MEMORANDUM

S-120-2025

TO: Michael Carpenter, P.E.
Director, Division of Structural Design

FROM: Adam Ross, P.E.
TEBM, Geotechnical Services Branch

BY: J.C. Wilhoite, P.E.
Structure Foundation Section

DATE: October 31, 2025

CC: J. Van Zee (CO)
C. Van Zee (CO)
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T. Hines (D2)
J. Jones (D2)
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R. Thomas (CO)
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SUBJECT: **Muhlenberg County**
FD04 089 0181 012-016
Item # 02-08802.00
Mars # 9106101D
Widen KY 181 by four feet on each side from intersection KY 601 to Wendell Ford Center
Culvert – 7x4 Sta. 99+34; S-120-2025
Geotechnical Engineering Structure Foundation Report

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. An onsite geotechnical exploration for the project was performed by Stantec.

The proposed 7'x4' culvert will be utilized as part of the proposed widening of KY 181 from the intersection with KY 601 to Wendell Ford Center near the Western Kentucky Parkway. The culvert is located approximately 0.93 miles north of the intersection with KY 601. The structure is located at station 99+34 (approximate Lat: 37.231817°, Long: -87.193186°).

2.0 SITE GEOLOGIC CONDITIONS

The proposed roadway alignment is located in the northeast corner of the Greenville Geologic 7.5-minute Quadrangle (GQ 907). Available geologic mapping indicates the alignment to be underlain by the Carbondale Formation. This formation is comprised of sandstone, siltstone, shale, limestone and coal. The findings from the drilling match this description for the bedrock encountered.

3.0 FIELD INVESTIGATION

Drilling for this project was performed by drill crews from Stantec. Two sample and core borings and one mechanical rockline sounding were performed along the proposed culvert location. The drill crew delivered the soil and rock samples to the geotechnical office for testing.

4.0 SUBSURFACE CONDITIONS

The soils encountered at the site were silt and clay mixtures (ML-CL), low and high plasticity clays (CL and CH) and clayey sands (SC) as designated by the USCS. When tested for unconfined compressive strength, the soil ranged in strength from 3,700 to 3,720psf. Refusal was encountered on the inlet (west) side of the culvert at 8.4’ in depth at the elevation of 431.7’. The rock core taken consisted of brownish and dark gray shale. The shale was extremely weathered for the top 3.9 feet. The KY RQD for the rock was 0% with a recovery of 100%. The Slake Durability Index (SDI) and Jar Slake (JS) for the core tested was 7% and 1, respectively.

5.0 ENGINEERING ANALYSIS

Due to the depths to rock and the existing flowline elevations, the culvert barrels should be designed with a yielding foundation. Embankment stability and settlement analyses are not of concern given the low fill heights and foundation soil composition. The culvert wingwalls should be founded on soil. Scour is not a geotechnical concern at this location with a paved flowline incorporated into the design.

6.0 FOUNDATION RECOMMENDATIONS:

6.1 Design this culvert for a **yielding** foundation. For a yielding foundation, any bedrock or boulders encountered within 2 ft. of the bottom slab must be excavated and backfilled with soil to the base of the footing elevation.

6.2 The culvert wingwalls shall be founded on soil. Size the footing a service limit state using the factored nominal resistance of **3,000 psf**. For checking strength and extreme limit states, the nominal bearing resistance has been determined to be 9,000 psf. Use a resistance factor of 0.45 for strength limit state analysis and a resistance factor of 1.0 for extreme limit state analysis.

6.3 This culvert should be designed with a paved flowline. The paved flowline shall also include the inlet and outlet apron portions of the culvert’s flowline. The ends of the aprons shall incorporate a toe-wall designed in accordance with Exhibit SD-9513 of the KYTC Division of Structural Design Guidance Manual. The toe wall height shall be as specified or embedded 1 foot into bedrock, whichever is less.

6.4 The wingwalls should be designed using Soil Type 3 of Exhibit SD-9413 in the Division of Structural Design Guidance Manual. It should be noted that the backfill slope being referred to is that which is perpendicular to the wingwall.

7.0 Plan Notes (Include the notes below at appropriate locations in the Plans.)

7.1 Any bedrock or boulders encountered within 2 feet below the bottom of culvert slab must be excavated and backfilled with properly compacted soil to the base of the slab.

7.2 Temporary sheeting or shoring/cofferdams and/or a dewatering method may be required for installation of the footings.

7.3 Solid rock excavation may be required to reach required footing elevations.

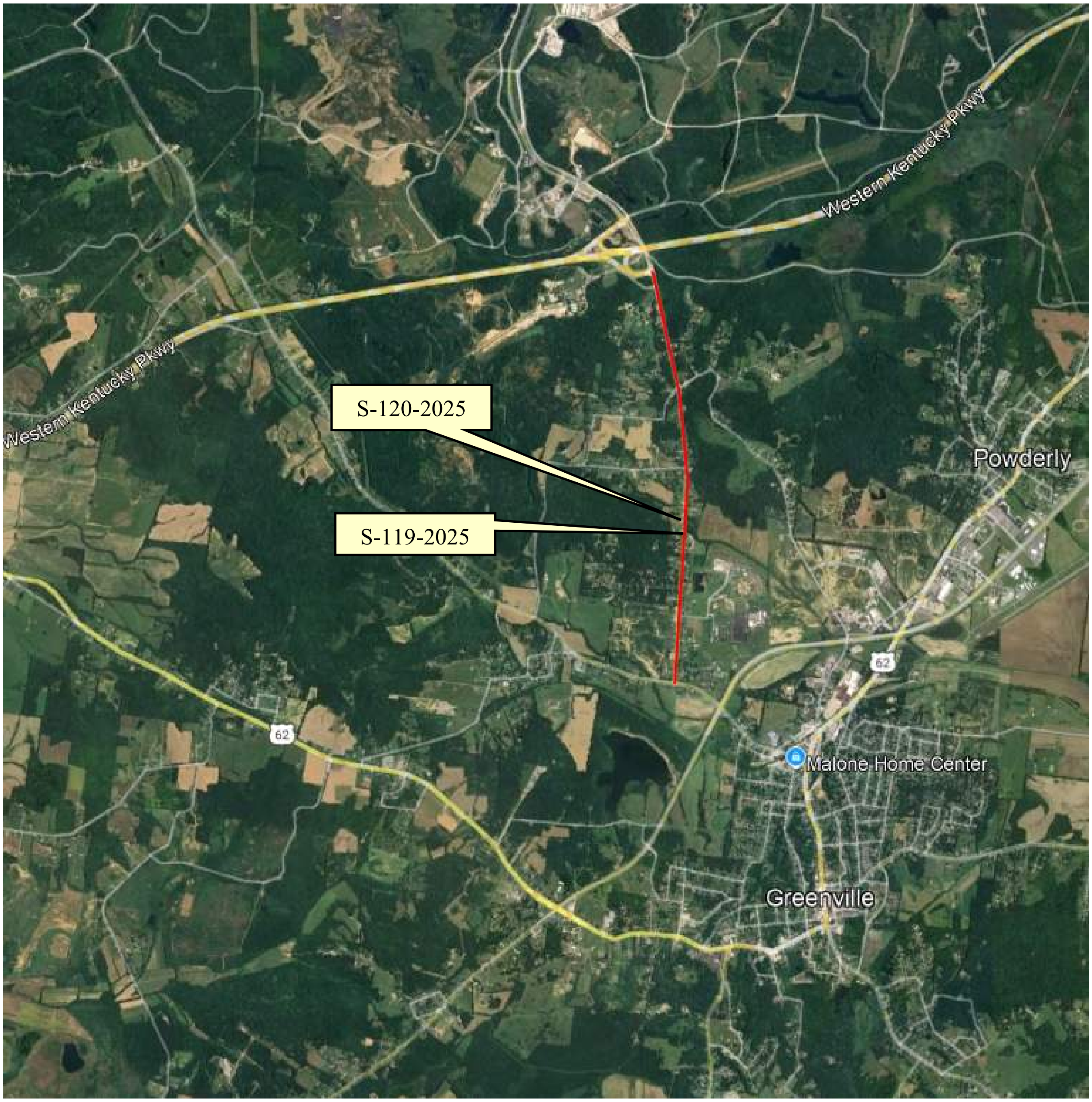
The designer should feel free to contact the Geotechnical Branch for further recommendations, or for any additional questions that arise pertaining to this project, at (502)564-2374.

Attachments:
Structure Location Map
Subsurface Data Sheet
Coordinate Data Sheet

Structure Location Map:

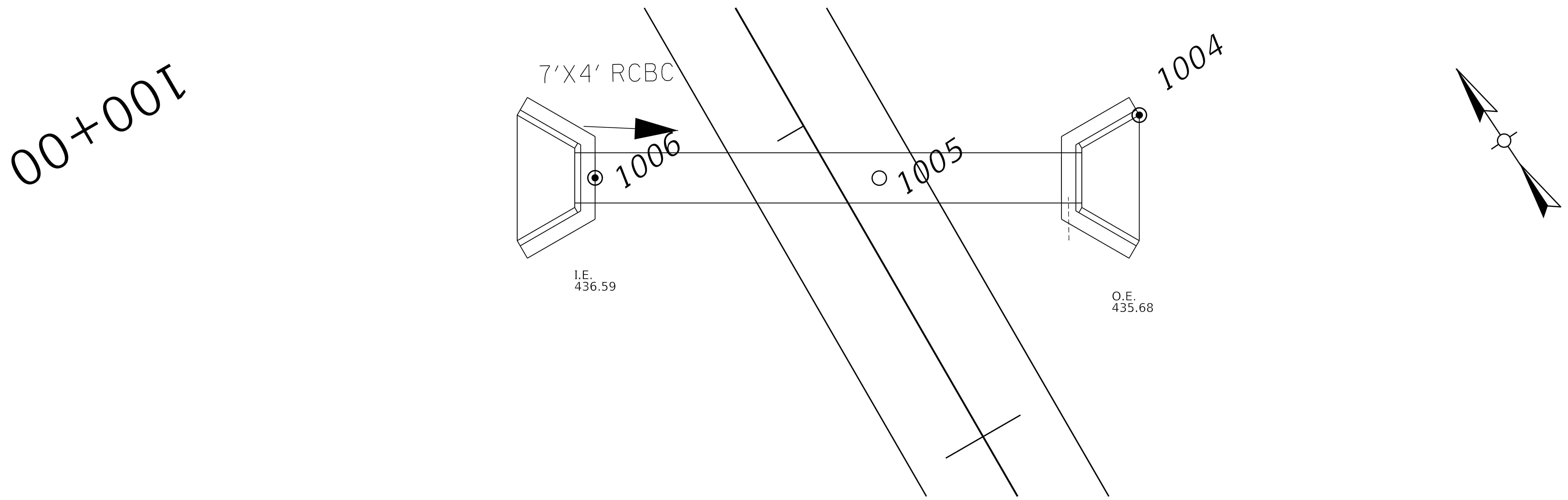
Culvert 6x4 @ Station 94+31; S-119-2025 Approx. Lat./Long: 37.230437°, -87.193258°

Culvert 7x4 @ Station 99+34; S-120-2025 Approx. Lat./Long: 37.231817°, -87.193186°



SUBSURFACE DATA

PLAN SCALE 1" = 10'



THE PRESUMPTIVE BEARING RESISTANCE AT THE SERVICE LIMIT STATE IS
16 KSF FOR SPREAD FOOTINGS ON COMPETENT BEDROCK

COMMONWEALTH OF KENTUCKY DEPARTMENT OF HIGHWAYS	REVISION	DATE	PREPARED BY Division of Structural Design Geotechnical Branch	DATE: – – DESIGNED BY: DETAILED BY: -- – –	CHECKED BY – –	RCBC 7 X 4 AT STA 99+34 CROSSING UNNAMED	ROUTE KY 181	ITEM NO. 02–08802.00 SHEET NO.	COUNTY OF MUHLENBERG DRAWING NUMBER S–120–2025

OpenRoads Designer v23.00.01.11 USER: $$$$USER$$$$ DATE PLOTTED: $$$$DATE$$$$ FILE NAME: $$$$design$file$specification$$$$

COORDINATE DATA SUBMISSION FORM
KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County MUHLENBERG

Date 4/3/2025

Road Number KY-181

Survey Crew / Consultant D-2

Contact Person JEAN JONES,PE

Item # 02-08802 00

Mars # 9106101D

Project # FD04 089 0181 012-016

Notes:

S-123-2025

1003 landed in the middle of stream so
I put it at the top edge of the bank

Elevation Datum = [✓ NAVD88] or ASSUMED

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
1001	37.23037647	-87.19339949	1001	94+11.7	-31.6	439.2
1002	37.23043483	-87.19325765	1002	94+35.0	8.5	444.47
1003	37.23050042	-87.19311298	1003	94+59.9	49.7	437.99
1004	37.23178787	-87.19318455	1004	99+29.8	41.3	440.58
1005	37.2318618	-87.19318455	1005	99+38.4	5.5	444.62
1006	37.23187606	-87.19329852	1006	99+58.5	-28.7	440.39