**M E M O R A N D U M**

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

**FROM:** Geotechnical Branch

**BY:** Tyler Sheffield, P.E.
Geotechnical Branch, Structure Foundation Section

**DATE:** November 5, 2021

**SUBJECT:** **Jefferson County**
**12F0 FD52 056 0264 021-023D**
**Mars #:8556402D**
**Item #: 5-804.00**
**RECONSTRUCT THE WATTERSON EXPRESSWAY INTERCHANGE @US 42 INCLUDING SLIP RAMP TO KY 22**
**6'x4' RCBC Extension at Sta. 142+47 (40' Lt.)**
**Geotechnical Engineering Structure Foundation Report**

## 1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on Projectwise and through email for use in development of structure plans. The onsite geotechnical exploration for the project was performed by the consulting firm of American Engineers Inc.

The proposed 6'x4' culvert extension will be a part of the proposed improvements on I-264 in Jefferson County. The structure is located at I-264 approximate M.P. 22.55 Westbound. The structure is located in Louisville, KY.

## 2.0 SITE GEOLOGIC CONDITIONS

This structure is located in the Jeffersonville, new Albany, and Charlestown Geologic Quadrangle (GQ# 1211). The geologic mapping indicates that this site consists of the Louisville Limestone Formation.

## 3.0 FIELD INVESTIGATION

One (1) sample and core hole was taken at this structure's location as part of the structural geotechnical investigation. After drilling, the rock cores and soil samples were delivered to the KYTC Geotechnical Branch in Frankfort, KY where a geologist logged the rock and the soils were classified and tested in the Branch's laboratory.

## 4.0 LABORATORY TESTING

The laboratory soil testing for the investigation was completed by the Branch's laboratory. The soil sample obtained from the borings were determined to consist of low plasticity clay. The soil sample was designated as CL by the Unified Soil Classification System.

## 5.0 SUBSURFACE CONDITIONS

Depth to rock/refusal was 4.3 ft. The rock core taken at this site consisted of gray, fine to medium grain, crystalline limestone with few fossils, stylolites, and chert nodules. The KY RQD

value for the rock core taken at this proposed culvert location was 97% and core recovery was 100%. The top of rock/refusal elevation at this site was 540.7 ft.

## 6.0 ENGINEERING ANALYSIS

Due to the depth of the bedrock, embankment stability and settlement analyses were not performed. Please refer to Geotechnical Engineering Roadway Report R-001-2012 and R-003-2018 for geotechnical information related to construction of the roadway embankments.

Due to the rock depths and the proposed flow line elevations the culvert can be designed for a **non-yielding** or **yielding** foundation. See the recommendations below for the two alternatives.

## 7.0 FOUNDATION RECOMMENDATIONS:

**Alternate #1 (non-yielding)**

**7.1** Design this culvert for a **non-yielding** foundation. The culvert should be extended to bedrock or the overburden excavated to rock and backfilled with "Granular Embankment", non-erodible only, meeting the materials requirements of Section 805 of the Standard Specifications for Road and Bridge Construction, current edition. Contrary to the Standard Specifications, the maximum size for "Granular Embankment" should be 4".

**7.2** If the spread footings are to be founded on granular embankment extended to bedrock, size the footings at a service limit state using a factored bearing resistance of 8 ksf on "Granular Embankment". If the applied pressures are greater than 8 ksf, the Designer shall provide a note in the plans directing that the footings be extended to rock and prohibiting the use of granular replacement. The note would indicate that the Presumptive Factored Bearing Resistance at the Service Limit State is 30 ksf for spread footings on Competent Unweathered Bedrock. Contact this Branch for a more detailed analysis of nominal bearing resistance if the strength or extreme limit states control the footing design.

**7.3** 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 footings of the barrel of the culvert will require no embedment and bear directly on competent/unweathered bedrock. The footings of the wingwalls shall be embedded a minimum of 1.0 foot into unweathered bedrock.

**7.4** The ends of the aprons shall incorporate a toe-wall designed in accordance with Exhibit 513 of the KYTC Division of Structural Design Guidance Manual.

**7.5** The wingwalls should be designed using Soil Type 3 of Exhibit 413 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.

**Alternate #2 (yielding)**

**7.6** 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.

**7.7** The culvert wingwalls shall be founded on soil. Size the footing at a service limit state using the factored nominal resistance of 2.4 ksf. For checking strength and extreme limit states, the nominal bearing resistance has been determined to be 7.4 ksf. Use a resistance factor of 0.45 for strength limit state analysis and a resistance factor of 1.0 for extreme limit state analysis.

**7.8** 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 513 of the KYTC Division of Structural Design Guidance Manual.

**7.9** The wingwalls should be designed using Soil Type 3 of Exhibit 413 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.

## 8.0 Plan Notes

(Include the notes below at appropriate locations in the Plans, if applicable.)

**8.1** Solid rock excavation may be required to reach required footing elevations.

**8.2** Temporary sheeting or shoring/cofferdams and/or a dewatering method will be required for installation of the footings.

**8.3** All footing excavations in bedrock shall be cut neatly so that no forming or backfilling is necessary in the construction of the portions of the footings located in rock. Concrete should be placed directly against the cut rock faces. Mass concrete should be placed in the excavation from the top of the footing to the bedrock surface where the footing does not extend to the bedrock surface.

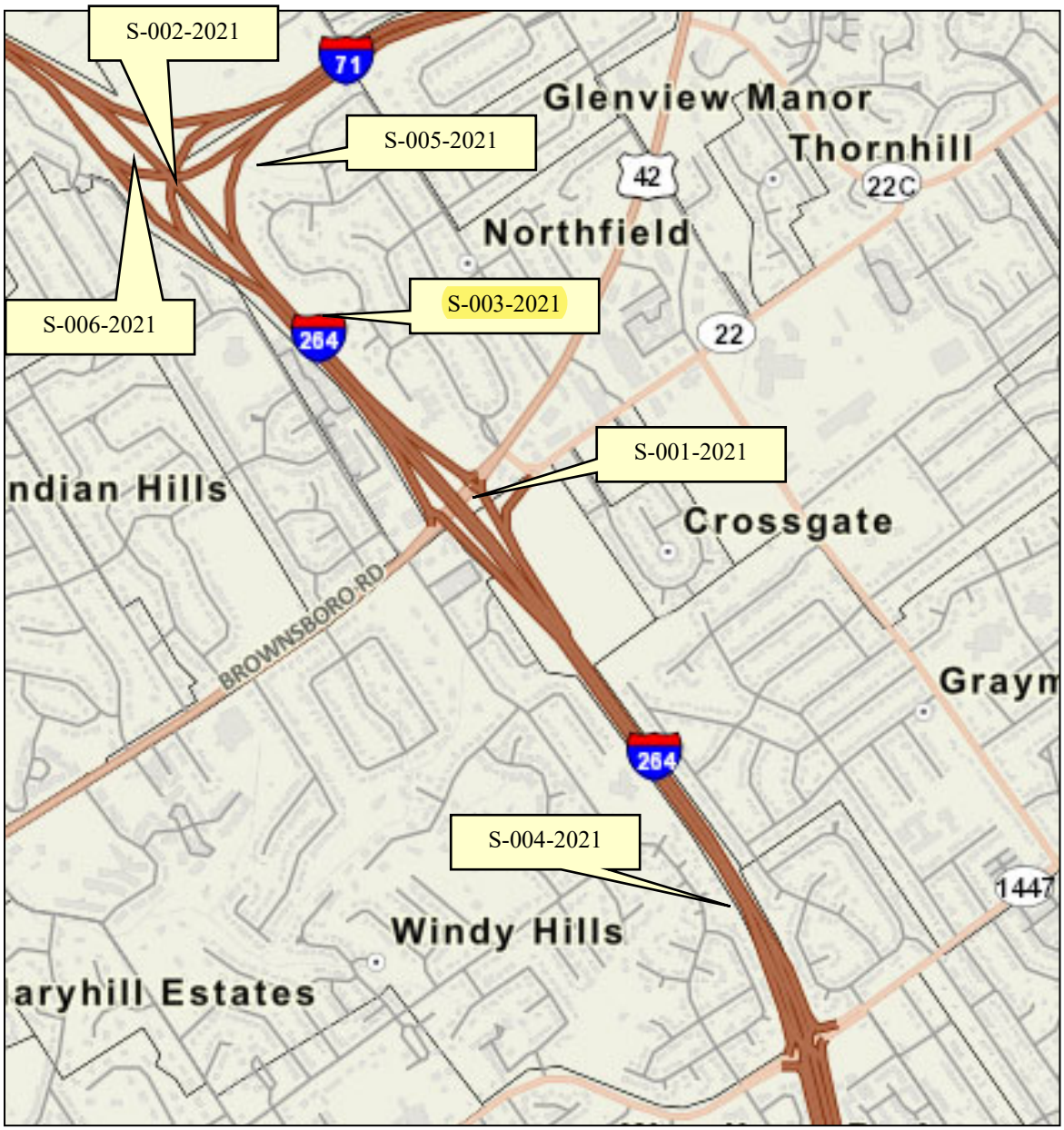
**8.4** If bedrock becomes softened at bearing elevation, the softened material shall be undercut to unweathered material prior to placing concrete.

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:

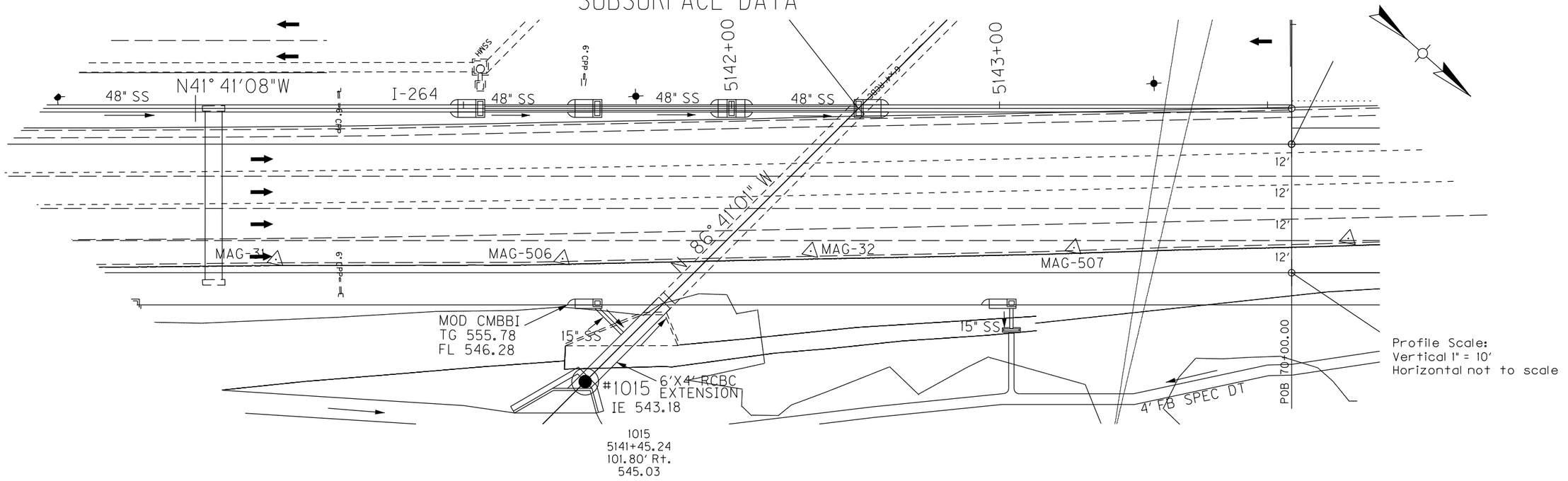
- Structure Location Map
- Subsurface Data Sheet
- Coordinate Data Sheet

**Structure Location Map:**
Approximate Lat./Long: 38.284793/-85.641396



# SUBSURFACE DATA

Plan Scale 1" = 20'




Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Hole No.
Station
Offset
Elev.
(NAVD 88 datum)

550 540 530 520 510 500 490

D50 (mm) 0.003
w% 22
LI 0.20
KYRQD 97
REC 100

A-7-6(20), CL, S+C=77(30+47)
Limestone: gray, fine to medium grain, crystalline, few fossils, stylolites, few chert nodules.

Top of Rock elev. = 540.73
No weathered rock

Datum

The Presumptive Factored Bearing Resistance at the Service Limit State is
30 ksf for Spread Footings on Competent Unweathered Bedrock

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS

KENTUCKY TRANSPORTATION CABINET

| REVISION | DATE |
|---|---|
| | |
| | |
| | |

PREPARED BY
Division of Structural Design
Geotechnical Branch

DATE: 04-NOVEMBER-2021
DESIGNED BY:
DETAILED BY: T. SHEFFIELD

CHECKED BY

CROSSING
**6'x4' RCBC Ext. at Sta. 5142+47**

ROUTE **I-264**

ITEM NO. **5-804.00**
SHEET NO.

COUNTY OF **JEFFERSON**
DRAWING NUMBER **S-003-2021**

S-003-2021 05-0804.00 Kentucky Transportation Cabinet

| ID | Latitude | Longitude | Hole | Station | Offset | Elevation(ft) | Comments |
|---|---|---|---|---|---|---|---|
| 1 | 38.2848005 | -85.6413467 | 1015 | 5141+45.24 | 101.8 | 545.033 | |