

# LEAVENWORTH COUNTY, KANSAS

## Design Build Road Repair (2) Mt. Olivet Failures

### ROAD REPAIR BID DOCUMENTS



**September 26, 2016**

Leavenworth County Public Works Department  
300 Walnut Street, Suite 007  
Leavenworth, KS 66048  
913-684-0470  
[www.leavenworthcounty.org](http://www.leavenworthcounty.org)

## NOTICE TO BIDDERS

The Leavenworth County Clerk, Leavenworth, Kansas, 300 Walnut Street will receive sealed proposals, until **10:30 a.m. local time on Wednesday, October 26, 2016**, for contractual Design and Construction services for the Design Build repair of Mt. Olivet Road. Information, specifications, and requirements regarding this project, as well as all bid documents and other requisite forms are provided in the **ROAD REPAIR BID DOCUMENTS** available at the Leavenworth County Public Works Department, and online at [www.leavenworthcounty.org](http://www.leavenworthcounty.org). The proposals will be received and the names of the firms responding will be publicly read at the Leavenworth County Clerk's Office at the time and place described above.

Proposals shall be submitted in a sealed envelope with the name of the bidder and "**Mt. Olivet Repair**" clearly written on the envelope and addressed to the Leavenworth County Clerk, 300 Walnut Street, Suite 106, Leavenworth Kansas 66048. Any proposals received after the closing time will be returned unopened.

If there are any questions please contact David Lutgen at 913-684-0470.

The Governing Body of the County of Leavenworth, Kansas, reserves the right to reject any or all bids, and to waive non-conformities.

Leavenworth County, Kansas is an equal opportunity employer. Small, minority, disadvantaged or women owned businesses are encouraged to submit bids.

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Janet Klasinski, County Clerk  
Courthouse, 300 Walnut Street, Suite 106  
Leavenworth, Kansas 66048  
(913) 684-0421

Leavenworth County, Kansas

**Design Build Mt. Olivet Road Repairs**

Bid Documents

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**MT. OLIVET ROAD REPAIRS**  
**PROJECT INFORMATION, SPECIFICATIONS, and REQUIREMENTS**

**1.0 GENERAL CONDITIONS and INFORMATION**

The Leavenworth County Public Works Department is requesting proposals from qualified entities to provide DESIGN AND CONSTRUCTION services for the repair of (2) failed sections of Mt. Olivet Road. The contract will be awarded based upon the proposal that provides the best bid that is in the best interest of Leavenworth County. Factors that will be given strong consideration for determination of the contract award include, but are not limited to, *qualification* of the Bidder, project *cost*, and construction *timeframes*. Leavenworth County reserves the right to reject any or all proposals, and to waive any non-conformity in any submitted proposal.

**1.1 Bid Documents**

There is no expressed or implied obligation for the County to reimburse responding firms for any expenses incurred in preparing bids in response to its request.

Any request for clarification or additional information deemed necessary by any respondent to present a bid shall be submitted in writing to David Lutgen, Leavenworth County Court House, Suite 007, Leavenworth, Kansas, 66048, a minimum of fourteen (14) calendar days prior to the proposal submission deadline. Any requests for clarification received after the above-stated deadline will not be considered. All requests received prior to the above deadline will be responded to in writing by the County in the form of an addendum addressed to all prospective respondents.

Contractors should read and be fully familiar with all contract documents before submitting a bid. In submitting a bid, the bidder warrants that it has read the contract documents and is fully familiar therewith and that it has visited the site of the work to fully inform itself as to all existing conditions and limitations and shall include in its bid a sum to cover the cost of all items of the work. Leavenworth County assumes no responsibility for any errors or misinterpretations of the bidder, or from the use of submittal of incomplete Bid Documents.

Bids shall be made upon the form provided, in ink or typewritten. The signature shall be in long hand, and the complete form shall be without alteration or erasure. No oral, telegraphic, facsimile, or telephonic bids or alterations will be considered. The following items must be included in the sealed envelope with the bid:

- a. Completed bid form.
- b. 5% Bid Security – Bid Bond, Cashier’s Check, or Certified Check (see below).

Each bidder shall file with its bid, a cashier’s check or a certified check drawn on any acceptable bank, made payable to Leavenworth County, Kansas, in the amount of not less than

five percent (5%) of the total bid, which shall be retained by Leavenworth County until a Contract for the project has been executed. Bid bonds will be returned to the unsuccessful bidders at such time as their bids are rejected. The bid deposit of the successful bidder will be returned when satisfactory bonds in the amount equal to 100% of the Contract amount, required insurance certificates, and other required documents have been furnished and the Contract Documents have been executed.

Each proposal must be sealed to provide confidentiality of the bid information prior to the submission date and time. All proposals and supporting documents become public information (except such information that discloses proprietary or financial information submitted in response to qualification statements) after the submission date and time in accordance with the Kansas Open Records Act.

To be considered, one (1) copy of the completed bid forms must be received by the County Clerk's Office, 300 Walnut Street, Suite 106, Leavenworth, KS 66048 by **10:30 a.m. on Wednesday, October 26, 2016**. Bids are to be sealed, and shall have "**Mt. Olivet Repair**" clearly marked on the outside. Leavenworth County reserves the right to reject any or all bids; to waive any and all irregularities and informalities; to negotiate contract terms with the successful Bidder; to disregard all nonconforming, nonresponsive or conditional bids; and the right to accept the best bid it feels is in the best interest of Leavenworth County.

Bids received after the specified deadline will not be considered, and will be returned unopened if the respondent is identified on the proposal envelope.

Bids may be withdrawn or modified prior to the submission date. Bids that are resubmitted or modified must be sealed and submitted to the County Clerk's Office prior the deadline. Each respondent may submit only one (1) bid.

Submission of a bid indicates acceptance by the firm of the conditions contained in the request for proposals, unless clearly and specifically noted in the bid submitted and confirmed in the contract between the County and the firm selected.

Leavenworth County, Kansas is an equal opportunity employer. Small, minority, disadvantaged, or women owned businesses are encouraged to submit bids on this contract.

## **1.2 Proposals Binding**

All bids submitted shall be binding upon the respondent if accepted by Leavenworth County within sixty (60) calendar days of the bid deadline. Negligence upon the part of the respondent in preparing the proposal confers no right of withdrawal after the time fixed for the submission of proposals.

### **1.3 Termination**

Subject to the provisions below, any contract derived from this Request For Proposal may be terminated by either party upon thirty (30) days advance written notice to the other party; but if any work or service hereunder is in progress but not completed as of the date of termination, then said contract may be extended upon written approval of the County until said work or service(s) are completed and accepted.

a. *Termination for Convenience:* In the event that the contract is terminated or cancelled upon request for the convenience of the County, without the required thirty (30) days advance written notice, then the County shall negotiate reasonable termination costs, if applicable.

b. *Termination for Cause:* Termination by the County for cause, default or negligence on the part of the Contractor shall be excluded from the foregoing provision; termination costs, if any, shall not apply. The thirty (30) days advance written notice requirement is waived in the event of Termination for Cause.

### **1.4 Tax Exempt**

Leavenworth County and its departments are exempt from state and local sales tax. The Contractor shall receive a tax exempt form from the Leavenworth County Public Works Department prior to commencing work.

### **1.5 Respondent Prohibited**

Respondents are prohibited from assigning, transferring, conveying, subletting, or otherwise disposing of the proposal or any resultant agreement or its rights, title, or interest therein or its power to execute such agreement to any other person, company, or corporation without the previous written approval of Leavenworth County.

### **1.6 Hold Harmless**

The Contractor agrees to protect, defend, indemnify and hold the County Commission, its officers, employees, and agents free and harmless from and against any and all losses, penalties, damages, settlements, costs, charges, professional fees or other expenses or liabilities of every kind and character arising out of or relating to any and all claims, liens, demands, obligations, actions, proceedings or causes of action of every kind and character in connection with or arising directly or indirectly out of the error, omission or negligent act of the Contractor. Without limiting the generality of the foregoing, any and all such claims, etc., relating to the personal injury, infringement of any patent, trademark, copyright (or application for any thereof) or of any other tangible or intangible personal or property right, or actual or alleged violation of any applicable statute, ordinance, administrative order, rule or regulation, or decree of any court, shall be included in the indemnity hereunder. The Contractor further agrees to investigate, handle, respond to, provide defense for and defend any such claims, etc., at its sole expense and agrees to bear all other costs and expenses related thereto, even if such claim is groundless, false or fraudulent.

## **1.7 Law Governing**

All contractual agreements shall be subject to, governed by, and construed according to the laws of the State of Kansas.

## **1.8 Anti-discrimination Clause**

No respondent on this request shall in any way, directly or indirectly, discriminate against any person because of age, race, color, handicap, sex, national origin, or religious creed.

## **1.9 Insurance**

The Contractor shall be required to maintain and carry in force for the duration of the contract, insurance coverage of the type and minimum liability limits as set forth below:

### *a. Comprehensive General Liability Insurance*

\$1,000,000.00 combined single limit per occurrence for bodily injury, personal injury and property damages. Policy will include:

- Premises and Operations
- Broad Form Contractual
- Personal Injury with employee exclusion deleted
- Products/Completed Operations
- Broad Form Property Damage
- Operation of Motor Vehicles

### *b. Workman's Compensation and Employer's Liability*

Contractor shall at all times maintain, and be responsible for Workman's Compensation insurance for all employees of the Contractor.

Before entering into a contract, the successful respondent shall furnish to the County Clerk a Certificate of Insurance verifying such coverage and identifying the County Commission, County of Leavenworth, Kansas, its officers, commissions, agents and employees as additional insured as pertains to the contract. This inclusion shall not make the County a partner or joint venture with the Contractor in its operations hereunder.

The County Commission, County of Leavenworth, Kansas, its officers, commissions, agents and employees shall be named as additional insured as respects: liability arising out of acts performed by or on behalf of the Contractor; projects and completed operations of the Contractor, premise owned, leased or used by the Contractor; or automobiles, leased, hired or borrowed by the Contractor.

The certificate holder on the Certificate of Insurance shall be as follows:

Board of Leavenworth County Commissioners  
Leavenworth, Kansas  
c/o County Clerk  
Courthouse, 300 Walnut Street  
Leavenworth, Kansas 66048

Prior to any material change or cancellation, the County Commission, County of Leavenworth, Kansas, its officers, commissions, agents and employees will be given thirty (30) days advanced written notice by registered mail to the stated address of the certificate holder. Further, the County Commission, of Leavenworth Kansas, its officers, commissions, agents and employees will be immediately notified of any reduction or possible reduction in aggregate limits of any such policy where such reduction, when added to any previous reductions, would exceed 25% of the aggregate limits.

In the event of an occurrence, it is further agreed that any insurance maintained by the County Commission, County of Leavenworth, Kansas, its officers, commissions, agents and employees shall apply in excess of and not contributed with insurance provided by policies named in this contract.

#### **1.10 Invoicing and Payments**

Invoices shall be prepared and submitted in duplicate to the address shown on the award of this proposal. Invoices shall contain the following information: description of services, unit prices, and expended totals. Invoices are to be remitted to the Leavenworth County Public Works Department prior to the third Monday of each month.

#### **1.11 Payment Schedule**

The County pays invoices once a month. The check is mailed approximately by the 10<sup>th</sup> calendar day of each month. To ensure the Contractor will be paid by the 10<sup>th</sup> calendar day of the following month the Contractor shall be responsible for submitting their monthly bill to the Leavenworth County Public Works Department prior to the third Monday of each month.

#### **1.12 Affirmative Action Requirements for County Contracts**

Equal opportunity in employment is the policy of the County of Leavenworth, Kansas, and the County has particular interest in assuring Equal Opportunity Employment among Contractors doing business with the County. Small, minority, disadvantaged or women owned businesses are encouraged to submit bids on this contract.

### 1.13 Project Time

The Contractor shall furnish the County Engineer with a detailed project schedule, providing dates on which it expects to commence and complete construction phases. The Contractor shall complete all required construction requirements and activities in accordance with the terms, and within the timeframe specified on the Contract documents, unless agreed to in writing by all parties or modified by an approved extension of time.

### 1.14 Liquidated Damages

In case of failure on the part of the Contractor to effect completion within the time specified, Leavenworth County shall have the right to deduct from the total compensation otherwise due the Contractor as liquidated damages, fixed and agreed to in advance, according to the following schedule:

<u>Contract Amount</u>			<u>Liquidated Damages</u>
\$ 0	to	25,000	\$ 75.00
\$ 25,000	to	50,000	\$ 125.00
\$ 50,000	to	100,000	\$ 200.00
\$ 100,000	to	500,000	\$ 400.00
\$ 500,000	to	1,000,000	\$ 600.00
\$ 1,000,000	to	2,000,000	\$ 925.00
\$ 2,000,000	to	5,000,000	\$ 1,375.00
\$ 5,000,000	to	10,000,000	\$ 2,000.00
\$ 10,000,000	and up		\$ 3,000.00

for each of the 24-hour calendar days, including Sundays and holidays, the work remains incomplete over the specified completion time. (LEAVENWORTH COUNTY RESERVES THE RIGHT TO ADJUST THE SCHEDULE OF LIQUIDATED DAMAGES, PRIOR TO BIDDING, BASED ON THE SCOPE AND URGENCY OF THE PROJECT.)

In the event moneys being retained by Leavenworth County shall not be sufficient to cover the amount of any liquidated damages, Leavenworth County may sue for and recover compensation for damages for nonperformance of this Contract at the time stipulated and provided for.

### 1.15 Bonds

The Contractor to whom the project is awarded will be required to furnish a Performance Bond and Two Year Guarantee Bond in the forms hereinafter provided in an amount equal to one-hundred percent (100%) of the amount of the Contract to be awarded in each case in addition to any other bonds as may be required by the Contract Documents. With each bond there shall be filed with Leavenworth County one copy of "Power of Attorney" certificate to include the date of the bonds. Failure to furnish such Bonds may, at the option of

Leavenworth County, be the basis for declaring the Contractor in default and pursuing such legal rights as Leavenworth County deems in its best interest, including, but not limited to, enforcement of Leavenworth County's rights as to bid security.

#### **1.16 Use of Premises**

- a) Contractor shall confine its operations to limits indicated by law, ordinances, rules, regulations, and permits of the State of Kansas and Leavenworth County, or directions of the County Engineer, and shall not unreasonably encumber the premises and/or project site.
- b) Contractor shall not load or permit any part of any structure, street, or highway to be loaded with a weight that exceeds load limits.

#### **1.17 Allowances**

The Contractor agrees that the Contract Price includes all allowances required by the Contract Documents, and declares that the Contract Price includes all other sums for expenses and overhead and fee on account of allowances as it deems proper. No demand for expenses or overhead and fee other than those included in the Contract Price shall be allowed.

#### **1.18 Temporary Facilities**

The Contractor shall provide and maintain sanitary temporary toilet facilities at the project site for accommodation of all persons engaged on the project. Temporary toilets shall be enclosed and weatherproof and kept in sanitary and an approved condition at all times. After use for same has ceased, Contractor shall remove the temporary toilet facilities from the project site.

#### **1.19 Concealed Conditions**

The Contractor understands that Leavenworth County makes no warranty, expressed or implied, that the various and sundry materials and information, including, by way of example and without limitation, soil tests, bore reports, utility locations, and other such data, reflect actual conditions. The Contractor represents and warrants that it has examined the site, reviewed the construction plans, and conducted such tests and examinations as it deems necessary and assumes all responsibility for the foregoing. That being the case, should concealed conditions encountered in the performance of the work below the ground, or should concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the Contract Documents, or should unknown physical conditions below the surface of the ground, or should concealed or unknown conditions be encountered in an existing structure of an unusual nature, differing materially from those ordinarily encountered or generally recognized as inherent in work of the character provided for in this Contract, be encountered, there shall be no adjustment in the Contract Price for any extra work necessitated thereby, although, if necessary, in the judgment of the County Engineer, the Contract Time may be adjusted.

## **1.20 Cleaning Up**

The Contractor shall at all times keep the project site free from accumulations of waste material or rubbish caused by its employees or activities.

## **1.21 Holiday Restrictions**

Construction activities shall not occur at the project site between the hours of 7:00 p.m. and 6:00 a.m., nor on weekends or Leavenworth County holidays, without prior written consent from the County Engineer, except such work as may be necessary for the proper care, maintenance, and protection of work already completed or of equipment, or in the case of an emergency.

## **2.0 CONTRACTOR'S SCOPE OF WORK**

### **2.1 Project Description**

Design build the repair for (2) failed sections of Mt Olivet Road.

### **2.2 Scope of Work**

The scope of work to be undertaken by the Contractor for this Project is as follows: Work with Alpha-Omega Geotech to prepare the design(s) to repair the (2) failed sections of Mt. Olivet Road. Submit plan to Leavenworth County for right-of-way and easement acquisition. Contractor will repair the Mt. Olivet Rd sections. Alpha-Omega Geotech will provide construction observation services.

Contact person with Alpha-Omega Geotech, Inc. –

Garic Abendroth, P.E.  
Engineering Department Manager  
913-371-0000

### **2.3 Right-of-Way**

The Contractor will provide Leavenworth County with a plan that shows the construction limits for the Contractor's proposed work at each site. Leavenworth County is responsible for the acquisition of all right-of-way and easements needed for this project.

No construction outside of existing right-of-way shall commence until all right-of-way and easements have been acquired.

### **3.0 ADDITIONAL WORK, SERVICES, AND MATERIALS**

#### **3.1 Construction Staking**

The Contractor shall employ the services of a licensed professional land surveyor to provide construction staking for the project.

#### **3.2 Permits**

LVCO shall be responsible for the associated tasks to secure any permits, permit modifications and/or permit extensions; LVCO shall be the Permit Holder.

The Contractor shall allow environmental compliance inspections by LVCO, and/or regulatory agencies, as required by permits and/or to facilitate any interim compliance reviews/assessments.

#### **3.3 Geotechnical Work**

The Geotechnical Engineering Reports prepared by Alpha Omega Geotech (**Attachments 1 and 2**) are being provided for the Applicant's information. The Contractor shall analyze the data to provide design and construction requirements. Any additional borings or geotechnical information needed by the Contractor must be obtained by the Contractor at no cost to LVCO.

#### **3.4 Public Involvement / Relations**

All information to be released to the public shall be prepared and controlled by LVCO. The Bridge Contractor shall provide LVCO with an emergency contact list of project personnel.

#### **3.5 Utilities**

Relocation of utilities on this project will be administered by the Contractor. The Westar power lines at the east site will remain in place during construction.

#### **3.6 Quality Control**

Contractor will employ Alpha Omega Geotech to perform quality control duties during construction activities.

#### **3.7 Construction Management**

It is the Contractor's responsibility to obtain supplemental materials that meet the contractual requirements. LVCO's role during construction operations will be limited to independent assurance, review, processing progress payments, and other Project control and Project management/administration efforts necessary to properly administer and manage the Project. The Contractor shall immediately cease any work not being performed according to the Contract requirements.

### **3.8 Occupational Safety and Health Standards**

All aspects of the Project shall comply with the Federal Occupational Safety and Health Act.

### **4.0 ATTACHMENTS**

Attachment 1 – Geotechnical Engineering Report prepared by Alpha Omega Geotech for Metropolitan Avenue Slope Failure, dated August 16, 2016. (This is the east site)

Attachment 2 – Geotechnical Engineering Report prepared by Alpha Omega Geotech for Mt. Olivet Road Slope Failure, dated August 19, 2016. (This is the west site)

Attachment 3 – East site location map

Attachment 4 – West site location map

BID PROPOSAL FORM

PROJECT IDENTIFICATION:

Leavenworth County, Kansas  
Mt. Olivet Road Repairs

THIS BID IS SUBMITTED TO:

Leavenworth County Clerk  
Leavenworth County Courthouse  
300 Walnut Street, Suite 106  
Leavenworth, KS 66048

1. The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an agreement with Leavenworth County in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents within the time and for the amount indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.

2. This Bid will remain subject to acceptance for 90 days after the day of bid opening. Bidder will sign and submit the Agreement with the Bonds and other documents required by the Bidding Documents within 15 days after the date of Owner's Notice to Proceed.

3. In submitting this Bid, Bidder represents that:

a. Bidder has examined copies of all the Bidding Documents and of the following Addenda (receipt of all which is hereby acknowledged):

No. \_\_\_\_\_ Dated \_\_\_\_\_

No. \_\_\_\_\_ Dated \_\_\_\_\_

b. Bidder has visited the site and become familiar with and satisfied itself as to the general, local, and site conditions that may affect cost, progress, performance, and furnishing of the Work.

c. Bidder is familiar with and has satisfied itself as to all Federal, state, and local Laws and Regulations that may affect cost, progress, performance, and furnishing of the Work.

d. Bidder is aware of the general nature of Work to be performed by Owner and others at the site that relates to Work for which this Bid is submitted as indicated in the Contract Documents.

e. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.

f. Bidder has given Leavenworth County written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Contract Documents and

the written resolution thereof by Leavenworth County is acceptable to Bidder, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work for which this Bid is submitted.

- g. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any person, firm, or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Leavenworth County.

4. Bidder will complete the Work for the following price and based upon the following unit prices:

**BID PROPOSAL**

<b>Item No.</b>	<b>Item Description</b>	<b>Quantity</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Total Item Cost</b>
1	Design Build Repair for (2) Mt. Olivet Sites*	1	LS	_____	_____
	*Bid to include all fees for Alpha Omega Geotech Services			<b>Bid Total</b>	_____
1	Commencement of On-Site Project Construction			_____	
2	Completion of Construction			_____	

5. Communications concerning this Bid shall be sent to Bidder at the following address:

SIGNATURE OF BIDDER

By \_\_\_\_\_  
(signature of individual)

Print name and title \_\_\_\_\_

Business name and address \_\_\_\_\_

\_\_\_\_\_

Phone No. \_\_\_\_\_

Date \_\_\_\_\_, 20\_\_\_\_

LEAVENWORTH COUNTY, KANSAS  
AGREEMENT BETWEEN LEAVENWORTH  
COUNTY AND CONTRACTOR  
FOR  
PUBLIC IMPROVEMENT OF Design Build Mt.  
Olivet Road Repairs

This agreement is made and entered into this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, by and between Leavenworth County, Kansas, hereinafter the "County" and

\_\_\_\_\_,  
hereinafter the "Contractor."

WITNESSETH:

WHEREAS, the County has caused to be prepared, in accordance with the law, Instructions to Bidders, Bid, this Agreement, General Conditions, Construction Plans, Specifications and other Contract Documents, as defined in the General Conditions and Technical Information and Requirements, for the work herein described, and has approved and adopted these said Contract Documents and has invited sealed Bids for furnishing construction materials, labor, tools, equipment and transportation necessary for, and in connection with, the construction of public improvements in accordance with the terms of this Agreement; and

WHEREAS, the Contractor has submitted to the County, in the manner and at the time specified, a sealed Bid in accordance with the terms of this Agreement; and

WHEREAS, the County, in the manner prescribed by law, has publicly opened, examined and canvassed the Bids submitted, and as a result of this canvass has, in accordance with the law, determined and declared the Contractor to be the best responsible bidder in the best interest of the County for the construction of the public improvements, and has duly awarded to the Contractor a contract therefor upon the terms and conditions set forth in this Agreement for the sum or sums named in the Bid attached to and made a part of this Agreement.

NOW, THEREFORE, in consideration of the compensation to be paid the Contractor, and of the mutual agreements herein contained, the parties hereto have agreed, and hereby agree, the County for itself and its successors and the Contractor for itself, himself/ herself or themselves, its, his/ her or their successors and assigns, or its, his/ her or their executors and administrators, as follows:

ARTICLE I. The Contractor will furnish at its own cost and expense all labor, tools, equipment, materials and transportation required to construct and complete the work designated, described and required by the Contract Documents, to wit:

all in accordance with the Notice to Bidders, Bid, this Agreement, General Conditions, Construction Plans, Technical Information and Requirements, Attachments, and other Contract Documents, all of which Contract Documents form the Contract, and are as fully a part hereof as if repeated verbatim herein; all work to be done in a good, substantial and workmanlike manner to the entire satisfaction of the County, and in accordance with the laws of the County, the State of Kansas and the United States of America. All terms used herein shall have the meanings ascribed to them in the General Conditions unless otherwise specified.

ARTICLE II. The County shall pay to the Contractor for the performance of the work embraced in this Contract, and the Contractor will accept in full compensation therefor, the sum of \_\_\_\_\_ DOLLARS (\$ \_\_\_\_\_) (subject to adjustment as provided by the Contract Documents) for all work covered by and included in the Contract award and designated in the foregoing Article I, payment thereof to be made in cash or its equivalent and in the manner provided in the Contract Documents.

ARTICLE III. The Contractor shall commence and complete all work by this Contract upon the dates stated in the awarded Bid. Accordingly, liquidated damages shall be assessed against Contractor, as stipulated liquidated damages and not as a penalty, in an amount as set forth in the General Conditions for each and every calendar day the work remains incomplete over the specified completion time.

ARTICLE IV. The Contractor shall not subcontract, sell, transfer, assign or otherwise dispose of the Contract or any portion thereof without previous written consent of the County. No subcontracts, or other transfer of Contract, shall release the Contractor of its liability under the Contract and bonds applicable thereto.

ARTICLE V. Contractor specifically acknowledges and confirms that: 1.) it has visited the site, made all inspections it deems appropriate and has read and fully understands the Contract Documents, including all obligations and responsibilities undertaken by it as specified herein and in other Contract Documents and knowingly accepts the same; 2.) it has furnished copies of all Contract Documents to its insurance carrier(s) and its surety(ies); and 3.) its insurance carrier(s) and surety(ies) agree to be bound as specified herein, in the Contract Documents and in the insurance policy(ies) and bonds as to liability and surety coverage.

ARTICLE VI. It is specifically agreed between the parties executing this Agreement that the Contract Documents are not intended to create any third party beneficiary relationship nor authorize anyone not a party to this Agreement to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of this Agreement. The duties, obligations and responsibilities of the parties to this Agreement with respect to third parties shall remain as imposed by law.

ARTICLE VII. This Agreement, together with the other Contract Documents, constitutes the entire agreement between the parties and supersedes all prior agreements, whether oral or written, covering the same subject matter. This Agreement may not be modified or amended except as provided herein or in the other Contract Documents.

ARTICLE VIII. This Agreement is entered into, under and pursuant to, and is to be construed and enforceable in accordance with the laws of the State of Kansas.

ARTICLE IX. Should any provision of this Agreement or the other Contract Documents be determined to be void, invalid, unenforceable or illegal for whatever reason, such provision(s) shall be null and void; provided, however, that the remaining provisions of this Agreement and/or the other Contract Documents shall be unaffected thereby and shall continue to be valid and enforceable.

WITNESS WHEREOF, Leavenworth County, Kansas, has caused this Agreement to be executed on its behalf, thereunto duly authorized, and the said Contractor has executed \_\_\_\_\_ counterparts of this contract in the prescribed form and manner, the day and year first above written.

LEAVENWORTH COUNTY, KANSAS

By \_\_\_\_\_  
Robert Holland, Chairman – Board of  
Leavenworth County Commissioners

ATTEST:

\_\_\_\_\_  
Janet Klasinski, County Clerk

\_\_\_\_\_  
Contractor

By \_\_\_\_\_

(SEAL)

Title \_\_\_\_\_

(If the Contract is not executed by the President of the Corporation or general partner of the partnership, please provide documentation, which authorizes the signatory to bind the corporation or partnership. If a corporation, Contractor shall furnish the County a current certificate of good standing, dated within ten (10) days of the date of this Contract.)

STATUTORY PAYMENT BOND

(Pursuant to Kan. Stat. Ann. 60-1111)

Bond No. \_\_\_\_\_

KNOW ALL MEN BY THESE PRESENTS: That the undersigned, a corporation organized under the laws of the State of Kansas, \_\_\_\_\_ as Principal, and \_\_\_\_\_, as Surety and guarantor, are held and firmly bound unto the STATE OF KANSAS in the sum of \$ \_\_\_\_\_ lawful money of the United States of America, for the payment of which well and truly to be made the said Principal and Surety hereby bind themselves and their respective successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THE FOREGOING OBLIGATION IS SUCH THAT, Whereas the Principal has on the \_\_\_\_ day of \_\_\_\_\_, 201\_\_\_\_, entered into a written agreement with Leavenworth County, Kansas, hereinafter called the Owner, for furnishing all tools, equipment, materials and supplies and performing all labor and incidentals thereto necessary in connection with Design Build Mt. Olivet Road Repairs.

NOW THEREFORE, if the Principal or the subcontractor or subcontractors of the Principal shall pay all indebtedness incurred for labor furnished, materials, equipment or supplies, used or consumed in connection with or in or about the construction of or in making such public improvements, then this obligation shall become null and void; otherwise, it shall remain in full force and effect. If the Principal or the subcontractor or subcontractors of \_\_\_\_\_ furnished, materials, equipment or supplies, used or consumed in connection with or in or about the construction or in making such public improvements, then the Surety shall pay the same in any amount not exceeding the amount of this obligation, together with any interest and other sums as provided by law.

Surety further agrees that any persons to whom there is due any sum for such public improvements as hereinabove stated, or said person's assigns or successors, may bring action on this bond for the recovery of said indebtedness; provided, that no action shall be brought on this bond after six (6) months from the completion of said public improvements.

THE REST OF THIS PAGE IS LEFT INTENTIONALLY BLANK

PERFORMANCE AND TWO YEAR GUARANTEE BOND

**Design Build Mt. Olivet Road Repairs**

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned \_\_\_\_\_

\_\_\_\_\_

hereinafter referred to as the "Contractor", and \_\_\_\_\_

a Corporation organized under the laws of the State of \_\_\_\_\_

and authorized to transact business in the State of \_\_\_\_\_ as Surety,

are held and firmly bound unto Leavenworth County, Kansas, hereinafter referred to as the "Owner" in the penal sum of

\_\_\_\_\_ DOLLARS, lawful money

of the United States of America for the payment of which the sum, well and truly to be made, we

bind ourselves and our heirs, executors, administrators, successors, and assigns, jointly and

severally by these presents.

THE CONDITION OF THE FOREGOING OBLIGATION IS SUCH THAT:

WHEREAS, the above bonded Contractor has, on the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, entered into a written contract with the aforesaid Owner for furnishing all materials, equipment, tools, superintendence, labor, and other facilities and accessories, for the construction of certain improvements as designated, defined and described in the said Contract and the Conditions thereof, and in accordance with the Specifications and plans thereof; a copy of said Contract being attached hereto and made a part hereof:

NOW THEREFORE, if the said Contractor shall and will, in all particulars, well, duly and faithfully observe, perform and abide by each and every covenant, condition, and part of the said Contract, and the Conditions, Specifications, Plans and other Contract Documents thereto attached or, by reference, made part thereof, according to the true intent and meaning in each case, and if said Contractor shall replace all defective parts, material and workmanship for a period of two years after acceptance by the Owner, then this obligation shall be and become null and void; otherwise it shall remain in full force and effect.

PROVIDED FURTHER, if said Contractor fails in all particulars to duly and faithfully observe, perform and abide by each and every covenant, condition and part of the said contract and the conditions, specifications, plans and other contract documents, thereto attached, or, by reference made a part thereof, according to the true intent and meaning in each case, or if said Contractor shall fail to replace all defective parts, material and workmanship for a period of two years after acceptance by the owner then the surety will pay the costs to complete the project and/or the costs to repair any defective parts for the period of two years after acceptance, and any other damages incurred by the owner in procuring completion and/or repair, such amount not exceeding the amount of this obligation, together with interest as provided by law.

PROVIDED FURTHER, that if the said Contractor fails to duly pay for any labor, materials, sustenance, provisions, provender, gasoline, lubricating oils, fuel oils, greases, equipment and tools consumed or used in said work, groceries and foodstuffs, and all insurance premiums, compensation liability, and

otherwise, or any other supplies or materials used or consumed by such Contractor or his, their, or its sub- Contractors in performance of the work contracted to be done, the Surety will pay the same in any amount not exceeding the amount of this obligation together with interest as provided by law.

PROVIDED FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration, or additional to the terms of the contract, or the work to be performed thereunder, or the specifications accompanying the same, shall in any ways affect this obligation on this bond and it does hereby waive notice of any change, extension of time, or addition to the terms of the contract, or to the work, or to the specifications.

TESTIMONY WHEREOF, the said Contractor has hereunto set his hand, and the said Surety has caused these presents to be executed in its name, and its corporate seal to be hereunto affixed, by its attorney-in-fact duly authorized hereunto so to do, at \_\_\_\_\_

on this the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_

BY: \_\_\_\_\_

\_\_\_\_\_

By \_\_\_\_\_ SEAL

By \_\_\_\_\_ SEAL  
(Attorney-in-fact)

By \_\_\_\_\_ SEAL  
(State Representative)

(Accompany this bond with Attorney-in-Fact's authority form the Surety Company certified to include the date of the bond)

CONTRACTOR'S ASSURANCE  
OF GOOD TITLE TO  
MATERIALS INCLUDED IN PROJECT

The undersigned Contractor swears under penalty of perjury that all materials and equipment incorporated in the work performed under the contract for which final payment is now being made are free and clear of all security interests and encumbrances.

Dated: \_\_\_\_\_

\_\_\_\_\_  
CONTRACTOR

BY \_\_\_\_\_

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
NOTARY PUBLIC

My appointment expires:

\_\_\_\_\_

EAST SITE

**ALPHA-OMEGA  
GEOTECH**

1701 State Avenue  
Kansas City, KS 66102

t 913-371-0000  
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AOGeotech.com

GEOTECHNICAL ENGINEERING REPORT  
**METROPOLITAN AVENUE SLOPE FAILURE**

LEAVENWORTH COUNTY, KANSAS  
(A-OG 16-236E)

Date: August 16, 2016

Submitted to: Mr. David Lutgen, P.E.  
Deputy Director of Public Works  
Leavenworth County  
300 Walnut, Suite 007  
Leavenworth, KS 66048

Submitted by: ALPHA-OMEGA GEOTECH, INC.

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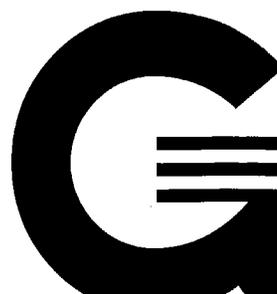
Appendix 1 – Repair Recommendations

Appendix 2 – Boring Locations

Appendix 3 - Laboratory Test Results

Appendix 4 - Boring Logs

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August 16, 2016

Mr. David Lutgen, P. E.  
Deputy Director of Public Works  
Leavenworth County  
300 Walnut, Suite 300  
Leavenworth, KS 66048

**METROPOLITAN AVENUE SLOPE FAILURE**

METROPOLITAN AVENUE NW OF 172<sup>ND</sup> STREET  
LEAVENWORTH COUNTY, KANSAS  
(A-OG 16-236E)

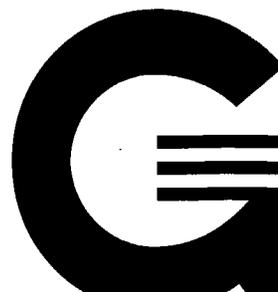
Dear Mr. Lutgen:

We have completed our limited geotechnical engineering investigation for your above-referenced project.

**INTRODUCTION**

Attached are the following items that were utilized in our analysis and evaluation of the subsurface conditions at this site: a sketch giving the approximate location of seven (7) borings made on this site with reference to the existing site features; the detailed results of twenty moisture contents (ASTM D2216), thirteen (13) dry densities, six (6) sets of Atterberg limits (ASTM D4318), six (6) unconfined compression (ASTM D2166) tests from our laboratory, twenty (20) calibrated pocket penetrometer readings; and seven (7) auger boring (ASTM D1452) logs that describe the materials encountered, their thicknesses and the sampling depths where Shelby tube, thin-walled steel, samplers (ASTM D1587) were used, Standard Penetration (ASTM D1586) tests were performed and bag samples were collected from the auger cuttings in these test borings.

Our personnel located each of the selected borings by measuring from the existing site features and should be considered accurate only to the extent implied by the method of measurement. Elevations were provided by Leavenworth County after the borings were completed. Each of the borings was completed by our drill crew using a CME 55 high-torque, ATV track-mounted drill rig.



Mr. David Lutgen, P.E.  
AOG 16-236E  
August 16, 2016  
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Metropolitan Avenue Slope Failure  
Metropolitan Avenue NW of 172<sup>nd</sup> Street  
Leavenworth, Kansas

## **SUBSURFACE INVESTIGATION & TEST RESULTS**

Seven (7) borings were performed at various locations throughout the proposed development. All of the borings were extended auger/split-spoon refusal which was encountered at depths of about 2 fbeg (feet beneath existing grade) to 23 fbeg.

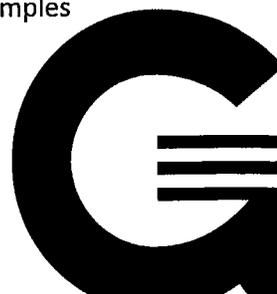
It should be understood that the depth of auger refusal applies to the type of drilling equipment that was used. As such, it might be possible to extend some of these borings deeper using different drilling equipment and/or techniques. Conversely, residual sandstone, shale and limestone materials through which our drill rig penetrated without achieving refusal may be difficult to excavate depending upon the equipment being used. As such, Alpha-Omega Geotech, Inc. shall not be responsible for the determination of others regarding rippability or ease of excavation within the insitu subgrade, bedrock and geo-intermediate materials.

Predominantly clay soils were encountered in all borings. Thin-walled, steel, Shelby tube samplers were used to collect relatively undisturbed samples from these borings for laboratory analysis. Dry densities of specimens cut from the Shelby tube samples were found to moderate ranging from 89.0 to 114.7 pcf. Depending upon the material composition, the moisture content of the specimens cut from these tube samples ranged from 7.1 to 27.7 percent. The unconfined compressive strength of specimens cut from the Shelby tube samples ranged from 1817 to 5816 psf. It should be noted that several of the maximum unconfined compressive strength values were obtained at high strain rates nearing and exceeding 10 percent. As a result, given the onsite soil types, these high strain rates typically indicate that larger settlements could occur unless a lower allowable bearing capacity value is used than otherwise indicated by the unconfined compressive strength test results. Calibrated pocket penetrometer readings varying from 1.25 tsf (2500 psf) to 4.5 tsf (9000 psf) were obtained on the recovered Shelby tube samples from these test borings. However, it should be noted that the pocket penetrometer values tend to over-estimate the strength of insitu subgrade materials relative to the actual unconfined compressive strength test.

In addition to the Shelby tubes samples, the Standard Penetration test (SPT) was also used to evaluate the consistency of the insitu subgrade materials encountered in these test borings and is made by advancing a hollow split spoon sampler into the base of the auger hole by dropping a 140 lb. hammer a distance of 30 inches on the drill rods. Each drop of the hammer is one blow and these blow counts are recorded for each of three 6-inch advances of the sampler. The first 6-inch advance is the seating drive and the summation of the blow counts of the final two 6-inch advances is taken as the standard penetration resistance. The standard penetration resistance, or N-value as it is known, along with the soil classification, can be used to estimate the density, shear strength and other soil properties.

The N-values obtained from each of the SPT's completed in these borings using a CME automatic hammer are included on the boring logs and summarized in the Summary of Laboratory Testing sheets.

The Atterberg consistency limits were determined for six generally representative samples taken at a shallow depth from within the proposed building areas. Based on the Atterberg limits, these samples



were identified in accordance with the Unified Soil Classification System (USCS) as fat clay and lean clay, i.e. a CH and CL material, respectively. The results of these laboratory analyses are presented in the following table:

Table #2

Sample	Depth	Atterberg Limits			USCS Classification
		Liquid Limit	Plastic Limit	Plasticity Index	
B3 ST-2	5'-7'	62%	24%	38%	CH
B3 ST-3	7'-9'	52%	23%	29%	CH
B3 ST-4	9'-11'	68%	25%	43%	CH
B4 ST-3	5'-7'	57%	22%	35%	CH
B4 ST-4	7'-9'	45%	21%	24%	CL
B5 ST-5	9'-11'	50%	24%	26%	CH/CL

Based on the Atterberg limits, it is anticipated the majority of the onsite soil materials generally possess a moderate to high swelling potential. The swelling potential of a clay soil is an indication of the volume changes that may take place with variations in the soil moisture content.

Except for the samples for which the Atterberg limits were determined, all of the other soil classifications given throughout the laboratory test data as well as the boring logs were made using visual and tactile techniques described in ASTM D2488. As a result, additional analyses could reveal other soil types of different classification and potentially higher plasticity and swelling potential both onsite and within the nearby vicinity.

In the borings that were made at this site, no water was encountered at the time of drilling. However, a twenty-four-hour water level was not established in these borings due to time restrictions as well as potential safety hazards associated with open bore holes. Although the ground water levels given on the boring logs reflect the conditions observed at the time the borings were made, they should not be construed to represent an accurate or permanent condition. There is uncertainty involved with short-term water level observations in bore holes especially in clay soils of relatively low permeability. The ground water level should be expected to fluctuate with variations in precipitation, site grading and drainage conditions. In addition, it is also possible that seasonal perched ground water may be encountered within these soil deposits and bedrock formations at different depths during other times of the year based on drainage conditions, seasonal snowmelt and rainwater infiltration.

**DISCUSSION**

It is understood this project consists of the evaluation of the existing slope failure on Metropolitan Avenue and to determine a design build repair approach with Leavenworth County. Based on our initial site visits, discussions and evaluation of the subsurface investigation, it appears that the existing slope



Mr. David Lutgen, P.E.  
AOG 16-236E  
August 16, 2016  
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Metropolitan Avenue Slope Failure  
Metropolitan Avenue NW of 172<sup>nd</sup> Street  
Leavenworth, Kansas

has a relatively shallow, surficial failure that can be repaired by excavating the existing mobilized slope and rebuilding the slope with a geogrid reinforced slope to support the roadway section. The details of the repair are detailed in the Appendix Section #1. Once the slope has been rebuilt, it is assumed that the same standard county road paving section would be replaced on the new engineered embankment fill. AOG will work with Leavenworth County engineers and contractors to replace the slope in approximately the same position as the initial slope allowing the roadway alignment and easements to all match the original designs.

### **INSPECTION AND TESTING RECOMMENDATIONS**

Unless Alpha-Omega Geotech, Inc. is retained to provide the construction observation, monitoring and testing services for this project, we cannot accept any responsibility for any conditions that deviate from those identified in this subsurface investigation nor for the performance of the engineered slope, pavements and other structures including any retaining walls that are a part of this project. Alpha-Omega Geotech, Inc. is accredited by AASHTO and we are experienced in construction quality control and have a fully-equipped soil, concrete, aggregate, rock and asphalt testing laboratory as well as qualified field technicians to provide these field services.

It is not economically practical to perform enough exploratory borings on any site to identify all subsurface conditions. Some conditions affecting the design and/or construction may not become known until the project is underway. The boring logs, field SPT and laboratory test results depict subsurface conditions only at the specified locations and depths at the site. The boundaries between soil and rock layers indicated on the boring logs are based on observations made during drilling and an interpretation of the laboratory testing results. The exact depths of these boundaries are approximate and the transitions between soil and rock types may be gradual rather than being clearly defined. Also, due to the prior development at this site as well as the natural conditions of the formation of soils and rock, it is possible that unanticipated subsurface conditions may be encountered during construction. Monitoring of the subsurface conditions that are revealed during construction is needed to verify that subsurface conditions are consistent with those conditions identified in this preliminary geotechnical investigation. If variations in subsurface conditions are encountered, it will be necessary for Alpha-Omega Geotech, Inc. to re-evaluate the recommendations that have been made in this report.

*Special Inspections should be performed in accordance with the local building code under which the project is designed, as adopted by Leavenworth County, Kansas.*

Prior to filling, it is recommended that a representative of Alpha-Omega Geotech, Inc. should verify that the site has been properly stripped of all topsoil and other deleterious material, benched as needed and prepared for the placement of fill. The compaction of any structural fill beneath the new slope and any other areas where settlement control is necessary should be tested lift-by-lift by a representative of Alpha-Omega Geotech, Inc. as it is being placed. Also, in accordance with the local building code, any fill that is used to construct slopes steeper than 4:1 (H:V) must be placed as engineered controlled fill and the compaction tested lift-by-lift during placement.



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AOG 16-236E  
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Metropolitan Avenue Slope Failure  
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Leavenworth, Kansas

Assuming that uniform fill material is used, nuclear density gauges (ASTM D2922/D3017) should be used to test compaction wherever necessary. However, if fill material of non-uniform consistency is used, other evaluation methods may be required. Such methods may include, but not be limited to, the use of a GeoGauge Stiffness meter, Dynamic Cone Penetrometer (DCP), proof-rolling or other visual inspection techniques.

Any geotextile fabric and geogrid reinforcement that is utilized should be placed and overlapped as needed in accordance with the manufacturer's recommendations, which should be verified by a representative of Alpha-Omega Geotech, Inc. Wherever possible, in addition to compaction testing, cut and fill areas should be proof-rolled with a loaded tandem-axle dump truck to identify soft areas that will need to be corrected. A representative of Alpha-Omega Geotech, Inc. should observe this proof-rolling. Checks should also be made of the subbases, concrete and any pavement materials.

Finally, the inspection and testing services listed herein are given as a minimum and it should be understood that additional inspection and testing services might also be required or otherwise beneficial.

#### **LIMITATIONS**

This report is presented in broad terms to provide a comprehensive assessment of the interpreted subsurface conditions and their potential effect on the adequate design and economical construction of the slope repair along Metropolitan Avenue in Leavenworth County, Kansas, as discussed herein. This report has been prepared for the exclusive use of our client for specific application to the project discussed herein and has been prepared within our client's directive and budgetary constraints and in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

It should be noted that the concept of risk is an important aspect of the geotechnical engineering evaluation and report since the recommendations given in this report are not based on exact science but rather analytical tools and empirical methods in conjunction with engineering judgment and experience. Therefore, the recommendations given herein should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soil materials and the proposed structures will perform as planned. Nevertheless, the geotechnical engineering recommendations presented herein are Alpha-Omega Geotech, Inc.'s professional opinion of those measures that are necessary for the proposed structures to perform according to the proposed design based on the information provided to Alpha-Omega Geotech, Inc., the referenced information gathered during the course of this investigation and our experience with these conditions.

It is also strongly suggested that Alpha-Omega Geotech, Inc. should review your plans and specifications dealing with the earthwork, as well as any pavements prior to construction to confirm compliance with the recommendations given herein. Particular details of construction specifications or quality control may develop, and we would be pleased to respond to any questions regarding these details.



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August 16, 2016  
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Metropolitan Avenue Slope Failure  
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If Alpha-Omega Geotech, Inc. is not retained to review the project plans and specifications, address to the proposed slope repair, provide the recommended construction phase observation, monitoring and testing services and respond to any subsurface conditions that are identified during construction to evaluate whether or not changes in the recommendations given in this report are needed, we cannot be held responsible for the impact of those conditions on the project or the future performance of the slope, pavements and/or structures that may be involved.

The scope of our services did not include any environmental assessment or investigation for the presence of hazardous or toxic materials in the soil, surface water, ground water or air, either on, below or adjacent to this site. In addition, no determination regarding the presence or absence of wetlands was made. Furthermore, it should be understood that the scope of geotechnical services for this project does not include either specifically or by implication any biological (i.e. mold, fungi or bacteria) assessment of the site or the proposed construction. Any statements in this report or included on the boring logs regarding odors, colors and unusual or suspicious items or conditions are strictly for informational purposes only.

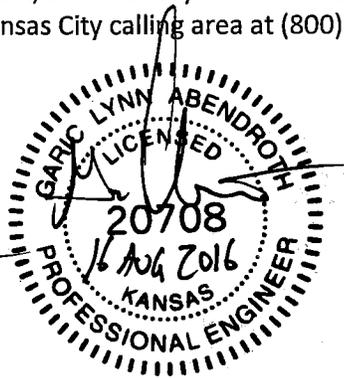
We appreciate the opportunity to be of service to the Leavenworth County, and look forward to working with you throughout the construction process. We are prepared to provide the Special Inspection services that will be required by the local building code under which this project is designed, as adopted by the Leavenworth County, Kansas as well as the other necessary construction observation, monitoring and testing services discussed in this report.

If you have any questions concerning this report, or if we may be of further assistance, please call us at (913) 371-0000 or from beyond the local Kansas City calling area at (800) 546-0878.

Sincerely,  
ALPHA-OMEGA GEOTECH, INC.



Garlic Abendroth, P.E.  
Engineering Department Manager



Enclosures



**Appendix Section 1**

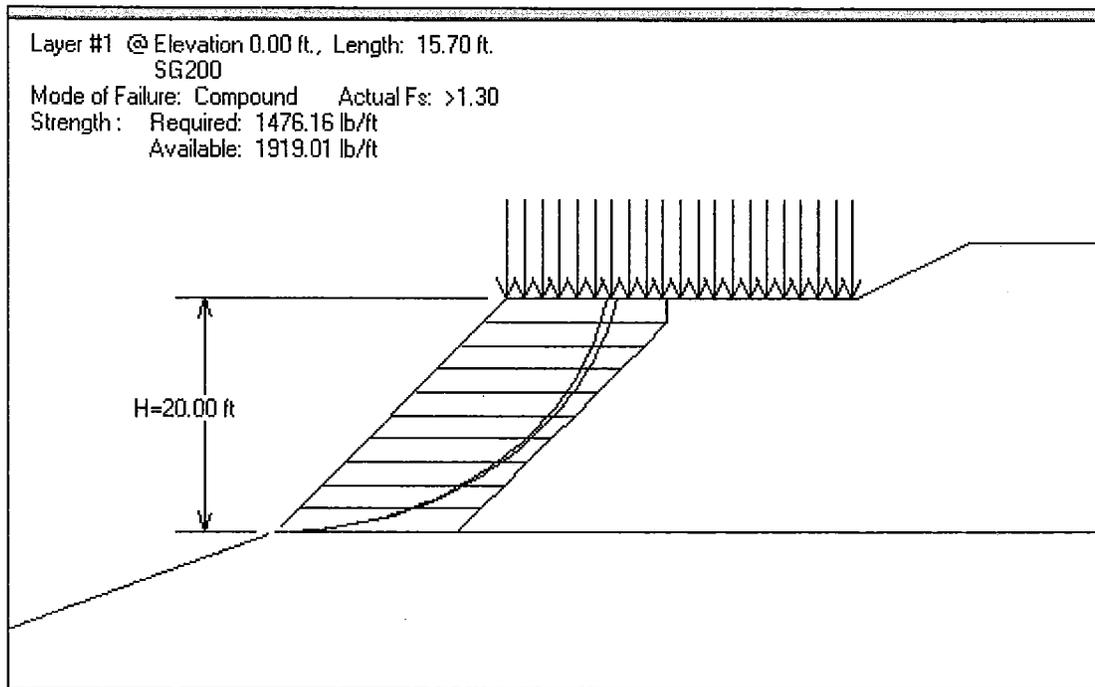
**REPAIR RECOMMENDATIONS**



## Metropolitan Avenue Slope Failure Leavenworth County, Kansas

A-OG Project 16-236E  
August 15, 2016

Geogrid-Reinforced Engineered Slope Design:



Please see detailed analyses results attached.

### Summary:

AOG to provide onsite observation, monitoring and testing services during all field operations related to construction of the geogrid-reinforced engineered slope.

- This geogrid-reinforced slope design (typical detail) may need to be adjusted based on actual field conditions;
- Install the geogrid-reinforced slope along the roadway extending a minimum distance of 20 feet beyond each end of the current failure zone;
- Remove the existing pavement, base and subgrade to expose the underlying bedrock layer, which is expected to be continuous beneath the westbound (northern) lane. It is anticipated that the southern edge of this bedrock layer will be identified somewhere beneath the original horizontal alignment of the roadway. It is assumed that this southern face of the bedrock layers (shale, limestone, sandstone)



## Metropolitan Avenue Slope Failure

Leavenworth County, Kansas

A-OG Project 16-236E

August 15, 2016

Page 2 of 4

beneath the original roadway alignment will be essentially vertical, but may taper outward slightly with depth;

- Remove all existing soil, base rock and fill material from the edge of the bedrock down to an elevation equivalent to the pre-slope failure elevation along the toe of the roadway embankment, i.e. approximately the original elevation of the fence line;
- The geogrid-reinforced engineered slope has been designed to have a maximum steepness of 1:1 (H:V), which should allow re-establishment of the original horizontal roadway alignment. As the height of the slope will vary, it is generally expected that the toe of the geogrid-reinforced engineered slope can roughly match the southern boundary of the roadway easement.

### Shear Key

- Once all of the existing soil, base rock and fill material has been removed down the base elevation of the geogrid-reinforced engineered slope, it is recommended that a shear key should be excavated beneath the toe of the slope. Including the sloping necessary to construct this shear key, it is anticipated that both the excavation work as well as a portion of the shear key may extend beyond the current roadway easement;
- To adequately secure toe resistance and support the weight of the new geogrid-reinforced engineered slope fill and roadway loads, it is recommended that a shear key should be installed down to stable, hard bedrock (shale, limestone or sandstone). Based on the findings from our initial test borings, it is generally anticipated that the depth of the shear key may range from about 12 to 15 feet ( $\pm$ ), depending on the natural formation of the bedrock layers. At the base, it is recommended that the shear key should be at least 8 feet in width, and at least 12 feet in width at the top, i.e. the base of the geogrid-reinforced engineered slope;
  - As the excavation work is made, it may prove more practical to adjust the horizontal position of the shear key based on the southward extent of the bedrock layers beneath the existing roadway;
  - It is anticipated that AOG's field personnel will work with the excavating contractor to properly install the shear key to provide maximum benefit and protection of the geogrid-reinforced engineered slope;
- The shear key may be constructed using shot rock or rocky rubble with a maximum dimension of the about 12 to 16 inches. It would be advantageous for the material used to construct the shear key to contain sufficient clay to fill any void spaces, and create a very dense compacted matrix. It may be possible to consider concrete rubble as well; nevertheless, it is recommended that AOG's field personnel should consult with the excavating contractor to determine suitability of any material proposed for use to construct the shear key.



## Metropolitan Avenue Slope Failure

Leavenworth County, Kansas

A-OG Project 16-236E

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### Geogrid-Reinforced Engineered Slope

- After removal of all existing soil, base rock and fill material exposing the southern edge of the bedrock layers beneath the existing roadway, and installing the shear key, place a 12" layer of clean crushed limestone aggregate (1.5-inch minus, clean) fully encapsulated within a non-woven geotextile fabric to inhibit the infiltration of silts and clays ("Blanket Drain"). This Blanket Drain should extend from the toe of the geogrid-reinforced engineered slope northward to the exposed bedrock face;
  - Place and overlap the non-woven geotextile fabric in accordance with the manufacturer's recommendations, which should be verified by AOG's field personnel during construction;
- Place nominal 6" layer of crushed limestone aggregate over the encapsulated Blanket Drain;
- Geogrid shall have a minimum strength at 5% strain of 1400 lb/ft;
- Place first layer of geogrid atop the 6" layer of crushed limestone aggregate over the geotextile fabric encapsulated Blanket Drain. Place subsequent layers of geogrid at 2' vertical centers. Minimum geogrid lengths per following table:

Grid Layer (*)	Elevation (from toe)	Minimum Geogrid Length (**)
1	0.0	16 feet
2	2.0	16 feet
3	4.0	16 feet
4	6.0	16 feet
5	8.0	16 feet
6	10.0	16 feet
7	12.0	16 feet
8	14.0	16 feet
9	16.0	16 feet

(\*) Number of geogrid layers may be adjusted based on actual slope height.  
(\*\*) As needed, extend geogrids to exposed bedrock face beneath the existing horizontal roadway alignment.

- Place and install all geogrid layers per manufacturer's installation guidelines. Provide minimum 2-3' geogrid overlaps, as needed;
- Use crusher-run limestone, such as KDOT AB-3, to construct the geogrid-reinforced engineered controlled fill. Between each layer of geogrid, place the crusher-run limestone in three (3) lifts of equal



**Metropolitan Avenue Slope Failure**

Leavenworth County, Kansas

A-OG Project 16-236E

August 15, 2016

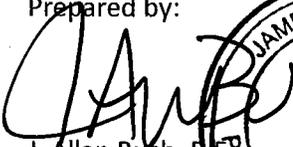
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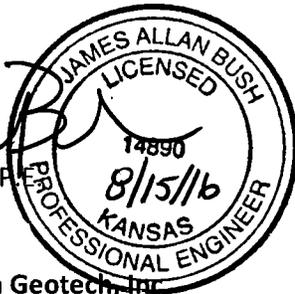
thickness and compact to at least 95% of the Standard Proctor (ASTM D698) maximum dry density at a moisture content sufficient to achieve the specified level of compaction;

- Final surface cover along face of slope shall consist of Riprap stone (avg. 6" dimension, 12" thick).

We truly appreciate the opportunity to be of service, enjoy working with the project design and construction team, and would be pleased to respond to any questions.

Prepared by:

  
J. Allan Bush, P.E.  
President



**Alpha-Omega Geotech, Inc.**

Specialty Simplified. *Real World Confidence.*

t. 913 371 0000 | d. 913 717 4081

jabush@AOGeotech.com | AOGeotech.com



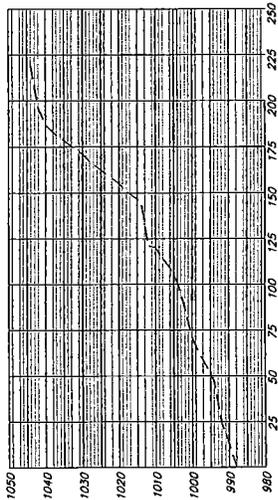
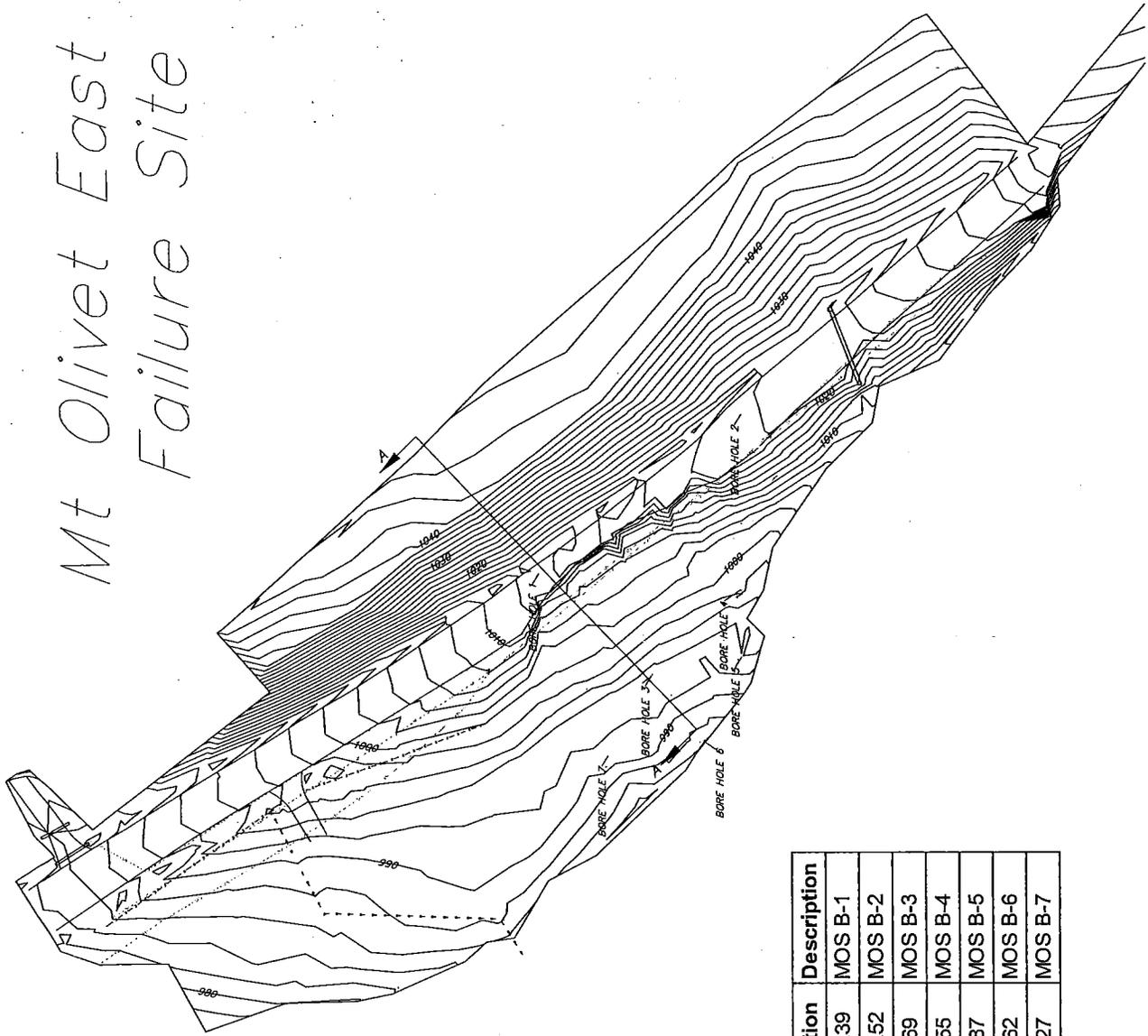
**Appendix Section 2**

**SITE SKETCH – BORING LOCATIONS**





# Mt Olivet East Failure Site



Point	Northing	Easting	Elevation	Description
17	379018.202	2167992	1013.39	MOS B-1
18	378895.712	2168088	1021.52	MOS B-2
13	378950.485	2167930	992.69	MOS B-3
11	378896.494	2167982	998.55	MOS B-4
12	378895.965	2167941	993.87	MOS B-5
14	378918.984	2167890	986.62	MOS B-6
15	378976.856	2167882	991.27	MOS B-7

**Appendix Section 3**

**LABORATORY TEST RESULTS**



# Summary of Laboratory Testing

SLT 22205

## Alpha-Omega Geotech, Inc.

1701 State Avenue  
 Kansas City, KS 66102  
 Office: (913) 371-0000 Fax: (913) 371-6710  
 Website: www.aogotech.com



PROJECT NAME: Metropolitan Avenue PROJECT NUMBER: 16-236E  
 PROJECT LOCATION: Leavenworth, KS DATE: 6/23/2016

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits			USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	% Swell	Remarks
						LL	PL	PI					
B-2	SS-1	2'-3.5'	Light brown, mottled gray, speckled reddish brown FAT CLAY						CH				N = 12
B-2	SS-2	3.5'-5'	Light brown, mottled gray, speckled reddish brown FAT CLAY (weathered shale)						CH				N = 17
B-2	SS-3	8.5'-9'	Light reddish brown LEAN CLAY with a trace of gravel (weathered shale)						CL				N = 50/1"
B-3	ST-1	1'-3'	Brown LEAN CLAY with a trace of organics						CL				PP = 1.50 tsf
B-3	ST-2	5'-7'	Light brown, mottled light gray, spotted reddish brown FAT CLAY (weathered shale)	21.5	106.8	62.0	24.0	38.0	CH				PP = 2.00 tsf
B-3	ST-3	7'-9'	Brown, mottled gray, speckled reddish brown FAT CLAY	22.4	106.2	52	23	29	CH	2491	4.2		PP = 4.00 tsf
B-3	ST-4	9'-11'	Light brown, mottled gray and reddish brown FAT CLAY with slickensided sides	21.9	108.0	68	25	43	CH	2652	4.7		PP = 4.25 tsf
B-3	SS-1	13'-14.5'	Brown, mottled gray and reddish brown LEAN CLAY (weathered shale)						CL				N = 53
B-3	SS-2	17'-17.4'	Gray LEAN CLAY (shale)						CL				N = 50/4"

# Summary of Laboratory Testing

SLT 22205

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 Kansas City, KS 66102  
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PROJECT NAME: Metropolitan Avenue  
 PROJECT LOCATION: Leavenworth, KS  
 PROJECT NUMBER: 16-236E  
 DATE: 6/23/2016

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits			USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	% Swell	Remarks
						LL	PL	PI					
B-4	ST-1	1'-3'	Brown FAT CLAY with a trace of organics (finger roots)	27.7	92.1				CH				PP = 1.75 tsf
B-4	ST-2	3'-5'	No Recovery										
B-4	ST-3	5'-7'	Brown, spotted gray, dark brown and reddish brown FAT CLAY with slickensided sides	23.6	99.9	57	22	35	CH	1817	15.6		PP = 2.50 tsf
B-4	ST-4	7'-9'	Brown, spotted reddish brown LEAN CLAY with a trace of gravel	19.7	111.6	45	21	24	CL	5816	3.9		PP = 4.50+ tsf
B-4	SS-1	9'-10.5'	Reddish brown FAT CLAY	17.9					CH				N = 17
B-4	SS-2	13'-15'	Reddish brown FAT CLAY	9.4					CH				N = 25
B-4	SS-3	17'-19'	Brown, mottled reddish brown and gray FAT CLAY with a trace of gravel	12.4					CH				N = 27
B-5	ST-1	1'-3'	Brown FAT CLAY with a trace of organics (finger roots)						CH				PP = 4.50 tsf
B-5	ST-2	3'-5'	Brown FAT CLAY						CH				PP = 1.50 tsf

# Summary of Laboratory Testing

SLT 22205

## Alpha-Omega Geotech, Inc.

1701 State Avenue  
 Kansas City, KS 66102  
 Office: (913) 371-0000 Fax: (913) 371-6710  
 Website: www.aogseotech.com



PROJECT NAME: Metropolitan Avenue  
 PROJECT LOCATION: Leavenworth, KS  
 PROJECT NUMBER: 16-236E  
 DATE: 6/23/2016

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits			USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	% Swell	Remarks
						LL	PL	PI					
B-5	ST-3	5'-7'	Brown FAT CLAY with a trace of sand and gravel	26.8	89.0				CH				PP = 1.75 tsf
B-5	ST-4	7'-9'	Light brown, mottled gray and reddish brown FAT CLAY (weathered shale)	23.1	104.8				CH				PP = 1.25 tsf
B-5	ST-5	9'-11'	Light brown and gray LEAN/FAT CLAY with slickensided (weathered shale)	18.5	113.3	50	24	26	CL/CH	3690	4.0		PP = 3.25 tsf
B-5	SS-1	13'-14.5'	Brown, mottled gray and reddish brown LEAN CLAY (weathered shale)	13.0					CL				N = 40
B-5	SS-2	17'-18.5'	Gray LEAN CLAY (shale)	9.8					CL				N = 43
B-6	ST-1	1'-3'	Brown FAT CLAY with a trace of organics (finger roots)						CH				PP = 2.25 tsf
B-6	ST-2	3'-5'	Light brown, mottled gray, spotted reddish brown and dark brown LEAN CLAY						CL				PP = 1.50 tsf
B-6	ST-3	5'-7'	Light brown, spotted dark brown, gray and reddish brown FAT CLAY with a trace of gravel	22.8	105.3				CH				PP = 3.75 tsf
B-6	ST-4	7'-9'	Light brown, spotted gray and reddish brown FAT CLAY (weathered shale)	18.5	114.7				CH	4256	7.2		PP = 3.75 tsf

# Summary of Laboratory Testing

SLT 22205

## Alpha-Omega Geotech, Inc.

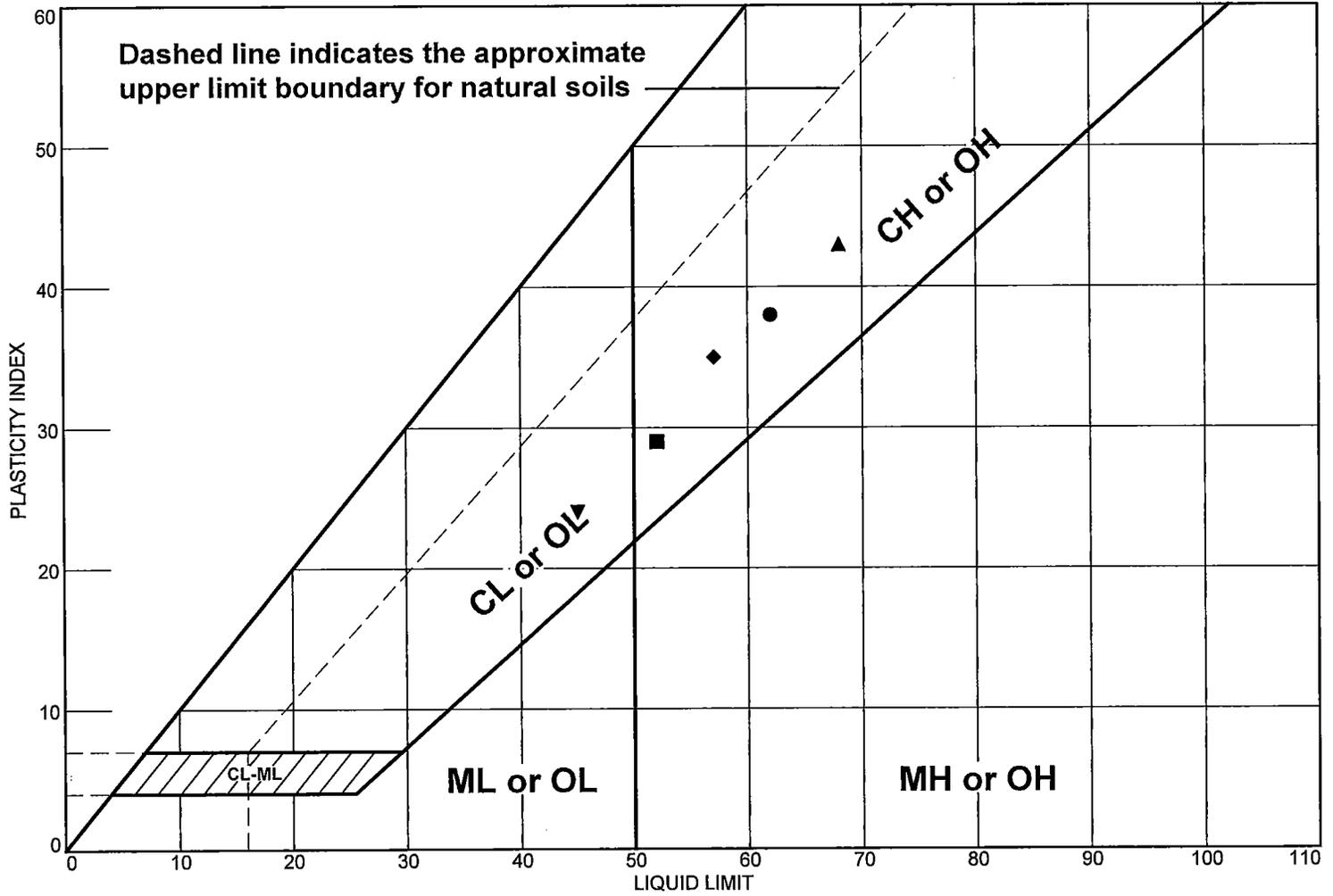
1701 State Avenue  
 Kansas City, KS 66102  
 Office: (913) 371-0000 Fax: (913) 371-6710  
 Website: www.aogeotech.com



PROJECT NAME: Metropolitan Avenue PROJECT NUMBER: 16-236E  
 PROJECT LOCATION: Leavenworth, KS DATE: 6/23/2016

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL PL PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	% Swell	Remarks
B-6	SS-1	9'-10.5'	Gray and brown, spotted reddish brown LEAN CLAY (weathered shale)	15.5			CL				N = 23
B-6	SS-2	13'-14.5'	Brown, mottled reddish brown and gray LEAN CLAY (weathered shale)				CL				N = 40
B-6	SS-3	17'-18.5'	Gray and brown, mottled reddish brown LEAN CLAY (weathered shale)	7.1			CL				N = 50/5"
B-7	ST-1	1'-3'	Brown FAT CLAY with a trace of organics (finger roots)				CH				PP = 2.25 tsf
B-7	ST-2	3'-5'	Brown, mottled light gray and reddish brown, speckled dark brown FAT CLAY	25.0	104.5		CH				PP = 1.50 tsf
B-7	ST-3	5'-7'	Light brown, spotted dark brown, gray and reddish brown FAT CLAY				CH				PP = 1.50 tsf
B-7	ST-4	7'-9'	Brown, mottled reddish brown FAT CLAY	22.8	104.7		CH				PP = 2.50 tsf
B-7	ST-5	9'-11'	Brown, mottled reddish brown FAT CLAY				CH				

# LIQUID AND PLASTIC LIMITS TEST REPORT



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● Light brown, mottled light gray, spotted reddish brown FAT CLAY	62	24	38			CH
■ Brown, mottled gray, speckled reddish brown FAT CLAY	52	23	29			CH
▲ Light brown, mottled gray and reddish brown FAT CLAY with slickened sides	68	25	43			CH
◆ Brown, spotted gray, dark brown and reddish brown FAT CLAY with slickened sides	57	22	35			CH
▼ Brown, spotted reddish brown LEAN CLAY with a trace of gravel	45	21	24			CL

Project No. 16-236E      Client:

Project: Metropolitan Avenue

● Source of Sample: B-3      Depth: 5      Sample Number: ST-2  
 ■ Source of Sample: B-3      Depth: 7      Sample Number: ST-3  
 ▲ Source of Sample: B-3      Depth: 9      Sample Number: ST-4  
 ◆ Source of Sample: B-4      Depth: 5      Sample Number: ST-3  
 ▼ Source of Sample: B-4      Depth: 7      Sample Number: ST-4

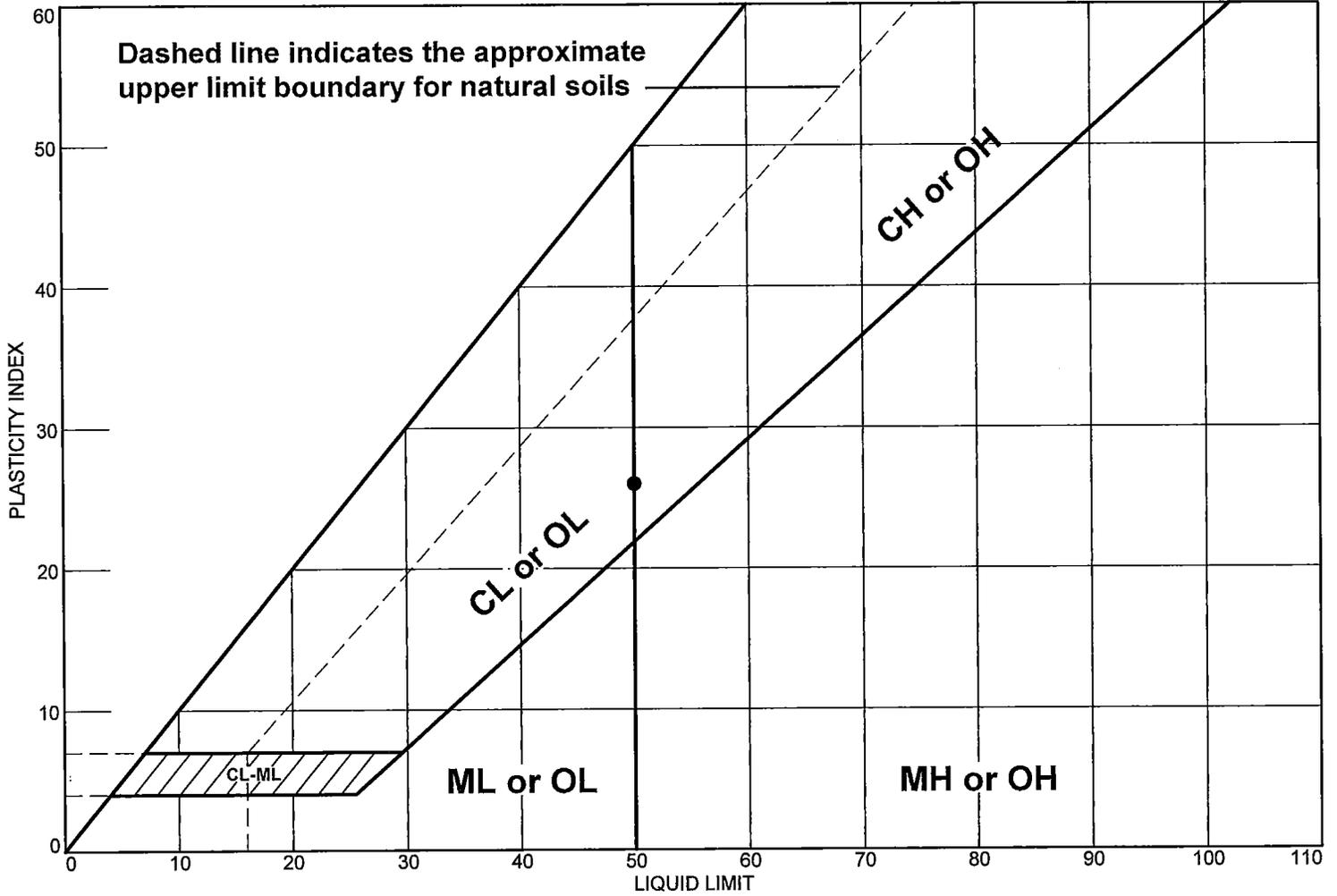
Remarks:



Figure 1 of 1

Tested By: ● DB   ■ TB   ▲ DB   ◆ DB   ▼ DB   Checked By: GA

# LIQUID AND PLASTIC LIMITS TEST REPORT



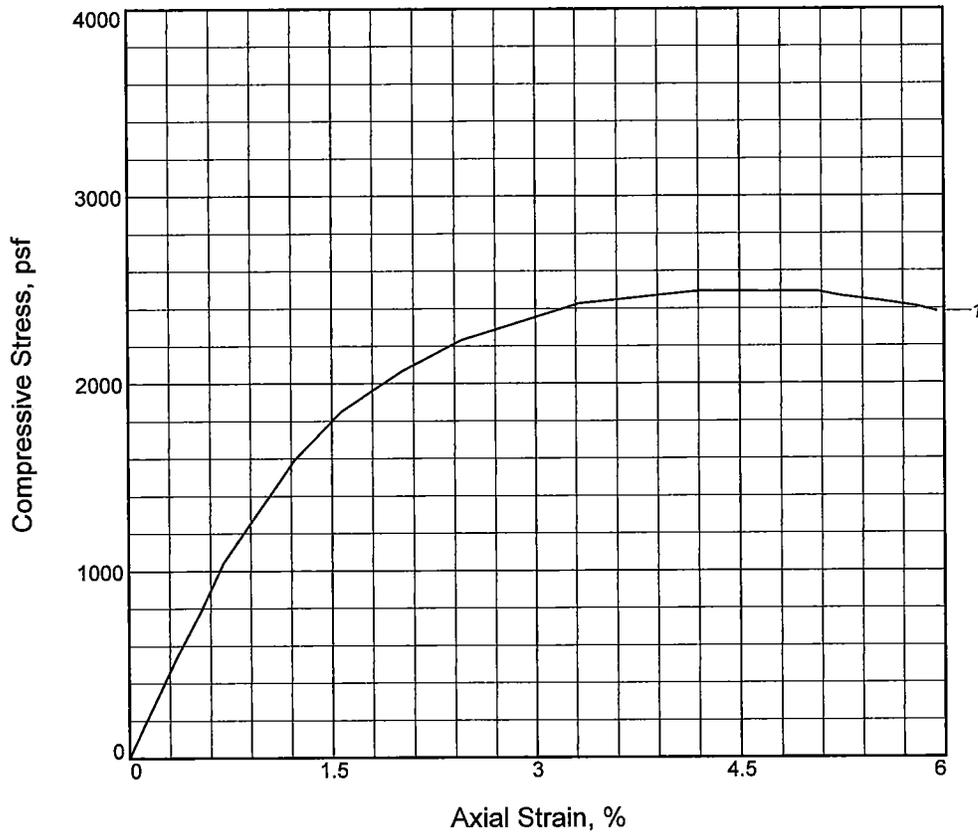
MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● Light brown and gray LEAN/FAT CLAY with slickened sides (weathered shale)	50	24	26			CL-CH

**Project No.** 16-236E      **Client:**  
**Project:** Metropolitan Avenue  
**● Source of Sample:** B-5      **Depth:** 9      **Sample Number:** ST-5

**Remarks:**



# UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	2491			
Undrained shear strength, psf	1246			
Failure strain, %	4.2			
Strain rate, in./min.	0.08			
Water content, %	22.4			
Wet density, pcf	130.1			
Dry density, pcf	106.2			
Saturation, %	103.2			
Void ratio	0.5865			
Specimen diameter, in.	2.86			
Specimen height, in.	5.72			
Height/diameter ratio	2.00			

**Description:** Brown, mottled gray, speckled reddish brown FAT CLAY

LL =      PL =      PI =      Assumed GS= 2.70      Type: Undisturbed

**Project No.:** 16-236E  
**Date Sampled:** 7/7/2016  
**Remarks:**

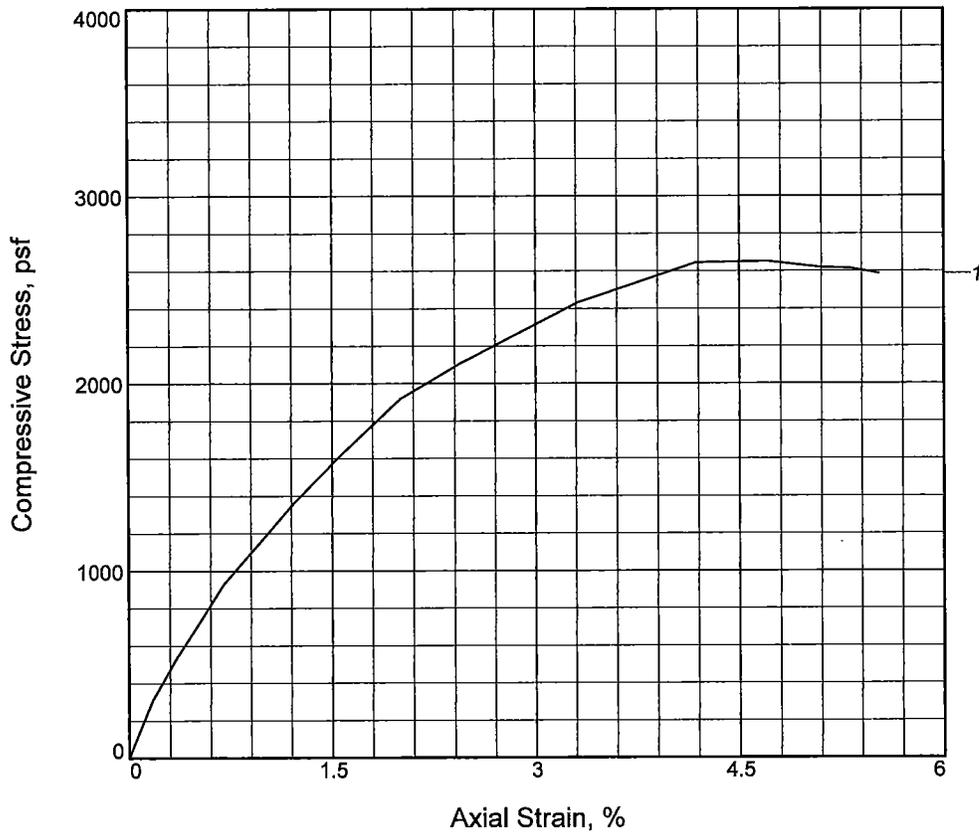
**Client:**  
**Project:** Metropolitan Avenue  
**Source of Sample:** B-3      **Depth:** 7  
**Sample Number:** ST-3

Figure 1 of 1



Tested By: DB      Checked By: GA

# UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	2652			
Undrained shear strength, psf	1326			
Failure strain, %	4.7			
Strain rate, in./min.	0.08			
Water content, %	21.9			
Wet density, pcf	131.7			
Dry density, pcf	108.0			
Saturation, %	105.6			
Void ratio	0.5612			
Specimen diameter, in.	2.87			
Specimen height, in.	5.74			
Height/diameter ratio	2.00			

**Description:** Light brown, mottled gray and reddish brown FAT CLAY with slickened sides

LL =      PL =      PI =      Assumed GS= 2.70      Type: Undisturbed

**Project No.:** 16-236E  
**Date Sampled:** 7/7/2016  
**Remarks:**

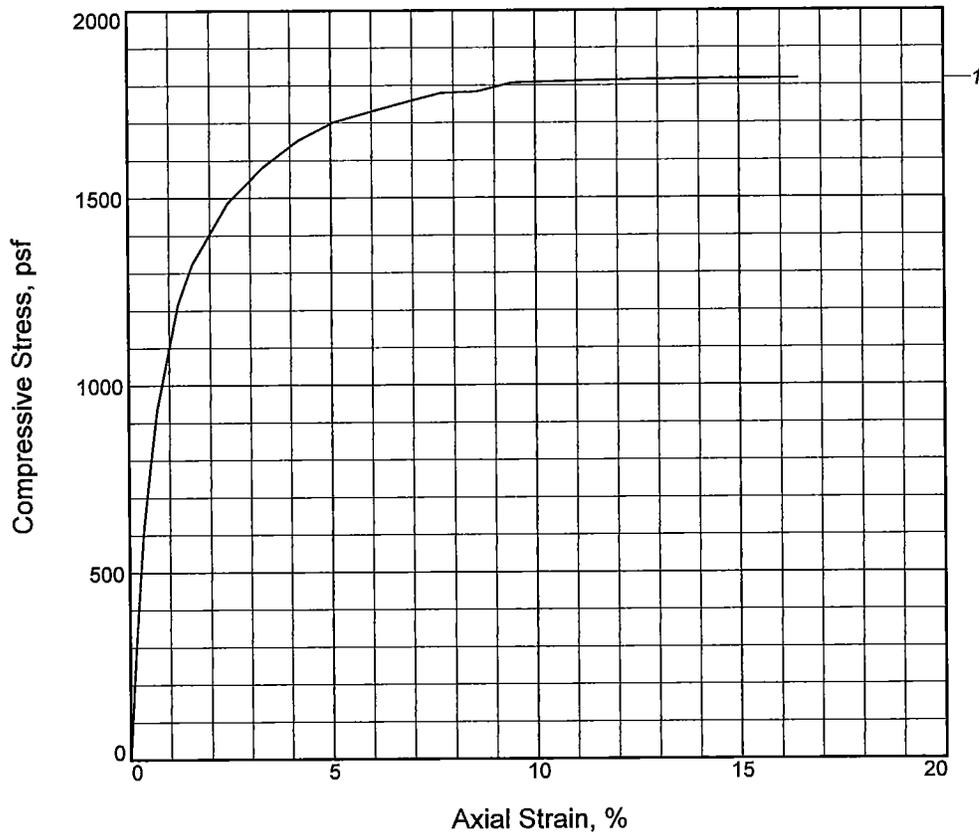
**Client:**  
**Project:** Metropolitan Avenue  
**Source of Sample:** B-3      **Depth:** 9  
**Sample Number:** ST-4

Figure 1 of 1



Tested By: DB      Checked By: GA

# UNCONFINED COMPRESSION TEST



Sample No.	1		
Unconfined strength, psf	1817		
Undrained shear strength, psf	909		
Failure strain, %	15.6		
Strain rate, in./min.	0.08		
Water content, %	23.6		
Wet density, pcf	123.5		
Dry density, pcf	99.9		
Saturation, %	92.6		
Void ratio	0.6865		
Specimen diameter, in.	2.86		
Specimen height, in.	5.72		
Height/diameter ratio	2.00		

**Description:** Brown, spotted gray, dark brown and reddish brown FAT CLAY with slickened sides

LL =      PL =      PI =      Assumed GS= 2.70      Type: Undisturbed

**Project No.:** 16-236E  
**Date Sampled:** 7/7/2016  
**Remarks:**

**Client:**  
**Project:** Metropolitan Avenue  
**Source of Sample:** B-4      **Depth:** 5  
**Sample Number:** ST-3

Figure 1 of 1



Tested By: DB      Checked By: GA







## Appendix Section 4

### BORING LOGS

Note: The logs of subsurface conditions shown in this section apply only at the specific boring location and depths at the date indicated and might not be indicative of all subsurface conditions that may be encountered. This information is not warranted to be representative of subsurface conditions at other locations, depths and times. The passage of time or construction operations at or adjacent to this site may result in changes to the soil conditions at these boring locations and depths. As a result, the character of subsurface materials shall be each bidder's responsibility.





**LOG OF BORING  
No. B-1**

PROJECT: Metropolitan Avenue PROJECT NO.: 16-236E  
 CLIENT: Leavenworth County  
 PROJECT LOCATION: Leavenworth, KS  
 LOCATION: See Site Sketch ELEVATION: 1013.4  
 DRILLER: Mike Burdick, Sr. LOGGED BY: Sam Heustis  
 DRILLING METHOD: AO/NX DATE: 6/16/2016  
 DEPTH TO - WATER> INITIAL:  None AFTER 24 HOURS:  NA CAVING>  None

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS
Depth (ft.)										
0		Base rock								
		Reddish brown weathered sandstone (very hard, slow drilling)								Ss
1010		Limestone [%REC=78, RQD=17]								LS
1005		Gray shale [%REC=100, RQD=10]								SH
1000		Auger refusal at about 2.5' on limestone End of coring at about 12.5'								
995										
990										
985										
980										



ALPHA-OMEGA GEOTECH

**LOG OF BORING**  
No. B-2

PROJECT: Metropolitan Avenue PROJECT NO.: 16-236E  
 CLIENT: Leavenworth County  
 PROJECT LOCATION: Leavenworth, KS  
 LOCATION: See Site Sketch ELEVATION: 1021.5  
 DRILLER: Mike Burdick, Sr. LOGGED BY: Sam Heustis  
 DRILLING METHOD: AO/SS/NX DATE: 6/16/2016  
 DEPTH TO - WATER> INITIAL:  None AFTER 24 HOURS:  NA CAVING>  C  None

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS
Depth (ft.)										
0		Asphalt								CH
1020		Brown FAT CLAY								CH
	2 5 7	Light brown, mottled gray, speckled reddish brown FAT CLAY								CH
	3 6 11	Light brown, mottled gray, speckled reddish brown FAT CLAY (weathered shale)								CH
5		Light reddish brown LEAN CLAY with a trace of gravel (weathered shale)								CL CH LS
1015		Light reddish brown LEAN CLAY with a trace of gravel (weathered shale)								SH
	50/1"	Limestone [%REC=,RQD=]								
10		Weathered shale [%REC=,RQD=]								
1010		Auger refusal at about 10' on limestone End of coring at about 17'								
15										
1005										
20										
1000										
25										
995										
30										
990										
35										
985										



ALPHA-OMEGA GEOTECH

**LOG OF BORING**  
No. B-3

PROJECT: Metropolitan Avenue PROJECT NO.: 16-236E  
 CLIENT: Leavenworth County  
 PROJECT LOCATION: Leavenworth, KS  
 LOCATION: See Site Sketch ELEVATION: 992.7  
 DRILLER: Mike Burdick, Sr. LOGGED BY: Chuck Jacobs  
 DRILLING METHOD: AO/SS/ST DATE: 6/22/2016  
 DEPTH TO - WATER> INITIAL: None AFTER 24 HOURS: NA CAVING> C None

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS	
Depth (ft.)											
0		Brown LEAN CLAY with a trace of organics								CL	
1		Brown LEAN CLAY with a trace of organics							1.50	CL	
3		Brown LEAN CLAY with a trace of organics								CL	
5		Light brown, mottled light gray, spotted reddish brown FAT CLAY	21.5	106.8	62	38			2.00	CH	
7		Brown, mottled gray, speckled reddish brown FAT CLAY		106.2	52	29		2491	4.00	CH	
9		Light brown, mottled gray and reddish brown FAT CLAY with slickened sides	21.9	108.0	68	43		2652	4.25	CH	
11		Light brown, mottled gray and reddish brown FAT CLAY with slickened sides								CH	
13		Brown, mottled gray and reddish brown LEAN CLAY (very hard, slow drilling)								CL	
14.5		Brown, mottled gray and reddish brown LEAN CLAY (very hard, slow drilling)								CL	
17		Gray LEAN CLAY (very hard, slow drilling)								CL	
17.3		End of boring at about 17.3'									



**LOG OF BORING**  
No. B-4

PROJECT: Metropolitan Avenue PROJECT NO.: 16-236E  
 CLIENT: Leavenworth County  
 PROJECT LOCATION: Leavenworth, KS  
 LOCATION: See Site Sketch ELEVATION: 998.6  
 DRILLER: Chuck Jacobs LOGGED BY: Sam Heustis  
 DRILLING METHOD: AO/SS/ST DATE: 6/22/2016  
 DEPTH TO - WATER> INITIAL:  None AFTER 24 HOURS:  NA CAVING>  C  None

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS
Depth (ft.)										
0		Brown FAT CLAY (possible fill)								CH
		Brown FAT CLAY with a trace of organics (finger roots) (possible fill)	27.7	92.1					1.75	CH
995		No Recovery (clayey gravel, possible fill)								
5		Brown, spotted gray, dark brown and reddish brown FAT CLAY with slickened sides	23.6	99.9	57	35		1817	2.50	CH
990		Brown, spotted reddish brown LEAN CLAY with a trace of gravel	19.7	111.6	45	24		5816	4.50	CL
10		Reddish brown FAT CLAY	17.9							CH
985		Reddish brown FAT CLAY	9.4							CH
15		Brown, mottled reddish brown and gray FAT CLAY with a trace of gravel	12.4							CH
980		Brown, mottled reddish brown and gray FAT CLAY with a trace of gravel								CH
20		Auger refusal at about 21' on rock End of boring at about 21'								
975										
25										
970										
30										
965										
35										



**LOG OF BORING  
No. B-5**

PROJECT: Metropolitan Avenue PROJECT NO.: 16-236E  
 CLIENT: Leavenworth County  
 PROJECT LOCATION: Leavenworth, KS  
 LOCATION: See Site Sketch ELEVATION: 993.9  
 DRILLER: Mike Burdick, Sr. LOGGED BY: Chuck Jacobs  
 DRILLING METHOD: AO/SS/ST/NX DATE: 6/22/2016  
 DEPTH TO - WATER> INITIAL:  None AFTER 24 HOURS:  NA CAVING> C None

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS
Depth (ft.)										
0		Topsoil								
1		Brown FAT CLAY with a trace of organics (finger roots)							4.50	CH
3		Brown FAT CLAY							1.50	CH
5		Brown FAT CLAY with a trace of sand and gravel	26.8	89.0					1.75	CH
7		Light brown, mottled gray and reddish brown FAT CLAY (weathered shale)	23.1	104.8					1.25	CH
9		Light brown and gray LEAN/FAT CLAY with slickened sides (weathered shale)	18.5	113.3	50	26		3690	3.25	CL-CH
11		Light brown and gray LEAN/FAT CLAY with slickened sides (weathered shale)								CL-CH
13		Brown, mottled gray and reddish brown LEAN CLAY	13.0							CL
14.5		Brown, mottled gray and reddish brown LEAN CLAY								CL
17		Gray LEAN CLAY (shale)	9.8							CL
18.5		Gray LEAN CLAY (shale)								CL
23.5		Gray shale [%REC=80, RQD=5]								SH
33		Auger refusal at about 23.5' End of coring at about 33'								



**LOG OF BORING  
No. B-6**

PROJECT: Metropolitan Avenue PROJECT NO.: 16-236E  
 CLIENT: Leavenworth County  
 PROJECT LOCATION: Leavenworth, KS  
 LOCATION: See Site Sketch ELEVATION: 986.6  
 DRILLER: Mike Burdick, Sr. LOGGED BY: Chuck Jacobs  
 DRILLING METHOD: AO/SS/ST DATE: 6/20/2016  
 DEPTH TO - WATER> INITIAL:  None AFTER 24 HOURS:  NA CAVING>  C  None

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS
Depth (ft.)										
0		Brown FAT CLAY								CH
985		Brown FAT CLAY with a trace of organics (finger roots)							2.25	CH
		Light brow, mottled gray, spotted reddish brown and dark brown LEAN CLAY							1.50	CL
5		Light brown, spotted dark brown, gray and reddish brown FAT CLAY with a trace of gravel	22.8	105.3					3.75	CH
980		Light brown, spotted gray and reddish brown FAT CLAY (weathered shale)	18.5	114.7				4256	3.75	CH
10		Gray and brown, spotted reddish brown LEAN CLAY (weathered shale)	15.5							CL
975		Gray and brown, spotted reddish brown LEAN CLAY (weathered shale)								CL
15		Brown, mottled reddish brown and gray LEAN CLAY (very hard, slow drilling)								CL
970		Brown, mottled reddish brown and gray LEAN CLAY (very hard, slow drilling)								CL
		Gray and brown, mottled reddish brown LEAN CLAY (very hard, slow drilling)	7.1							CL
20		End of boring at about 18.5'								
965										
25										
960										
30										
955										
35										
950										



**LOG OF BORING**  
No. B-7

PROJECT: Metropolitan Avenue PROJECT NO.: 16-236E  
 CLIENT: Leavenworth County  
 PROJECT LOCATION: Leavenworth, KS  
 LOCATION: See Site Sketch ELEVATION: 991.3  
 DRILLER: Mike Burdick, Sr. LOGGED BY: Chuck Jacobs  
 DRILLING METHOD: AO/HA/ST DATE: 6/20/2016  
 DEPTH TO - WATER> INITIAL:  None AFTER 24 HOURS:  NA CAVING>  C  None

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS	
Depth (ft.)											
0		Brown FAT CLAY								CH	
990		Brown FAT CLAY with a trace of organics (finger roots)							2.25	CH	
		Brown, mottled light gray and reddish brown, speckled dark brown FAT CLAY	25.0	104.5					1.50	CH	
5		Light brown, spotted dark brown, gray and reddish brown FAT CLAY							1.50	CH	
985		Brown, mottled reddish brown FAT CLAY	22.8	104.7					2.50	CH	
		Brown, mottled reddish brown FAT CLAY								CH	
10		Brown, mottled reddish brown FAT CLAY								CH	
980		Brown, mottled reddish brown FAT CLAY (Lost shelby tube in boring- hard shale)								CH	
		End of boring at about 13'									
15											
975											
20											
970											
25											
965											
30											
960											
35											
955											

# KEY TO SYMBOLS

Symbol Description

Symbol Description

Strata symbols

	<b>BASE</b>
	<b>SANDSTONE</b>
	<b>LIMESTONE</b>
	<b>SHALE</b>
	<b>ASPHALT</b>
	<b>FAT CLAY</b>
	<b>LEAN CLAY</b>
	<b>Weathered SHALE</b>
	<b>No Recovery</b>

	<b>Topsoil</b>
	<b>LEAN/FAT CLAY</b>

Misc. Symbols

	<b>Drill rejection</b>
---	------------------------

Soil Samplers

	<b>Standard penetration test</b>
	<b>Undisturbed thin wall Shelby tube</b>

Notes:

1. Borings were drilled on June 16-22 2016 using auger only, split spoon, shelly tube and core barrel techniques.
  2. Ground water was not encountered while in the drilling process.
  3. Borings were staked by Alpha-Omega Geotech, Inc.
  4. These logs are subject to the limitations, conclusions, and recommendations in this report.
  5. Results of tests conducted on samples recovered are reported on the logs.
- Abbreviations are:

<p>DDen = natural dry density (pcf)</p> <p>w% = natural moisture content (%)</p> <p>UComp = Unconfined compression (psf)</p> <p>-200 = percent passing #200 sieve (%)</p> <p>DCP = Dynamic Cone Penetrometer</p>	<p>LL = Liquid limit</p> <p>PI = Plasticity index</p> <p>PPen = Pocket Penetrometer</p> <p>RQD = Rock Quality</p>
--	---

**Appendix Section 5**  
**DESIGN CALCULATIONS**



# ALPHA-OMEGA GEOTECH

## Metropolitan Avenue Slope Repair

### PROJECT IDENTIFICATION

Title: Metropolitan Avenue Slope Repair  
Project Number: 16-236E  
Client: Leavenworth County Public Work  
Designer: J. Allan Bush, P.E.  
Station Number:

### Description:

Geogrid-reinforced engineered slope to support roadway at failure section. Typical cross-section, which should be used to stabilize the roadway at least 20 feet along the roadway beyond each end of the current failure zone. Geogrid lengths may need to be modified based on field conditions - to be determined by AOG field personnel during construction.

**File path and name:** C:\Users\jabush\Documents\My Documents\Geotech Reports\.....  
.....2016\16-236E.str

**Date and time of creating the input data file:** Fri Aug 12 11:41:55 2016

**Design performed according to Limit Equilibrium – USA**

### Company's information:

Name: Alpha-Omega Geotech, Inc.  
Street: 1701 State Avenue  
Kansas City, KS 66102  
Telephone #: 913-371-0000  
Fax #: 913-371-6710

**E-Design Philosophy and Program Developed by:**

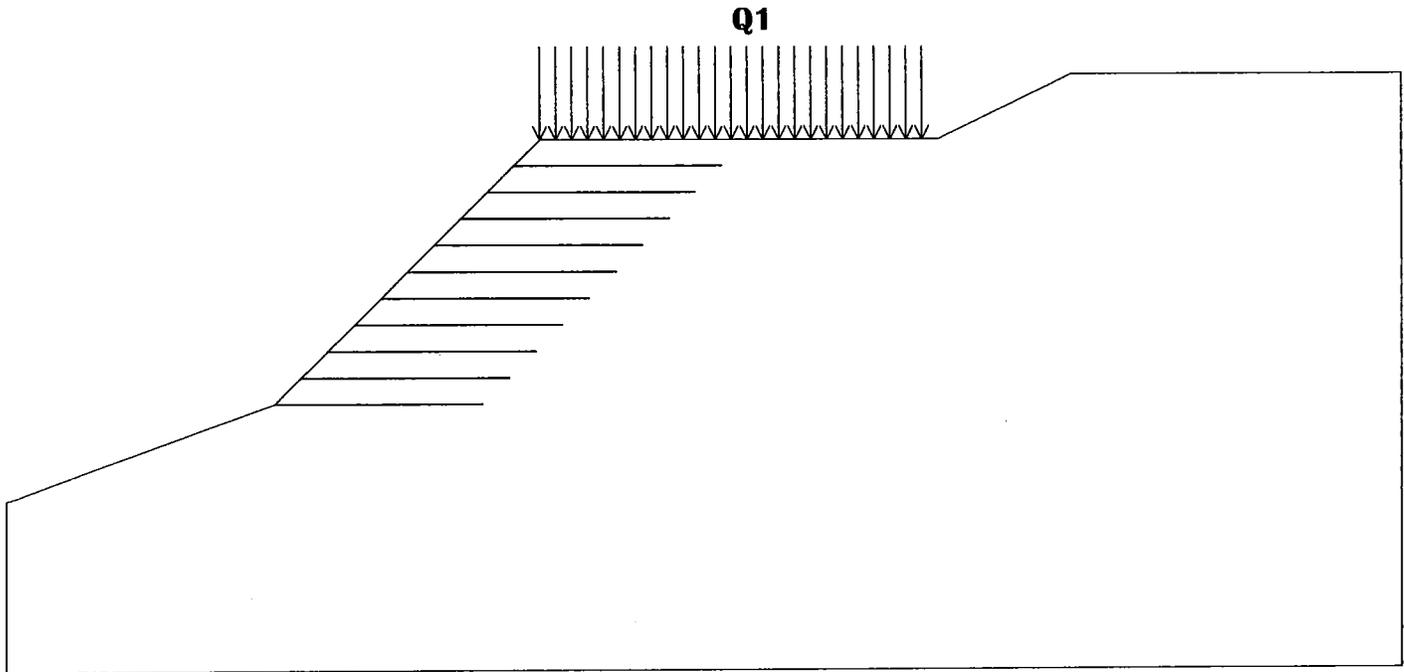
**Dov Leshchinsky, Ph.D.  
33 The Horseshoe  
Newark, Delaware 19711, USA**

**DESIGN STANDARD: Limit Equilibrium – USA**

Life expectancy of the structure is between 10 and 60 years.

Height of slope, H [ft]	20.00
Slope angle, $i^\circ$	45.00
Horizontal length, A [ft]	30.00
Horizontal length, B [ft]	10.00
Backslope angle, $\beta^\circ$	26.00
Slope at bottom of wall, $\alpha^\circ$	20.00
Surcharge load over A, Q1 [lb/ft <sup>2</sup> ]	1000.00
Surcharge load over backslope B, Q2 [lb/ft <sup>2</sup> ]	0.00
Surcharge load away from backslope, Q3 [lb/ft <sup>2</sup> ]	0.00

Water is not present.



SCALE:  
 0 5 10 15 20[ft]







### DETAILED RESULTS OF TIEBACK AND COMPOUND ANALYSES

#	Elevation [ft]	Name	Total Length [ft]	Embedded Length to resist pullout, Le [ft]	Length to slip surface, La [ft]	Strength for:		Controlling Mode of Failure
						Compound stability (available) T-compound [lb/ft]	Tieback (required) T-tieback [lb/ft]	
1	0.00	SG200	8.41	8.12	0.29	1476.16	1144.21	Compound
2	2.00	SG200	12.88	3.14	9.74	1476.16	1072.18	Compound
3	4.00	SG200	14.78	2.64	12.14	1476.16	1000.12	Compound
4	6.00	SG200	15.16	1.88	13.28	1476.16	911.89	Compound
5	8.00	SG200	15.51	1.78	13.73	1476.16	847.82	Compound
6	10.00	SG200	15.70	1.98	13.72	1476.16	764.31	Compound
7	12.00	SG200	14.41	1.06	13.35	1476.16	701.38	Tieback
8	14.00	SG150	13.80	1.10	12.70	662.15	632.88	Tieback
9	16.00	SG150	12.94	1.14	11.80	662.15	560.52	Tieback
10	18.00	SG150	11.70	1.02	10.68	662.15	422.60	Tieback

## RESULTS OF DIRECT SLIDING AND DEEPSEATED ANALYSES

### DIRECT SLIDING

Required length of bottom layer to produce the specified

$F_s$ -direct sliding = 1.50 is 0.00 ft.

Maximum length based on compound and tieback analyses to insure

$F_s$ -uncertainties = 1.30 and  $F_s$ -pullout = 1.50, is 15.70 ft.

### DEEPSEATED

Deepseated factor of safety,  $F_s$ -deepseated, based on Bishop's analysis, is 2.33.

The critical circle is forced to pass outside the reinforced zone defined by the bottom geosynthetic layer; its maximum potential depth is restricted to 40.00 ft.

The critical circle is at:  $X_c = -3.40$ ,  $Y_c = 20.00$ , Radius = 41.71 feet.

In case the crest elevation is above H, StrataSlope assumes a tension crack between the crest and H (see graphic screen).

NOTES: (1) To obtain satisfactory  $F_s$ -deepseated, re-run StrataSlope with a larger specified value of  $F_s$ -direct sliding. This will force deeper circles that should yield larger deepseated safety factor.

(2) When having poor material in the backfill soil or in the foundation soil, please be aware that this Bishop-analysis gives only an indication of the  $F_s$ -deepseated. Use in this case other soil stability software programs to verify this achieved  $F_s$ -deepseated.

### TIEBACK & COMPOUND

Tieback/compound slip surfaces are not restricted from penetrating the foundation soil.



WEST SITE

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Kansas City, KS 66102

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AOGeotech.com

GEOTECHNICAL ENGINEERING REPORT

**MT. OLIVET ROAD SLOPE FAILURE**

LEAVENWORTH COUNTY, KANSAS  
(A-OG 16-237E)

Date: August 19, 2016

Submitted to: Mr. David Lutgen, P.E.  
Deputy Director of Public Works  
Leavenworth County  
300 Walnut, Suite 007  
Leavenworth, KS 66048

Submitted by: ALPHA-OMEGA GEOTECH, INC.

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DISCUSSION .....3

SLOPE REMOVE/REPLACE/REPAIR RECOMMENDATIONS.....3

INSPECTION AND TESTING RECOMMENDATIONS.....5

LIMITATIONS.....6

Appendix 1 – Boring Locations

Appendix 2 - Laboratory Test Results

Appendix 3 - Boring Logs



# ALPHA-OMEGA GEOTECH

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AOGeotech.com

August 19, 2016

Mr. David Lutgen, P. E.  
Deputy Director of Public Works  
Leavenworth County  
300 Walnut, Suite 300  
Leavenworth, KS 66048

## MT. OLIVET ROAD SLOPE FAILURE

MT. OLIVET ROAD WEST OF 187<sup>TH</sup> STREET  
LEAVENWORTH COUNTY, KANSAS  
(A-OG 16-237E)

Dear Mr. Lutgen:

We have completed our limited geotechnical engineering investigation for your above-referenced project.

### INTRODUCTION

Attached are the following items that were utilized in our analysis and evaluation of the subsurface conditions at this site: a sketch giving the approximate location of five (5) borings made on this site with reference to the existing site features; the detailed results of eight (8) moisture contents (ASTM D2216), eight (8) dry densities, three (3) unconfined compression (ASTM D2166) tests from our laboratory, eight (8) calibrated pocket penetrometer readings; and five (5) auger boring (ASTM D1452) logs that describe the materials encountered, their thicknesses and the sampling depths where Shelby tube, thin-walled steel, samplers (ASTM D1587) were used, Standard Penetration (ASTM D1586) tests were performed and bag samples were collected from the auger cuttings in these test borings.

Our personnel located each of the selected borings by measuring from the existing site features and should be considered accurate only to the extent implied by the method of measurement. Elevations were provided by Leavenworth County after the borings were completed. Each of the borings was completed by our drill crew using a CME 55 high-torque, ATV track-mounted drill rig.

Mr. David Lutgen, P.E.  
AOG 16-237E  
August 19, 2016  
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Mt. Olivet Road Slope Failure  
Mt. Olivet Rd W. of 187th Street  
Leavenworth, Kansas

## **SUBSURFACE INVESTIGATION & TEST RESULTS**

Five (5) borings were performed at various locations throughout the failure area. All of the borings were extended auger/split-spoon refusal which was encountered at depths of about 3 fbg (feet beneath existing grade) to 20 fbg.

It should be understood that the depth of auger refusal applies to the type of drilling equipment that was used. As such, it might be possible to extend some of these borings deeper using different drilling equipment and/or techniques. Conversely, residual sandstone, shale and limestone materials through which our drill rig penetrated without achieving refusal may be difficult to excavate depending upon the equipment being used. As such, Alpha-Omega Geotech, Inc. shall not be responsible for the determination of others regarding rippability or ease of excavation within the insitu subgrade, bedrock and geo-intermediate materials.

Predominantly clay soils were encountered in all borings. Thin-walled, steel, Shelby tube samplers were used to collect relatively undisturbed samples from these borings for laboratory analysis. Dry densities of specimens cut from the Shelby tube samples were found to moderate ranging from 90.1 to 107.5 pcf. Depending upon the material composition, the moisture content of the specimens cut from these tube samples ranged from 17.7 to 29.4 percent. The unconfined compressive strength of specimens cut from the Shelby tube samples ranged from 2559 to 2796 psf. It should be noted that several of the maximum unconfined compressive strength values were obtained at high strain rates nearing and exceeding 10 percent. As a result, given the onsite soil types, these high strain rates typically indicate that larger settlements could occur unless a lower allowable bearing capacity value is used than otherwise indicated by the unconfined compressive strength test results. Calibrated pocket penetrometer readings varying from 1.25 tsf (2500 psf) to 4.0 tsf (8000 psf) were obtained on the recovered Shelby tube samples from these test borings. However, it should be noted that the pocket penetrometer values tend to over-estimate the strength of insitu subgrade materials relative to the actual unconfined compressive strength test.

In addition to the Shelby tubes samples, the Standard Penetration test (SPT) was also used to evaluate the consistency of the insitu subgrade materials encountered in these test borings and is made by advancing a hollow split spoon sampler into the base of the auger hole by dropping a 140 lb. hammer a distance of 30 inches on the drill rods. Each drop of the hammer is one blow and these blow counts are recorded for each of three 6-inch advances of the sampler. The first 6-inch advance is the seating drive and the summation of the blow counts of the final two 6-inch advances is taken as the standard penetration resistance. The standard penetration resistance, or N-value as it is known, along with the soil classification, can be used to estimate the density, shear strength and other soil properties.

The N-values obtained from each of the SPT's completed in these borings using a CME automatic hammer are included on the boring logs and summarized in the Summary of Laboratory Testing sheets.

The soil classifications given throughout the laboratory test data as well as the boring logs were made using visual and tactile techniques described in ASTM D2488. As a result, additional analyses could



Mr. David Lutgen, P.E.  
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reveal other soil types of different classification and potentially higher plasticity and swelling potential both onsite and within the nearby vicinity.

In the borings that were made at this site, no water was encountered at the time of drilling. However, a twenty-four-hour water level was not established in these borings due to time restrictions as well as potential safety hazards associated with open bore holes. Although the ground water levels given on the boring logs reflect the conditions observed at the time the borings were made, they should not be construed to represent an accurate or permanent condition. There is uncertainty involved with short-term water level observations in bore holes especially in clay soils of relatively low permeability. The ground water level should be expected to fluctuate with variations in precipitation, site grading and drainage conditions. In addition, it is also possible that seasonal perched ground water may be encountered within these soil deposits and bedrock formations at different depths during other times of the year based on drainage conditions, seasonal snowmelt and rainwater infiltration.

## **DISCUSSION**

It is understood this project consists of the evaluation of the existing slope failure on Mt. Oliver Road and to determine a design build repair approach with Leavenworth County. Based on our initial site visits, discussions and evaluation of the subsurface investigation, it appears that the existing slope has a relatively shallow, surficial failure that can be repaired by excavating the existing mobilized slope and rebuilding the slope with a properly placed engineered soil to support the roadway section. Once the slope has been rebuilt, it is assumed that the same standard county road paving section would be replaced on the new engineered embankment fill. AOG will work with Leavenworth County engineers and contractors to replace the slope in approximately the same position as the initial slope allowing the roadway alignment and easements to all match the original designs.

## **SLOPE REMOVE/REPLACE/REPAIR RECOMMENDATIONS**

AOG to provide onsite observation, monitoring and testing services during all field operations related to construction of the geogrid-reinforced engineered slope.

- This engineered fill slope may need to be adjusted based on actual field conditions;
- The removal/replacement zone of the slope along the roadway should extend a minimum distance of 20 feet beyond each end of the current failure zone;
- Remove the existing pavement, base and subgrade to expose the underlying bedrock layer, which is expected to be continuous beneath the westbound (northern) lane. It is anticipated that the southern edge of this bedrock layer will be identified somewhere beneath the original horizontal alignment of the roadway. It is assumed that this southern face of the bedrock layers (shale, limestone, sandstone) beneath the original roadway alignment will be essentially vertical, but may taper outward slightly with depth;



- Remove all existing soil, base rock and fill material from the edge of the bedrock down to an elevation equivalent to the pre-slope failure elevation along the toe of the roadway embankment, i.e. approximately the original elevation of the fence line;
- The engineered soil slope has been designed to have a maximum steepness of 3:1 (H:V), which should allow re-establishment of the original horizontal roadway alignment. As the height of the slope will vary, it is generally expected that the toe of the engineered soil slope can roughly match the southern boundary of the roadway easement.

#### **Shear Key**

- Once all of the existing soil, base rock and fill material has been removed down to the base elevation of engineered slope, it is recommended that a shear key should be excavated beneath the toe of the slope. Including the sloping necessary to construct this shear key, it is anticipated that both the excavation work as well as a portion of the shear key may extend beyond the current roadway easement;
- To adequately secure toe resistance and support the weight of the new engineered slope fill and roadway loads, it is recommended that a shear key should be installed down to stable, hard bedrock (shale, limestone or sandstone). Based on the findings from our initial test borings, it is generally anticipated that the depth of the shear key may range from about 9 to 12 feet ( $\pm$ ), depending on the natural formation of the bedrock layers. At the base, it is recommended that the shear key should be at least 8 feet in width, and at least 12 feet in width at the top, i.e. the base of the engineered slope;
  - As the excavation work is made, it is may prove more practical to adjust the horizontal position of the shear key based on the southward extent of the bedrock layers beneath the existing roadway;
  - It is anticipated that AOG's field personnel will work with the excavating contractor to properly install the shear key to provide maximum benefit and protection of the engineered slope;
- The shear key may be constructed using shot rock or rocky rubble with a maximum dimension of the about 12 to 16 inches. It would be advantageous for the material used to construct the shear key to contain sufficient clay to fill any void spaces, and create a very dense compacted matrix. It may be possible to consider concrete rubble as well; nevertheless, it is recommended that AOG's field personnel should consult with the excavating contractor to determine suitability of any material proposed for use to construct the shear key.

#### **Engineered Soil Slope**

- After removal of all existing soil, base rock and fill material exposing the southern edge of the bedrock layers beneath the existing roadway, and installing the shear key, place a 12" layer of clean crushed limestone aggregate (1.5-inch minus, clean) fully encapsulated within a non-woven geotextile fabric to inhibit the infiltration of silts and clays ("Blanket Drain"). This



Blanket Drain should extend from the toe of the engineered slope northward to the exposed bedrock face;

- Place and overlap the non-woven geotextile fabric in accordance with the manufacturer's recommendations, which should be verified by AOG's field personnel during construction;
- Place nominal 6" layer of crushed limestone aggregate over the encapsulated Blanket Drain. Compact to at least 95% of the Standard Proctor (ASTM D698) maximum dry density at a moisture content sufficient to achieve the specified level of compaction;
- To the extent practical, it is anticipated that the onsite suitable clay soil materials would be re-used to construct the engineered slope fill.
- All soil materials used to construct the engineered slope fill shall be approved by A-OG prior to placement. In addition, any imported fill material shall also be submitted to A-OG at least 72-hrs prior to placement for approval.
- All engineered fill to be placed in loose lifts not exceeding about 8 inches in thickness and compact to at least 95% of the Standard Proctor (ASTM D698) maximum dry density at a moisture content with -1 to +3 percent of the optimum moisture content. Moisture control of all fill is critical to achieve stability;
- Lift thickness and compaction of all materials used to construct the engineered controlled fill shall be verified by A-OG lift-by-lift continuously throughout placement.
- Final surface cover along face of slope shall consist of Riprap stone (avg. 6" dimension, 12" thick).

#### **INSPECTION AND TESTING RECOMMENDATIONS**

Unless Alpha-Omega Geotech, Inc. is retained to provide the construction observation, monitoring and testing services for this project, we cannot accept any responsibility for any conditions that deviate from those identified in this subsurface investigation nor for the performance of the engineered slope, pavements and other structures including any retaining walls that are a part of this project. Alpha-Omega Geotech, Inc. is accredited by AASHTO and we are experienced in construction quality control and have a fully-equipped soil, concrete, aggregate, rock and asphalt testing laboratory as well as qualified field technicians to provide these field services.

It is not economically practical to perform enough exploratory borings on any site to identify all subsurface conditions. Some conditions affecting the design and/or construction may not become known until the project is underway. The boring logs, field SPT and laboratory test results depict subsurface conditions only at the specified locations and depths at the site. The boundaries between soil and rock layers indicated on the boring logs are based on observations made during drilling and an interpretation of the laboratory testing results. The exact depths of these boundaries are approximate and the transitions between soil and rock types may be gradual rather than being clearly defined. Also,



Mr. David Lutgen, P.E.  
AOG 16-237E  
August 19, 2016  
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Mt. Olivet Road Slope Failure  
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due to the prior development at this site as well as the natural conditions of the formation of soils and rock, it is possible that unanticipated subsurface conditions may be encountered during construction. Monitoring of the subsurface conditions that are revealed during construction is needed to verify that subsurface conditions are consistent with those conditions identified in this preliminary geotechnical investigation. If variations in subsurface conditions are encountered, it will be necessary for Alpha-Omega Geotech, Inc. to re-evaluate the recommendations that have been made in this report.

Special Inspections should be performed in accordance with the local building code under which the project is designed, as adopted by Leavenworth County, Kansas.

Prior to filling, it is recommended that a representative of Alpha-Omega Geotech, Inc. should verify that the site has been properly stripped of all topsoil and other deleterious material, benched as needed and prepared for the placement of fill. The compaction of any structural fill beneath the new slope and any other areas where settlement control is necessary should be tested lift-by-lift by a representative of Alpha-Omega Geotech, Inc. as it is being placed. Also, in accordance with the local building code, any fill that is used to construct slopes steeper than 4:1 (H:V) must be placed as engineered controlled fill and the compaction tested lift-by-lift during placement.

Assuming that uniform fill material is used, nuclear density gauges (ASTM D2922/D3017) should be used to test compaction wherever necessary. However, if fill material of non-uniform consistency is used, other evaluation methods may be required. Such methods may include, but not be limited to, the use of a GeoGauge Stiffness meter, Dynamic Cone Penetrometer (DCP), proof-rolling or other visual inspection techniques.

Any geotextile fabric and geogrid reinforcement that is utilized should be placed and overlapped as needed in accordance with the manufacturer's recommendations, which should be verified by a representative of Alpha-Omega Geotech, Inc. Wherever possible, in addition to compaction testing, cut and fill areas should be proof-rolled with a loaded tandem-axle dump truck to identify soft areas that will need to be corrected. A representative of Alpha-Omega Geotech, Inc. should observe this proof-rolling. Checks should also be made of the subbases, concrete and any pavement materials.

Finally, the inspection and testing services listed herein are given as a minimum and it should be understood that additional inspection and testing services might also be required or otherwise beneficial.

#### **LIMITATIONS**

This report is presented in broad terms to provide a comprehensive assessment of the interpreted subsurface conditions and their potential effect on the adequate design and economical construction of the slope repair along Mt. Olivet Road in Leavenworth County, Kansas, as discussed herein. This report has been prepared for the exclusive use of our client for specific application to the project discussed herein and has been prepared within our client's directive and budgetary constraints and in



Mr. David Lutgen, P.E.  
AOG 16-237E  
August 19, 2016  
Page 7 of 8

Mt. Olivet Road Slope Failure  
Mt. Olivet Rd W. of 187th Street  
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accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

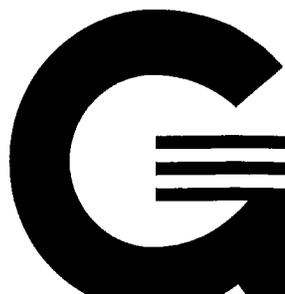
It should be noted that the concept of risk is an important aspect of the geotechnical engineering evaluation and report since the recommendations given in this report are not based on exact science but rather analytical tools and empirical methods in conjunction with engineering judgment and experience. Therefore, the recommendations given herein should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soil materials and the proposed structures will perform as planned. Nevertheless, the geotechnical engineering recommendations presented herein are Alpha-Omega Geotech, Inc.'s professional opinion of those measures that are necessary for the proposed structures to perform according to the proposed design based on the information provided to Alpha-Omega Geotech, Inc., the referenced information gathered during the course of this investigation and our experience with these conditions.

It is also strongly suggested that Alpha-Omega Geotech, Inc. should review your plans and specifications dealing with the earthwork, as well as any pavements prior to construction to confirm compliance with the recommendations given herein. Particular details of construction specifications or quality control may develop, and we would be pleased to respond to any questions regarding these details.

*If Alpha-Omega Geotech, Inc. is not retained to review the project plans and specifications, address to the proposed slope repair, provide the recommended construction phase observation, monitoring and testing services and respond to any subsurface conditions that are identified during construction to evaluate whether or not changes in the recommendations given in this report are needed, we cannot be held responsible for the impact of those conditions on the project or the future performance of the slope, pavements and/or structures that may be involved.*

The scope of our services did not include any environmental assessment or investigation for the presence of hazardous or toxic materials in the soil, surface water, ground water or air, either on, below or adjacent to this site. In addition, no determination regarding the presence or absence of wetlands was made. Furthermore, it should be understood that the scope of geotechnical services for this project does not include either specifically or by implication any biological (i.e. mold, fungi or bacteria) assessment of the site or the proposed construction. Any statements in this report or included on the boring logs regarding odors, colors and unusual or suspicious items or conditions are strictly for informational purposes only.

We appreciate the opportunity to be of service to the Leavenworth County, and look forward to working with you throughout the construction process. We are prepared to provide the Special Inspection services that will be required by the local building code under which this project is designed, as adopted by the Leavenworth County, Kansas as well as the other necessary construction observation, monitoring and testing services discussed in this report.



Mr. David Lutgen, P.E.  
AOG 16-237E  
August 19, 2016  
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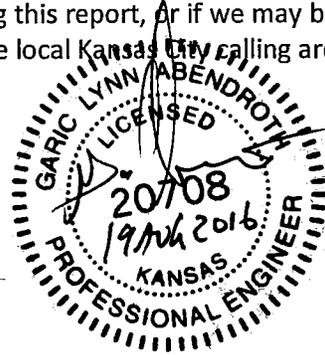
Mt. Olivet Road Slope Failure  
Mt. Olivet Rd W. of 187th Street  
Leavenworth, Kansas

If you have any questions concerning this report, or if we may be of further assistance, please call us at (913) 371-0000 or from beyond the local Kansas City calling area at (800) 546-0878.

Sincerely,  
ALPHA-OMEGA GEOTECH, INC.



Garic Abendroth, P.E.  
Engineering Department Manager



Enclosures



**Appendix Section 1**

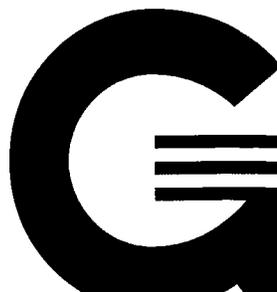
**SITE SKETCH – BORING LOCATIONS**





**Appendix Section 2**

**LABORATORY TEST RESULTS**



# Summary of Laboratory Testing

SLT 22205

## Alpha-Omega Geotech, Inc.

1701 State Avenue  
 Kansas City, KS 66102  
 Office: (913) 371-0000 Fax: (913) 371-6710  
 Website: www.aogeotech.com



ALPHA-OMEGA GEOTECH

PROJECT NAME: Mount Olivet Road Site PROJECT NUMBER: 16-237E  
 PROJECT LOCATION: Leavenworth, KS DATE: 6/23/2016

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL PL PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B-1A	SS-1	2'-2.5'	Brown, spotted gray and reddish brown FAT CLAY with a trace of gravel				CH					N = 50/1"
B-2	SS-1	2'-3.5'	Brown, spotted gray and reddish brown FAT CLAY				CH					N = 15
B-2	SS-2	3.5'-5'	Light brown, mottled gray, spotted reddish brown LEAN CLAY				CL					N = 17
B-2	SS-3	8.5'-10'	Brown, spotted reddish brown LEAN CLAY with a trace of gravel				CL					N = 12
B-2	SS-4	13.5'-13.8'	Brown, spotted reddish brown LEAN CLAY with a trace of gravel				CL					N = 50/2"
B-3	ST-1	1'-3'	Brown, speckled reddish brown FAT CLAY	29.4	90.1		CH					PP = 2.25 tsf
B-3	ST-2	3'-5'	Brown, speckled reddish brown FAT CLAY with a trace of sand and gravel	21.7	95.2		CH		2704	4.9		PP = 4.00 tsf
B-3	ST-3	5'-7'	Brown, speckled reddish brown and dark brown FAT CLAY with a trace of gravel	24.9	102.8		CH		2796	17.6		PP = 2.00 tsf
B-3	ST-4	7'-9'	Light brown, mottled reddish brown FAT CLAY with a trace of gravel	29.4	92.8		CH					PP = 1.25 tsf
B-4	ST-1	1'-3'	Brown LEAN CLAY with a trace of gravel	25.6	97.9		CL					PP = 2.50 tsf

# Summary of Laboratory Testing

SLT 22205

## Alpha-Omega Geotech, Inc.

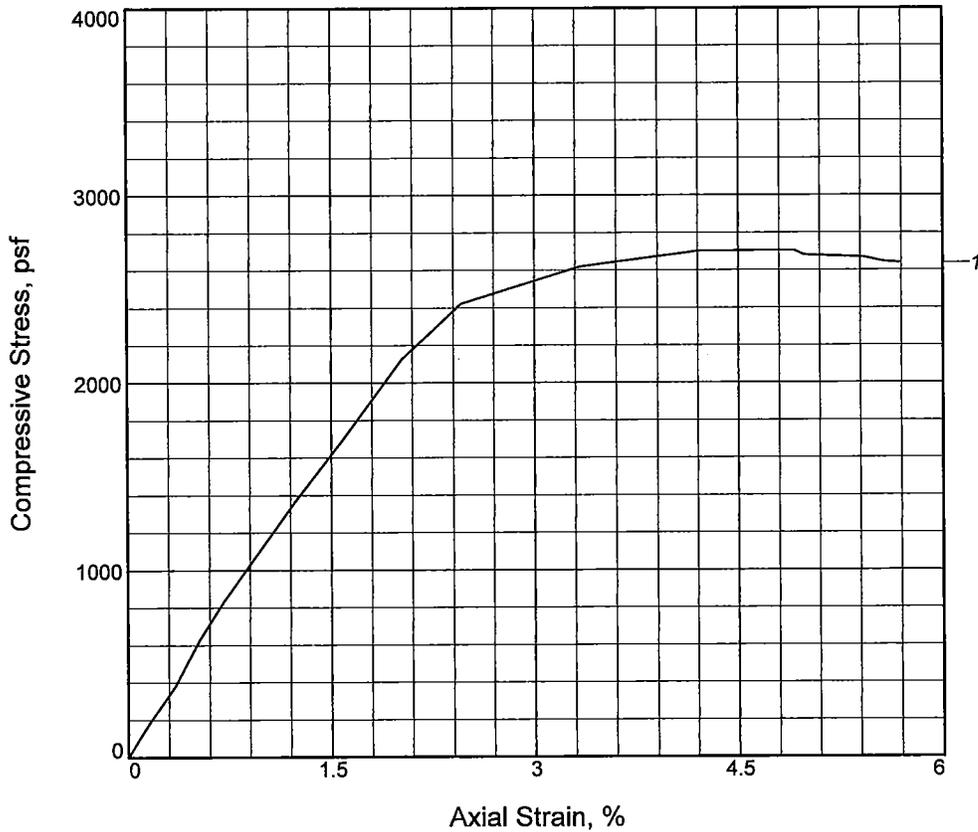
1701 State Avenue  
 Kansas City, KS 66102  
 Office: (913) 371-0000 Fax: (913) 371-6710  
 Website: www.aogeotech.com



PROJECT NAME: Mount Olivet Road Site PROJECT NUMBER: 16-237E  
 PROJECT LOCATION: Leavenworth, KS DATE: 6/23/2016

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits			USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	% Swell	Remarks
						LL	PL	PI					
B-4	ST-2	3'-5'	Light brown FAT CLAY with a trace of gravel	18.4	106.3				CH				PP = 2.00 tsf
B-4	ST-3	5'-7'	Brown, mottled gray, speckled reddish brown FAT CLAY with a trace of sand and gravel	26.4	102.8				CH				PP = 1.75 tsf
B-4	ST-4	7'-9'	Light brown, spotted gray and reddish brown FAT CLAY with a trace of gravel with slickened sides	17.7	107.5				CH	2559	6.5		PP = 3.50 tsf

# UNCONFINED COMPRESSION TEST



Sample No.	1		
Unconfined strength, psf	2704		
Undrained shear strength, psf	1352		
Failure strain, %	4.9		
Strain rate, in./min.	0.08		
Water content, %	21.7		
Wet density, pcf	115.8		
Dry density, pcf	95.2		
Saturation, %	76.1		
Void ratio	0.7712		
Specimen diameter, in.	2.85		
Specimen height, in.	5.70		
Height/diameter ratio	2.00		

**Description:** Brown, speckled reddish brown FAT CLAY with a trace of sand and gravel

LL =	PL =	PI =	Assumed GS= 2.70	Type: Undisturbed
------	------	------	------------------	-------------------

**Project No.:** 16-237E  
**Date Sampled:** 7/6/2016  
**Remarks:**

**Client:**  
**Project:** Mt. Olivet Road Site  
**Source of Sample:** B-3      **Depth:** 3  
**Sample Number:** ST-2

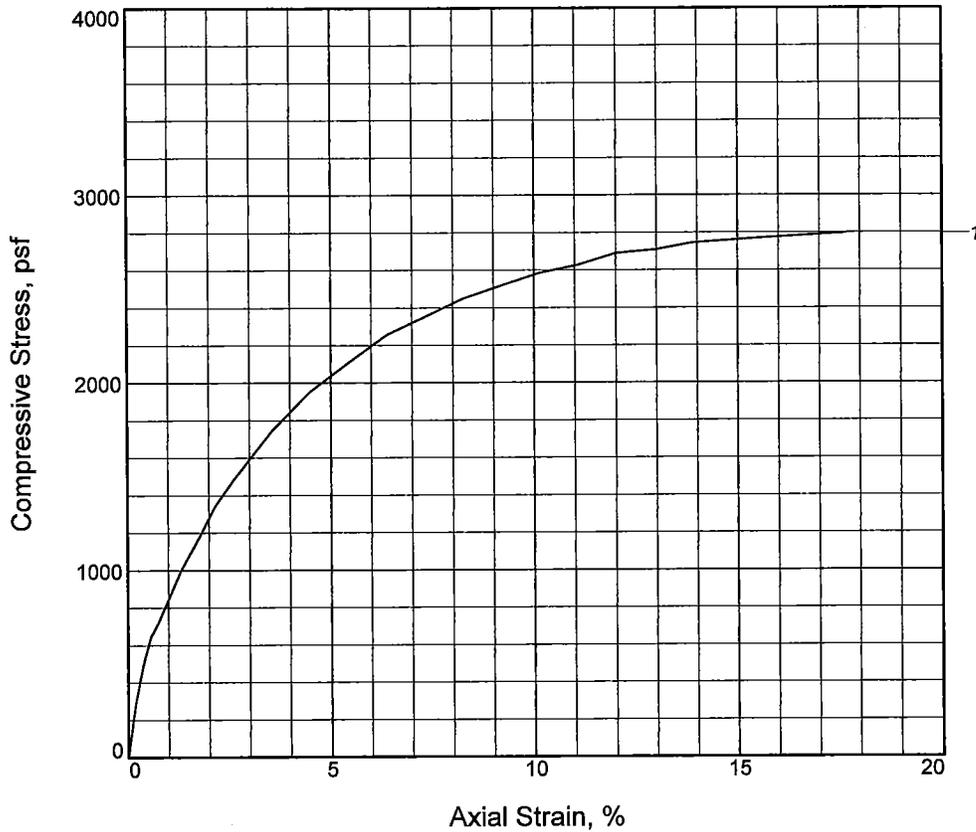


Figure 1 of 1

Tested By: DB

Checked By: GA

# UNCONFINED COMPRESSION TEST



Sample No.	1		
Unconfined strength, psf	2796		
Undrained shear strength, psf	1398		
Failure strain, %	17.6		
Strain rate, in./min.	0.08		
Water content, %	24.9		
Wet density, pcf	128.4		
Dry density, pcf	102.8		
Saturation, %	105.0		
Void ratio	0.6390		
Specimen diameter, in.	2.66		
Specimen height, in.	5.33		
Height/diameter ratio	2.00		

**Description:** Brown, speckled reddish brown and dark brown FAT CLAY with a trace of gravel

LL =      PL =      PI =      Assumed GS= 2.70      Type: Undisturbed

**Project No.:** 16-237E  
**Date Sampled:** 7/6/2016  
**Remarks:**

**Client:**  
**Project:** Mt. Olivet Road Site  
**Source of Sample:** B-3      **Depth:** 5  
**Sample Number:** ST-3

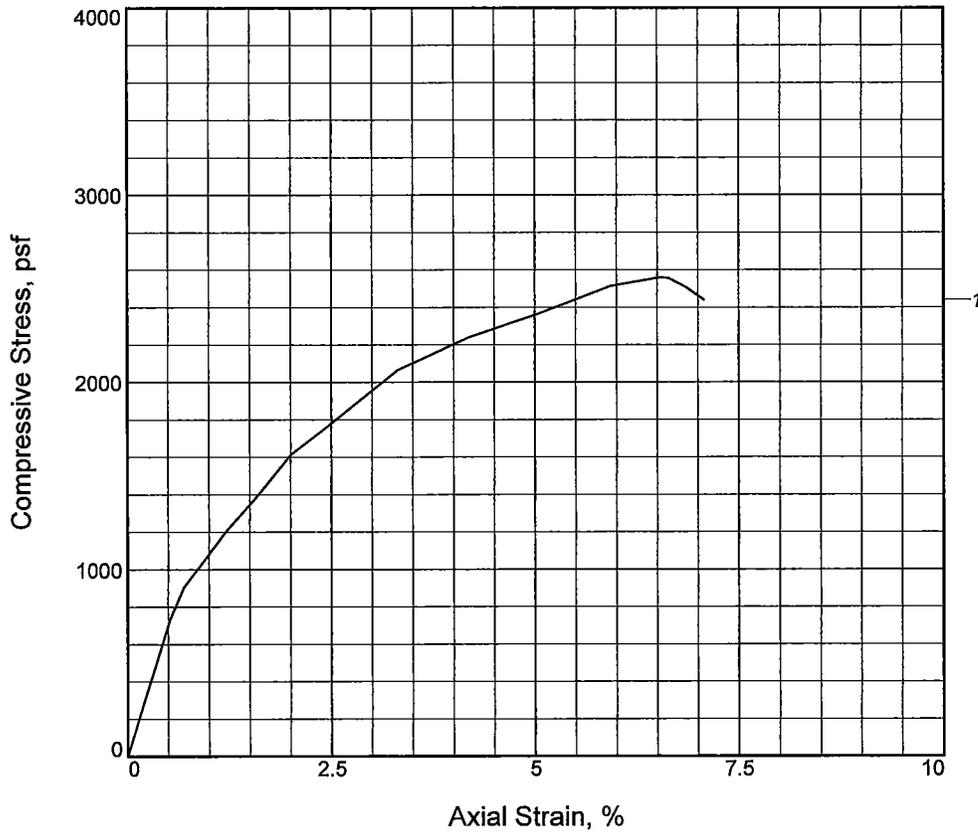
Figure 1 of 1



Tested By: DB

Checked By: GA

# UNCONFINED COMPRESSION TEST



Sample No.	1		
Unconfined strength, psf	2559		
Undrained shear strength, psf	1280		
Failure strain, %	6.5		
Strain rate, in./min.	0.08		
Water content, %	17.7		
Wet density, pcf	126.6		
Dry density, pcf	107.5		
Saturation, %	84.2		
Void ratio	0.5674		
Specimen diameter, in.	2.87		
Specimen height, in.	5.74		
Height/diameter ratio	2.00		

**Description:** Light brown, spotted gray and reddish brown FAT CLAY with a trace of gravel with slickened sides

LL =      PL =      PI =      Assumed GS= 2.70      Type: Undisturbed

**Project No.:** 16-237E

**Date Sampled:** 7/6/2016

**Remarks:**

**Client:**

**Project:** Mt. Olivet Road Site

**Source of Sample:** B-4      **Depth:** 9

**Sample Number:** ST-4

Figure 1 of 1



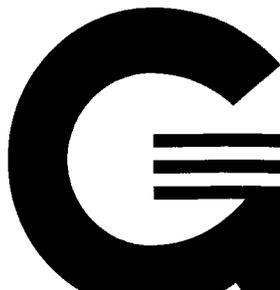
Tested By: DB

Checked By: GA

### Appendix Section 3

#### BORING LOGS

Note: The logs of subsurface conditions shown in this section apply only at the specific boring location and depths at the date indicated and might not be indicative of all subsurface conditions that may be encountered. This information is not warranted to be representative of subsurface conditions at other locations, depths and times. The passage of time or construction operations at or adjacent to this site may result in changes to the soil conditions at these boring locations and depths. As a result, the character of subsurface materials shall be each bidder's responsibility.

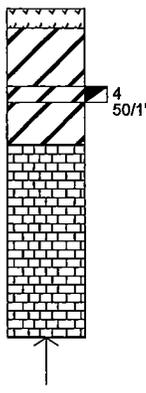




**LOG OF BORING  
No. B-1A**

PROJECT: Mt. Olivet Road Site PROJECT NO.: 16-237E  
 CLIENT: Leavenworth County  
 PROJECT LOCATION: Leavenworth, KS  
 LOCATION: \_\_\_\_\_ ELEVATION: 996.2  
 DRILLER: Mike Burdick, Sr. LOGGED BY: Chuck Jacobs  
 DRILLING METHOD: AO/SS/NX DATE: 6/23/2016  
 DEPTH TO - WATER> INITIAL:  None AFTER 24 HOURS:  NA CAVING>  C  None

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS
Depth (ft.)										
0		Topsoil								CH
995		Brown FAT CLAY with a trace of gravel	.5							CH
		Brown, spotted gray and reddish brown FAT CLAY with a trace of gravel	2							CH
			2.42							LS
5		Brown, spotted gray and reddish brown FAT CLAY with a trace of gravel (very hard, slow drilling)	3.5							
990		Limestone [%REC=55, RQD=100]	8.5							
		Auger refusal at about 3.5' on limestone End of coring at about 8.5'								
10										
985										
15										
980										
20										
975										
25										
970										
30										
965										
35										
960										





**LOG OF BORING  
No. B-1B**

PROJECT: Mt. Olivet Road Site PROJECT NO.: 16-237E  
 CLIENT: Leavenworth County  
 PROJECT LOCATION: Leavenworth, KS  
 LOCATION: \_\_\_\_\_ ELEVATION: 997.6  
 DRILLER: Mike Burdick, Sr. LOGGED BY: Chuck Jacobs  
 DRILLING METHOD: AO DATE: 6/23/2016  
 DEPTH TO - WATER> INITIAL:  None AFTER 24 HOURS:  NA CAVING>  C  None

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS
Depth (ft.)										
0		Gravel								
1		Brown LEAN CLAY								CL
3		Brown LEAN CLAY with rock debris								CL
10		Gray FAT CLAY								CH
19.5		Weathered limestone (very hard, slow drilling)								LS
20.5		Auger refusal at about 20.5' End of boring at about 20.5'								



**LOG OF BORING**  
No. B-2

PROJECT: Mt. Olivet Road Site PROJECT NO.: 16-237E  
 CLIENT: Leavenworth County  
 PROJECT LOCATION: Leavenworth, KS  
 LOCATION: \_\_\_\_\_ ELEVATION: 1002.6  
 DRILLER: Mike Burdick, Sr. LOGGED BY: Chuck Jacobs  
 DRILLING METHOD: AO/SS DATE: 6/23/2016  
 DEPTH TO - WATER> INITIAL:  None AFTER 24 HOURS:  NA CAVING>  C  None

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS
Depth (ft.)										
0		Asphalt								
1		Brown FAT CLAY								CH
2		Brown, spotted gray and reddish brown FAT CLAY								CH
3.5		Light brown, mottled gray, spotted reddish brown LEAN CLAY								CL
5		Light brown, mottled gray, spotted reddish brown LEAN CLAY								CL
8.5		Brown, spotted reddish brown LEAN CLAY with a trace of gravel								CL
10		Brown, spotted reddish brown LEAN CLAY with a trace of gravel								CL
13.5		Brown, spotted reddish brown LEAN CLAY with a trace of gravel								CL
13.75		Auger refusal at about 13.75' on rock End of boring at about 13.75'								



**LOG OF BORING  
No. B-3**

PROJECT: Mt. Olivet Road Site PROJECT NO.: 16-237E  
 CLIENT: Leavenworth County  
 PROJECT LOCATION: Leavenworth, KS  
 LOCATION: \_\_\_\_\_ ELEVATION: 974.3  
 DRILLER: Mike Burdick, Sr. LOGGED BY: Chuck Jacobs  
 DRILLING METHOD: AO/ST/NX DATE: 6/22/2016  
 DEPTH TO - WATER> INITIAL:  None AFTER 24 HOURS:  NA CAVING>  C  None

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS
Depth (ft.)										
0		Brown LEAN CLAY								CL
1		Brown, speckled reddish brown FAT CLAY	29.4	90.1					2.25	CH
3		Brown, speckled reddish brown FAT CLAY with a trace of sand and gravel	21.7	95.2				2704	4.00	CH
5		Brown, speckled reddish brown and dark brown FAT CLAY with a trace of gravel	24.9	102.8				2796	2.00	CH
7		Light brown, mottled reddish brown FAT CLAY with a trace of gravel	29.4	92.8					1.25	CH
9		Limestone (very hard, slow drilling)								LS
9.5		Limestone [%REC=13, RQD=100]								LS
14.5		Gray shale [%REC=100, RQD=5]								SH
19		Auger refusal at about 9.5' on limestone End of coring at about 19'								



**LOG OF BORING**  
No. B-4

PROJECT: Mt. Olivet Road Site PROJECT NO.: 16-237E  
 CLIENT: Leavenworth County  
 PROJECT LOCATION: Leavenworth, KS  
 LOCATION: \_\_\_\_\_ ELEVATION: 969.7  
 DRILLER: Mike Burdick, Sr. LOGGED BY: Chuck Jacobs  
 DRILLING METHOD: AO/ST DATE: 6/23/2016  
 DEPTH TO - WATER> INITIAL:  None AFTER 24 HOURS:  NA CAVING>  C  None

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS
Depth (ft.)										
0		Brown LEAN CLAY								CL
		Brown LEAN CLAY with a trace of gravel	25.6	97.9					2.50	CL
		Light brown FAT CLAY with a trace of gravel	18.4	106.3					2.00	CH
965		Brown, mottled gray, speckled reddish brown FAT CLAY with a trace of sand and gravel	26.4	102.8					1.75	CH
		Weathered rock (very hard, slow drilling)								RD
960		Light brown, spotted gray and reddish brown FAT CLAY with a trace of gravel with slickened sides	17.7	107.5				2559	3.50	CH
		Light brown, spotted gray and reddish brown FAT CLAY with a trace of gravel with slickened sides								CH
		Auger refusal at about 12' on rock End of boring at about 12'								
955										
950										
945										
940										
935										

# KEY TO SYMBOLS

Symbol Description

Symbol Description

Strata symbols

Soil Samplers

 Topsoil

 Standard penetration test

 FAT CLAY

 Undisturbed thin wall  
Shelby tube

 LIMESTONE

 Gravel

 LEAN CLAY

 Weathered LIMESTONE

 ASPHALT

 SHALE

Misc. Symbols

 Drill rejection

Notes:

1. Borings were drilled on June 22-23, 2016 using auger only, split spoon, shelly tube and core barrel techniques.
  2. Ground water was not encountered while in the drilling process.
  3. Borings were staked by Alpha-Omega Geotech, Inc.
  4. These logs are subject to the limitations, conclusions, and recommendations in this report.
  5. Results of tests conducted on samples recovered are reported on the logs.
- Abbreviations are:

DDen =	natural dry density (pcf)	LL =	Liquid limit
w%	natural moisture content (%)	PI =	Plasticity index
UComp =	Unconfined compression (psf)	PPen =	Pocket Penetrometer
-200 =	percent passing #200 sieve (%)	RQD =	Rock Quality
DCP =	Dynamic Cone Penetrometer		

# Leavenworth County, KS



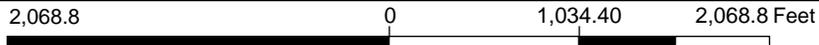
**Mt. Olivet East Site**

## Legend

- Parcel
- City Limit Line
- Major Road
- <all other values>
- 70
- Road
- Railroad
- Section
- County Boundary

**39°20'4.29"N**  
**94°58'27.14"W**

1 in. = 1034ft.



This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

## Notes

# Leavenworth County, KS



Mt. Olivet West Site

MT OLIVET RD

187TH ST

## Legend

- Parcel
- Parcel Number
- Subdivisions
- City Limit Line
- Major Road
- <all other values>
- 70
- Road
- Railroad
- Section
- County Boundary

39°20'19.85"N  
95° 0'48.28"W

1 in. = 517ft.



1,034.4 0 517.20 1,034.4 Feet



This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

## Notes