M E M O R A N D U M

TO: **Elizabeth Niemann, PE**
Project Management Coordinator
Division of Planning

FROM: **Michael Carpenter, PE**
Geotechnical Branch Manager
Division of Structural Design

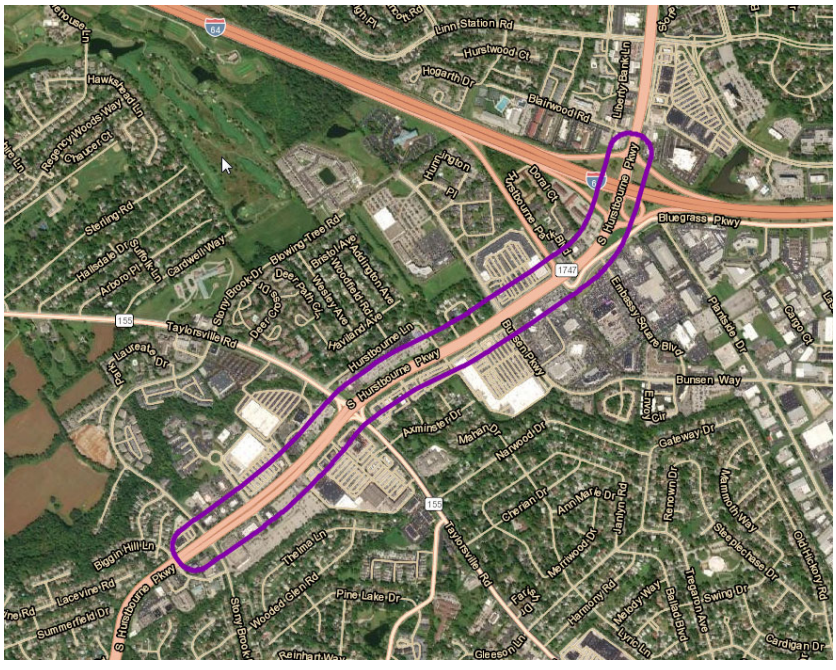
BY: **Sean House, PG**
Geotechnical Branch

DATE: **August 20, 2020**

SUBJECT: **Jefferson County**
FD52 056 1747 010-012P
Hurstbourne Parkway Improvements
From Stony Brook Drive to the I-64 westbound ramps
Item # 5-555.00
Mars # 1101301P
Geotechnical Overview Report

1.0 Project Description

The Kentucky Transportation Cabinet (KYTC) is conducting a study to identify and evaluate the KY 1747 (Hurstbourne Parkway) corridor in Jefferson County, stretching from Stony Brook Drive to the I-64 westbound ramps. The goal of this study is to identify practical, implementable solutions to improve safety, vehicle throughput, and pedestrian connectivity along the congested KY 1747 corridor. This overview will be utilized to identify geotechnical considerations for the study area. The project location and corridor are presented on the drawing provided.



2.0 Scope of Work

The scope of work for this study consists of performing a geotechnical overview for the proposed study area base upon research of available published data and the Geotechnical Branch's experience with highway design and construction within the region. General geotechnical and geologic characteristics of the study area have been identified and are discussed in this report. The following sources were used to perform a literature search:

- USGS Professional Paper 1151-H: The Geology of Kentucky: Physiography;
- USGS Professional Paper 1151-H: The Geology of Kentucky: Ordovician System;
- Geologic Map of the Jeffersontown Quadrangle (GQ# 999), by F.B. Moore, R.C. Kepferle and W.L. Peterson, published by the USGS, 1972;
- USDA Web Soil Survey, https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm;
- Available KYTC Arcmap Datasets and Layers
- KYTC Projects Nearby (KYTC Geotechnical Report Number):
    - Hurstbourne PKWY from Taylorsville Rd to I-64 (R-002-1996)
    - Hurstbourne PKWY from Linn Station Rd. to Eden Ave. (R-008-2017)
    - Bridge on I-64 over Hurstbourne PKWY at MP 14.8 (S-036-1976)
    - Noise Barrier Wall Along I-64 Between MP 13.95 and 14.5 (S-071-2013)
    - Wall on Hurstbourne PKWY North of Taylorsville Rd. (S-083-1995)

2.1 Topography and Drainage

The project study area is located in the Outer Bluegrass Region which is characterized with low to moderate relief and thin soil depths over Devonian and Silurian aged bedrock. Surface drainage is directed towards the South Fork of the Beargrass Creek located on the west side of the Hurstbourne Parkway.

2.2 Stratigraphy

Available geologic mapping (Jeffersontown Geologic Quadrangle (#999)) indicates the project area to be underlain by Devonian and Silurian aged bedrock formations. The Devonian Sellersburg and Jeffersonville Limestones and Middle Silurian Louisville Limestone are characterized by thin to thick bedded limestones that are suitable for construction purposes.

2.3 Soils and Unconsolidated Materials

Residual soils are the predominant soil type found within this area. They are derived in-place from a weathering process of the parent limestone, dolomitic limestone, and shale. The USDA Websoil Survey has the soils classified as silt loams. Previous Geotechnical investigations, using the USCS Classification System, has designated a majority of the soils as lean clays (CL).

2.4 Geologic Structures and Hazards

According to geologic mapping (GQ#999) the underlying bedrock is dipping down due west towards the Lyndon Syncline. There are no known fault systems within or around the project area.

Karst features are known to be in the Outer Bluegrass Physiographic Region. According to the KYTC Arcmap Karst Potential Map (Appendix B) the site location is in a medium to high risk karst area. However, sinkholes have yet to be observed along the project corridor. Springs are common between limestone beds, particularly within the disconformity of the Sellersburg and Jeffersonville Limestone and the Louisville Limestone. The Karst Potential Map (Appendix B) show there are springs up along this section of Hurstbourne Parkway. These springs furnish much of the water for the Middle and South Forks of the Beargrass Creek.

2.5 Mines and Quarries

An abandoned quarry lies approximately 1500 feet west of the intersection of KY 155 and the Hurstbourne Parkway. The Louisville Limestone and the Beechwood Limestone Member have been quarried along the drainages of the South Fork of Beargrass Creek.

2.6 Gas and Oil Wells

Based on the available geologic mapping, there are no oil and gas well in the vicinity of the project study area.

3.0 Geotechnical Considerations

Based on the available resources and the scope of the project the Geotechnical Branch does not anticipate any major geotechnical concerns.

3.1 Cut and Embankment Slope Considerations

Cut slope configurations in rock are generally controlled by bedrock lithology, bedrock quality, results of Slake Durability Index (SDI) tests in shales and siltstones, and by the presence of any fractures and/or joints. Slope configurations for rock cuts in durable bedrock can generally be 1H:2V presplit slopes on approximate 30-foot intervals of vertical height with 18 to 20-feet intermediate benches or 15-foot overburden benches. Slope configurations for non-durable bedrock or soils are generally constructed on 2H:1V slopes or flatter. Due to the shallow cut and fill heights anticipated to be constructed within the corridor, 2H:1V slopes will be adequate.

It is anticipated that material will have to be borrowed for embankment construction. Foundation soils are likely to be shallow and consist of low plasticity clays. Any durable rock or low plasticity soils borrowed from the project area should exhibit adequate stability at 2H:1V or flatter slope configurations up to 20-feet tall. Any embankments built 20-feet or taller will require stability analysis and may require flatter slopes.

3.2 Saturated, Soft, or Unstable Soils

Low plasticity clays with high silt contents may be present on the project where lanes are being added to the roadway. These types of soil can be very moisture sensitive and create subgrade problems where the roadway template is in a shallow fill or in cut conditions. Poor foundation and subgrade soils can be remedied by chemical stabilization. In areas where chemical modification is not feasible working platforms consisting of Kentucky Coarse Aggregate #2's, 3's, or 23's wrapped with Geotextile Fabric may be required.

There is a known stream channel within the project limits along with possible springs. Any saturated or unstable areas encountered within embankment foundation limits may need to be stabilized and the stream channel may need to be redirected or have pipes installed.

3.3 Water Wells and Springs

Springs may be present within the proposed study area. These locations should be inventoried to verify their locations. Spring boxes and/or granular material may be required in the vicinity of springs. Mapping indicates there are multiple groundwater monitoring wells just north of the west bound I-64 ramps. There are two plugged groundwater monitoring wells within the study limits. One south of the east bound ramps of I-64 and one north of Hurstbourne PKWY near Taylorsville Rd. All water wells and/or cisterns within the limits of construction, whether shown on the plans or not, shall be plugged in accordance with Section 708 of the current Standard Specifications for Road and Bridge Construction.

3.4 Retaining Wall

It appears that construction of a new retaining wall is proposed underneath the I-64 bridge on the southbound side of the Hurstbourne Parkway. A detailed retaining wall report will have to be developed to show the wall configuration. Quantities for granular backfill and Geotextile Fabric should be anticipated.

4.0 Conclusions

The purpose of this overview was to provide a general summary of the bedrock, soil, and geomorphic features likely to be encountered within the proposed alignment; and to identify geotechnical features that may have an adverse impact on the project.

Geotechnical drilling will be needed for roadway cut/fills and retaining wall. Because a portion of this project will be a widening project, information on pavement structure should be obtained to assist the team in pavement design. A chemically modified soil subgrade is the preferred method of stabilization but where it is not feasible a granular subgrade should be anticipated. Sampling of foundation soils should be performed for embankment situations.

The information presented in this overview should be reviewed in the general nature in which it was intended. A thorough geotechnical exploration of the proposed alignment and grade will be required to properly anticipate and plan for special requirements necessary for the design and construction of the proposed alignment.

APPENDIX A
USGS Geologic Map

Jefferson County
KY-1747 (Hurstbourne Parkway)

Planning Study
For Area from Stony Brook Dr
to I-64

N

Study Area

Sellersburg and Jefferson Limestones

Louisville Limestone

Sellersburg and Jefferson Limestones

Sellersburg and Jefferson Limestones

Waldron Shale

Legend

- Interstates
- US Highways
- State Roads
- Local Roads
- Louisville Limestone
- Sellersburg & Jeffersonville Limestone

0 1,000 2,000 4,000 Feet

USGS, DGI

APPENDIX B
Karst Potential Map

N

Jefferson County
KY-1747 (Hurstbourne Parkway)

Planning Study
For Area from Stony Brook Dr
to I-64

Study Area

64 64 64 64 64 64 64 64 64 64

6159

155 155 155 155

1747 1747 1747 1747 1747 1747

Legend

- Springs
- Sinkholes

Karst Potential

- INTENSE
- PRONE

USGS, DGI

0 1,000 2,000 4,000 Feet