GEOTECHNICAL ENGINEERING REPORT

MID-CONTINENT PUBLIC LIBRARY
COLBERN ROAD BRANCH
1000 NE COLBERN ROAD
LEE'S SUMMIT, MISSOURI

PREPARED FOR
MID-CONTINENT PUBLIC LIBRARY
INDEPENDENCE, MISSOURI

PREPARED BY
OLSSON, INC.
OLATHE, KANSAS

DECEMBER 30, 2019

OLSSON PROJECT NO. A18-0330

1700 East 123rd Street • Olathe, KS 66061 • (913) 829-0078 • FAX (913) 829-0258

olsson

December 30, 2019

Mid-Continent Public Library
Attn: Jake Wimmer
15616 E 24 Highway
Independence, Missouri 64050

Re: Geotechnical Engineering Report
MCPL Colbern Road
Lee's Summit, Missouri
Olsson Project No. A18-0330

Dear Mr. Wimmer,

Olsson, Inc. has completed the authorized Geotechnical Engineering Report for the above referenced project. This report describes our understanding of the project, presents the results of the borings and laboratory tests, discusses the observed subsurface conditions, and, based on these conditions, provides our opinions and geotechnical engineering recommendations for the Colbern Road project.

We appreciate the opportunity to provide our geotechnical engineering services for this project. If you have any questions or need further assistance, please contact us.

Respectfully submitted,
Olsson, Inc.

JD Putnam

Ian A. Dillon, PE

1700 E. 123rd Street / Olathe, KS 66061
O 913.829.0078 / olsson.com

TABLE OF CONTENTS

PAGE

A. PROJECT UNDERSTANDING

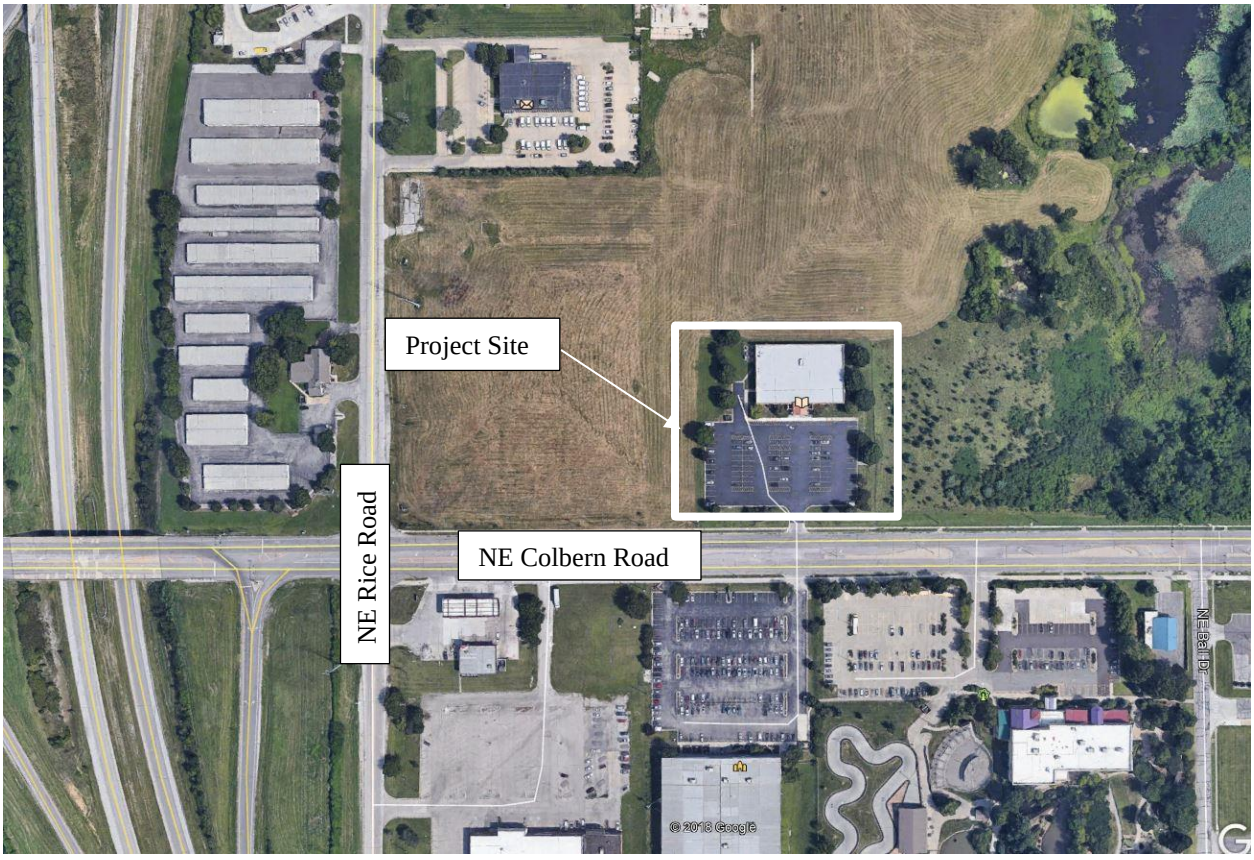
A.1. GEOTECHNICAL SCOPE

This Geotechnical Engineering Report presents the results of the subsurface exploration completed for the new library in Lee's Summit, Missouri. We drilled eight borings at the site for the proposed structure and the associated parking and drive areas. The locations of the borings are shown on the Boring Location Plan in Appendix A and the associated Borehole Reports are presented in Appendix B. The purpose of this exploration was to evaluate the existing subsurface conditions encountered at the borings and provide geotechnical design recommendations for the support of foundations, floor slabs, and pavements for the proposed structure.

A.2. PROJECT DESCRIPTION

The project site is located NE Rice Road and NE Colbern Road in Lee's Summit, Missouri as shown in Figure 1. The site is currently occupied by the existing library and associated pavements. We have not been informed of any foundation related distress within the existing structure. The existing site is relatively flat but gently slopes from the southwest to the northeast.

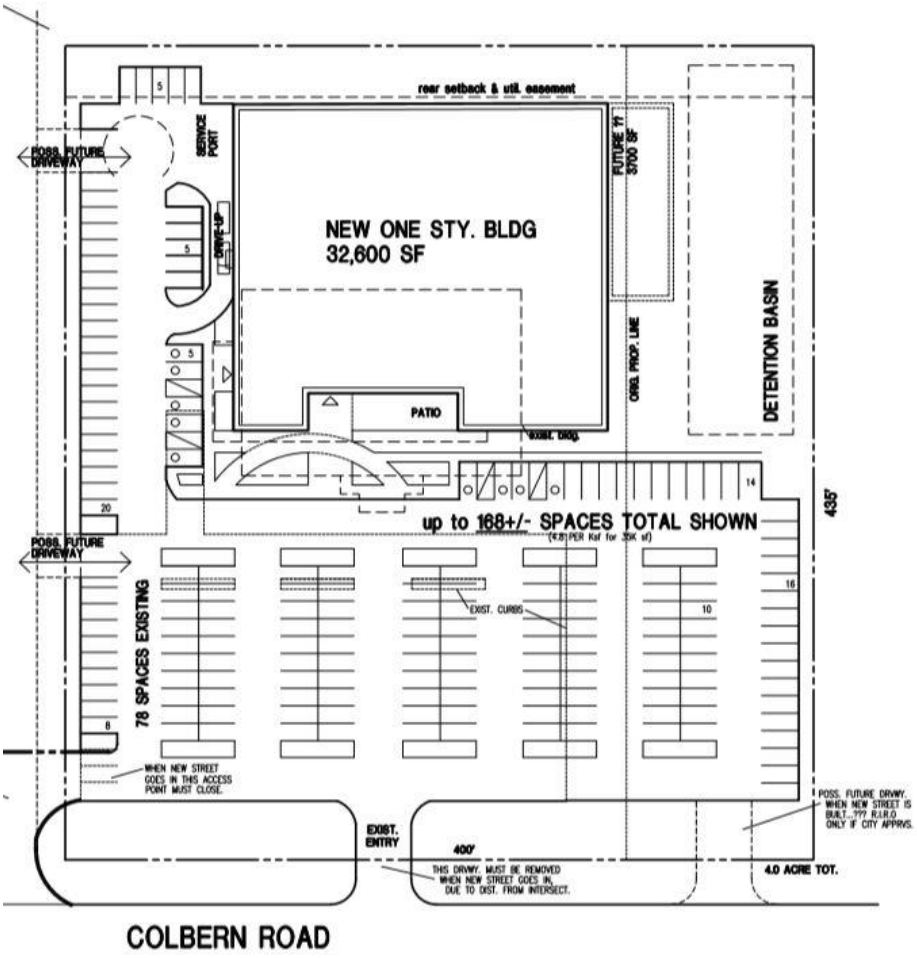
Figure 1: Site Location



A.3. PROJECT DESCRIPTION

We understand that the project will include the demolition of the existing structure and the reconstruction of a new library. The new library will be a single story, slab-on-grade structure. We also understand that the current parking lot will likely remain on site for the future library. At the time of this report, the finished floor elevation (FFE) and grading plans were not yet finalized, yet we anticipate cuts and fill to be minimal and the new FFE will likely maintain the existing FFE. A detention basis is planned for the northeast corner of the project site. The proposed site layout is presented in Figure 2.

Figure 2: Site Layout



B. Exploratory and Test Procedures

B.1. Field Exploration

The drill crew used a truck mounted drill rig to complete the eight borings at the site. The drill crew located the borings in the field by using GPS coordinates. The approximate locations of the borings are presented on the Boring Location Plan in Appendix A.

The borings were drilled to a depth ranging from 10 feet to 15 feet. Soil samples were obtained by using thin-walled sampling tubes and split-barreled procedures. The drill crew prepared field logs for each boring. These field logs contained visual classifications of the materials encountered during the drilling process as well as the drillers' interpretation of the subsurface conditions between the samples. Water level observations were made during and immediately after the drilling process. The Borehole Reports are presented in Appendix B.

B.2. Laboratory Testing

At our laboratory, we visually classified the soil samples in accordance with the Unified Soil Classification System (USCS). We measured the moisture content of each sample. Dry density and unconfined compression tests on selected tube samples. Two Atterberg limits test was performed on selected samples to aid in the classification of the soils under the USCS. Based on the laboratory test results and our observations of the samples, we modified the field logs that were prepared by the drill crew. Results of the laboratory tests are shown on the appended Borehole Reports.

C. SUBSURFACE CONDITIONS

C.1. SOIL STRATIGRAPHY

The subsurface conditions shown on the boring logs represent conditions at the specific boring locations at the times they were drilled. Variations may occur between or beyond the borings. The stratifications lines shown on the boring logs represent the approximate locations of changes in soil and bedrock types. The actual transitions between materials is usually gradual. Based on the borings, the subsurface conditions at this project site can be generalized as follows.

Borings B-1 through B-6 were drilled for the new structure and encountered a relatively thin rootzone layer. Borings B-7 and B-8 were drilled in the existing parking lot. Beneath the rootzone and/or Asphalt/gravel layers, native lean-to-fat clay soils were encountered to depths ranging from 10.5 feet to 14 feet. Borings B-5, B-7 and B-8 terminated in the clay soils at depths of 14 feet, 10 feet and 10 feet respectively. The clay soils were generally stiff to very stiff in consistency. Variably weathered limestone and shale bedrock were encountered in borings B-1 through B-6. Limestone was encountered at borings B-2, B-3 and B-4 at depths of 10 feet, 10.5 feet and 11.5 feet respectively. The limestone resulted in practical auger refusal at 11.6 feet in boring B-4. A possible clay filled joint in the limestone was encountered at boring B-3B at approximately 11.7 feet. Shale bedrock was encountered at borings B-1 and B-6 at approximate depths of 14 feet.

C.2. GROUNDWATER SUMMARY

Water level observations were made at the boring locations during drilling and immediately upon completion. Water was observed in borings B-2 and B-3 during the drilling process at 13.5 feet and 11.7 feet respectively. Water was also observed immediately following the drilling process in B-3 at 10 feet. Variations and uncertainties exist with relatively short-term water level observations in boreholes. Water levels can and should be anticipated to vary between boring locations, as well as with time within specific borings. Water typically collects near the interface between different materials such as soil and bedrock. Groundwater levels may be expected to fluctuate with precipitation, site grading, drainage and adjacent land use. Long term monitoring with piezometers generally provides a more representative indication of the potential range of groundwater conditions.

D. GEOTECHNICAL CONSIDERATIONS

Demolition of the existing build is planned. We recommend the removal of the existing floor slab, any remaining below ground features, such as foundation elements, basement walls, or abandoned utility lines, be completely removed from the site prior to construction.

We further understand that the current parking lot will be revisited. However, if demolition of the existing parking lot is required, an ***Olsson*** representative should observe the exposed ground surface in the current parking lot areas.

Any loose, low density fills associated with prior construction should also be removed at this time. ***Olsson*** should observe the exposed grades in these areas following overexcavation and prior to placement of new fill. Excavations created by demolition and removal of existing structures or parking areas should be backfilled with structural fill, placed and compacted as recommended in this report.

E. SITE PREPARATION

E.1. BUILDING AND PAVEMENT AREAS

Demolition of the existing structure should include removal of floor slabs, foundations, utilities and any other below grade features that will conflict with the planned construction. Areas disturbed during demolition operations should be thoroughly evaluated by ***Olsson*** prior to placement of fill. All disturbed soils should be undercut prior to placement of fill. Where existing or abandoned underground utilities are encountered within the proposed building areas, the trench backfill should be evaluated by ***Olsson*** to determine if the backfill should be undercut and replaced. Outside the existing building any existing topsoil, vegetation and related root systems, frozen soil, and/or any other deleterious or unsuitable materials should be stripped from the construction area. Stripping depths will likely vary and should be adjusted as necessary. These unsuitable materials should be removed and carefully separated to avoid incorporation of organic materials into new fill sections or building areas.

Prior to placement of fill in areas below design grade and after completion of rough grading in cut areas of the site, the subgrade should be visually observed, and proof rolled to help delineate soft or disturbed areas. An ***Olsson*** representative should observe the proofrolling. Unsuitable areas identified by proofrolling should be undercut to expose stable material and backfilled with controlled engineered fill. Proofrolling should be accomplished using a fully loaded, tandem-axle dump truck or other equipment providing an equivalent subgrade loading.

Prior to placement of fill, the moisture content of the exposed grade should be evaluated in all construction areas. Where moisture contents are outside the range recommended for controlled fill, the exposed grade should be scarified, moisture conditioned and recompacted according to the recommendations presented in the "Fill Placement" section of this report. The required depth of scarification, moisture conditioning and recompaction will depend on soil conditions at the time of construction

E.2. STRUCTURAL FILL

All structural fill and backfill should consist of approved materials, free of organic matter (organic content less than 5 percent), and debris. Structural fill soils should not contain particle sizes larger than three inches. With the exception of the low volume change (LVC) layer beneath grade supported slabs, in our opinion, the existing soils are suitable for reuse at this site in new fill areas. Samples of all proposed fill materials should be submitted to the geotechnical engineer of record prior to use on the site. Laboratory Proctor compaction tests and classification tests should be performed on any fill material placed during mass grading operations.

We recommend that structural fill and backfill be compacted in accordance with the criteria provided in Table 1. An ***Olsson*** representative should observe fill placement operations and perform field density tests, as required.

Suitable fill materials should be placed in thin loose lifts of 8 inches or less. Within small excavations, such as in utility trenches, around manholes, or behind retaining walls, the use of vibrating plate compactors, jumping jack compactors or walk behind sheepsfoot compactors may be used to facilitate compaction in these areas. Loose lift thicknesses of 4 inches or less are recommended where small compaction equipment is used.

The moisture content for suitable borrow soils at the time of compaction should generally be maintained between the ranges specified above. More stringent moisture limits may be necessary with certain soils and some adjustments to moisture contents may be necessary to achieve compaction in accordance with project specifications.

Table 1: Fill Placement Guidelines

Area of Fill Placement	Material	Compaction Recommendation*	Moisture Content (Percent of Optimum)
Granular Layer – 4" beneath floor slabs	ASTM C-33, # 57 Stone	65% of Relative Density	As necessary to obtain density
Low Volume Change (LVC) – 18" below base of building granular layer	MoDOT Type 5 Baserock	95%	As necessary to obtain density
Structural Fill – on-site	On-site Cohesive Soil	95%	0 to 4 percent
Structural Fill – imported	LL < 60 PI < 30	95%	0 to +4 percent
Pavement Subgrade – 9" Recompacted Subgrade	LL < 60 PI < 30	95%	0 to +4 percent

*According to ASTM D-698 – Standard Proctor

E.3. DRAINAGE AND GROUNDWATER CONSIDERATIONS

Water should not be allowed to collect at the ground surfaces near foundations, floor slabs, or areas of new pavement, either during or after construction. Provisions should be made to quickly remove accumulating seepage water or storm water runoff from excavations. Undercut or excavated areas should be sloped toward one corner to allow rainwater or surface runoff to be quickly collected and gravity drained or pumped from construction areas. Subgrade soils that are exposed to precipitation or runoff should be evaluated by ***Olsson*** prior to the placement of new fill, reinforcing steel, or concrete, to determine if corrective action is required.

To minimize concerns related to improper or inadequate drainage away from foundation bearing subgrades or from cohesive backfill materials used in utility or foundation trenches, we recommend the following:

- Site grading should provide for efficient drainage of rainfall or surface runoff away from new structures and pavement.
- Roof run-off should be collected and transferred directly to the storm sewer system or directed to a location with positive and rapid drainage away from new structures and pavements.
- External hose connections in unpaved areas should incorporate splash blocks to prevent accidental flooding of foundation bearing or backfill soils. External hose connections should have cut-off valves inside the building to prevent accidental or unauthorized use.
- Maintenance personnel should be informed of the potential problems associated with watering near the building.

F. STRUCTURES

F.1. FOUNDATIONS

In our opinion, the new buildings can be supported on shallow foundations bearing on stiff to very stiff native clay and/or structural fill placed and compacted as recommended in this report. For shallow foundations supported on stiff to very stiff native clay soils and/or structural fill, a maximum net allowable soil bearing pressure of 2,000 pounds per square foot (psf) can be used for design. The net allowable soil bearing pressure refers to the bearing pressure at foundation level in excess of surrounding overburden pressure.

Exterior footings should bear at a minimum depth of 3 feet below the lowest adjacent final ground surface. Footings should have a minimum foundation width of 18 inches for continuous footings and 30 inches for isolated column footings. Earth formed trench footings should have a minimum width of 12 inches.

Lightly loaded interior partition walls (applying less than 0.75 kips per lineal foot (klf)) may be supported directly on the slab-on-grade floor. Depending on the floor slab design and the specific wall loads, it may be necessary to increase the floor slab reinforcement or provide a thickened slab cross-section below interior wall. For interior walls with loads greater than 0.75 klf, we recommend a footing be installed, independent of the floor slab, to properly distribute the wall loads to the underlying soils and reduce the potential for floor slab damage.

The base of all foundation excavations should be free of water and loose material (or soil) prior to placing concrete. Prior to placement of concrete, Olsson should observe the soil conditions. If the base of the footing excavations becomes disturbed during construction or if unsuitable bearing conditions are encountered, we recommend carefully extending the excavations to suitable bearing soils. Concrete should be placed soon after excavating to minimize disturbance of the bearing materials. Should the materials at bearing level become excessively dry, disturbed or saturated, the affected material should be removed prior to placing concrete.

In our opinion, foundations supported on clay soils (fill or native) could experience total settlements on the order of 1 inch and differential settlements on the order of ½ inch.

F.2. FLOOR SLAB SUBGRADE PREPARATION

A low volume change (LVC) material should be used to construct at least the top 18 inches of the building floor slab subgrades. We recommend the use of MoDOT Type 5 base rock for the LVC Zone.

The low volume change material should be placed and compacted in accordance with the *Structural Fill* section of this report. Upon completion of grading operations in the building areas, care should be taken to maintain the recommended subgrade moisture content and density until the floor slabs are constructed. Areas of the completed subgrade that become desiccated, saturated, frozen or disturbed by construction activity should be reconditioned to meet the recommendations of this report prior to placement of the granular leveling course and construction of the slabs.

A free draining compacted granular leveling course (e.g. ASTM C 33 Size No. 57 aggregate) having a minimum thickness of 6 inches should be placed below the floor slabs to provide uniform slab support. The layer of free-draining granular material should be in addition to the minimum 18-inch thick low volume change zone recommended below the building floor slab. If moisture vapor transmission through the concrete slab is a concern (e.g. if moisture sensitive floor coverings will be used), a vapor barrier should be used.

The procedures recommended above may not eliminate all future subgrade volume change and resultant floor slab movement. However, the procedures outlined should significantly reduce the potential for subgrade volume change. Common construction practice is to tie the slab-on-grade into the foundation elements to limit the impact of differential movement at doorways. Depending on the location of construction joints in the slab, the rigidity of the slab and foundation connection, and the magnitude of actual movement that occurs, some minor cracking within the floor slab could occur and should be anticipated.

F.3. SEISMIC SITE CLASSIFICATION

The subsurface profile for the project site consists of clay soils over limestone and shale bedrock. These conditions are consistent with the definition of Site Class "D" according to ASCE 7.

G. PAVEMENTS

G.1. PAVEMENT SUBGRADE PREPARATION

All pavements should be supported on a minimum of 9 inches of subgrade prepared in accordance with the recommendations presented in the Site Preparation section of this report. Construction scheduling often involves grading and paving by separate contractors and can involve a time lapse between the end of grading operations and the commencement of paving. Disturbance, desiccation or wetting of the subgrade soils between grading and paving can result in deterioration of the previously completed subgrade. If soft areas are identified during the subgrade preparation or if the subgrade soils have been exposed to adverse weather conditions, frost, excessive construction traffic, standing water, or similar conditions, the Olsson should be consulted to determine if corrective action is necessary.

It is important that the pavement subgrade support be relatively uniform, with no abrupt changes in the degree of support. Non-uniform pavement support can occur at the transition from cut to fill areas, or as a result of varying soil moisture contents or soil types, or where improperly placed utility backfill has been placed across or through areas to be paved. Improper subgrade preparation such as inadequate vegetation removal, failure to identify soft or unstable areas by proofrolling, and inadequate or improper compaction can also produce non-uniform subgrade support.

We recommend that the prepared subgrade extend a minimum of 2-feet outside the pavements, where feasible. Olsson should be present during subgrade preparation to observe, document, and test compaction of the materials at the time of placement. As recommended for all prepared soil subgrades, heavy, repetitive construction traffic should be controlled, especially during periods of wet weather, to minimize disturbance. The final prepared subgrade should be proof rolled with a loaded dump truck or similar rubber-tired equipment with a total weight of at least 20-tons, immediately prior to placement of new pavements. Proofrolling operations should be observed and documented by Olsson. Unstable or unsuitable soils revealed by proofrolling should be reworked to provide a stable subgrade or removed and replaced with structural fill.

Although not required, in our opinion, full depth flexible pavements supported on a stabilized subgrade tend to perform better and have longer design lives than pavements supported directly on a clay soil subgrade. Stabilization may also be required if subgrades become unstable. As a preferred pavement subgrade, the upper 9 inches of pavement subgrade should be stabilized with approximately 15 percent class C fly ash, 5 percent soil cement, or 5 percent hydrated lime (based on dry unit weights).

G.2. PAVEMENT DESIGN

Table 2 summarizes typical pavement sections for Asphaltic Cement (AC) with a granular base and Portland Cement Concrete (PCC). The sections represent typical minimum thicknesses. Routine maintenance of the pavement will be required, consisting of periodic seal coats and possibly one intermediate mill, in addition to regular crack maintenance.

PCC pavements are recommended for, loading/unloading areas, trash receptacle pads and approaches and other areas where heavy wheel loads will be concentrated. Concrete pavements in these areas should have a minimum thickness of 6 inches with a 4-inch leveling and drainage course of clean, crushed rock placed below the pavements. The leveling and drainage course for the PCC pavements should have an appropriate sub-drainage or other connection to a suitable gravity outfall to remove water from the drainage layer. The pavement subgrade should be graded to provide positive drainage below the granular base section. We further recommend that the length of concrete sections be such that no heavy truck wheels are allowed to rest on AC sections during loading/unloading operations.

The performance of pavements will be dependent upon a number of factors, including subgrade conditions at the time of paving, rainwater runoff, and traffic. Rainwater runoff should not be allowed to seep below pavements from adjacent areas. Pavements should be sloped approximately 1/4 inch per foot to provide rapid surface drainage.

Table 2: Minimum Recommended Pavement Sections

Parking Areas & Drive Areas	Heavy Vehicle Areas*
AC w/ Granular Base: 5" Asphalt Concrete 9" Compacted MoDOT Type 5 Baserock	Full Depth PCC: 8" PCC 4" Clean Rock Base *Applies to trash receptacle pads

*-Preferred subgrade stabilized w/ 15% Class C fly ash, 5% soil cement, or 5% lime

The pavement subgrade should be graded to adjacent storm sewer inlets and provisions should be made to provide drainage from the granular section into the storm sewer. Drainage of the granular base is particularly important where two different sections of pavements (AC and PCC) abut, so that water does not pond beneath the pavements and saturate the subgrade soils.

H. CONCLUSIONS AND LIMITATIONS

H.1. CONSTRUCTION OBSERVATION AND TESTING

We recommend that all earthwork during construction be monitored by a representative of ***Olsson***, including site preparation, placement of all structural fill and trench backfill, and pavement subgrades. The purpose of these services would be to provide ***Olsson*** the opportunity to observe the soil conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein.

H.2. LIMITATIONS

The conclusions and recommendations presented in this report are based on the information available regarding the proposed construction, the results obtained from our borings, laboratory testing program, and our experience with similar projects. The borings represent a very small statistical sampling of subsurface soils and it is possible that conditions may be encountered during construction that are substantially different from those indicated by the borings. In these instances, adjustments to design and construction may be necessary.

This geotechnical report is based on the site plan and information provided to ***Olsson*** and our understanding of the project as noted in this report. Changes in the location or design of new structures and could significantly affect the conclusions and recommendations presented in this geotechnical report. ***Olsson*** should be contacted in the event of such changes to determine if the recommendations of this report remain appropriate for the revised site design.

This report was prepared under the direction and supervision of a Professional Engineer registered in the State of Missouri with the firm of **Olsson, Inc.** The conclusions and recommendations contained herein are based on generally accepted, professional, geotechnical engineering practices at the time of this report, within this geographic area. No warranty, express or implied, is intended or made. This report has been prepared for the exclusive use of **Mid-Continent Public Library** and their authorized representatives for specific application to the proposed project described herein.

APPENDIX A
Boring Location Plan

olsson

Boring Location Plan

Scale: n.t.s.
Project No. A18-0330
Approved by: JDP
Date: 12/20/2019

Mid-Continent Public Library: Colbern Road
Lee's Summit, Missouri

APPENDIX B
Symbols and Nomenclature
Boring Logs

SYMBOLS AND NOMENCLATURE

DRILLING NOTES

DRILLING AND SAMPLING SYMBOLS

SS:	Split-Spoon Sample (1.375" ID, 2.0" OD)	HSA:	Hollow Stem Auger	NE:	Not Encountered
U:	Thin-Walled Tube Sample (3.0" OD)	CFA:	Continuous Flight Auger	NP:	Not Performed
CS:	Continuous Sample	HA:	Hand Auger	NA:	Not Applicable
BS:	Bulk Sample	CPT:	Cone Penetration Test	% Rec:	Percent of Recovery
MC:	Modified California Sampler	WB:	Wash Bore	WD:	While Drilling
GB:	Grab Sample	FT:	Fish Tail Bit	IAD:	Immediately After Drilling
SPT:	Standard Penetration Test Blows per 6.0"	RB:	Rock Bit	AD:	After Drilling
				CI:	Cave-In

DRILLING PROCEDURES

Soil samples designated as "U" samples on the boring logs were obtained in using Thin-Walled Tube Sampling techniques. Soil samples designated as "SS" samples were obtained during Penetration Test using a Split-Spoon Barrel sampler. The standard penetration resistance 'N' value is the number of blows of a 140 pound hammer falling 30 inches to drive the Split-Spoon sampler one foot. Soil samples designated as "MC" were obtained in using Thick-Walled, Ring-Lined, Split-Barrel Drive sampling techniques. Recovered samples were sealed in containers, labeled, and protected for transportation to the laboratory for testing.

WATER LEVEL MEASUREMENTS

Water levels indicated on the boring logs are levels measured in the borings at the times indicated. In relatively high permeable materials, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels is not possible with only short-term observations.

SOIL PROPERTIES & DESCRIPTIONS

Descriptions of the soils encountered in the soil test borings were prepared using Visual-Manual Procedures for Descriptions and Identification of Soils.

PARTICLE SIZE

Boulders	12 in. +	Coarse Sand	4.75mm-2.0mm	Silt	0.075mm-0.005mm
Cobbles	12 in.-3 in.	Medium Sand	2.0mm-0.425mm	Clay	<0.005mm
Gravel	3 in.-4.75mm	Fine Sand	0.425mm-0.075mm		

COHESIVE SOILS

Consistency	Unconfined Compressive Strength (Qu) (tsf)
Very Soft	<0.25
Soft	0.25 – 0.5
Firm	0.5 – 1.0
Stiff	1.0 – 2.0
Very Stiff	2.0 – 4.0
Hard	> 4.0

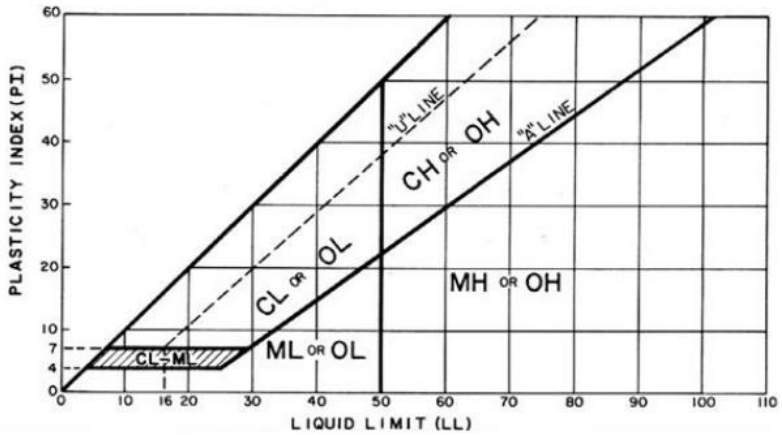
COHESIONLESS SOILS

Relative Density	'N' Value
Very Loose	0 – 3
Loose	4 – 9
Medium Dense	10 – 29
Dense	30 – 49
Very Dense	≥ 50

COMPONENT %

Description	Percent (%)
Trace	<5
Few	5 - 10
Little	15 - 25
Some	30 - 45
Mostly	50 - 100

PLASTICITY CHART



ROCK QUALITY DESIGNATION (RQD)

Description	RQD (%)
Very Poor	0 – 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 – 100

olsson

olsson

BOREHOLE REPORT NO. B-1

Sheet 1 of 1

PROJECT NAME: **Mid-Continent Public Structural & Civil Evaluations**

CLIENT: **Mid-Continent Public Library**

PROJECT NUMBER: **A18-0330**

LOCATION: **Lee's Summit, Missouri**

Split Spoon | Shelby Tube

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN CLAY *Stiff, dark brown*			SS 1		3-6-11 N=17	3.1	22.3		42/17	
	3.0'										
	FAT CLAY *Stiff, red brown*			U 2				28.0	94.4		P.P.=4.25
			5								
	6.0'										
	Firm, light red brown										
				SS 3		2-3-4 N=7		26.4			
			10								
	13.7'										
	WEATHERED SHALE 14.2'			SS 4		3-50/3"		36.6			
	Red brown										
	BASE OF BORING AT 14.2 FEET										

WATER LEVEL OBSERVATIONS	
WD	▽ Not Encountered
IAD	▼ Not Encountered
AD	▼ Not Encountered

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	11/19/19	FINISHED:	11/19/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
DRILLER:	K. PATTERSON	LOGGED BY:	D. Martin
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-2

Sheet 1 of 1

PROJECT NAME: Mid-Continent Public Structural & Civil Evaluations	CLIENT: Mid-Continent Public Library
PROJECT NUMBER: A18-0330	LOCATION: Lee's Summit, Missouri

Split Spoon ☒ Shelby Tube ■

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.2'		0								
	FAT CLAY										
	Firm, dark brown			SS 1		2-3-3 N=6		27.6			
	4.0'			U 2			3.3	24.6	99.2		
	Very stiff, olive brown		5								
	6.0'										
	Firm, light brown			SS 3		2-3-3 N=6		24.5			
	10.0'		10								
	WEATHERED LIMESTONE										
	Light brown, clay seams										
	▽			SS 4		2-50		35.9			
	14.5'										

BASE OF BORING AT 14.5 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 13.5 ft
IAD	▼ Not Encountered
AD	▼ Not Encountered

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	11/19/19	FINISHED:	11/19/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
DRILLER:	K. PATTERSON	LOGGED BY:	D. Martin
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-3

Sheet 1 of 1

PROJECT NAME	CLIENT
Mid-Continent Public Structural & Civil Evaluations	Mid-Continent Public Library
PROJECT NUMBER	**LOCATION**
A18-0330	Lee's Summit, Missouri

Split Spoon ☒ Shelby Tube ■

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.5'		0								
	FAT CLAY										
	Firm, dark brown			SS 1		3-3-4 N=7		26.8			
	2.3'										
	Very stiff, olive red brown			U 2			2.4	25.2	99.5		
			5								
	6.0'										
	Firm, light brown										
				SS 3		3-4-5 N=9		26.7			
	▼		10								
	11.0'										
	11.5'										
	Yellow brown, shaley 11.7'										
	WEATHERED LIMESTONE										
	FAT CLAY										
	Dark brown, clay joint										
	13.6'										
	LIMESTONE 13.9'			SS 4		50/5"		28.5			

BASE OF BORING AT 13.9 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 11.7 ft
IAD	▼ 10.0 ft after 0 Hrs
AD	▼ Not Encountered

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	11/19/19	FINISHED:	11/19/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
DRILLER:	K. PATTERSON	LOGGED BY:	D. Martin
METHOD: CONTINUOUS FLIGHT AUGER			

olsson

BOREHOLE REPORT NO. B-4

Sheet 1 of 1

PROJECT NAME: **Mid-Continent Public Structural & Civil Evaluations**

CLIENT: **Mid-Continent Public Library**

PROJECT NUMBER: **A18-0330**

LOCATION: **Lee's Summit, Missouri**

Split Spoon | Shelby Tube

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE — 0.3'		0								
	FAT CLAY										
	Stiff, dark brown			SS 1		3-4-5 N=9		15.5			
	— 4.0'			U 2			1.1	23.8	95.7		
	Stiff, olive brown with red		5								
	— 6.0'										
	Stiff, light brown										
				SS 3		3-3-4 N=7		34.2			
	— 10.5'		10								
	WEATHERED LIMESTONE — 11.3'										
	LIMESTONE — 11.6'										
	REFUSAL AT 11.6 FEET										

WATER LEVEL OBSERVATIONS	
WD	▽ Not Encountered
IAD	▼ Not Encountered
AD	▼ Not Encountered

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	11/18/19	FINISHED:	11/18/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
DRILLER:	K. PATTERSON	LOGGED BY:	D. Martin
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-5

Sheet 1 of 1

PROJECT NAME: Mid-Continent Public Structural & Civil Evaluations	CLIENT: Mid-Continent Public Library
PROJECT NUMBER: A18-0330	LOCATION: Lee's Summit, Missouri

Split Spoon ☒ Shelby Tube ■

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE ***0.4'***		0								
	LEAN CLAY										
	Stiff, dark brown			SS 1		4-4-5 N=9		25.7		49/26	
	4.0'			U 2				26.9	93.0		P.P.=3.75
	FAT CLAY		5								
	Stiff, olive brown										
	6.0'										
	Firm, light brown										
			10	SS 3		2-3-3 N=6		24.0			
				U 4			0.5	47.1	75.2		
	14.0'										

BASE OF BORING AT 14.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ Not Encountered
IAD	▼ Not Encountered
AD	▼ Not Encountered

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	11/19/19	FINISHED:	11/19/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
DRILLER:	K. PATTERSON	LOGGED BY:	D. Martin
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-6

Sheet 1 of 1

PROJECT NAME: Mid-Continent Public Structural & Civil Evaluations	CLIENT: Mid-Continent Public Library
PROJECT NUMBER: A18-0330	LOCATION: Lee's Summit, Missouri

Split Spoon ☒ Shelby Tube ■

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	FAT CLAY										
	Stiff, dark brown			SS 1		4-5-4 N=9		20.0			
	4.0'			U 2			2.9	25.2	95.9		
	Stiff, olive brown with red		5								
	6.0'										
	Stiff, light brown										
			10	SS 3		2-3-4 N=7		28.8			
	14.0'										
	WEATHERED SHALE			SS 4		3-17-17 N=34		39.3			
	Brown with gray, clayey 15.0'		15								

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ Not Performed
IAD	▼ Not Performed
AD	▼ Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	11/19/19	FINISHED:	11/19/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
DRILLER:	K. PATTERSON	LOGGED BY:	D. Martin
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-7

Sheet 1 of 1

PROJECT NAME: Mid-Continent Public Structural & Civil Evaluations	CLIENT: Mid-Continent Public Library
PROJECT NUMBER: A18-0330	LOCATION: Lee's Summit, Missouri

Split Spoon | Shelby Tube

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ASPHALT 0.4'		0								
	AGGREGATE BASE 0.9'										
	FAT CLAY			SS 1		4-4-4 N=8		27.6			
	Stiff, dark brown										
	4.0'			U 2			0.7	27.9	94.3		
	Firm, olive brown		5								
	6.0'										
	Firm, light brown										
	10.0'		10	SS 3		2-2-3 N=5		23.2			

BASE OF BORING AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ Not Performed
IAD	▼ Not Performed
AD	▼ Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	11/19/19	FINISHED:	11/19/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
DRILLER:	K. PATTERSON	LOGGED BY:	D. Martin
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-8

Sheet 1 of 1

PROJECT NAME: Mid-Continent Public Structural & Civil Evaluations	CLIENT: Mid-Continent Public Library
PROJECT NUMBER: A18-0330	LOCATION: Lee's Summit, Missouri

Split Spoon ☒ Shelby Tube ■

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ASPHALT 0.4'		0								
	AGGREGATE BASE 0.9'										
	FAT CLAY										
	Stiff, dark brown			SS 1		3-4-7 N=11		28.1			
	4.0'										
	Stiff, olive brown			U 2			1.0	28.0	95.2		
	6.0'		5								
	Firm, brown										
	10.0'		10	SS 3		2-3-2 N=5		27.0			

BASE OF BORING AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ Not Encountered
IAD	▼ Not Encountered
AD	▼ Not Encountered

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	11/19/19	FINISHED:	11/19/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
DRILLER:	K. PATTERSON	LOGGED BY:	D. Martin
METHOD: CONTINUOUS FLIGHT AUGER			