5. *--Abutment scour depths for the 100- and 500-year discharges at structure 132005200200 on Route US 52, crossing Juniper Creek in Chesterfield County, South Carolina*

Recurrence interval for discharge	Discharge (cubic feet per second)	Depth of scour[1, 2] at left abutment (feet)	Depth of scour[1, 2] at right abutment (feet)
100-year	2,430	---	9.9
500-year	3,790	6.7	13.0

[1] Abutment scour depths were calculated using the Froehlich (1989) live-bed abutment scour equation, assuming no abutment protection.

[2] The words "right" and "left" refer to directions that would be reported by an observer facing downstream.

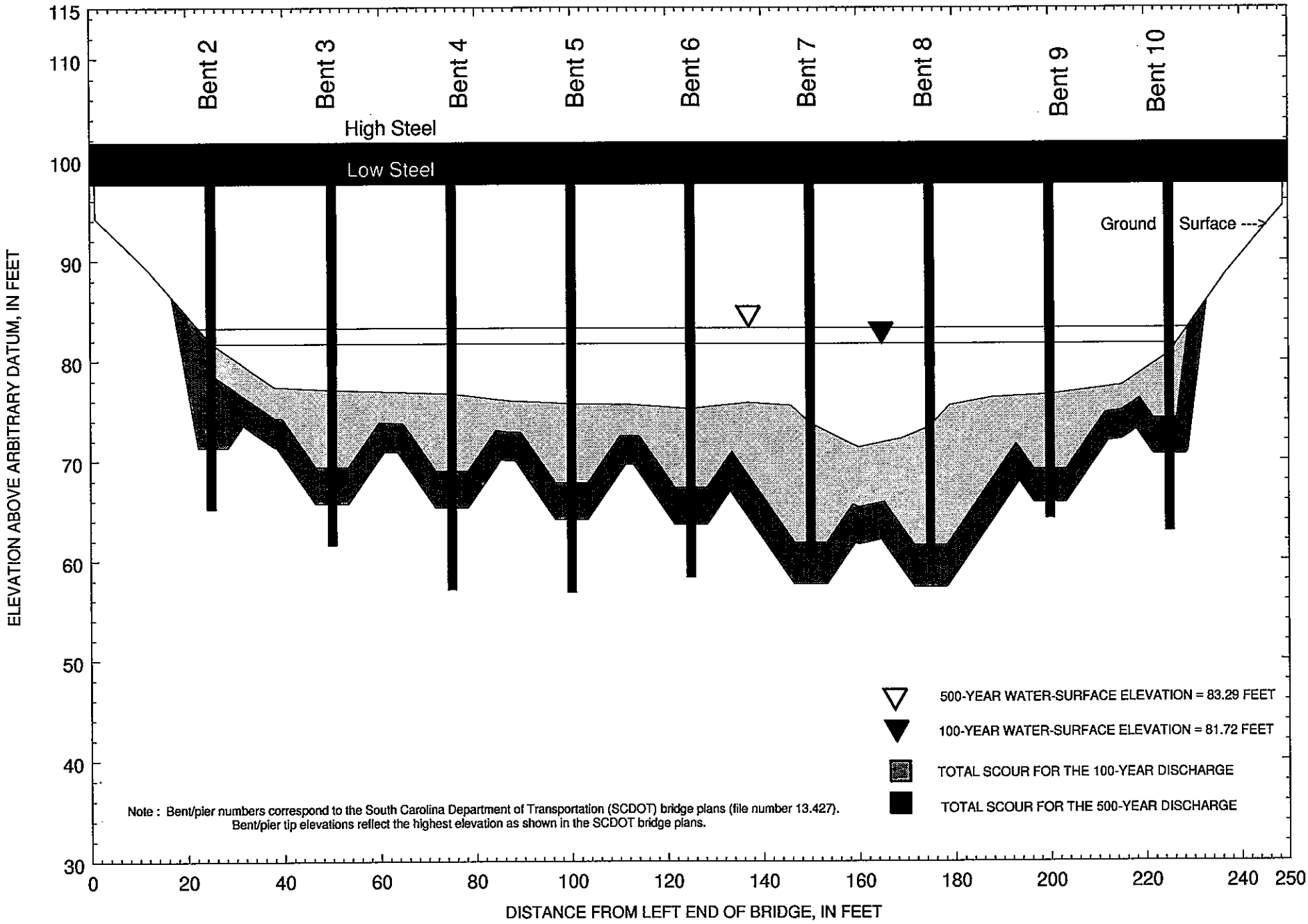

Figure 2.--Total scour depths for the 100- and 500-year discharges at structure 132005200200 on Route US 52, crossing Juniper Creek in Chesterfield County, South Carolina.

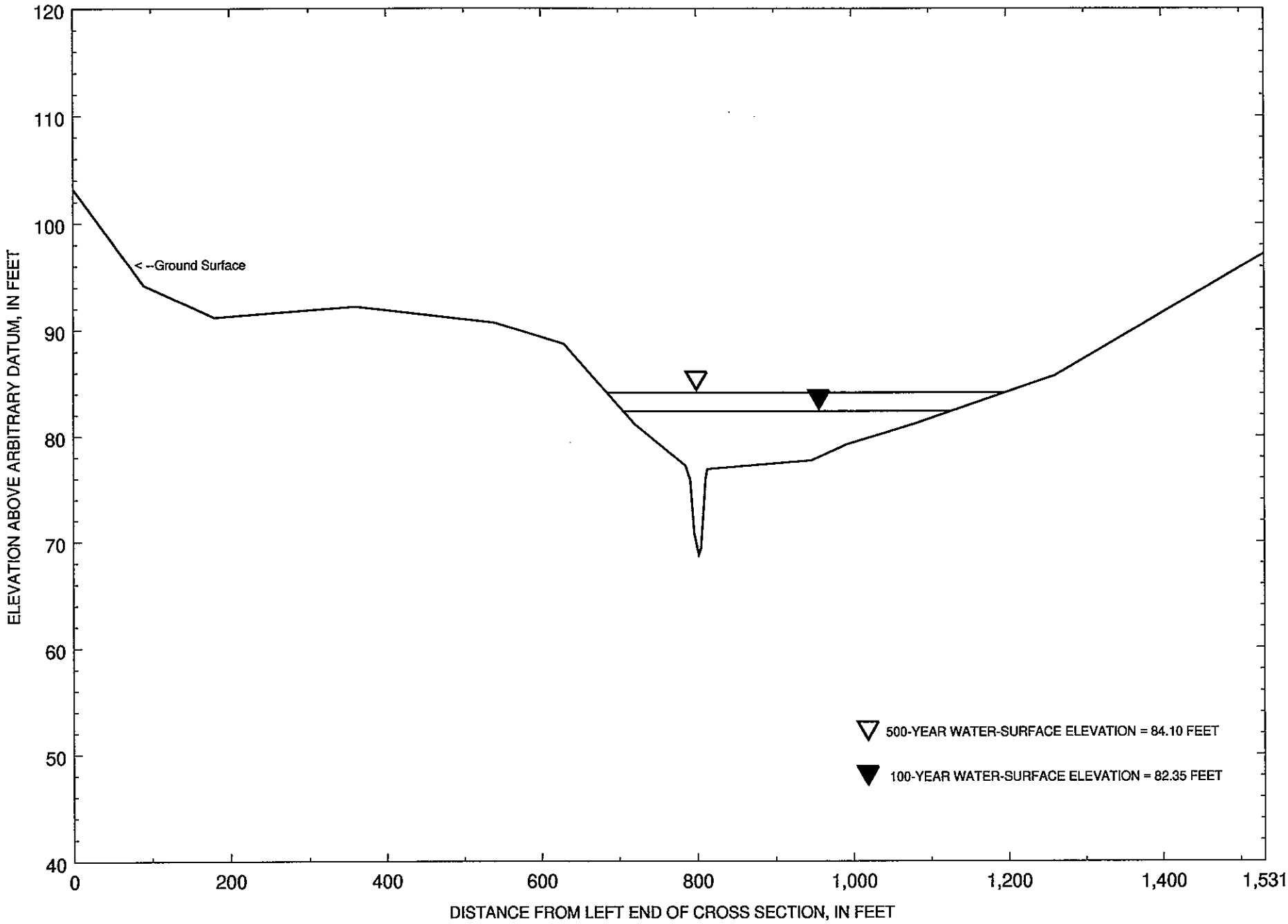

Figure 3.-- Approach cross section of structure 132005200200 on Route US 52, crossing Juniper Creek in Chesterfield County, South Carolina.

Figure 4.--Structure 132005200200 on Route US 52, crossing Juniper Creek in Chesterfield County, South Carolina as viewed from the downstream channel (March 16, 1994).

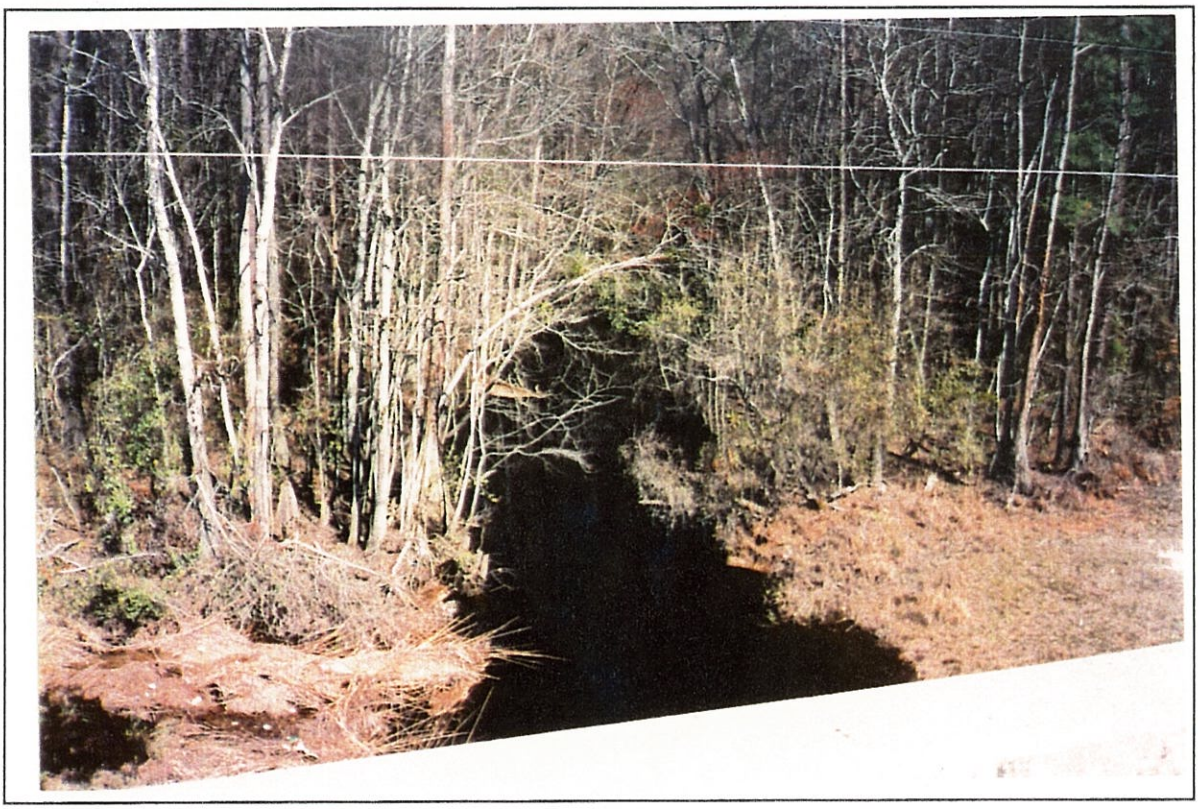

Figure 5.--Downstream channel as viewed from structure 132005200200 on Route US 52, crossing Juniper Creek in Chesterfield County, South Carolina (March 16, 1994).

Figure 6.-Upstream channel as viewed from structure 132005200200 on Route US 52, crossing Juniper Creek in Chesterfield County, South Carolina (March 16, 1994).

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Shearman, J. O., 1990, User's manual for WSPRO--a computer model for water surface profile computations: Federal Highway Administration Publication FHWA-IP-89-027, 187 p.

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U.S. Geological Survey, Interagency Advisory Committee on Water Data, 1982, Guidelines for determining flood flow frequency, Bulletin 17B of the Hydrology Subcommittee, 190 p.

SCOUR REPORT SUMMARY

Structure Number 132005200200 *Stream* Juniper Creek

County Chesterfield *Road* US 52 *District* 4

Description of Bridge

Bridge length 250 *ft* *Bridge width* 47 *ft* *Max span length* 25 *ft*

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

Abutment type Spillthrough *Embankment type* Sloping

Riprap on abutment? No *Date of inspection* 8-8-1990

Description of riprap Sparse coverage of 12- to 18-inch granite riprap. Deck seepage has caused erosion of soil beneath the riprap.

Brief description of piers/pile bents Nine interior bents each consisting of two 2.8- by 1.8-ft interior concrete piles and four 1.4-ft square exterior concrete piles

Is bridge skewed to flood plain according to USGS topo map? Yes *Angle* 26

Is bridge located on a bend in channel? Yes *If so, describe (mild, moderate, severe)* The stream bends slightly to the right at the bridge.

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	8-8-1990	0	0
Level II	3-16-1994	0	0

Potential for debris Low because Eureka Lake is located approximately 1,100 ft upstream of the Route US 52 crossing.

Describe any features near or at the bridge that may affect flow (include observation date). Eureka Lake is located approximately 1,100 ft upstream of the Route US 52 crossing.

Description of Flood Plain

General topography Typical upper Coastal Plain topography.

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

Date of inspection 3-16-1994

D/S left: Moderate to thick hardwoods and pines with moderate underbrush

D/S right: Moderate to thick hardwoods and pines with moderate underbrush

U/S left: Moderate to thick hardwoods and pines with moderate underbrush

U/S right: Moderate to thick hardwoods and pines with moderate underbrush

Description of Channel

Average top width 28 *ft* *Average depth* 7.3 *ft*

Predominant bed material Sand *Bank material* Silty sand

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

Vegetative cover on channel banks near bridge: Date of inspection 3-16-1994

D/S left: Moderate coverage of woody vegetation

D/S right: Moderate coverage of woody vegetation

U/S left: Moderate coverage of woody vegetation

U/S right: Moderate coverage of woody vegetation

Do banks appear stable? Yes *If not, describe location and type of instability and date of observation.*

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

Hydrology

Drainage area 64.0 mi^2

Percentage of drainage area in physiographic provinces:

Physiographic province	*Percent of drainage area*
upper Coastal Plain	100

Is drainage area considered rural or urban? Rural *Describe any significant urbanization and potential for development.* The drainage area encompasses a predominantly rural area with little development in recent years.

Is there a USGS gage on the stream of interest? Yes

USGS gage description Juniper Creek near Cheraw, SC

USGS gage number 02130500

Gage drainage area 64 mi^2

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

If so, describe Lake Eureka is present upstream but the effect on the hydrology/ hydraulics is negligible.

Calculated Discharges

Q100 2,430 ft^3/s *Q500* 3,790 ft^3/s

Method used to determine discharges Discharges were computed by weighting the log-Pearson Type III frequency analysis of station 02130500, Juniper Creek near Cheraw, with the regression equation discharges. Reference: USGS WRIR 91-4157, "Techniques for estimating magnitude and frequency of floods in South Carolina, 1988" by W. B. Guimaraes and L.R. Bohman.

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 335.9 ft to the USGS survey to obtain the SCDOT plans' datum (file number 13.427).

Description of reference marks used to determine USGS datum. RM1 is a chiseled square on the upstream left abutment headwall of the Route US 52 bridge with an assumed elevation of 100.00 ft. RM2 is a chiseled square on the downstream right abutment headwall of the Route US 52 bridge with a surveyed elevation of 99.99 ft.

Cross-Sections Used in WSPRO Analysis

*Cross-section ID	*Section Reference Distance (SRD) in feet*	**How cross-section was developed*	*Comments*
EXIT	-250	2	Exit cross section
FULV	0	2	Full-valley cross section
BRIDG1	0	1	U/S bridge face
APPR	297	2	Approach cross section

* 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.

Juniper Creek has a relatively uniform flood plain width in the study area, with no downstream natural or man-made contractions of flow that cause significant backwater at the Route US 52 crossing. Therefore, it was assumed that slope-conveyance methodology would be adequate for estimating the starting water-surface elevation for the water-surface profile computations. The USGS flood routing program was used to route the flood hydrograph through the dam of Eureka Lake. The flood hydrograph routing shows that the dam has little impact on the 100- and 500-year peak discharges. Because the change was less than 10 percent, it was decided to neglect the effect of the pond.

For this study, the WSPRO model requires, as a minimum, an exit cross section one bridge width downstream of the bridge, a full-valley cross section at the downstream face of the bridge, the bridge cross section, and an approach cross section one bridge width upstream of the bridge. Cross sections at the upstream and downstream faces of the bridge were directly surveyed and the more constricted (upstream) bridge face was used in the WSPRO model. The section reference distance (SRD) at the downstream face of the bridge was set to zero. A survey was made of the channel 100 feet upstream of Route US 52. This survey data was combined with the flood plain cross section elevations obtained from the SCDOT road plans (Federal Aid project number 304) to construct a cross section representative of the approach, exit, and full-valley cross sections at Route US 52. The SCDOT stations were adjusted by a skew of 26 degrees in order to orient the cross section perpendicular to the natural flood plain. The cross section was then shifted by the channel slope to the appropriate SRD to represent the approach, full-valley, and exit cross sections required by the WSPRO model.

Bridge Hydraulics

Average embankment elevation 99.6 *ft*

Average low steel elevation 97.6 *ft*

100-year discharge 2,430 ft^3/s

Water-surface elevation at D/S bridge face 81.72 *ft*

Area of flow at D/S bridge face 1,018 ft^2

Average velocity in bridge opening 2.39 *ft/s*

Maximum WSPRO tube velocity at bridge 3.67 *ft/s*

Water-surface elevation at Approach section with bridge 82.35 *ft*

Water-surface elevation at Approach section without bridge 82.17 *ft*

Amount of backwater caused by bridge 0.18 *ft*

500-year discharge 3,790 ft^3/s

Water-surface elevation at D/S bridge face 83.29 *ft*

Area of flow at D/S bridge face 1,306 ft^2

Average velocity in bridge opening 2.90 *ft/s*

Maximum WSPRO tube velocity at bridge 4.32 *ft/s*

Water-surface elevation at Approach section with bridge 84.10 *ft*

Water-surface elevation at Approach section without bridge 83.78 *ft*

Amount of backwater caused by bridge 0.32 *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 5 and a graph of the scour depths is shown on figure 2.

The local pier scour was determined using the Colorado State University pier scour equation (Richardson and others, 1993). Bents 2 through 6 are located on the left overbank and were analyzed using the maximum left overbank WSPRO tube velocity and the depth of flow at each bent. Bents 9 and 10 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 7 and 8 are located in the channel and were analyzed using 90 percent of the maximum WSPRO tube velocity and the maximum depth within the channel at the bridge. The maximum depth within the channel was used to account for possible changes in the thalweg during a flood. The bridge is skewed approximately 26 degrees to the channel. However, because the columns are spaced far apart and flow would pass between them, a skew of 13 degrees was used for the pier scour.

The left and right overbanks at the bridge were analyzed for contraction scour using Laursen's clear-water contraction scour equation (Richardson and others, 1993).

Eureka Lake is located approximately 1,100 ft upstream of the Route US 52 bridge. Therefore, sediment transport is likely to be minimal and it was decided that clear-water scour would best represent the contraction scour processes at the bridge; consequently, the potential channel contraction scour was determined using Laursen's clear-water contraction scour equation (Richardson and others, 1993.

The abutments are not fully protected by riprap, therefore abutment scour was calculated using the Froehlich (1989) live-bed abutment scour equation.

WSPRO INPUT FILE

```
T1          Structure 132005200200, (250 ft bridge)
T2          Juniper Creek at US 52, Chesterfield County
T3          WJS 3-16-1995, file: wspro.june
*
*            Q100     Q500
Q            2430    3790
*
*
SK           0.0022  0.0022
*
*            SURV taken from SCDOT road plans at centerline (24 ft U/S of
*            D/S face). Channel section surveyed 100 ft U/S of bridge and
*            inserted into SCDOT road plans survey. The USGS flood routing
*            program was used to route the flood hydrograph through the dam.
*            The flood hydrograph routing shows that the dam has little impact
*            on the 100- and 500-year peak discharges. Because the change was
*            less than 10 percent, it was decided to neglect the effect of the
*            pond and use the Q100 and Q500 discharges calculated from the flood
*            frequency equation at or near a gaged site on the same stream.
*            A 26 degree skew is applied to the overbanks but not to the channel.
*
*
XT    SURV  24   .0022
GR           0  102.6  90 93.6 180  90.6  360 91.6  539 90.1  629 88.1
GR           719 80.6 785 76.6 791  75.3  796 70.2  802 68.2  805 68.8
GR           811 75.4 813 76.3 947  77.1  992 78.6 1082 80.6 1261 85.1
GR          1531 96.6
*
*
XS    EXIT  -250
GT
N           0.16  0.055  0.16
SA              785   813
PX
*
*
XS    FULV    0
GT
PX
*
*            U/S FACE OF BRIDGE
*
*
BR    BRDG1  0  97.6  26
GR             0 97.6   1   97.6   1.1  94.2  12 89.1  25 81.8  38 77.4
GR            50 77.1  62   76.9   75   76.7  87 76.0 100 75.7 113 75.6
GR           125 75.2 137   75.8  146   75.5 150 73.7 160 71.3 169 72.2
GR           175 73.4 179   75.5  188   76.3 200 76.6 215 77.5 225 80.7
GR           237 88.8 248.9 95.43 249   97.6 250 97.6 0 97.6
N            0.045  0.040  0.045
SA               146    179
CD           3  47  1  99.6
PW 1         73.4  1.8 73.7 1.8 73.7 3.6 75.2  3.6 75.2  5.4 75.7  5.4 75.7  7.2
PW           76.6  7.2 76.6 9.0 76.7 9.0 76.7 10.8 77.1 10.8 77.1 12.6 80.7 12.6
PW           80.7 14.4 81.8 14.4 81.8 16.2 97.6 16.2 97.6 0
PX
*
```

WSPRO INPUT FILE --Continued

```
*             SRD OF APPROACH( 250 FT + 47 FT )= 297 FT
*
*              SCDOT road plans survey with surveyed channel section inserted
*
XT   SURV1 24   .0022
GR           0  102.6  90 93.6 180  90.6  360 91.6  539 90.1  629 88.1
GR          719 80.6 785 76.6 791  75.3  796 70.2  802 68.2  805 68.8
GR          811 75.4 813 76.3 947  77.1  992 78.6 1082 80.6 1261 85.1
GR         1531 96.6
*
AS   APPR   297
GT
*
BP          639
*
N              0.16   0.055   0.16
SA                 785    813
PX
*
*
HP 1 BRDG1 81.72 0 81.72
HP 2 BRDG1 81.75 0 81.75 2430
HP 1 APPR  82.35 0 82.35
HP 2 APPR  82.35 0 82.35 2430
*
HP 1 BRDG1 83.29 0 83.29
HP 2 BRDG1 83.32 0 83.32 3790
HP 1 APPR  84.10 0 84.10
HP 2 APPR  84.10 0 84.10 3790
*
EX
ER
```

WSPRO OUTPUT

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WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V042094              MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

      Structure 132005200200, (250 ft bridge)
      Juniper Creek at US 52, Chesterfield County
      WJS 3-16-1995, file: wspro.june
         *** RUN DATE & TIME: 03-22-95  14:38
   CROSS-SECTION PROPERTIES:  ISEQ =  3;  SECID = BRDG1;  SRD =        0.

    WSEL  SA#      AREA         K   TOPW   WETP  ALPH     LEW     REW      QCR
            1       563     55596    109    109                              7279
            2       263     40712     30     31                              4453
            3       191     16932     43     44                              2294
   81.72            1018    113239    181    184  1.18      25     227     12635


   VELOCITY DISTRIBUTION:  ISEQ =  3;  SECID = BRDG1;  SRD =        0.

        WSEL      LEW      REW     AREA        K         Q      VEL
       81.75     25.1    226.6   1023.1   114153.    2430.     2.38

X STA.        25.1        51.4        66.1        79.4        90.9       101.0
  A(I)            79.7        63.1        60.6        57.7        54.5
  V(I)            1.53        1.93        2.01        2.10        2.23

X STA.       101.0       110.6       119.9       128.7       138.1       147.5
  A(I)            52.7        51.6        51.4        51.8        52.3
  V(I)            2.31        2.36        2.36        2.35        2.33

X STA.       147.5       153.1       157.3       161.0       164.7       168.5
  A(I)            40.4        35.4        34.0        33.1        34.0
  V(I)            3.01        3.43        3.57        3.67        3.57

X STA.       168.5       172.9       179.1       189.6       202.5       226.6
  A(I)            36.1        42.8        54.7        60.7        76.7
  V(I)            3.36        2.84        2.22        2.00        1.58
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WSPRO OUTPUT --Continued

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WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V042094            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure 132005200200, (250 ft bridge)
        Juniper Creek at US 52, Chesterfield County
        WJS 3-16-1995, file: wspro.june
           *** RUN DATE & TIME: 03-22-95  14:38
    CROSS-SECTION PROPERTIES:  ISEQ =  4;  SECID = APPR ;  SRD =     297.

     WSEL  SA#      AREA         K   TOPW   WETP  ALPH    LEW    REW      QCR
             1       216      3895     80     80                          2014
             2       265     28262     28     34                          4614
             3      1072     22590    315    315                         11224
    82.35           1552     54747    423    429  4.90    705   1128      7625



    VELOCITY DISTRIBUTION:  ISEQ =  4;  SECID = APPR ;  SRD =     297.

         WSEL      LEW      REW     AREA         K         Q     VEL
        82.35    705.2   1127.7   1552.1   54747.    2430.    1.57

X STA.       705.2       774.6       788.5       793.3       796.0       797.9
  A(I)           165.4        69.7        33.1        27.4        22.5
  V(I)            0.73        1.74        3.68        4.43        5.41

X STA.       797.9       799.6       801.2       802.7       804.3       806.1
  A(I)            21.6        20.7        20.5        20.1        23.2
  V(I)            5.63        5.86        5.93        6.03        5.25

X STA.       806.1       809.0       817.6       836.8       856.5       877.7
  A(I)            29.3        52.0       102.9       103.3       109.0
  V(I)            4.15        2.34        1.18        1.18        1.11

X STA.       877.7       900.6       924.7       952.1       992.0      1127.7
  A(I)           114.3       117.0       128.3       152.4       219.6
  V(I)            1.06        1.04        0.95        0.80        0.55
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WSPRO OUTPUT --Continued

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WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V042094            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

      Structure 132005200200, (250 ft bridge)
      Juniper Creek at US 52, Chesterfield County
      WJS 3-16-1995, file: wspro.june
         *** RUN DATE & TIME: 03-22-95  14:38
   CROSS-SECTION PROPERTIES:  ISEQ =  3;  SECID = BRDG1;  SRD =       0.

 WSEL  SA#      AREA         K   TOPW   WETP  ALPH     LEW     REW      QCR
         1       736     85217    111    112                          10741
         2       310     53403     30     31                           5685
         3       260     27171     45     46                           3551
83.29            1305    165791    186    190  1.13      22     229     18468


   VELOCITY DISTRIBUTION:  ISEQ =  3;  SECID = BRDG1;  SRD =       0.

      WSEL      LEW      REW     AREA         K         Q     VEL
     83.32     22.3    228.9   1311.0  166878.    3790.    2.89

X STA.        22.3        47.8        62.0        74.7        86.0        96.3
  A(I)             98.7        80.3        74.5        70.1        68.7
  V(I)             1.92        2.36        2.55        2.70        2.76

X STA.        96.3       106.2       115.8       124.6       133.7       143.3
  A(I)             68.0        66.4        63.2        64.5        66.1
  V(I)             2.79        2.85        3.00        2.94        2.87

X STA.       143.3       151.0       156.2       160.4       164.6       169.0
  A(I)             59.1        48.1        44.5        43.9        44.9
  V(I)             3.21        3.94        4.26        4.32        4.22

X STA.       169.0       174.0       181.8       192.6       205.2       228.9
  A(I)             48.0        60.4        69.3        75.7        96.6
  V(I)             3.95        3.14        2.74        2.50        1.96
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WSPRO OUTPUT --Continued

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WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V042094            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure 132005200200, (250 ft bridge)
        Juniper Creek at US 52, Chesterfield County
        WJS 3-16-1995, file: wspro.june
           *** RUN DATE & TIME: 03-22-95  14:38
    CROSS-SECTION PROPERTIES:  ISEQ =  4;  SECID = APPR ;  SRD =     297.

     WSEL  SA#      AREA         K   TOPW   WETP  ALPH    LEW     REW      QCR
             1       374      8327    101    101                             4085
             2       314     37515     28     34                             5954
             3      1683     41964    384    384                            19993
    84.10           2371     87806    513    519  4.71    684    1197     13324



    VELOCITY DISTRIBUTION:  ISEQ =  4;  SECID = APPR ;  SRD =     297.

         WSEL      LEW      REW     AREA         K         Q     VEL
        84.10    684.2   1197.3   2370.8    87806.    3790.    1.60

X STA.       684.2       762.0       785.7       791.3       795.4       797.9
  A(I)           231.1       147.8        42.5        44.0        32.7
  V(I)            0.82        1.28        4.45        4.31        5.79

X STA.       797.9       800.0       802.0       804.0       806.3       810.2
  A(I)            31.1        29.8        29.5        33.6        43.3
  V(I)            6.10        6.35        6.42        5.64        4.37

X STA.       810.2       823.5       842.8       863.0       883.7       906.2
  A(I)            96.9       137.0       140.7       141.3       150.9
  V(I)            1.96        1.38        1.35        1.34        1.26

X STA.       906.2       930.1       955.6       989.2      1037.0      1197.3
  A(I)           156.9       163.2       186.3       212.0       320.0
  V(I)            1.21        1.16        1.02        0.89        0.59
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WSPRO OUTPUT --Continued

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WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V042094            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure 132005200200, (250 ft bridge)
        Juniper Creek at US 52, Chesterfield County
        WJS 3-16-1995, file: wspro.june
           *** RUN DATE & TIME: 03-22-95  14:38

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

EXIT :XS    ******     707      1474   0.21  *****    81.17    78.05    2430    80.96
      -249  ******    1120     51769   4.91  *****  *******     0.34    1.65

FULV :FV       250     707      1475   0.21   0.55    81.72  *******    2430    81.51
         0     250    1120     51821   4.91   0.00     0.00     0.34    1.65
        <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

APPR :AS       297     707      1478   0.21   0.65    82.38  *******    2430    82.17
       297     297    1121     51936   4.91   0.00     0.01     0.34    1.64
        <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

            <<<<<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

BRDG1:BR       250      25      1018   0.11   0.67    81.84    78.13    2430    81.72
         0     250     227    113355   1.27   0.00     0.00     0.20    2.39

     TYPE PPCD FLOW       C     P/A     LSEL   BLEN   XLAB   XRAB
       3.   1.   1.   0.888   0.079    97.60 ****** ****** ******

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

APPR :AS       250     705      1553   0.19   0.67    82.54    79.25    2430    82.35
       297     266    1128     54794   4.90   0.03     0.01     0.32    1.56

      M(G)    M(K)       KQ    XLKQ    XRKQ    OTEL
     0.515   0.221   42577.    683.    884.    81.86

                  <<<<<END OF BRIDGE COMPUTATIONS>>>>>
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WSPRO OUTPUT --Continued

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WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V042094_           MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure 132005200200, (250 ft bridge)
        Juniper Creek at US 52, Chesterfield County
        WJS 3-16-1995, file: wspro.june
           *** RUN DATE & TIME: 03-22-95  14:38

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

EXIT :XS    ******      688       2203    0.22   *****    82.78     79.19     3790     82.56
      -249  ******     1184      80764    4.76   *****  *******      0.31     1.72

FULV :FV       250      688       2204    0.22    0.55    83.34  *******     3790     83.12
         0     250     1184      80821    4.76    0.00     0.00      0.31     1.72
          <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

APPR :AS       297      688       2208    0.22    0.65    83.99  *******     3790     83.78
       297     297     1184      80954    4.75    0.00     0.01      0.31     1.72
          <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

             <<<<<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

BRDG1:BR       250       22       1306    0.18    0.68    83.47     78.88     3790     83.29
         0     250      229     165815    1.35    0.00     0.00      0.22     2.90

     TYPE PPCD FLOW       C      P/A     LSEL    BLEN    XLAB    XRAB
       3.   1.   1.   0.861    0.081    97.60  ******  ******  ******

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

APPR :AS       250      684       2369    0.19    0.78    84.28     80.39     3790     84.10
       297     310     1197      87711    4.71    0.03     0.02      0.28     1.60

      M(G)    M(K)        KQ     XLKQ     XRKQ     OTEL
     0.585   0.257     64953.    688.     894.     83.63

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

PIER SCOUR COMPUTATIONS
FOR
Juniper Creek at US 52, Struc. 132005200200, Chesterfield Co.,
Q100, WJS 3-21-1995, file scour.june.1

HYDRAULIC VARIABLES USED IN CSU EQUATION

PIER NUMBER	2	3	4	5	6	7	8
PIER STATION (FT)	25	50	75	100	125	150	175
LOCATION OF PIER	lfp	lfp	lfp	lfp	lfp	mcl	mcr
Y1: DEPTH (FT)	0.0	4.6	5.0	6.0	6.5	10.4	10.4
V1: VEL. (FPS)	2.4	2.4	2.4	2.4	2.4	3.3	3.3
a: PIER WIDTH (FT)	1.8	1.8	1.8	1.8	1.8	1.8	1.8
L: PIER LENGTH (FT)	11.2	11.2	11.2	11.2	11.2	11.2	11.2
PIER SHAPE	1	1	1	1	1	1	1
ATTACK ANGLE	13	13	13	13	13	13	13
K1 (SHAPE COEF.)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
K2 (ANGLE COEF.)	1.67	1.67	1.67	1.67	1.67	1.67	1.67
FROUDE NO.	0.00	0.20	0.19	0.17	0.17	0.18	0.18

COMPUTED SCOUR DEPTHS USING CSU EQUATION

SCOUR DEPTH (FT)	0.00	4.16	4.21	4.32	4.36	5.33	5.33
MAX SCOUR DEPTH (FT)	0.00	4.58	4.63	4.75	4.80	5.86	5.86

HYDRAULIC VARIABLES USED IN CSU EQUATION

PIER NUMBER	9	10
PIER STATION (FT)	200	225
LOCATION OF PIER	rfp	rfp
Y1: DEPTH (FT)	5.1	1.0
V1: VEL. (FPS)	2.8	2.8
a: PIER WIDTH (FT)	1.8	1.8
L: PIER LENGTH (FT)	11.2	11.2
PIER SHAPE	1	1
ATTACK ANGLE	13	13
K1 (SHAPE COEF.)	1.00	1.00
K2 (ANGLE COEF.)	1.67	1.67
FROUDE NO.	0.22	0.49

COMPUTED SCOUR DEPTHS USING CSU EQUATION

SCOUR DEPTH (FT)	4.51	3.63
MAX SCOUR DEPTH (FT)	4.97	3.99

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

CONTRACTION SCOUR COMPUTATIONS
FOR
Juniper Creek at US 52, Struc. 132005200200, Chesterfield Co.,
Q100, WJS 3-21-1995, file scour.june.1

MAIN CHANNEL IN BRIDGE OPENING
CLEAR-WATER CONTRACTION SCOUR COMPUTATIONS

DISCHARGE IN CONTRACTED SECTION (CFS)	=	874.
WIDTH OF CONTRACTED SECTION (FT)	=	28.6
MEDIAN GRAIN SIZE (FT)	=	0.0014
COMPUTED DEPTH OF CONTRACTED SECTION (FT)	=	15.8
AVERAGE FLOOD PLAIN DEPTH (FT)	=	9.8
DEPTH OF CONTRACTION SCOUR (FT)	=	6.0

LEFT OVERBANK IN BRIDGE OPENING
CLEAR-WATER CONTRACTION SCOUR COMPUTATIONS

DISCHARGE IN CONTRACTED SECTION (CFS)	=	1190.
WIDTH OF CONTRACTED SECTION (FT)	=	97.1
MEDIAN GRAIN SIZE (FT)	=	0.0008
COMPUTED DEPTH OF CONTRACTED SECTION (FT)	=	8.5
AVERAGE FLOOD PLAIN DEPTH (FT)	=	5.4
DEPTH OF CONTRACTION SCOUR (FT)	=	3.1

RIGHT OVERBANK IN BRIDGE OPENING
CLEAR-WATER CONTRACTION SCOUR COMPUTATIONS

DISCHARGE IN CONTRACTED SECTION (CFS)	=	363.
WIDTH OF CONTRACTED SECTION (FT)	=	32.4
MEDIAN GRAIN SIZE (FT)	=	0.0008
COMPUTED DEPTH OF CONTRACTED SECTION (FT)	=	7.9
AVERAGE FLOOD PLAIN DEPTH (FT)	=	5.4
DEPTH OF CONTRACTION SCOUR (FT)	=	2.5

ABUTMENT SCOUR COMPUTATIONS
FOR
Juniper Creek at US 52, Struc. 132005200200, Chesterfield Co.,
Q100, WJS 3-21-1995, file scour.june.1

RIGHT ABUTMENT
SCOUR COMPUTATIONS

ABUTMENT TYPE	3 -SPILL THROUGH
DISCHARGE BLOCKED BY ABUTMENT (CFS)	797.
AREA BLOCKED BY ABUTMENT (SQ FT)	899.0
DEPTH OF FLOW AT ABUTMENT (FT)	4.2
LENGTH OF ABUT. 90 DEG. TO FLOW (FT)	283.0
ABUTMENT SKEW (DEG)	-26
AJUSTED ABUTMENT LENGTH (FT)	213.0
AVERAGE F/P VELOCITY U/S OF ABUT. (FPS)	0.9
FROUDE NUMBER	0.076
K1 COEF.	0.6
K2 COEF.	1.0

DESIGN DEPTH OF SCOUR (FROELICH EQUATION, 1989) (FT) = 9.9

PIER SCOUR COMPUTATIONS
FOR
Juniper Creek at US 52, Struc. 132005200200, Chesterfield Co.,
Q500, WJS 3-20-1995, file scour.june.5

HYDRAULIC VARIABLES USED IN CSU EQUATION

PIER NUMBER	2	3	4	5	6	7	8
PIER STATION (FT)	25	50	75	100	125	150	175
LOCATION OF PIER	lfp	lfp	lfp	lfp	lfp	mcl	mcr
Y1: DEPTH (FT)	1.5	6.2	6.6	7.6	8.1	12.0	12.0
V1: VEL. (FPS)	3.2	3.2	3.2	3.2	3.2	3.9	3.9
a: PIER WIDTH (FT)	1.8	1.8	1.8	1.8	1.8	1.8	1.8
L: PIER LENGTH (FT)	11.2	11.2	11.2	11.2	11.2	11.2	11.2
PIER SHAPE	1	1	1	1	1	1	1
ATTACK ANGLE	13	13	13	13	13	13	13
K1 (SHAPE COEF.)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
K2 (ANGLE COEF.)	1.67	1.67	1.67	1.67	1.67	1.67	1.67
FROUDE NO.	0.46	0.23	0.22	0.20	0.20	0.20	0.20

COMPUTED SCOUR DEPTHS USING CSU EQUATION

SCOUR DEPTH (FT)	4.05	4.91	4.95	5.04	5.09	5.84	5.84
MAX SCOUR DEPTH (FT)	4.46	5.40	5.44	5.55	5.59	6.42	6.42

HYDRAULIC VARIABLES USED IN CSU EQUATION

PIER NUMBER	9	10
PIER STATION (FT)	200	225
LOCATION OF PIER	rfp	rfp
Y1: DEPTH (FT)	6.7	2.6
V1: VEL. (FPS)	3.1	3.1
a: PIER WIDTH (FT)	1.8	1.8
L: PIER LENGTH (FT)	11.2	11.2
PIER SHAPE	1	1
ATTACK ANGLE	13	13
K1 (SHAPE COEF.)	1.00	1.00
K2 (ANGLE COEF.)	1.67	1.67
FROUDE NO.	0.21	0.34

COMPUTED SCOUR DEPTHS USING CSU EQUATION

SCOUR DEPTH (FT)	4.89	4.30
MAX SCOUR DEPTH (FT)	5.38	4.73

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

CONTRACTION SCOUR COMPUTATIONS
FOR
Juniper Creek at US 52, Struc. 132005200200, Chesterfield Co.,
Q500, WJS 3-20-1995, file scour.june.5

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MAIN CHANNEL IN BRIDGE OPENING
CLEAR-WATER CONTRACTION SCOUR COMPUTATIONS

DISCHARGE IN CONTRACTED SECTION (CFS)	=	1220.
WIDTH OF CONTRACTED SECTION (FT)	=	28.6
MEDIAN GRAIN SIZE (FT)	=	0.0014
COMPUTED DEPTH OF CONTRACTED SECTION (FT)	=	21.0
AVERAGE FLOOD PLAIN DEPTH (FT)	=	11.3
DEPTH OF CONTRACTION SCOUR (FT)	=	9.7

LEFT OVERBANK IN BRIDGE OPENING
CLEAR-WATER CONTRACTION SCOUR COMPUTATIONS

DISCHARGE IN CONTRACTED SECTION (CFS)	=	1950.
WIDTH OF CONTRACTED SECTION (FT)	=	97.1
MEDIAN GRAIN SIZE (FT)	=	0.0008
COMPUTED DEPTH OF CONTRACTED SECTION (FT)	=	13.0
AVERAGE FLOOD PLAIN DEPTH (FT)	=	7.0
DEPTH OF CONTRACTION SCOUR (FT)	=	6.0

RIGHT OVERBANK IN BRIDGE OPENING
CLEAR-WATER CONTRACTION SCOUR COMPUTATIONS

DISCHARGE IN CONTRACTED SECTION (CFS)	=	620.
WIDTH OF CONTRACTED SECTION (FT)	=	32.4
MEDIAN GRAIN SIZE (FT)	=	0.0008
COMPUTED DEPTH OF CONTRACTED SECTION (FT)	=	12.4
AVERAGE FLOOD PLAIN DEPTH (FT)	=	7.0
DEPTH OF CONTRACTION SCOUR (FT)	=	5.4

ABUTMENT SCOUR COMPUTATIONS
FOR
Juniper Creek at US 52, Struc. 132005200200, Chesterfield Co.,
Q500, WJS 3-20-1995, file scour.june.5

LEFT ABUTMENT
SCOUR COMPUTATIONS

ABUTMENT TYPE	3 -SPILL THROUGH
DISCHARGE BLOCKED BY ABUTMENT (CFS)	9.
AREA BLOCKED BY ABUTMENT (SQ FT)	11.0
DEPTH OF FLOW AT ABUTMENT (FT)	5.9
LENGTH OF ABUT. 90 DEG. TO FLOW (FT)	3.9
ABUTMENT SKEW (DEG)	26
AJUSTED ABUTMENT LENGTH (FT)	1.9
AVERAGE F/P VELOCITY U/S OF ABUT. (FPS)	0.8
FROUDE NUMBER	0.059
K1 COEF.	0.6
K2 COEF.	1.0

DESIGN DEPTH OF SCOUR (FROELICH EQUATION, 1989) (FT) = 6.7

RIGHT ABUTMENT
SCOUR COMPUTATIONS

ABUTMENT TYPE	3 -SPILL THROUGH
DISCHARGE BLOCKED BY ABUTMENT (CFS)	1490.
AREA BLOCKED BY ABUTMENT (SQ FT)	1453.0
DEPTH OF FLOW AT ABUTMENT (FT)	5.8
LENGTH OF ABUT. 90 DEG. TO FLOW (FT)	352.0
ABUTMENT SKEW (DEG)	-26
AJUSTED ABUTMENT LENGTH (FT)	250.9
AVERAGE F/P VELOCITY U/S OF ABUT. (FPS)	1.0
FROUDE NUMBER	0.075
K1 COEF.	0.6
K2 COEF.	1.0

DESIGN DEPTH OF SCOUR (FROELICH EQUATION, 1989) (FT) = 13.0

FED. ROAD SYM. NO.	STATE	COUNTY	FILE NO.	F.A. PROJ. NO.	SHEET NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	Chesterfield	13.427		52	1	14

INDEX OF SHEETS

SOUTH CAROLINA
STATE HIGHWAY DEPARTMENT
COLUMBIA

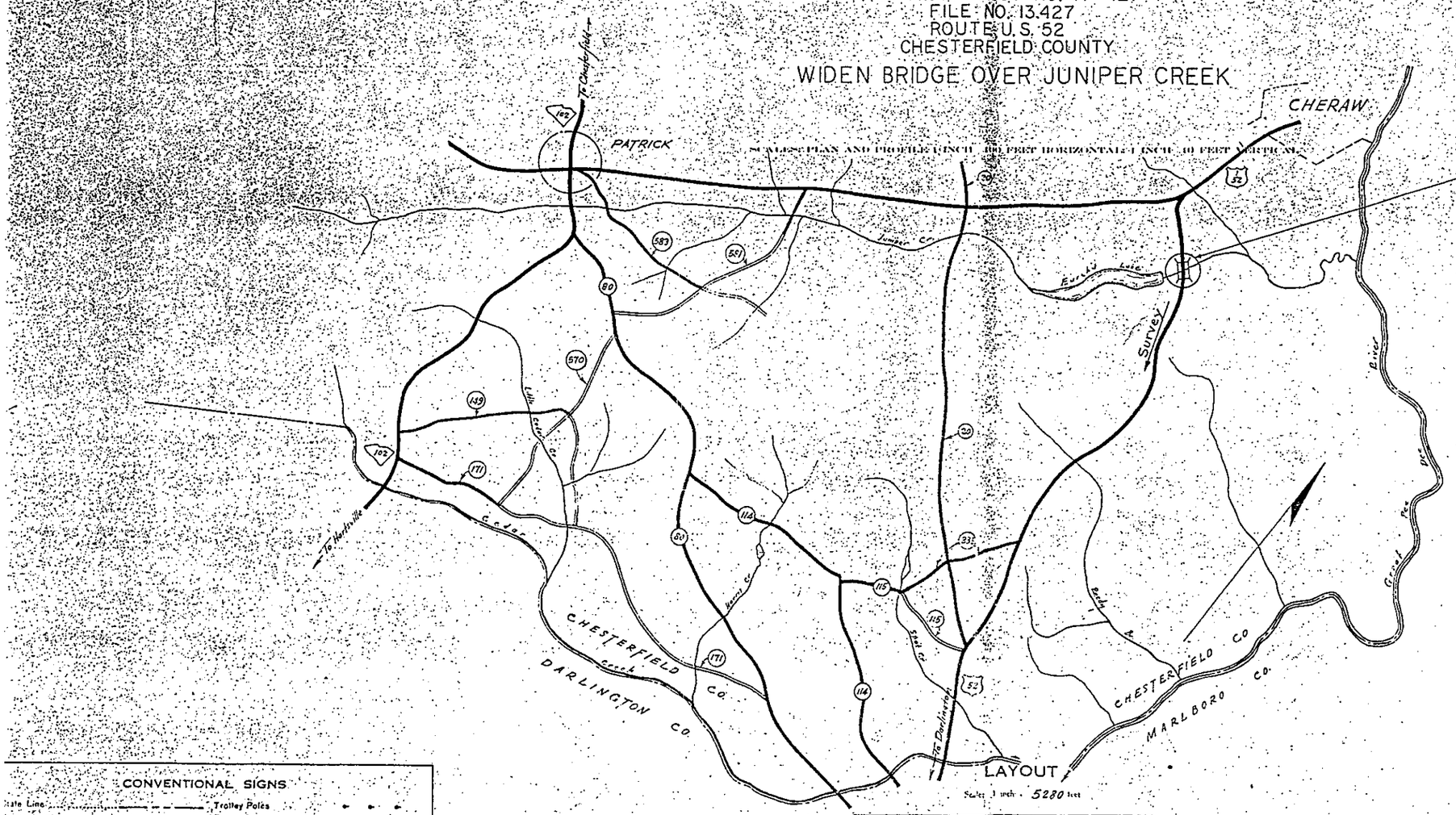
PLAN AND PROFILE OF PROPOSED STATE HIGHWAY

STATE PROJECT NO. A-427
FILE NO. 13.427
ROUTE U.S. 52
CHESTERFIELD COUNTY

WIDEN BRIDGE OVER JUNIPER CREEK

SUMMARY OF ESTIMATED QUANTITIES

CONCRETE, CLASS "A"	434.5 (432.5 ±) C.Y.
REINFORCING STEEL	85,145 LBS.
16" SQUARE PRESTRESSED CONCRETE PILING	1860 L.F.
INTAKE SPILLWAY ASSEMBY	4 EA.
8" PIPE SLOPE DRAINS	130 L.F.



250'-0"± R.C. BRIDGE TO BE WIDENED FROM STA. 179+00 TO STA. 181+50

LAYOUT
Scale 1 inch = 5280 feet

Net Length of Roadway	.000 Miles
Net Length of Bridges	.047 Miles
Net Length of Project	.047 Miles
Length of Exceptions	.000 Miles
Gross Length of Project	.047 Miles

Equalities in Stationing

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
Cut and R.O.W. Lines of	Buildings
Improved Road	Bridge
Railroad	Concrete Box Culvert
Top or Embankment	Pipe Culvert
Guard Rail	Drop Inlet and Culvert
Point of Intersection (P.I.)	Hub on Center Line

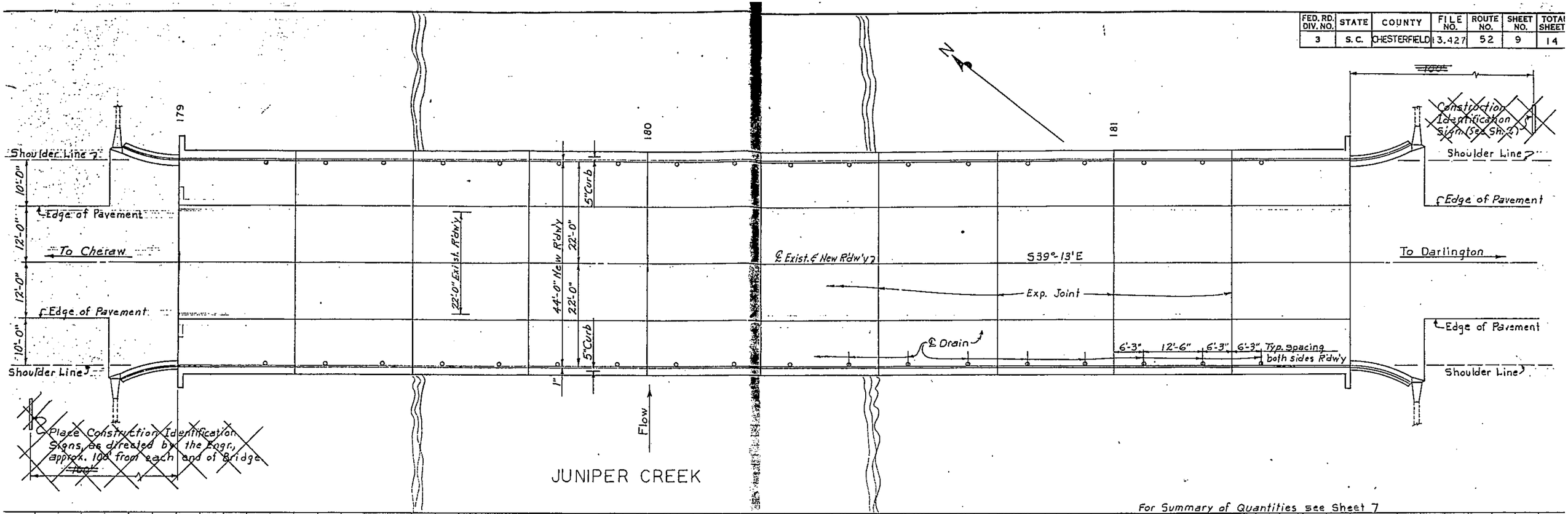
LEGEND
PROPOSED PROJECT
OTHER ROADS

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

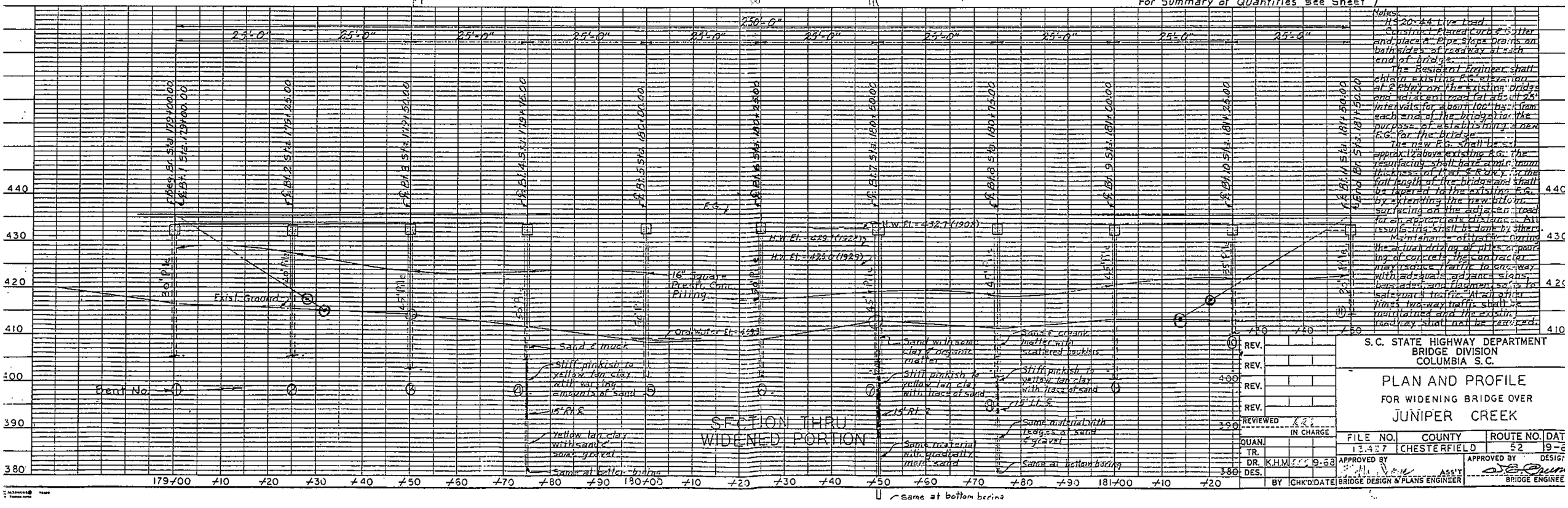
APPROVED
STATE HIGHWAY ENGINEER — DATE 10/4/68

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.	CHESTERFIELD	13.427	52	9	14



For Summary of Quantities see Sheet 7



Notes:

H-20-44 Live Load.

Construct Plated curb & gutter and place 6" Pipe Slope Drains on both sides of roadway at each end of bridge.

The Resident Engineer shall obtain existing E.G. elevation at ℄ R'dw'y on the existing bridge and adjacent road fat 25' or 25' intervals for about 100' back from each end of the bridge for the purpose of establishing a new E.G. for the bridge.

The new E.G. shall be set approx. 1' above existing E.G. The resurfacing shall have a min. thickness of 1½" at ℄ R'dw'y for the full length of the bridge and shall be tapered to the existing E.G. by extending the new bituminous surfacing on the adjacent road for an appropriate distance. All resurfacing shall be done by sheets. Maintenance of traffic during the actual driving of piles & pouring of concrete, the contractor may reduce traffic to one-way with adequate advance signs, barricades and flagmen, so as to safeguard traffic. At all other times two-way traffic shall be maintained and the existing roadway shall not be restricted.

REV.
REV.
REV.
REV.

REVIEWED [illegible] IN CHARGE

	BY	CHK'D	DATE
QUAN.			
TR.			
DR.	K.H.M.	[illegible]	9-68
DES.			

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

PLAN AND PROFILE

FOR WIDENING BRIDGE OVER

JUNIPER CREEK

FILE NO.	COUNTY	ROUTE NO.	DAT
13.427	CHESTERFIELD	52	9-6

APPROVED BY [illegible] ASS'T BRIDGE DESIGN & PLANS ENGINEER

APPROVED BY [illegible] DESIGN BRIDGE ENGINEE

PILE RECORD ON DOCKET NO. 13,427

FED. ROAD DIV. NO.	STATE	COUNTY	FILE ~~DOCKET~~ NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
3	S.C.	Chesterfield	13,427	US 52	2	5

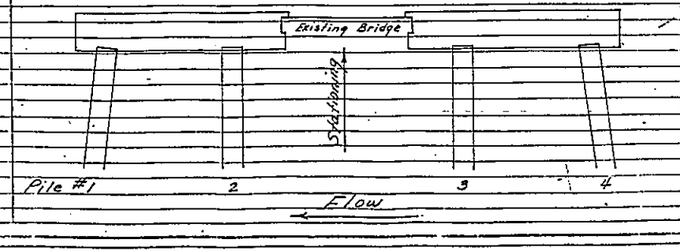
WEIGHT OF HAMMER 2,750# Ram TYPE Delmag D-12 Diesel

TE 69	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 CAP	PEN. IN GROUND OR BELOW FOOTING CAP	PEN. PER BLOW	FALL OF HAMMER	BEARING VALUE	PAY LENGTH	C.O. @ 40 %	C.O. @ 25 %
27	1		1			30		30	—	30	92.351	69.8	62.351	92.184	29.833	0.050	6	66.0	30		
27	1		2			30		30	—	30	92.351	67.4	62.351	92.184	29.833	.150	6	47.1	30		
14	1		3			30		30	—	30	92.351	68.4	62.351	92.184	29.833	.0875	6	57.4	30		
14	1		4			30		30	—	30	92.351	65.4	62.351	92.184	29.833	.060	7	77.0	30		
												Pt. Bk.						Bent 1 to Bent 2			
30	1	3	1			30		30	—	30	92.352	74.4	62.352	92.185	29.833	0.175	6	44.0	30		
30	1	2	2			30		30	—	30	92.352	68.4	62.352	92.185	29.833	.250	6	36.7	30		
14	1	1	3			30		30	—	30	92.352	65.4	62.352	92.185	29.833	.200	6	41.2	30		
14	1	1	4			30		30	—	30	92.352	70.4	62.352	92.185	29.833	.125	6	50.8	30		
												Pt. Bk.						Bent 1 to Bent 2			
26	2		1			40		40	9.6	30.4	92.423	74.5	62.023	79.9	17.9	0.050	7	77.0	40		
26	2		2			40		40	7.2	32.8	92.423	71.6	59.623	79.9	20.3	.050	7	77.0	40		
30	2		3			40		40	5.6	34.4	92.423	69.0	58.023	79.5	21.5	.0375	7	81.0	40		
30	2		4			40		40	6.7	33.3	92.423	71.1	59.123	79.5	20.4	.0375	6	69.5	40		
												Pt. Bk.						Bent 2 to Bent 3			
26	3		1			45		45	10.5	34.5	92.481	71.0	57.981	76.0	18.0	0.025	7	85.6	45		
26	3		2			45		45	5.8	39.2	92.481	62.3	53.281	76.0	22.7	.0375	6	69.5	45		
30	3		3			45		45	11.0	34.0	92.481	74.5	58.481	74.4	15.9	.0125	6	77.6	45		
1	3		4			45		45	10.9	34.1	92.481	78.4	58.381	74.4	16.9	.0375	8	92.6	45		
												Pt. Bk.						Bent 2 to Bent 3			
24	4		1			50		50	11.5	38.5	92.526	67.5	54.026	74.3	20.3	0.025	6	73.3	50		
24	4		2			50		50	10.5	39.5	92.526	66.0	53.026	74.3	21.3	.050	6	66.0	50		
6	4		3			50		50	9.3	40.7	92.526	69.3	51.826	72.9	21.1	.0375	7	81.0	50		
6	4		4			50		50	11.2	38.8	92.526	62.7	43.726	72.9	29.2	.075	7	70.0	50		
												Pt. Bk.						Bent 3 to Bent 4			
13	5		1			50		50	9.9	40.1	92.555	65.4	52.455	72.5	20.0	0.0375	7	81.0	50		
13	5		2			50		50	11.2	38.8	92.555	65.3	53.755	72.5	18.7	.0375	7	81.0	50		
7	5		3			50		50	0.2	49.8	92.555	59.8	42.755	72.9	30.1	.200	7	48.0	50		
7	5		4			50		50	0.1	49.9	92.555	57.6	42.655	72.9	30.2	.125	7	59.2	50		
												Pt. Bk.						Bent 3 to Bent 4			
12	6		1			50		50	12.7	37.3	92.563	68.3	55.263	72.6	17.3	0.025	6	73.3	50		
12	6		2			50		50	7.7	42.3	92.563	61.3	50.263	72.6	22.3	.0375	6	69.5	50		
12	6		3			50		50	—	50.0	92.563	58.6	42.563	73.0	30.4	.150	6	47.1	50		
13	6		4			50		50	10.0	40.0	92.563	57.2	52.563	73.0	20.4	.025	8	97.8	50		
												Pt. Bk.						Bent 4 to Bent 5			
10	7		1			45		45	8.0	37.0	92.551	63.6	55.551	73.3	17.7	0.050	6	66.0	45		
10	7		2			45		45	—	45.0	92.551	54.6	47.551	73.3	25.7	.100	6	55.0	45		
14	7		3			45		45	6.2	38.8	92.551	68.5	53.751	73.5	19.7	.025	7	85.6	45		
14	7		4			45		45	9.6	35.4	92.551	67.8	57.151	73.5	16.3	.025	7	85.6	45		
												Pt. Bk.						Bent 4 to Bent 5			
5	8		1			45		45	10.5	34.5	92.521	67.2	58.021	73.2	15.2	0.0375	7	81.0	45		
5	8		2			45		45	—	45.0	92.521	59.5	47.521	73.2	25.7	.100	6	55.0	45		
20	8		3			45		45	6.7	38.3	92.521	64.2	54.221	71.2	17.0	.025	7	85.6	45		
20	8		4			45		45	10.4	34.6	92.521	65.4	57.921	71.2	13.3	.0125	7	90.6	45		
												Pt. Bk.						Bent 5 to Bent 6			
3	9		1			45		45	13.6	31.4	92.476	68.8	61.076	74.5	13.4	0.0375	7	81.0	45		
3	9		2			45		45	9.7	35.3	92.476	66.7	57.176	74.5	17.3	.050	7	77.0	45		
27	9		3			45		45	10.7	34.3	92.476	65.4	58.176	73.9	15.7	.025	7	85.6	45		
27	9		4			45		45	11.8	33.2	92.476	62.2	59.276	73.9	14.6	.0125	7	73.3	45		
												Pt. Bk.						Bent 6 to Bent 7			
3	10		1			35		35	2.3	32.7	92.420	64.2	57.720	81.0	21.3	0.050	7	77.0	35		
3	10		2			35		35	1.5	33.5	92.420	62.9	58.920	81.0	22.1	.0375	6	69.5	35		
21	10		3			35		35	—	35.0	92.420	67.4	57.420	79.8	22.4	.0625	6	62.8	35		
21	10		4			35		35	2.2	32.8	92.420	71.6	59.620	79.8	20.2	.025	6	73.3	35		
												Pt. Bk.						Bent 7 to Bent 8			
TOTAL						1860		1860	254.8	1605.2									1860		

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 %	C.O. @ 25 %
TOTAL										1605.2									1860		
GRAND TOTAL																					

NOTES CONCERNING ANY UNUSUAL FOUNDATION CONDITIONS

BENT NO.	FOOTING	PILE NO.	REMARKS



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 _____ DOCKET NO. 13,427

CONSTRUCTION RECORD DATA

FED. ROAD DIST. No.	STATE	COUNTY	E.F.A. PROJ. No.	ROUTE No.	SHEET No.	TOTAL SHEETS
8	S. C.	CHESTERFIELD	304	601	1	87

INDEX OF SHEETS

STATE OF SOUTH CAROLINA
STATE HIGHWAY DEPARTMENT

PLAN AND PROFILE OF PROPOSED
STATE HIGHWAY

E. FED. AID PROJECT
No. 304

ROUTE NO. ~~US 601~~ 52

CHESTERFIELD COUNTY
INTERSECTION RT. US-1 TO POINT NEAR THE DARLINGTON CO. LINE

SCALES: PLAN AND PROFILE, 1 INCH = 100 FEET HORIZONTAL; 1 INCH = 10 FEET VERTICAL.

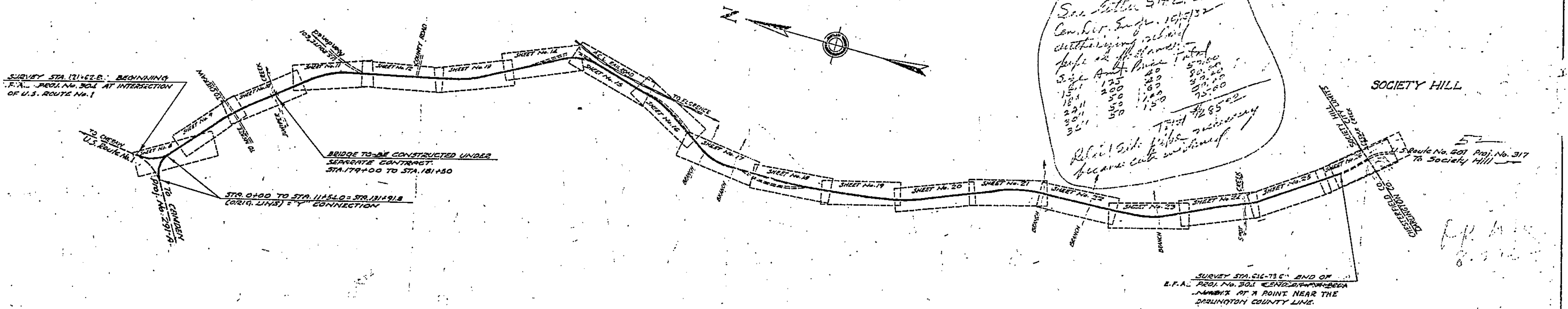
SUMMARY OF ESTIMATED QUANTITIES

STATION	SHEET NO.	ITEM	CONCRETE (CU. YD'S.) CLASS "A"	CONCRETE (CU. YD'S.) CLASS "B"	REINFORCING STEEL (LBS.)	EXCAVATION (CU. YD'S.) STRUCTURES	EXCAVATION (CU. YD'S.) WET	EXCAVATION (CU. YD'S.) DRY	PILES (LINEAR FEET) TREATED	PILES (LINEAR FEET) UNTREATED	TONS	
—	— 3	ENDWALLS FOR PIPE CULVERTS		75.40	347	—						
—	—	~~[illegible]~~		—	~~[illegible]~~	—						
—	—	~~[illegible]~~		—	~~[illegible]~~	—						
296+95	14–26	4X6X28 R.C. BOX CULVERTS	21.5	—	2623	38.						
377+90	17–29	7X7X34 R.C. BOX CULVERT	43.4	—	4191	99.						
520+30	—	CUT-OFF WALL FOR 8X6 CULVERT	1.0	—	—	—						
540+85	22–30	Do. 4X4 R.C. BOX CULV. EXT. 3' EACH END	3.9	—	876	7.						
570+16	23–31	4X4 R.C. BOX CULV. EXT. 12' ON LEFT	5.8	—	583	26.						
—		~~RIPRAP AT BRIDGES~~				—					300	
		TOTALS	73.6	75.4	8624	170					300	

DIAM.	CORRUGATED IRON	REINF. CONCRETE
	TOTAL PIPE FOR CULVERTS	
15"	42. LINEAR FEET	66. LINEAR FEET
18"	96.	816.
24"	—	816.
30"	—	30.
36"	—	270.

TOTAL CLEARING AND GRUBBING IN R/W	LUMP SUM	
TOTAL CLEARING AND GRUBBING ON PITS	3.	ACRES
TOTAL COMMON EXCAVATION	112,259	CUBIC YARDS
~~[illegible]~~	~~[illegible]~~	~~[illegible]~~
~~[illegible]~~	~~[illegible]~~	~~[illegible]~~
~~[illegible]~~	~~[illegible]~~	~~[illegible]~~
~~[illegible]~~	~~[illegible]~~	~~[illegible]~~
~~[illegible]~~	~~[illegible]~~	~~[illegible]~~
~~[illegible]~~	~~[illegible]~~	~~[illegible]~~
~~[illegible]~~	~~[illegible]~~	~~[illegible]~~
TOTAL OVERHAUL ON EXCAVATION	38063.	CUBIC YARD STA.
TOTAL 15" CONC. PIPE RELAID	22.	LINEAR FEET
TOTAL 18" CONC. PIPE RELAID	120.	LINEAR FEET
TOTAL 24" CONC. PIPE RELAID	82.	LINEAR FEET
TOTAL 30" CONC. PIPE RELAID	93.	LINEAR FEET
TOTAL 36" CONC. PIPE RELAID	101.	LINEAR FEET
TOTAL FINISHING EARTH GRADED ROADS	55.879	M. L. F.

~~* Includes 4108 C.Y. Ditch Excavation~~
~~[illegible]~~



See letter S.H.E. to Com. Dir. Engr. 10/5/32 authorizing relaid pipe as follows:

Size	Amt.	Price	Total
15"	125	.40	50.00
18"	200	.40	80.00
24"	50	.60	30.00
30"	50	1.00	50.00
36"	50	1.50	75.00
		Total	$285.00

Relaid side pipe necessary because cut widening

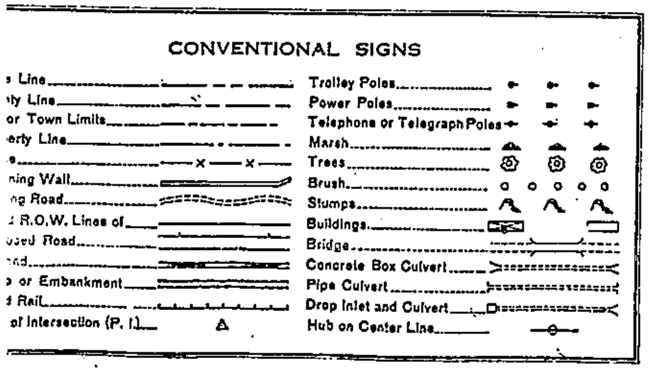
SUMMARY OF ESTIMATED QUANTITIES FOR E. FED. AID. PROJ. 304

TOTAL CLEARING AND GRUBBING WITHIN R.O.W.	LUMP SUM	
TOTAL CLEARING AND GRUBBING ON PITS	13.0	ACRES
TOTAL COMMON EXCAVATION	* 21,585	CU. YDS.
TOTAL LOCAL CLAY GRAVEL FOR BASE COURSE	ϕ 33,798	CU. YDS.
TOTAL OVERHAUL FOR 1½ CENTS PER CU. YD. STATION	95,382	CU. YD. STAS.
TOTAL BITUMINOUS SURF. (WITH PRIME) WITHOUT SEAL COAT	120,247	SQ. YDS.
TOTAL SEAL COAT	120,247	SQ. YDS.
TOTAL OVERHAUL OF CLAY GRAVEL OR MATERIAL EXCAVATED HAULED OVER ½ MILE	15,661	CU. YD. HALF MI.
TOTAL SCARIFYING, MIXING, REMIXING, SHAPING AND RESHAPING	151.111	M. LIN. FT.
TOTAL ADDITIONAL SCARIFYING, MIXING, REMIX, SHAPING AND RESHAPING	15.000	M. LIN. FT.
TOTAL SELECTED MATERIAL FOR SHOULDERS	† 1025	CU. YDS.
TOTAL CLASS "B" CONCRETE	3.0	CU. YDS.
TOTAL 15" REINF. CONCRETE PIPE	127	LIN. FT.
TOTAL 18" " " "	180	LIN. FT.
TOTAL 24" " " "	60	LIN. FT.
TOTAL CONCRETE GUTTER	1700	LIN. FT.
TOTAL VITRIFIED TILE UNDERDRAIN	600	LIN. FT.
TOTAL FED AID MARKERS	2	EACH
TOTAL " " No. PLATES	2	EACH

* Estimated 2000 C.Y. Per Mile And Includes 1089 C.Y. Estimated For 6" Of Excavation And Backfill In Cut Sections Where Impervious Material Is To Be Replaced With Porous Material
ϕ Includes 15% Extra For Compaction
† Includes 10% Extra For Any Additional Material Necessary

SUMMARY OF ESTIMATED QUANTITIES FOR CULVERT EXTENSION

STATION	SHEET	ITEM	CLASS "A" CONC.	STEEL	EXCAVATION
390+90.7	17-26A	DOUBLE 8'X6'X30' R.C. BOX CULVERT. EXTEND.	8.92	1055	4.03



LEGEND

PROPOSED PROJECT	▬
OTHER ROADS	┅

LAYOUT

Scale: 1 Inch = 2000 Ft.

Net Length of Roadway		10.248	Miles
Net Length of Bridges		0.047	Miles
Net Length of Project	=	10.295	Miles
Exceptions	=	0.000	Miles
Gross Length of Project	=	10.295	Miles

Equalities in Stationing

131+56.8 = 131+91.8	169+50.0 = 165+88.0
210+48.5 = 210+97.8	267+12.5 = 267+49.3
317+70.1 = 317+71.6	358+70.4 = 357+53.8
386+35.1 = 386+35.4	413+29.1 = 413+33.3
417+76.4 = 417+77.9	472+70.1 = 472+76.9
530+71.1 = 530+77.0	578+65.4 = 579+66.0

Note: All workmanship and material on this project to conform with South Carolina State Highway Department Specifications, Contract and Bond; for Roads and Culverts, revised Aug. 1st 1931 and for Bridges, revised Sept. 1st, 1930, as amended and approved by the U. S. Secretary of Agriculture.

E.F.A. PROJ. 304 APPROVED — DATE
Chas H Moorefield — 8-30-32
STATE HIGHWAY ENGINEER

APPROVED (GRADING CONTRACT) — DATE
Chas H Moorefield — 7-15-31
STATE HIGHWAY ENGINEER

RECOMMENDED FOR APPROVAL — DATE
[redacted] [redacted]
DISTRICT ENGINEER - BUREAU OF PUBLIC ROADS

RECOMMENDED FOR APPROVAL — DATE
[redacted] [redacted]
CHIEF ENGINEER - BUREAU OF PUBLIC ROADS

APPROVED — DATE
[redacted] [redacted]
DIRECTOR - BUREAU OF PUBLIC ROADS

FED. ROAD DIST. NO.	STATE	COUNTY	FED. AID PROJ. NO.	ROUTE NO.	SHEET NO.	TOTAL SHEETS
8	S.C.	CHESTERFIELD	304	G01	10	84 124

Hub 3+7
53.8' 13.7' 36.0'
P.O.T.= 166+00.7

WALLACE MOORE
D 37½

See Ditch Note On Preceding Sheet

P.O.T.= 166+00.7

37½' R.O.W.

Ditch

EQUALITY: Sta 165+94.4 (P.O.T.) = Sta 165+94.0 (P.O.T.)

WALLACE MOORE
D 37½

5' Pine
P.O.T.= 175+02.3
8' Pine
5' Pine

170

175
P.O.T.= 175+02.3

37½' R.O.W. 50' R.O.W.
37½' R.O.W. 50' R.O.W.

S 39°-13' E

5' Blackgum
87.3' 74°
Tul. 60c
Posts
P.O.T.= 177+97.9

P.O.T.= 177+97.9

P.L.

JUNIPER CREEK

50' R.O.W. 75' R.O.W.
50' R.O.W. 75' R.O.W.

Slough

BRIDGE CONSTRUCTED UNDER SEPARATE CONTRACT
STA. 179+00 TO STA. 181+50

20" Pine
67.3'
91.6'
P.O.T.= 186+50.6
92.5
18" Pine

HENRY ANDERSON

18.5

Borrow Available

P.O.T.= 186+50.6

P.O.T.= 189+10.3

190

75' R.O.W. 50' R.O.W.
75' R.O.W. 50' R.O.W.

8" Pine
75
Hub
75
P.O.T. 189+10.3
75
Pines
80
Hub

HENRY ANDERSON

Use for 6-18 ft. Section From Sta. 166+00 to Sta. 179+00

Use for 4-Lane Section With Longitudinal Center Joint From Sta. 179+00 to Sta. 191+00

Use for 2-Lane Section With Longitudinal Center Joint From Sta. 181+50 to Sta. 199+00

B.M. Nail in Root 24" Pine 31' Right Sta. 171.04 El. 432.27

EXC. 3776 C.Y. EMB. 1885 C.Y.
BOR. — C.Y. 184% 889 C.Y.
TOT. 6216 C.Y. TOT. 6776 C.Y.
OVERHAUL 2178 C.Y. Sta.

B.M. Nail in Root 24" Pine 31' Right Sta. 179.96 El. 418.13

EXC. 1 C.Y. EMB. 1497 C.Y.
BOR. 1646 C.Y. 10% 150 C.Y.
TOT. 1647 C.Y. TOT. 1647 C.Y.
+69.6 +69.2

EXC. 1471 C.Y. EMB. 1772 C.Y.
BOR. 1578 C.Y. 10% 147.7 C.Y.
TOT. 16249 C.Y. TOT. 16249 C.Y.
+68.7 +68.7

B.M. NAIL IN ROOT 18" PINE
70 LT. STA. 187+00 EL. 431.00

PROFILE showing BORINGS AT BRIDGE

Subgrade as Constructed

5.00%

Muck
Sand
Clay
Clay

Muck
Muck
Muck

Bot. of Footings

Sand Clay
Sand Clay
Sand Clay

112+31.9
El. 432.48

Berm Ditch Both Sides

-0.50%

Elevations of Berm Ditch on Both Sides

Yardage and Subcuting Omitted Sta. 179+00 to Sta. 181+50
Yardage Omitted Sta. 179+00 to Sta. 181+70

BRIDGE CONSTRUCTED UNDER SEPARATE CONTRACT
STA. 179+00 TO STA. 181+50

Battered end bents are to be used with either alternate.

Fix Slabs on end bents.

End Bents are battered 2
Sta. 179+00 ℄ end bent

Els. Of Bottom Of Foots.
Bent No. 1 — 406.63
" 2 — 403.38
" 3 — 402.45
" 4 — 397.50
" 5 — 397.53
" 6 — 397.54
" 7 — 402.53
" 8 — 402.50
" 9 — 402.45
" 10 — 402.38
" 11 — 402.29

10 Spans @ 31'-2" = 250'-0" ℄ to ℄ of End Bents.
P.I. Sta. 180+25 El. 436.12
+0.80% -0.40%

250'-0" V.C.

K Fin. Gr. Els. over bents
435.62 435.71 435.76 435.83 435.87 435.93 435.98 435.98 435.93 435.87 435.71 435.62

435.62 434.58 434.08 433.62 433.39 433.64 433.72 435.55 436.57 437.78 438.13

Toe Fill = 179+29.2

Toe Fill = 181+17.0

Drain

+1.38%

All excavation above elev. 411.2 shall be classed as dry and all below that elev. as wet, regardless of the elev. of the water.

D.A. = 60.59 Mi.²
C = 1.0

Use 500 tons of Riprap on Slope of Fill at Bridge

Use 2 courses of sack concrete pavement of yards of bridge as shown on Sheet No. 9

400' V.C.

187+59.6
El. 432.64

+0.40%

+2.16%

High Water El. 432.7 (1908)
High Water El. 429.7 (1928)
Sta. 181+50 ℄ end bent
High Water El. 425.0 (1929)

+3.82%

Berm Ditch on Right

Elevation Berm Ditch on Rt

Elevations of Berm Ditch Both Sides

Berm Ditch Both Sides

PLATE I—PLAN PROFILE S.P.R. STANDARD

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CHERAW QUADRANGLE
SOUTH CAROLINA
7.5 MINUTE SERIES (TOPOGRAPHIC)

Mapped, edited, and published by the Geological Survey

Control by USGS, NOS/NOAA, USCE, and South Carolina Geodetic Survey

Topography by photogrammetric methods from aerial photographs taken 1968. Field checked 1971

Projection and 10,000-foot grid ticks: South Carolina coordinate system, north zone (Lambert conformal conic) 1000-metre Universal Transverse Mercator grid ticks, zone 17, shown in blue. 1927 North American datum

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

Red tint indicates area in which only landmark buildings are shown

Short dashed blue lines indicate elliptical bay outlines visible on aerial photographs

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

EXPLANATION
EXIT cross section

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Primary highway, hard surface
Secondary highway, hard surface
Light-duty road, hard or improved surface
Unimproved road
Interstate Route U. S. Route State Route

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1976

CHERAW, S. C.
N3437.5—W7952.5/7.5

1971

AMS 5053 III NW—SERIES V846

Figure 1.--Topography of study area and location of cross sections used in WSPRO analysis for structure 132005200200 on Route US 52, crossing Juniper Creek in Chesterfield County, South Carolina.