BUREAU of MATERIALS and RESEARCH

GEOTECHNICAL UNIT
GEOLOGY SECTION

BRIDGE FOUNDATION GEOLOGY REPORT

Project 99-75 K-6421-01
K-99 over Rock Creek Drainage at Westmoreland
Bridge No. 99-75-15.20(057)

Pottawatomie County

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BY

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Kansas Department of Transportation

MEMO TO: Jim L. Kowach, P.E., Chief, Bureau of Design

ATTENTION: Kenneth F. Hurst, P.E., Engineering Manager, State Bridge Office

FROM: Delmar Thompson, P.G., Regional Geologist, Lawrence

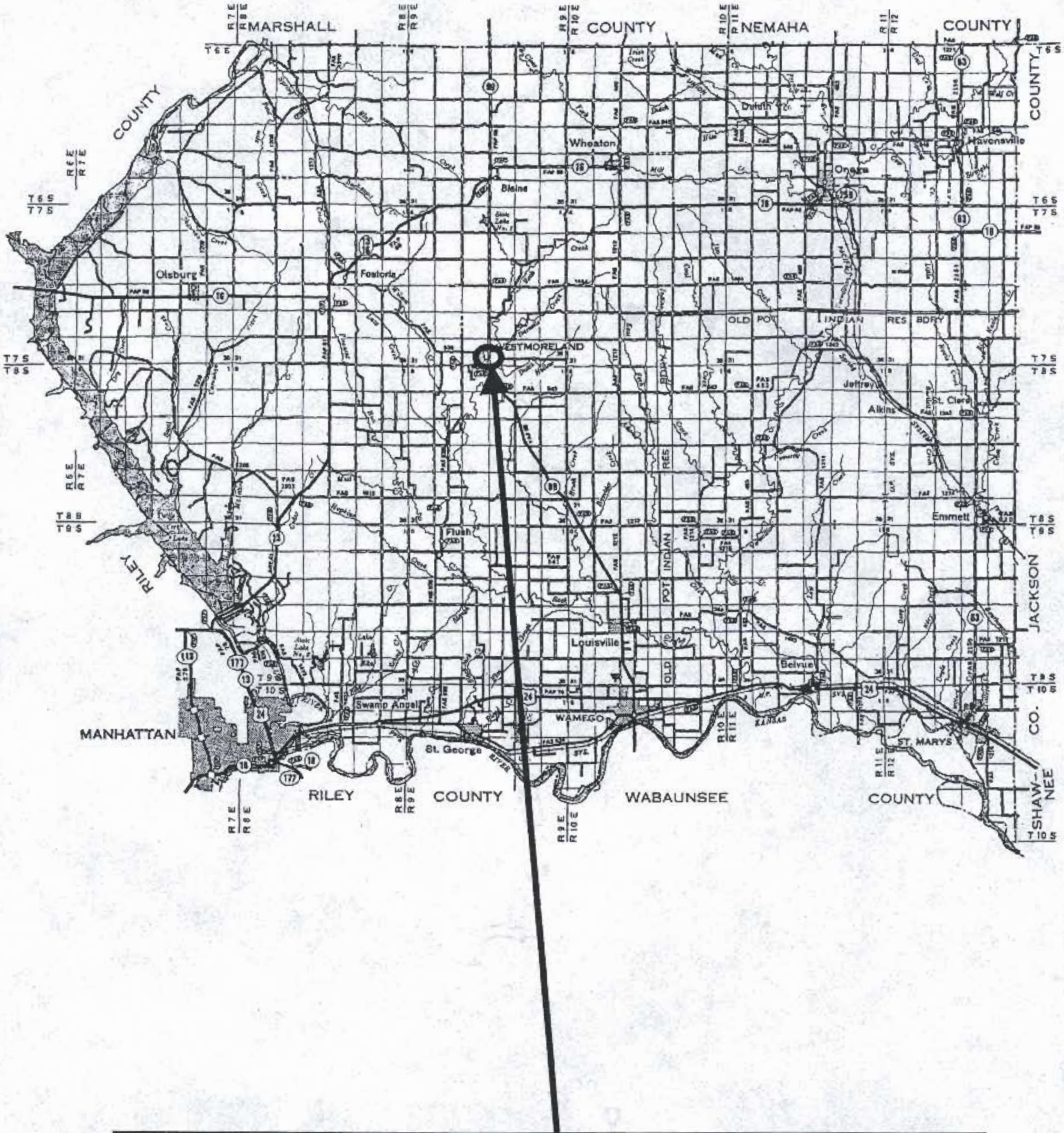
DATE: August 28, 2002

SUBJECT: Bridge Foundation Geology Report

RE: Project 99-75 K-6421-01
K-99 over Rock Creek Drainage at Westmoreland
Bridge No. 99-75-15.20(057)
Pottawatomie County

Three copies of the above report are attached to this memorandum. An Engineering Geology Bridge Sheet has been drawn on the Microstation Workstation. This file has been placed on the Design file server under the file name Dt06ft05/Geology/64211520.dgn. Two copies of the core hole logs and power auger logs are attached to this report. If questions arise over the contents of this report, please contact the Lawrence Regional Geology Office.

LSI:GNC:RWH:DLT: jmc
Attachments
c: Bureau of Construction and Maintenance
District I
Regional Geology Offices
Project File



Project 99-75 K-6421-01
K-99 over Rock Creek Drainage At Westmoreland
Pottawatomie County

INTRODUCTION

This report details the geologic setting and the footing recommendations associated with the design and construction of a proposed two-pier bridge on K-99 over Rock Creek Drainage on the east edge of the city of Westmoreland. The proposed bridge replacement project is located in the narrow flood plain of Rock Creek and Rock Creek Drainage and is flanked by the Flint Hills Physiographic Region of Kansas.

GEOLOGY AT THE BRIDGE SITE

Soil Mantle

The soil mantle at this bridge location includes all unconsolidated material above bedrock and consists of approximately 2.0 to 2.5 m of deep brown to gray-brown, silty clay with scattered light gravel. Thin, stratified, gravel lenses occur in the soil mantle which are comprised predominately of eroded limestone and chert fragments from the surrounding bedrock members of the Flint Hills Region, however, fragments of quartzite, granite, schist, gneiss, quartz, and other rock erratics can be found. These erratics are evidence that this region and the surrounding regions were glaciated 600,000 to 700,000 years ago. The erratics were transported from locations in the northern states and Canada by the huge ice sheets that blanketed the area during the Kansan Glacial Ice Age during the Pleistocene Epoch of Geologic time.

Larger erratic boulders of quartzite and granite are common in this region, and may be encountered in the subsurface. These larger glacial erratics are exposed in the stream channel and the surrounding hills.

Permian System
Lower Permian Series

All bedrock units encountered on the project are Permian aged rocks approximately 260 to 270 million years old. Geologic descriptions are detailed for each bedrock member below.

Council Grove Group
Speiser Shale Formation

The Speiser Shale Formation consists predominately of shale and limy shale, but a few thin limestone beds are present. One of these limestone beds lies at the mantle/bedrock interface and forms the flow line of the existing streambed and is visible at the bridge location. This limestone bed is approximately 0.4 to 0.5 m thick, gray to gray-brown, unit bedded and argillaceous in nature. This limestone bed is underlain by approximately 2.85 m of dark blue-gray to gray, platy, argillaceous shale, which grades to slabby, calcareous shale in the lower 0.3 meter. A thin, gray, persistent, unit-bedded, limestone bed approximately 0.25 to 0.35 m thick is underlying this shale. The lower portion of the Speiser Shale consists of approximately 6.10 m of varicolored gray, green, and maroon, platy to flaggy, argillaceous shale with flaggy, calcareous shale zones. The total thickness of the Speiser Shale Formation at this project location is approximately 9.6 to 9.8 meters.

Pier Foundations
Pier 1, Station 23+424.000
Pier 2, Station 23+436.000

Both drilled shaft footings or spread footings are viable options at the pier locations. Each option is detailed below.

Drilled Shaft Footing Option

Drilled shafts may be utilized at the pier locations. We recommend the sockets for the drilled shafts, at both pier locations, be constructed in the Speiser Shale Formation at elevation 346.35 with a maximum footing pressure of 1149 kPa (12 tsf). This will place the sockets at the top of a thin, 0.3 m thick, limestone bed within the Speiser Formation. Unconfined Compression Tests conducted on this limestone bed and the underlying shale indicate that there is adequate strength to carry the recommended load. If drilled shafts are utilized, care should be taken to stop advancement of the shaft construction once this thin limestone bed is encountered, at or near the above recommended elevation. Due to the shallow mantle depth at the proposed pier locations, casing will not be required for the construction of the drilled shafts.

Drilled Shaft Foundation Verification Test

If drilled shaft footings are utilized at the pier locations, the following note should be placed on the bridge sheet in the construction plans.

"The footing elevations listed will place the shaft sockets in the Speiser Shale Formation. The bottom of the shaft should be cleared of drilling debris. A 1.5-m deep test hole, no larger than 102 mm (4 inches) in diameter, should be made in the rock socket of each shaft as part of the acceptance of the founding elevation. This verification test should be done in the presence of the KDOT personnel in charge of the project"

Spread Footing Option

Spread footings can also be utilized at the pier locations. If spread footings are designed, we recommend constructing the footings in the Speiser Shale Formation at elevation 346.35 with a maximum footing pressure of 1149 kPa (12 tsf). This will place the base of the footing at the top of a thin, 0.3 m thick, limestone bed within the Speiser Formation. Unconfined Compression Tests conducted on this limestone bed and the underlying shale indicate that there is adequate strength to carry the recommended load. If spread footings are utilized, care should be taken to ensure that construction of the footings occurs on top of the limestone bed.

Spread Footing Bridge Foundation Notes

If spread footings are utilized at the pier locations, the following notes should be Observed and placed on the bridge sheet in the construction plans.

All excavation below the top of rock or the top of the footing within 1.0 m of the edge of the footing will be done by hand equipment only. No machine rock excavation is allowed below the top footing. Cut the rock to the neat lines shown on the plans. Do not use side forms, cast the concrete against the rock. Allow no loose material within the footing when the footing is considered ready to pour. If the material at the bottom of the footing

does not match the material shown on the geology sheet, do not proceed until the Regional Geologist reviews the site.

For all bridge spread footing locations, drill a 40-50 mm diameter hole, 1.5 m deep in the presence of the Engineer to verify the quality and soundness of the material below the footing elevation. For footings less than 10 m^2, drill one hole in the center of each footing. For footings greater than 10 m^2, drill one hole at each corner of each footing.

When the material in the bottom of the footing is shale, do not allow water to pond in the footing excavation pit. Many Kansas shale members weather quickly in the presence of water. Once the excavation in shale is complete, place the reinforcing steel and concrete in a timely manner to minimize the exposure time of the shale. If the water cannot be cut off, then a seal coarse of Grade 25 concrete may be used to encase the bottom of the footing. Consult the State Bridge Office before attempting a seal coarse. If water is persistent, then tremie the concrete for the seal coarse. Do not allow the concrete to be placed on or through water where mixing or washing of the concrete can occur. Do not allow concrete to be placed if water is moving through the footing.

Fissure Note

"If fissures of considerable size are found in the bedrock at the spread footing elevations, all loose material should be removed to solid material and the fissure should be backfilled with concrete. Besides lowering the footings, any additional work, due to unforeseen conditions, to properly prepare the foundation for the spread footing will be deemed "Extra Work".

Lateral Load Parameters

Soil and rock parameters for laterally loaded pile design are as follows:
NPY=0 NPPY= 3

Soil Mantle
No soil samples were taken at this location.

Speiser Shale Formation
Shale, clayey and limy, gray, firm.

		YP(I,J)	**PP(I,J)**
Average Qu	17.0 tsf	0.0000	0.0000 k/ft
Average Dry Weight	118.0 bs/ft^3	0.0350	47.600 k/ft
Average Moisture	16.2 %	0.1017	85.000 k/ft
GAM1	0.137 kcf		

Hydrology

The groundwater elevation at the proposed bridge location during was measured and recorded at an average elevation of 349.0. Any excavation below the ground water table will require sheeting and dewatering equipment.

Investigative Procedure

Information from four power auger soundings and one core drill sounding, as well as information from the surface geology investigation, were used to develop the subsurface geology for this foundation geology report. Selected bedrock samples were submitted to our testing facility for unconfined compression testing. The results of these tests, a log of the core drill sounding, and a log of the power auger soundings are included with this report.

Acknowledgments

The following individuals assisted in conducting the foundation investigation for this project: Rob Vervynck, ET. Senior; and Ryan Salber, ET.