Jeff Brechbill

From: Asadi, Reza <RASADI@indot.IN.gov>
Sent: Wednesday, May 07, 2014 10:33 AM
To: Jeff Brechbill
Cc: Jeff Hicks; Wooldridge, Joann; Zaheer, Mir; Khan, Athar
Subject: RE: Des 0013790 - US 40 in Downtown Richmond, Wayne County

Jeff,

You can use "IC" for subgrade treatment.

Kind Regards,

Reza Asadi
Geotechnical Engineer
Office of Geotechnical Engineering
120 South Shortridge Road
Indianapolis, IN 46219
Phone: (317) 610-7251 ext 221
Fax: (317) 356-9351
email: RAsadi@INDOT.in.gov

From: Jeff Brechbill [mailto:jbrechbill@firstgroupengineering.com]
Sent: Wednesday, May 07, 2014 9:59 AM
To: Asadi, Reza
Cc: FGE-Jeff Hicks; Wooldridge, Joann
Subject: Des 0013790 - US 40 in Downtown Richmond, Wayne County
Importance: High

Reza,

This project includes a recommendation of Subgrade Treatment Type IA. In accordance with Memo 14-04, we are requesting a different subgrade treatment recommendation since Type IA is now obsolete.

Thanks!

Jeff L. Brechbill, P.E.
First Group Engineering, Inc.
5925 Lakeside Blvd.
Indianapolis, IN 46278
(317) 216-7705 ext. 217

Jeff Brechbill

From: Siddiki, Nayyar Zia <NSIDDIKI@indot.IN.gov>
Sent: Wednesday, July 27, 2016 10:17 AM
To: Jeff Brechbill
Cc: Wooldridge, Joann; 'FGE-Jeff Hicks'; Gill, Robert; Anthony, Rich; Hoy, Mike
Subject: RE: Richmond US 40 Des 0013790 - Geotechnical Items Needed

Jeff,
My answers are in red. Let me know if you need more clarification. Thx, Nayyar

---

From: Jeff Brechbill [mailto:jbrechbill@firstgroupengineering.com]
Sent: Tuesday, July 26, 2016 4:10 PM
To: Siddiki, Nayyar Zia <NSIDDIKI@indot.IN.gov>
Cc: Wooldridge, Joann <JWOOLDRIDGE@indot.IN.gov>; 'FGE-Jeff Hicks' <jhicks@firstgroupengineering.com>; Gill, Robert <D30GILL@indot.IN.gov>; Anthony, Rich <ranthony@indot.IN.gov>; Hoy, Mike <MHoy@indot.IN.gov>
Subject: RE: Richmond US 40 Des 0013790 - Geotechnical Items Needed

---

Nayyar,

Thank you very much for your review and comments. We just have a couple of follow-up questions:

1. In areas where wet soils are encountered, do you anticipate that the undercutting, #5 stone, and geotextiles would be utilized for 11th Street only? Also, should this be paid for as #5 stone and geotextiles? If so, I assume we would need a Unique Special Provision and Unique Pay Item Code assigned for this. Do you have a sample from where this has been used before, or will we need to prepare this? (#5 stone is not a standard pay item in CES).
   When wet soils (>2 % over OMC) encountered below the subgrade, excavate 6 inches below Type IC. Place a layer of geotextile (rip rap) on the grade and Construct with NO 5 with appropriate compaction(Use the appropriate spec section (standard pay item), and write a Restrictive Type USP stating that you want to use No. 5 Stone for that item)
2. Do you have an estimate of how much area may need to use this treatment (for undistributed quantity)?
   Based on moisture tests , 20 % of subgrade area should be fine.
3. It appears that the #5 stone will outlet into the underdrain trench, and from there water will travel in the underdrain trench into underdrain pipes, and then into storm inlets. Does this sound ok?
   As discussed ,No 5 may drain into underdrains.
4. Just want to clarify that you intend for geotextiles to be used above the #5 stone (not below)?
   As discussed geotextile is intended to use below the NO 5.

5. Will your e-mail be acceptable as a revision to the approved Geotechnical Report or will an official addendum need to be approved?
   I believe e mail recommendation should be fine.

Thanks!

Jeff L. Brechbill, P.E.
First Group Engineering, Inc.
5925 Lakeside Blvd.
Indianapolis, IN 46278
(317) 216-7705 ext. 217
JBrechbill@FirstGroupEngineering.com

From: Siddiki, Nayyar Zia [mailto:NSIDDIKI@indot.IN.gov]
Sent: Friday, July 22, 2016 2:09 PM
To: Jeff Brechbill
Cc: Wooldridge, Joann; 'FGE-Jeff Hicks'; Gill, Robert; Anthony, Rich; Hoy, Mike
Subject: RE: Richmond US 40 Des 0013790 - Geotechnical Items Needed

Jeff,

Upon review of geotechnical report and experience with these soils in urban areas I agree with geotechnical report recommendations which is as follows:

An undistributed quantity of subgrade improvement should be included in the
contract document that is equal to 20 percent of the subgrade area
If the wet soils condition encountered during construction hare is recommendations
Excavate a six inches below the Type IC subgrade
Place a layer of geotextile (rip rap)
Construct with 6 inches No 5 aggregates and out let into storm sever
Construct Type IC , subgrade in accordance with Sec 300
Contact me if you have question.
Nayyar

From: Hoy, Mike
Sent: Wednesday, July 20, 2016 10:55 AM
To: Siddiki, Nayyar Zia <NSIDDIKI@indot.IN.gov>; Jeff Brechbill <jbrechbill@firstgroupengineering.com>
Cc: Wooldridge, Joann <JWOOLDRIDGE@indot.IN.gov>; 'FGE-Jeff Hicks' <jhicks@firstgroupengineering.com>; Gill, Robert <D30GILL@indot.IN.gov>; Anthony, Rich <ranthony@indot.IN.gov>
Subject: RE: Richmond US 40 Des 0013790 - Geotechnical Items Needed

Jeff – I'm going to defer to Nayyar.

Nayyar,

Chicago Testing Laboratory, Inc.
18000 South Williams Street, Thornton, IL 60476 p 708.877.1801 f 708.877.6926
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Testing • Inspection • Training • Consulting • Research • Geotechnical
Founded 1912
www.chicagotestinglab.com
info@chicagotestinglab.com

June 9, 2010

Mr. Athar Khan
INDOT Office of Geotechnical Engineering
120 S. Shortridge Road
Indianapolis, Indiana 46219-0389

Re: Results of Subsurface Investigation and Geotechnical Engineering Evaluation
Roadway Rehabilitation
Eastbound US 40 from S. 3rd Street to S. 11th Street/ Main Street Intersection
Wayne Township, Wayne County, Richmond, Indiana
INDOT Project No. 0013790
Des No. 0013790
CTL Project No. 10IN202

Dear Mr. Khan:

Enclosed are the results of the Subsurface Investigation and Geotechnical Engineering Evaluation for the proposed Roadway Rehabilitation project on US 40 in Wayne Township, Wayne County, Indiana.

The purpose of this study was to obtain general subsurface information in the areas of the proposed improvements, and formulate the geotechnical parameters/recommendations relevant to the proposed design and construction. This report summarizes our findings, test results and resulting recommendations/opinions regarding the soil and groundwater conditions as they impact the proposed project.

We appreciate the opportunity to work with you on this project and look forward to serving as your Geotechnical Engineering Consultant on future projects. We would be pleased to discuss any questions you have about the contents of this report.

Respectfully Submitted,
Chicago Testing Laboratory, Inc.

Abdul Khalaf
Geotechnical Engineer

Christopher Chan, P.E.
Geotechnical Engineer

Attn: Mr. Reza Asadi, INDOT Office of Geotechnical Engineering

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The following 'Executive Summary' briefly outlines, for preliminary review only, the pertinent Geotechnical aspects of the proposed project. Additional discussion of each of these items is presented in the appropriate report section, which should not be separated from this Summary. The entire report text, inclusive of our understanding of the proposed project, as well as the appropriate limitations and qualifications, should be reviewed prior to incorporating these recommendations, to understand any special site preparation/modification which may be required to satisfy these recommendations (such as dewatering, subgrade preparation, unsuitable soil removal, compaction criteria, etc.).

Subsurface Conditions (See Report Section 3.3)

The roadway surface was covered with 1 to 12 inches of Asphalt. The Asphalt was generally underlain by 6 to 9 inches of Concrete except for RB-1, RB-2 and TS-4 where only Asphalt was encountered at the roadway surface. The near surface soils were generally granular at the western portion of the site from approximately Station No. 65+40 to Station No. 93+45 and predominantly cohesive at the east and north portions from approximately Station No. 71+00 to Station No. 99+50. The granular soils predominantly consisted of Very Loose to Dense Sand and Sand/Gravel. The predominant underlying cohesive soils consisted of Soft to Hard Silty Clay Loam, Silty Loam, Sandy Loam, Clay and Clay Loam. Exceptions were noted in RB-1, where apparent bedrock was encountered at 4 feet below the existing ground surface.

General Site and Subgrade Preparation (See Report Section 4.2.1)

It is very important to provide positive drainage during construction before the subgrade treatment is performed in order to avoid any wet soil conditions. Ditches/subsurface drains must be kept open at all times, and the subgrade should be graded at the end of each day, to facilitate good drainage.

Depending on the weather, some wet surface soil maybe encountered during construction. An undistributed quantity should be included in the contract that is equal to 15% of the subgrade area. This pay item can be used for improvement of existing foundation soils before subgrade treatment or embankment fill is placed (if needed).

Pavement Design: (See Report Section 4.3)

Subsurface drains with Filter Fabric are recommended only if they exist in the adjacent sections of the project area. The following Resilient Modulus table can be used for pavement design:

Pavement Design Considerations	
Resilient Modulus for Improved Subgrade	7,000 psi
Resilient Modulus for Existing Subgrade	4,000 psi
Subgrade Material	Silty Clay Loam, A-6
Depth of Water	Generally dry or at approximately 10 feet or deeper
Subgrade Treatment	Type "IA" (US 40)

Traffic Signals and Light Poles: (See Report Section 4.1)

Six signalized intersections consisting of 16 traffic signals and, are discussed in this report in addition to a number of light poles. The remaining structures consist of smaller storm sewers, manholes and sanitary pipes.

The bearing capacity analysis for the Traffic Signal and for lighting pole foundations is given in the text. Factored bearing resistance for foundation widths of 3 feet can be designed for **2,500 psf**. For details, please refer to the Summary of Geotechnical Parameters table in Bearing Capacity Analysis in Appendix B.

Groundwater control using sump pump or well points will be required during construction particularly at Structure Nos. 18, 22, 27, 33 and 57 where water was encountered at approximately 3 to 10 feet above the structure inverts. It will be the contractor responsibility to ensure a proper dewatering scheme is available prior to excavations.

Results of Subsurface Investigation and Geotechnical Engineering Evaluation
Roadway Rehabilitation
Eastbound US 40 from 3rd Street to S. 11th Street/Main Street Intersection
Wayne Township, Wayne County, Richmond, Indiana
INDOT Project No. 0013790
Des No. 0013790
CTL Project No. 10IN202

1.0 PROJECT INFORMATION

The purpose of this study was to (1) investigate the subsurface conditions to the depths penetrated by the Borings, (2) evaluate the engineering characteristics of the subsurface materials, and (3) provide information to assist in the design and construction of the proposed project.

The proposed project consists of roadway pavement replacements at Eastbound US 40 (SA Street) from 3rd Street to the Intersection of S. 11th Street and Main Street located in Wayne Township, Wayne County, Richmond, Indiana.

The beginning of the project starts at Station 65+30 Line "A" and ends at Station 99+55.22 Line "A".

The main elements of the project roadway rehabilitation include:

1) Replacement of existing roadway pavement and sidewalk concrete.

2) Replacement of 16 traffic signals at the intersections of EB US 40 at 5th Street, EB US 40 at 6th Street, EB US 40 at 7th Street, EB US 40 at 10th Street, EB US 40 at 11th Street and the intersection of 11th Street at Main Street.

3) Removal/Replacement of existing light poles.

4) Replacement/construction of storm/sanitary sewers including manholes ranging from 4 to 20 feet in depth.

See Section 4.1 for more detailed information and recommendations about the proposed structures.

Project specific information was obtained through review of a set of plan, profile and cross section sheets provided by INDOT in addition to contacts made with the INDOT geotechnical staff and First Group Engineering, Inc.

No significant grade changes are proposed, however, minimum cut and fill will be required during the roadway rehabilitation.

The general layout of the project and other site details are shown on the General Site Location Map and Boring Location Plan Map included in Appendix A of this report.

2.0 FIELD INVESTIGATION AND LAB TESTING

The field investigation program consisted of drilling 6 Roadway Borings (RB-1 through RB-6) drilled to depths of 5 to 10 feet and 6 Traffic Sign Borings (TS-1 through TS-6) drilled to depths of 20 feet below the existing ground surface. However, TS-6 was terminated at 10 feet below the surface. Some borings were relocated to avoid the presence of underground utility lines (See Appendix A, Boring Location Summary Table for details). The soil borings were performed with a truck mounted rotary drill rig using hollow stem augers.

The borings were located in the field by a representative from our office using the existing site features (i.e. roadways, fence lines, property lines or marker pins, power lines, topographic features, etc.) as references for measuring/pacing distances and approximating right angles. A map showing the approximate boring locations, 'Boring Location Plan Map', is included in Appendix A for your reference. This map is intended to provide the general locations of the borings with respect to other project features. It is not intended to be used for determining accurate boring locations. For detailed boring locations, please refer to the 'Boring Location Summary Table' also included in Appendix A.

Samples of the soils recovered from the soil borings were sealed in jars and brought to our laboratory for review and classification testing. The soil samples were visually classified under the supervision of a Geotechnical Engineer based upon texture, grain size, color, moisture condition and plasticity in general conformance with the AASHTO Soil Classification System and relevant information contained in the INDOT Standard Specifications (ISS, 2010 Ed.). Once classification testing was completed, select samples were then tested for a variety of index/engineering properties. The tests typically performed include: calibrated hand penetrometer tests (approximation of the unconfined compressive strength), in-situ moisture content (AASHTO T265), grain size distribution (AASHTO T88), pH (ASTM D2976), organic content (AASHTO T267), Atterberg limits (AASHTO T89 & T90), unconfined compressive strength (AASHTO T208). Standard Proctor (AASHTO T99) and a Resilient Modulus (AASHTO T307) tests were performed by INDOT.

The results of all laboratory tests are shown either on the Boring Logs in Appendix A or in the appropriate section of Appendix B. On the Boring Logs, the field and laboratory results are plotted next to the soil types they represent. Similar soil types are grouped into main strata. The stratification lines designate the estimated/approximate interface between similar materials; in-situ transitions may be more gradual.

Elevations given on the Boring Logs are based on the boring locations, and an interpolation of the topographic (elevation) contours shown on the project plans and cross sections provided to us for this work.

3.0 SUMMARY OF FINDINGS

3.1 Geology (Central Indiana)

The general surface topography across central Indiana is relatively flat to gently rolling. Most of the relief across the area is developed by glacially deposited moraines and eskers, and along more recent alluvial features such as streams and rivers.

The surficial geology of central Indiana includes mostly till plains of Wisconsinan age (approximately 22,000 years ago) overlying older Illinoian age tills. The soils comprising the tills
are typically stiff to very stiff, low to moderate plasticity, silts and clays with minor (although varying) amounts of sand and gravel. Occasional isolated areas of concentrated sand & gravel can be found typically associated with moraine type deposits that have fluvial characteristics.

Superimposed on the till plains are recent age fluvial deposits associated with modern rivers and streams. The soils comprising the recent fluvial deposits vary from predominantly sand and gravel in the channel proper, to silts and clays in the terrace areas.

The bedrock geology of Indiana changes as you move from west to east across the state. The youngest rocks (Pennsylvanian age) are found in the western part of the state, with the oldest (Ordovician age) being found in the east. The bedrock lithology typically consists of soft, sedimentary rocks such as Shale, weathered or argillaceous Limestone and occasional Sandstone, to medium hard sedimentary rocks such as Dolomite. The depth to bedrock increases across the central portion of the state from west to east, typically ranging from 50 to 100 feet in the west, to 200 feet in portions of the eastern part of the state.

3.2 Site Conditions

Eastbound US 40 consists of 3 lanes, asphalt paved (12 foot wide each). Concrete curbs and concrete sidewalks were noted along the roadway pavement. The existing ground surface at the project area is relatively flat. The general surface drainage is directed toward the municipal sewers.

Surface elevations along the existing roadway centerline of the project are approximately at 969 to 982 feet above mean sea level (AMSL).

3.3 Subsurface Conditions

This section presents a 'generalized' description of the subsurface conditions encountered by the Borings. For more detailed information at a specific location, please refer to the Boring Logs in Appendix A.

The roadway surface was covered with 1 to 12 inches of Asphalt. The Asphalt was generally underlain by 6 to 9 inches of Concrete except for RB-1, RB-2 and TS-4 where only Asphalt was encountered at the roadway surface. The near surface soils were generally granular at the western portion of the site from approximately Station No. 65+40 to Station No. 93+45 and predominantly cohesive at the east and north portions from approximately Station No. 71+00 to Station No. 99+50. The granular soils predominantly consisted of Very Loose to Dense Sand and Sand/Gravel. The predominant underlying cohesive soils consisted of Soft to Hard Silty Clay Loam, Silty Loam, Sandy Loam, Clay and Clay Loam. Exceptions were noted in RB-1, where apparent bedrock was encountered at 4 feet below the existing ground surface.

For more detailed information, please refer to the tables of Summary of Classification Test Results and Summary of Special Laboratory Tests in Appendix B.

3.4 Groundwater Conditions

Short-term groundwater levels were monitored during the drilling operations, at the end of drilling and 24 hours after completion. The groundwater conditions are summarized in the table below. Cave in depths are provided on the Boring Logs in Appendix A.

Summary Table of Groundwater Conditions:

Boring No.	During Drilling (feet)	End of Drilling (feet)	24 Hour Reading (feet)	Groundwater Elevation (feet)	Approximate Lighting Pole Foundation Elevation (feet)
RB-1	Dry	Dry	Dry	-	964
RB-2	Dry	Dry	-	-	968
RB-3	Dry	Dry	-	-	N/A
RB-4	Dry	Dry	-	-	970
RB-5	Dry	Dry	-	-	971
RB-6	Dry	Dry	Dry	-	N/A

Summary of Groundwater Conditions: Continued

Boring No.	During Drilling (feet)	End of Drilling (feet)	24 Hour Reading (feet)	Groundwater Elevation (feet)	Approximate Traffic Signal Foundation Elevation (feet)
TS-1	Dry	Dry	-	-	964-968
TS-2	11	11	10	959	957-961
TS-3	Dry	Dry	Dry	-	962-966
TS-4	Dry	Dry	Dry	-	966970
TS-5	13.5	13	13	968	969-973
TS-6	Dry	Dry	-	-	970-974

This information along with other interpreting factors, such as the soils moisture condition, soil color change from brown to gray (often used as an indirect indicator of long term groundwater), etc., were used to formulate our opinions and recommendations regarding the anticipated groundwater seepage conditions.

Fluctuations in the long-term groundwater levels are normal and will change throughout the year based upon variations in precipitation, evaporation, surface runoff and other developments in the area. The groundwater levels discussed herein and indicated on the Boring Logs represent the conditions at the time the measurements were obtained.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Our conclusions and recommendations can obviously only be based on the information known to us at the time of this writing; e.g. the project information outlined above and the field/laboratory test results (presented on the Boring Logs in Appendix A). If the proposed scope of the project, such as project limits, finished grade elevations, loading conditions, basic assumptions, etc., are different than those stated, or if conditions encountered during construction differ from those summarized herein, the INDOT Geotechnical Section should be contacted for further recommendations.

4.1 Traffic Signals and Light Poles

There are a total of 8 signalized intersections located on the site, however, only six intersections consisting of 16 traffic signals are included in this project.

The traffic signals are located at the intersections of EB US 40 at 5th Street, EB US 40 at 6th Street, EB US 40 at 7th Street, EB US 40 at 10th Street, EB US 40 at 11th Street and the intersection of 11th Street at Main Street. The other two sets of traffic signals are located at 8th and 9th streets and are part of another ongoing project.

The traffic signal pole foundations are expected to be 3 feet in diameter and will extend approximately 8 feet to12 feet below the existing ground surface.

The following table includes structure information and soil conditions at the approximate traffic signal foundation elevations:

Soil Condition Table at Foundation Inverts

Signal Location	Station No.	Boring No.	Water Elevation (feet)	Foundation Invert Elevation (feet)	Soil Condition at Foundation Invert
EB US 40 at 5th Street	71+50	TS-1	Dry	964	Medium Dense Sand and Gravel A-2-4 to Very Stiff Clay (A-6)
EB US 40 at 6th Street	74+30	TS-2	959	957	Dense Sand (A-3)
EB US 40 at 7th Street	79+40	TS-3	Dry	962	Medium Stiff to Very Soft Sandy Loam (A-2-6)
EB US 40 at 10th Street	89+25	TS-4	Dry	966	Dense Sand (A-3)
EB US 40 at 11th Street	93+45	TS-5	962	969	Soft Silty Clay Loam (A-6)
11th Street at Main Street	99+50	TS-6	Dry	970	Stiff Silty Clay Loam (A-6)

Soil conditions at the approximate traffic sign invert elevations consisted of Medium Dense to Dense Sand/Gravel and Soft to Very Stiff Clay, maybe inadequate for support at some locations. Extended shafts maybe required where the Soft Sandy Loam and Silty Clay Loam were encountered at the intersections of EB US 40 at 7th Street and EB US 40 at 11th Street. Foundations should be extended slightly deeper to bear on Stiff Silty Loam and Dense Sand.

Number of light poles removal/replacement along east bound US 40 are included in the project. The street lighting pole foundations will extend approximately to 6 feet below the existing ground surface. Soil conditions at the approximate traffic sign invert elevations were Medium Dense Sand/Gravel and Soft Silty Clay Loam to Very Stiff Clay. The Soft Silty Clay Loam was encountered in RB-4 located just east of 8th Street. However, the pole shaft should be extended to the Dense Sand encountered at 8 feet below the surface.

The remaining subgrade soils at the invert elevations of the other traffic signals and lighting poles generally consisted of Medium Dense to Dense Sand/Gravel and Stiff to Very Stiff Clay and Silty Clay Loam. These Soils are generally considered adequate for support.

The bearing capacity analysis for the Traffic Signal and for lighting pole foundations is given in the text. Factored bearing resistance for foundation widths of 3 feet can be designed for **2,500 psf**. For details, please refer to the Summary of Geotechnical Parameters table in Section 4.1.2 and Bearing Capacity Analysis in Appendix B.

Groundwater control using sump pump or well points will be required during sign replacement at the location of EB US 40 at 6th Street where water was encountered at approximately 2 feet above the structure inverts. It will be the contractor responsibility to ensure a proper dewatering scheme is available prior to excavations.

4.1.1 Construction Recommendations

All the soils surrounding the drainage pipes and box culverts should be compacted to at least 95% of the maximum dry density as determined in accordance with Section 203.24 of the Indiana Department of Transportation Special Specifications. If 95% of the maximum dry density cannot be obtained at the bottom of the excavation, or in other areas, or if soft soils are encountered at depths that make removal impractical, the Geotechnical Engineering Section should be contacted for further recommendations.

The drainage structures should be properly encased. The Type 2 Structure Backfill per Section 904 should be placed around the pipe in uniform layers, not exceeding 6 inches thickness, and mechanically compacted thoroughly in layers simultaneously on each sided of the structure.

When the level of fill reaches the top of the structure, two lifts should be carefully spread and hand compacted over the pipes without traversing the structure with heavy equipment. The Type 2 Structure Backfill per Section 904 should be compacted to at least 95% of the Indiana Department of Transportation Standard Specifications. Compaction with heavy equipment should not begin until a minimum of two lifts has been placed, hand compacted, and tested. The compaction equipment should traverse the drainage structure perpendicular to the axis.

It is important to protect the drainage pipes during construction because maximum strength does not develop until the fill consolidates. To avoid imposing concentrated loads far in excess of those in which the drainage structure would normally carry, heavy construction equipment should not cross the drainage structure prematurely. Also, heavy vehicles moving too close to the walls of the drainage pipe can create an eccentric loading with potential harmful results.

The operation of equipment over the structure shall be in accordance with the recommendations of the pipes and box culverts manufacturer.

4.2 Roadway

4.2.1 General Site and Subgrade Preparation

The existing ground surface at and around the US 40 Project area consists primarily of asphalt overlying concrete pavement, curbs and concrete sidewalks. Generally, the site consists of commercial and residential areas.

Roadway Improvements: The roadway improvements at the site consist mainly of roadway resurfacing, small drainage pipes and traffic signal/light pole replacements. Soils encountered in the upper 2 feet that contain any Organic Matter should be removed and replaced with B Borrow or No. 53 aggregate.

The predominant near surface soil type of the roadway consisted of Loose to Dense Sand and Gravel and Soft to Very Stiff Clay, Silty Loam, Clay Loam and Silty Clay Loam,. The exposed cohesive soils should be proofrolled with a heavy rubber tired vehicles and the granular soils should be rolled with heavy vibratory rollers. If any soft soils or other unsuitable soils are encountered which cannot be readily proofrolled, they should be removed and replaced with B Borrow or No. 53 aggregate as discussed later on in this section.

It is very important to provide positive drainage during construction before the subgrade treatment is performed in order to avoid any wet soil conditions. Ditches/subsurface drains must be kept open at all times, and the subgrade should be graded at the end of each day, to facilitate good drainage.

Depending on the weather, some wet surface soil maybe encountered during construction. An undistributed quantity should be included in the contract that is equal to 15% of the subgrade area. This pay item can be used for improvement of existing foundation soils before subgrade treatment or embankment fill is placed (if needed).

General Subgrade Preparation: The existing Asphalt and underlying Concrete pavement should be completely removed.

Once the Asphalt and Concrete are removed, subgrade preparation should consist of proofrolling and/or a thorough evaluation by the Geotechnical Engineer. Proofrolling should consist of several passes over the subgrade surface with equipment as indicated in ISS Section 203.26. Any areas which deflect, rut or pump excessively during proofrolling, should be undercut to a maximum depth of 2 feet and replaced with B Borrow or No. 53 Aggregate.

Even stable subgrade materials, if exposed to a combination of wet weather and construction traffic, will deteriorate. If these soils are allowed to become saturated, and subsequently exposed to construction traffic, by repeated passes with rubber tired equipment, softening of the subgrade soils will occur. If construction is planned for wet weather months, subgrade stability may be marginal. Care exercised by the contractor to minimize construction traffic following rainfall will reduce these types of problems. Problems with these soils should be minimal during dry weather.

4.2.2 Roadway Cut/Fill Sections

Cut Sections: Minimal roadway cuts for US 40 are required due to the proposed roadway rehabilitation.

The contractor should plan and prepare his excavation activities to comply with all local, state and federal regulations. OSHA requirements should be followed. These general observations must be confirmed, or modified, by the contractors' competent person responsible for excavation safety.

Fill Sections: Minor fill will be required to achieve the designed grade during roadway resurfacing. The proposed roadway grade will generally be close to the existing grade.

Prior to any fill placement, the subgrade should be prepared as outlined in Section 4.2.1 "General Site & Subgrade Preparation" section of this report. (Also reference ISS Section 203.09).

Finished grade fill areas should be sloped, and 'sealed off smooth' with rubber tired equipment at the end of each day to allow for efficient surface drainage. If a lengthy period of time occurs between the initial site preparation proofroll, and the placement of the final structural elements (i.e. base course aggregate and/or asphalt), proofrolling may be required again to insure that no soft or unstable spots have developed since the initial evaluation.

4.2.3 Groundwater and Dewatering Considerations

Short-term groundwater levels were monitored during the drilling operations, at the end of drilling and 24 hours after completion. The position of water levels found in test borings normally vary with seasonal precipitation and runoff. Surface or seepage water in excavations should be removed to minimize softening and disturbance of the subgrade. Conventional sump and pump may not be enough to remove groundwater infiltration at some structures. It will be contractor responsibility to ensure a proper dewatering scheme is available prior to excavations.

4.3 Pavement Design

The 2012 average daily traffic (A.A.D.T.) volume at EB US 40 from 3rd to 11th Streets is 16,739 vehicles per day (V.P.D.) and 2,286 VPD at EB US 40 from S. A Street to Main Street. The 2032 average daily traffic volume is projected to be, 20,425 VPD and 2,789 VPD respectively. A thorough sub-grade evaluation should be performed in all pavement areas in accordance with Section 4.2.1 "General Site & Subgrade Preparation" section of this report. Preparation of the pavement subgrade should consist of stripping, proofrolling, and excavation and replacement of unsuitable subgrade soils. Once firm and stable subgrade has been confirmed, suitable engineered fill material may be placed and compacted up to finished grades, if required. If possible, surface grades should be such that surface runoff is quickly conveyed to drainage facilities; a minimum grade of 4-8% is recommended. Subgrade Treatment Type "IA" is recommended for pavement design along US 40.

The following parameters are recommended for pavement design:

Pavement Design Considerations	
Resilient Modulus for Improved Subgrade	7,000 psi
Resilient Modulus for Existing Subgrade	4,000 psi
Subgrade Material	Silty Clay Loam, A-6
Depth of Water	Generally dry or at approximately 10 feet or deeper
Subgrade Treatment	Type "IA" (US 40)

5.0 CLOSING REMARKS

Chicago Testing Laboratory, Inc. has planned and supervised the geotechnical engineering services, has evaluated the findings, and has prepared this report in accordance with generally accepted geotechnical engineering practices. The recommendations presented in this report are based on information disclosed by a limited number of Borings. The Boring information must be extrapolated to estimate the subsurface conditions occurring over the entire site. No other warranties, either

expressed or implied, are made concerning this report. If the scope of the project is changed or other than stated, we should be advised of the changes so the conclusions and recommendations presented in this report can be revised.

We respectfully request Chicago Testing Laboratory's continued involvement is this project to insure the enclosed recommendations have been properly interpreted and incorporated into the project plans and specifications by reviewing project specifications and grading & site drainage plans.

APPENDIX A

RESULTS OF FIELD INVESTIGATION

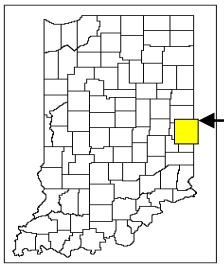
General Site Location Map (1 page)

Boring Location Plan Map (1 page)

Boring Location Summary Table (1 page)

Boring Logs (12 pages)

General Notes – AASHTO (1 page)



Project Location

N

GENERAL SITE LOCATION MAP
Roadway Rehabilitation of East Bound US 40
From S. Third Street to E. Main Street
Wayne County, Wayne Township, Richmond, Indiana
Des # 0013790
INDOT Project # 0013790
CTL Project No. 10IN202

Figure No. 1

BORING LOCATION PLAN MAP

Roadway Rehabilitation of East Bound US 40
From S. Third Street to E. Main Street
Wayne County, Wayne Township, Richmond, Indiana
Des # 0013790
INDOT Project # 0013790
CTL Project No. 10IN202

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Figure No. 2

BORING LOCATION SUMMARY TABLE

Roadway Rehabilitation of East Bound US 40
From S. Third Street to E. Main Street
Wayne Township, Wayne County, Richmond, Indiana
Des # 0013790
CTL Project No. 10IN202

Boring	Station	Offset	Line	Depth	Rig Type	Boring Elevation	Remarks
RB-1	65+40	15' Right	"A"	5'	Truck	970'	Relocated due to the presence of Utilities
RB-2	68+20	15' Right	"A"	10'	Truck	974'	
RB-3	77+00	15' Right	"A"	7.5'	Truck	972	
RB-4	83+00	15' Right	"A"	10'	Truck	976	
RB-5	86+25	15' Right	"A"	10'	Truck	977'	
RB-6	96+00	12' Right	"A"	7.5'	Truck	981'	Relocated due to the presence of Utilities
TS-1	71+50	15' Right	"A"	20'	Truck	976'	
TS-2	74+30	30' Right	"A"	20'	Truck	969'	
TS-3	79+40	15' Right	"A"	20'	Truck	974'	
TS-4	89+25	35' Right	"A"	20'	Truck	978'	
TS-5	93+45	12' Right	"A"	20'	Truck	981'	Relocated due to the presence of Utilities
TS-6	99+50	6' Right	"A"	10'	Truck	982'	Relocated due to the presence of Utilities

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BORING LOG

BORING NO.: **RB-1**
SHEET 1 OF 1
LATITUDE :
LONGITUDE :
DATUM :
DATE STARTED : 04-21-10
DATE COMPLETED : 04-21-10

ROUTE # : US 40 COUNTY : Wayne
PROJECT TYPE : Roadway Widening
LOCATION : Eastbound Us 40 Third Street To Eleventh Street, Richmond, Indiana
DES NO. : 0013790 PROJECT NO.: 0013790

ELEVATION	: 970.0	BORING METHOD	: HSA	HAMMER	: Auto
STATION	: 65+40	RIG TYPE	: Truck	DRILLER/INSP	: CTL
OFFSET	: 15.0 ft Right	CASING DIA.	: 3 1/4	TEMPERATURE	: 65 °F
LINE	: 'A'	CORE SIZE	:	WEATHER	: Sunny
DEPTH	: 5.0 ft				

GROUNDWATER: ▽ Encountered at Dry ▼ At completion Dry ▼ Dry After 24 hours

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI	REMARKS
969.0		**Asphalt**. 1.0				3.7					
	2.5	**Sand and Gravel**, **A-2-4**, Dark Brown, Moist, Loose, With Trace Of Organic Matter, (RB-3, SS-2).	SS 1	4 4 3	40	7.1					
967.0		3.0									
		Sand and Gravel, **A-2-4**, Brown, Moist, Dense, (RB-3, SS-2).	SS 2	11 15 11	80						
966.0		4.0									
		Limestone Moist, Slightly Weathered, (Visual).									
965.0	5.0	5.0									5.0, Refusal At 5', Rock Encountered At 4'
		Bottom of Boring at 5.0 ft									
	7.5										
	10.0										

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BORING LOG

BORING NO.: **RB-2**
SHEET 1 OF 1
LATITUDE :
LONGITUDE :
DATUM :
DATE STARTED : 04-22-10
DATE COMPLETED : 04-22-10

ROUTE # : US 40 COUNTY : Wayne
PROJECT TYPE : Roadway Widening
LOCATION : Eastbound Us 40 Third Street To Eleventh Street, Richmond, Indiana
DES NO. : 0013790 PROJECT NO.: 0013790

ELEVATION	: 974.0	BORING METHOD	: HSA	HAMMER	: Auto
STATION	: 68+20	RIG TYPE	: Truck	DRILLER/INSP	: CTL
OFFSET	: 15.0 ft Right	CASING DIA.	: 3 1/4	TEMPERATURE	: 65 °F
LINE	: 'A'	CORE SIZE	:	WEATHER	: Sunny
DEPTH	: 10.0 ft				

GROUNDWATER: ▽ Encountered at Dry ▼ At completion Dry

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI	REMARKS
973.1		**Asphalt**. 0.9									
			SS 1	16 6 5	100	7.0					
	2.5		SS 2	4 2 3	80	7.0					
	5.0	**Sand and Gravel**, **A-2-4**, Brown, Moist, Loose To Medium Dense, (RB-3, SS-2).									
			SS 3	10 15 10	80	3.9					
	7.5										
			SS 4	5 8 9	100	4.6					
964.0	10.0	10.0									
		Bottom of Boring at 10.0 ft									

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BORING LOG

BORING NO.: **RB-3**
SHEET 1 OF 1
LATITUDE :
LONGITUDE :
DATUM :
DATE STARTED : 04-22-10
DATE COMPLETED : 04-22-10

ROUTE # : US 40 COUNTY : Wayne
PROJECT TYPE : Roadway Widening
LOCATION : Eastbound Us 40 Third Street To Eleventh Street, Richmond, Indiana
DES NO. : 0013790 PROJECT NO.: 0013790

ELEVATION	: 972.0	BORING METHOD	: HSA	HAMMER	: Auto
STATION	: 77+00	RIG TYPE	: Truck	DRILLER/INSP	: CTL
OFFSET	: 15.0 ft Right	CASING DIA.	: 3 1/4	TEMPERATURE	: 65 °F
LINE	: 'A'	CORE SIZE	:	WEATHER	: Sunny
DEPTH	: 7.5 ft				

GROUNDWATER: Encountered at Dry At completion Dry Caved in at 4.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI	REMARKS
971.7		**Asphalt**. 0.3									
		Concrete, Moist.									
971.0		1.0				11.5					
	2.5	**Silty Clay Loam**, **A-7-6**, Brown, Moist, Medium Stiff, With Trace Of Gravel, (RB-6, SS-1).	SS 1	5 4 5	80	5.0		NP	NP	NP	
969.0		3.0									
	5.0	**Sand and Gravel**, **A-2-4(0)**, Brown, Moist, Very Loose, (RB-3, SS-2).	SS 2	3 3 3	100	8.3					
			SS 3	6 2 2	100						
964.5	7.5	7.5									
		Bottom of Boring at 7.5 ft									

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BORING LOG

BORING NO.: **RB-4**
SHEET 1 OF 1
LATITUDE :
LONGITUDE :
DATUM :
DATE STARTED : 04-22-10
DATE COMPLETED : 04-22-10

ROUTE # : US 40 COUNTY : Wayne
PROJECT TYPE : Roadway Widening
LOCATION : Eastbound Us 40 Third Street To Eleventh Street, Richmond, Indiana
DES NO. : 0013790 PROJECT NO.: 0013790

ELEVATION	: 976.0	BORING METHOD	: HSA	HAMMER	: Auto
STATION	: 83+00	RIG TYPE	: Truck	DRILLER/INSP	: CTL
OFFSET	: 15.0 ft Right	CASING DIA.	: 3 1/4	TEMPERATURE	: 65 °F
LINE	: 'A'	CORE SIZE	:	WEATHER	: Sunny
DEPTH	: 10.0 ft				

GROUNDWATER: ▽ Encountered at Dry ▼ At completion Dry

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI	REMARKS
975.7		**Asphalt**. 0.3									
975.0		**Concrete**, Moist. 1.0				7.5					
	2.5		SS 1	3 6 8	60	13.6					
			SS 2	2 2 5	60						
	5.0	**Silty Clay Loam**, **A-7-6**, Gray, Moist, Stiff To Soft, With Trace Of Gravel, (RB-6, SS-1).				10.7					
	7.5		SS 3	3 2 3	60						
968.0		8.0				7.0					
		Sand and Gravel, **A-2-4(0)**, Gray, Dense, (RB-3, SS-2).	SS 4	21 13 10	100						
966.0	10.0	10.0									
		Bottom of Boring at 10.0 ft									

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BORING LOG

BORING NO.: **RB-5**
SHEET 1 OF 1
LATITUDE :
LONGITUDE :
DATUM :
DATE STARTED : 04-21-10
DATE COMPLETED : 04-21-10

ROUTE # : US 40 COUNTY : Wayne
PROJECT TYPE : Roadway Widening
LOCATION : Eastbound Us 40 Third Street To Eleventh Street, Richmond, Indiana
DES NO. : 0013790 PROJECT NO.: 0013790

ELEVATION	: 977.0	BORING METHOD	: HSA	HAMMER	: Auto
STATION	: 86+25	RIG TYPE	: Truck	DRILLER/INSP	: CTL
OFFSET	: 15.0 ft Right	CASING DIA.	: 3 1/4	TEMPERATURE	: 65 °F
LINE	: 'A'	CORE SIZE	:	WEATHER	: Sunny
DEPTH	: 10.0 ft				

GROUNDWATER: ▽ Encountered at Dry ▼ At completion Dry

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI	REMARKS
976.7		**Asphalt**. 0.3									
976.2		**Concrete**. 0.8									
			SS 1	4 3 3	40	5.1					
	2.5	**Sand and Gravel**, **A-2-4(0)**, Brown, Moist, Loose, (RB-3, SS-2).				4.3					
			SS 2	3 2 4	50						
972.0	5.0	5.0									
			SS 3	7 19 12	100	11.8					
	7.5	**Clay**, **A-6**, Dark Brown To Black, Moist, Very Stiff, (TS-1, SS-6).				16.3	4.63				
			SS 4	6 9 14	100						
967.0	10.0	10.0									
		Bottom of Boring at 10.0 ft									

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BORING LOG

BORING NO.: **RB-6**
SHEET 1 OF 1
LATITUDE :
LONGITUDE :
DATUM :
DATE STARTED : 04-22-10
DATE COMPLETED : 04-22-10

ROUTE # : US 40 COUNTY : Wayne
PROJECT TYPE : Roadway Widening
LOCATION : Eastbound Us 40 Third Street To Eleventh Street, Richmond, Indiana
DES NO. : 0013790 PROJECT NO.: 0013790

ELEVATION	: 981.0	BORING METHOD	: HSA	HAMMER	: Auto
STATION	: 96+00	RIG TYPE	: Truck	DRILLER/INSP	: CTL
OFFSET	: 12.0 ft Right	CASING DIA.	: 3 1/4	TEMPERATURE	: 65 °F
LINE	: 'A'	CORE SIZE	:	WEATHER	: Sunny
DEPTH	: 7.5 ft				

GROUNDWATER: ▽ Encountered at Dry ▼ At completion Dry ▼ Dry After 24 hours

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI	REMARKS
980.7		**Asphalt**, LOI=2.1%. 0.3									
980.2		**Concrete**. 0.8									
		Silty Clay Loam, **A-7-6**, Brown, Moist, Soft To Medium Stiff, With Trace Of Gravel, (RB-6, SS-1).	SS 1	2 2 4	100	26.9		43	17	26	
	2.5					27.3					
978.0		3.0									
			SS 2	2 2 3	100						
	5.0	**Clay**, **A-6**, Grayish Brown, Moist, Soft To Medium Stiff, (TS-1, SS-6).				12.6					
			SS 3	2 4 6	100						
973.5	7.5	7.5									
		Bottom of Boring at 7.5 ft									

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BORING LOG

BORING NO.: **TS-1**
SHEET 1 OF 1
LATITUDE :
LONGITUDE :
DATUM :
DATE STARTED : 04-21-10
DATE COMPLETED : 04-21-10

ROUTE # : US 40 COUNTY : Wayne
PROJECT TYPE : Roadway Widening
LOCATION : Eastbound Us 40 Third Street To Eleventh Street, Richmond, Indiana
DES NO. : 0013790 PROJECT NO.: 0013790

ELEVATION	976.0	BORING METHOD	HSA	HAMMER	Auto
STATION	71+50	RIG TYPE	Truck	DRILLER/INSP	CTL
OFFSET	30.0 ft Right	CASING DIA.	3 1/4	TEMPERATURE	65 °F
LINE	'A'	CORE SIZE		WEATHER	Sunny
DEPTH	20.0 ft				

GROUNDWATER: Encountered at Dry At completion Dry Caved in at 10.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI	REMARKS
975.7		**Asphalt**, (Visual). 0.3									
975.0		**Concrete**. 1.0									
	2.5	**Silty Clay Loam**, **A-7-6**, Dark Brown, Moist, Medium Dense, With Trace Of Gravel, (RB-6, SS-1).	SS 1	12 15 12	80	5.5					
973.0		3.0	SS 2	12 13 16	80	4.1					
	5.0										
	7.5	**Sand and Gravel**, **A-2-4**, Brown, Moist, Loose To Medium Dense, (RB-3, SS-2).	SS 3	5 5 6	100	5.4					
	10.0		SS 4	5 4 6	100	8.3					
964.0		12.0									
	12.5										
	15.0	**Clay**, **A-6(11)**, Dark Gray To Gray, Wet, Very Stiff, (TS-1, SS-6).	SS 5	12 12 12	80	12.0					
	17.5										
956.0	20.0	20.0	SS 6	5 10 11	100	17.1	6.31	37	19	18	
		Bottom of Boring at 20.0 ft									

INDOT BORING LOG 10IN202 US 40.GPJ IN_DOT1.GDT 6/7/10

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BORING LOG

BORING NO.: **TS-2**
SHEET 1 OF 1
LATITUDE :
LONGITUDE :
DATUM :
DATE STARTED : 04-23-10
DATE COMPLETED : 04-23-10

ROUTE # : US 40 COUNTY : Wayne
PROJECT TYPE : Roadway Widening
LOCATION : Eastbound Us 40 Third Street To Eleventh Street, Richmond, Indiana
DES NO. : 0013790 PROJECT NO.: 0013790

ELEVATION	: 969.0	BORING METHOD	: HSA	HAMMER	: Auto
STATION	: 74+30	RIG TYPE	: Truck	DRILLER/INSP	: CTL
OFFSET	: 25.0 ft Right	CASING DIA.	: 3 1/4	TEMPERATURE	: 65 °F
LINE	: 'A'	CORE SIZE	:	WEATHER	: Partly Sunny
DEPTH	: 20.0 ft				

GROUNDWATER: ▽ Encountered at 11.0 ft ▼ At completion 11.0 ft ▼ 10.0 ft After 24 hours

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI	REMARKS
968.7		**Asphalt**. 0.3									
968.0		**Concrete**. 1.0				15.7					
	2.5	**Silty Clay Loam**, **A-6**, Gray, Moist, Very Soft To Soft, (TS-4, SS-2).	SS 1	3 3 2	80						
			SS 2	1 2 1	60	19.4					
	5.0										
963.0		6.0				11.4					
	7.5		SS 3	7 11 10	100						
			SS 4	5 14 17	100	11.3					
	10.0 ▼	**Sand**, **A-3(0)**, Gray, Moist To Wet, Medium Dense To Dense, With Trace Of Gravel, (TS-2, SS-5).									
	12.5										
			SS 5	10 20 27	100	21.4		NP	NP	NP	
	15.0										
953.5		15.5									
	17.5	**Silty Loam**, **A-4(3)**, Gray, Moist, Hard, (TS-2, SS-6).									
			SS 6	10 22 31	100	21.7	7.15	22	15	7	
949.0	20.0	20.0									
		Bottom of Boring at 20.0 ft									

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BORING LOG

BORING NO.: **TS-3**
SHEET 1 OF 1
LATITUDE :
LONGITUDE :
DATUM :
DATE STARTED : 04-22-10
DATE COMPLETED : 04-22-10

ROUTE # : US 40 COUNTY : Wayne
PROJECT TYPE : Roadway Widening
LOCATION : Eastbound Us 40 Third Street To Eleventh Street, Richmond, Indiana
DES NO. : 0013790 PROJECT NO.: 0013790

ELEVATION	: 974.0	BORING METHOD	: HSA	HAMMER	: Auto
STATION	: 79+40	RIG TYPE	: Truck	DRILLER/INSP	: CTL
OFFSET	: 15.0 ft Right	CASING DIA.	: 3 1/4	TEMPERATURE	: 65 °F
LINE	: 'A'	CORE SIZE	:	WEATHER	: Sunny
DEPTH	: 20.0 ft				

GROUNDWATER: Encountered at Dry; At completion Dry; Dry After 24 hours; Caved in at 11.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI	REMARKS
973.7		**Asphalt**. 0.3									
973.0		**Concrete**. 1.0									
	2.5		SS 1	6 3 5	80	5.0					
			SS 2	3 3 3	60	8.6					
	5.0										
		Sandy Loam, **A-2-6(0)**, Brown, Moist To Wet, Medium Stiff To Very Soft, With Trace Of Gravel, (TS-3, SS-4).	SS 3	2 1 2	60	9.4					
	7.5										
			SS 4	2 1 2	60	12.0		25	13	12	
	10.0										
961.5	12.5	12.5									
			SS 5	3 6 6	100	12.9					
	15.0										
		Silty Loam, **A-4(3)**, Gray, Moist, Stiff To Very Stiff, (TS-2, SS-6).									
	17.5										
			SS 6	8 9 12	100	11.1					
954.0	20.0	20.0									
		Bottom of Boring at 20.0 ft									

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BORING LOG

BORING NO.: **TS-4**
SHEET 1 OF 1
LATITUDE :
LONGITUDE :
DATUM :
DATE STARTED : 04-22-10
DATE COMPLETED : 04-22-10

ROUTE # : US 40 COUNTY : Wayne
PROJECT TYPE : Roadway Widening
LOCATION : Eastbound Us 40 Third Street To Eleventh Street, Richmond, Indiana
DES NO. : 0013790 PROJECT NO.: 0013790

ELEVATION	: 978.0	BORING METHOD	: HSA	HAMMER	: Auto
STATION	: 89+25	RIG TYPE	: Truck	DRILLER/INSP	: CTL
OFFSET	: 35.0 ft Right	CASING DIA.	: 3 1/4	TEMPERATURE	: 65 °F
LINE	: 'A'	CORE SIZE	:	WEATHER	: Sunny
DEPTH	: 20.0 ft				

GROUNDWATER: ▽ Encountered at Dry ▼ At completion Dry ▼ Dry After 24 hours

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI	REMARKS
977.5		**Asphalt**. 0.5									
977.0		**Gravel**, Brown, Moist. 1.0				22.9					
	2.5	**Silty Clay Loam**, **A-6(13)**, Brown, Moist, Soft, (TS-4, SS-2).	SS 1	2 2 2	100						
			SS 2	2 2 3	80	36.6		38	19	19	
972.5	5.0	5.5									
	7.5		SS 3	6 21 29	50	7.3					
	10.0		SS 4	7 16 27	100	12.5					
	12.5	**Sand**, **A-3(0)**, Dark Reddish Brown, Moist, Dense, With Trace Of Gravel, (TS-2, SS-5).									
	15.0		SS 5	43 22 19	100	4.9					
	17.5										
960.0		18.0									
		Silty Loam, **A-4(3)**, Gray, Moist, Very Stiff, (TS-2, SS-6).	SS 6	15 23 17	100	7.2					
958.0	20.0	20.0									
		Bottom of Boring at 20.0 ft									

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BORING LOG

BORING NO.: **TS-5**
SHEET 1 OF 1
LATITUDE :
LONGITUDE :
DATUM :
DATE STARTED : 04-23-10
DATE COMPLETED : 04-23-10

ROUTE # : US 40 COUNTY : Wayne
PROJECT TYPE : Roadway Widening
LOCATION : Eastbound Us 40 Third Street To Eleventh Street, Richmond, Indiana
DES NO. : 0013790 PROJECT NO.: 0013790

ELEVATION	: 981.0	BORING METHOD	: HSA	HAMMER	: Auto
STATION	: 93+45	RIG TYPE	: Truck	DRILLER/INSP	: CTL
OFFSET	: 12.0 ft Right	CASING DIA.	: 3 1/4	TEMPERATURE	: 65 °F
LINE	: 'A'	CORE SIZE	:	WEATHER	: Sunny
DEPTH	: 20.0 ft				

GROUNDWATER: ▽ Encountered at 13.5 ft ▼ At completion 13.0 ft ▼ 13.0 ft After 24 hours

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI	REMARKS
980.7		**Asphalt**. 0.3									
980.1		**Concrete**. 0.9									
	2.5		SS 1	3 3 4	100	22.4					
			SS 2	3 3 3	100	12.5					
	5.0										
	7.5	**Silty Clay Loam**, **A-6**, Brown, Moist, Soft To Medium Stiff, (TS-4, SS-2).	SS 3	2 3 2	100	12.2					
	10.0		SS 4	2 2 2	100	12.9					
	12.5										
967.5 ▽		13.5									
	15.0	**Sand**, **A-3(0)**, Gray, Wet, Very Dense, With Trace Of Gravel, (TS-2, SS-5).	SS 5	5 21 16	80	7.5					
964.0		17.0									
	17.5	**Silty Clay Loam**, **A-6**, Gray, Slightly Moist, Stiff, (TS-4, SS-2).				8.3					
961.0	20.0	20.0	SS 6	9 5 10	100						
		Bottom of Boring at 20.0 ft									

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BORING LOG

BORING NO.: **TS-6**
SHEET 1 OF 1
LATITUDE :
LONGITUDE :
DATUM :
DATE STARTED : 04-23-10
DATE COMPLETED : 04-23-10

ROUTE # : US 40 COUNTY : Wayne
PROJECT TYPE : Roadway Widening
LOCATION : Eastbound Us 40 Third Street To Eleventh Street, Richmond, Indiana
DES NO. : 0013790 PROJECT NO.: 0013790

ELEVATION	: 982.0	BORING METHOD	: HSA	HAMMER	: Auto
STATION	: 99+50	RIG TYPE	: Truck	DRILLER/INSP	: CTL
OFFSET	: 6.0 ft Right	CASING DIA.	: 3 1/4	TEMPERATURE	: 65 °F
LINE	: 'A'	CORE SIZE	:	WEATHER	: Partly Sunny
DEPTH	: 10.0 ft				

GROUNDWATER: ▽ Encountered at Dry ▼ At completion Dry

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI	REMARKS
981.9		**Asphalt**. 0.1									
981.4		**Concrete**. 0.6									
		Sand, **A-3(0)**, Brown, Moist, Medium Dense, With Trace Of Gravel, (TS-2, SS-5).	SS 1	6 5 10	80	3.5					
	2.5					25.8		34	16	18	2.5, Refusal, Offset 6'
979.0		3.0	SS 2	3 3 6	100						
	5.0					12.1					
		Clay Loam, **A-6(9)**, Brown, Moist, Stiff, (TS-6, SS-2).	SS 3	5 6 6	100						
	7.5					10.4					
			SS 4	6 9 13	100						
972.0	10.0	10.0									10.0, Boring Was Terminated
		Bottom of Boring at 10.0 ft									

GENERAL NOTES

AASHTO Soils Classification Guidelines - INDOT 2006

Soils are to be classified in general accordance with AASHTO M 145 ('Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes') and with the grain-size classification procedures outlined in these notes. The following soil classification guidelines are outlined in section 903 of the Indiana Department of Transportation Standard Specifications (2006).

Grain Size Classification	Size Range
Boulders	Over 3 in. (75 mm)
Gravel	3 inches to #10 sieve (75mm to 2.00mm)
Coarse Sand	#10 to #40 sieve (2.00mm to 425 µm)
Fine Sand	#40 to #200 sieve (425 µm to 75 µm)
Silt	0.075mm to 0.002 mm
Clay	Smaller than 0.002 mm
Colloids	Smaller than 0.001 mm

Classification of soils having **0 to 19%** retained on #10 (2.00mm) sieve are to be classified as follows:

Classification	% Sand & Gravel	% Silt	% Clay
Sand	80-100	0-20	0-20
Sandy LOAM	50-80	0-50	0-20
LOAM	30-50	30-50	0-20
Silty LOAM	0-50	50-80	0-20
Silt	0-20	80-100	0-20
Sandy Clay LOAM	50-80	0-30	20-30
Clay Loam	20-50	20-50	20-30
Silty Clay LOAM	0-30	50-80	20-30
Sandy Clay	50-70	0-20	30-50
Silty Clay	0-20	50-70	30-50
Clay	0-50	0-50	30-100

Classification of soils having **20% or more r**etained on #10 (2.00mm) sieve are to be modified with the following:

Percentage	Modifier
20% to 35%	with some gravel
36% to 50%	and gravel

Classification of Soils having **20% or more r**etained on #10 (2.00mm) sieve **and less than 20% p**assing #200 (75 µm) sieve are to be classified as follows:

Classification	% Gravel	% Sand	% Silt	% Clay
Gravel	85-100	0-15	0-15	0-15
Sandy Gravel	40-85	15-40	0-20	0-20
Gravelly Sand	20-40	40-80	0-20	0-20
Sand & Gravel	20-50	20-50	0-20	0-20

Classification of **Organic Soils** (AASHTO T 267)

Classification	Percentage
with trace organic matter	1 to 6
with little organic matter	7 to 12
with some organic matter	13 to 18
Organic Soil (A-8)	19-30
Peat (A-8)	More than 30

Classification of soils with calcium and magnesium carbonate content known as **Marly Soils**

Classification	Percentage
with trace marl	1 to 9
with little marl	10 to 17
with some marl	18 to 25
Marly Soil (A-8)	26 to 40
Marl (A-8)	More than 40

RELATIVE DENSITY OF GRANULAR SOILS

Relative in-place density of granular soils

DENSITY CLASSIFICATION	APPROXIMATE RANGE OF N *
Very Loose	0 - 5
Loose	6 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	over 50

STRENGTH AND CONSISTENCY OF COHESIVE SOILS

Strength and consistency of fine grain cohesive soils

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH, Qu (tsf)	APPROXIMATE RANGE OF N *
Very Soft	0.25	0 - 3
Soft	0.25 - 0.49	4 - 5
Medium Stiff	0.50 - 0.99	6 - 10
Stiff	1.00 - 1.99	11 - 15
Very Stiff	2.00 - 3.99	16 - 30
Hard	4.00 +	over 30

* STANDARD PENETRATION TEST (AASHTO T 206/ASTM D1586) - A 2.0" outside-diameter, split barrel sampler is driven into undisturbed soil by means of a 140 pound weight falling freely through a vertical distance of 30 inches. The sampler is normally driven 3 successive 6 inch increments. The total number of blows required for the final 12 inches of penetration is the Standard Penetration Resistance (N).

APPENDIX B

LABORATORY TEST RESULTS

Summary of Classification Test Results (1 page)

Summary of Special Laboratory Test Results (5 pages)

Lab Test Results (16 pages)
Unconfined Compressive Strength (3)
pH Lab Results (1)
Hydrometer/Grain Size Distribution Curves (8)
Resilient Modulus Tests (4)

Bearing Capacity Analysis (2 Pages)

SUMMARY OF CLASSIFICATION TEST RESULTS

Roadway Rehabilitation of East Bound US 40
From S. Third Street to E. Main Street
Wayne Township, Wayne County, Richmond, Indiana
Des # 0013790
CTL Project No. 10IN202

Boring No.	Sample No.	Sample Depth (ft.)	Textural Classification	AASHTO Classification	% Gravel (76.2 - 2.0 mm)	% Sand (2.00 – 0.074 mm)	% Silt and Clay (0.075 mm)	% Silt (0.075 – 0.002 mm)	% Clay (below 0.002 mm)	LL	PL	PI	% LOI	% Ca/ Mg	% Moisture	pH
RB-3	SS-2	2.5-4	Sand & Gravel	A-2-4(0)	41	44	15	10	5	NP	NP	NP			5.0	
RB-6	SS-1	1-2.5	Silty Clay Loam	A-7-6(22)	1	14	85	58	27	43	17	26			26.9	
TS-1	SS-6	18.5-20	Clay	A-6(11)	10	19	71	36	35	37	19	18			17.1	
TS-2	SS-5	13.5-15	Sand	A-3(0)	5	85	10	7	3	NP	NP	NP			21.4	
TS-2	SS-6	18.5-20	Silty Loam	A-4(3)	3	15	82	71	11	22	15	7			21.7	
TS-3	SS-4	8.5-10	Sandy Loam	A-2-6(0)	31	44	25	16	9	25	13	12			12.0	
TS-4	SS-2	2.5-4	Silty Clay Loam	A-6(13)	6	21	74	54	20	38	19	19			36.6	
TS-6	SS-2	2.5-4	Clay Loam	A-6(9)	3	32	66	36	30	34	16	18			25.8	

SUMMARY OF SPECIAL LABORATORY TEST RESULTS
Roadway Rehabilitation of East Bound US 40
From S. Third Street to E. Main Street
Wayne Township, Wayne County, Richmond, Indiana
Des # 0013790
CTL Project No. 10IN202

Boring	Sample No.	Sample Depth (ft.)	Specific Gravity (Gs)	Moisture Content (%)	pH	LOI (%)	Unconfined Compressive Strength, Qu (tsf)
RB-1	SS-1	1.0 – 2.5		3.7		2.4	
	SS-2	2.5 – 4.0		7.1			
RB-2	SS-1	1.0 – 2.5		7.0			
	SS-2	23.5 – 4.0		7.0			
	SS-3	6.0 – 7.5		3.9			
	SS-4	8.5 – 10		4.6			
RB-3	SS-1	1.0 – 2.5		11.5			
	SS-2	2.5 – 4.0	2.731	5.0	9.1		
	SS-3	6.0 – 7.5		8.3			

Boring	Sample No.	Sample Depth (ft.)	Specific Gravity (Gs)	Moisture Content (%)	pH	LOI (%)	Unconfined Compressive Strength, Qu (tsf)
RB-4	SS-1	1.0 – 2.5		7.5	8.1		
	SS-2	2.5 – 4.0		13.6			
	SS-3	6.0 – 7.5		10.7			
	SS-4	8.5 – 10		7.0			
RB-5	SS-1	1.0 – 2.5		5.1			
	SS-2	2.5 – 4.0		4.3			
	SS-3	6.0 – 7.5		11.8			
	SS-4	8.5 – 10		16.3			2.26
RB-6	SS-1	1.0 – 2.5	2.692	26.9	8.1		
	SS-2	2.5 – 4.0		27.3		2.1	
	SS-3	6.0 – 7.5		12.6			

Boring	Sample No.	Sample Depth (ft.)	Specific Gravity (Gs)	Moisture Content (%)	pH	LOI (%)	Unconfined Compressive Strength, Qu (tsf)
TS-1	SS-1	1.0 – 2.5		5.5		1.2	
	SS-2	2.5 – 4.0		4.1			
	SS-3	6.0 – 7.5		5.4			
	SS-4	8.5 – 10		8.3			
	SS-5	13.5.5 – 15		12.0			
	SS-6	18.5 – 20	2.791	17.1	7.7		3.08
TS-2	SS-1	1.0 – 2.5		15.7			
	SS-2	2.5 – 4.0		19.4			
	SS-3	6.0 – 7.5		11.4			
	SS-4	8.5 – 10		11.3			
	SS-5	13.5.5 – 15	2.703	21.4	8.3		
	SS-6	18.5 – 20	2.699	21.7	7.9		3.49

Boring	Sample No.	Sample Depth (ft.)	Specific Gravity (Gs)	Moisture Content (%)	pH	LOI (%)	Unconfined Compressive Strength, Qu (tsf)
TS-3	SS-1	1.0 – 2.5		5.0			
	SS-2	2.5 – 4.0		8.6			
	SS-3	6.0 – 7.5		9.4			
	SS-4	8.5 – 10	2.762	12.0	8.8		
	SS-5	13.5.5 – 15		12.9			
	SS-6	18.5 – 20		11.1			
TS-4	SS-1	1.0 – 2.5		22.9			
	SS-2	2.5 – 4.0	2.707	36.6	8.1		
	SS-3	6.0 – 7.5		7.3			
	SS-4	8.5 – 10		12.5			
	SS-5	13.5.5 – 15		4.9		1.0	
	SS-6	18.5 – 20		7.2			

Boring	Sample No.	Sample Depth (ft.)	Specific Gravity (Gs)	Moisture Content (%)	pH	LOI (%)	Unconfined Compressive Strength, Qu (tsf)
TS-5	SS-1	1.0 – 2.5		22.4			
	SS-2	2.5 – 4.0		12.5			
	SS-3	6.0 – 7.5		12.2			
	SS-4	8.5 – 10		12.9			
	SS-5	13.5.5 – 15		7.5			
	SS-6	18.5 – 20		8.3			
TS-6	SS-1	1.0 – 2.5		3.5			
	SS-2	2.5 – 4.0	2.789	25.8	6.8		
	SS-3	6.0 – 7.5		12.1			
	SS-4	8.5 – 10		10.4			

Chicago Testing Laboratory, Inc.

30W114 Butterfield Rd. Warrenville, IL 60555 630-393-2851 (office) 630-393-2857 (fax)

REPORT OF UNCONFINED COMPRESSION TEST, AASHTO T-208/ASTM D 2166

PROJECT: INDOT Des. No. 13790 Project No: 10IN202 REPORT: 1004046

LOCATION: Richmond, Wayne County, Indiana CLIENT: Indiana Department of Transportation DATE: 5/24/2010

SAMPLE ID: TS-1, 18.5-20 ft. bgs SOIL CLASSIFICATION: A-6(11)

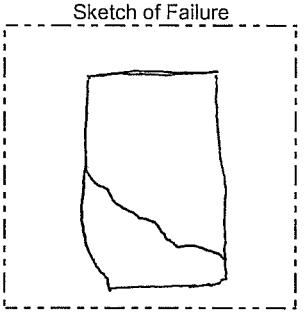
SPECIMEN DIA.: 1.339 in. SPECIMEN LENGTH: 2.795 in. MOISTURE CONTENT: 16% DRY DENSITY: 104 pcf

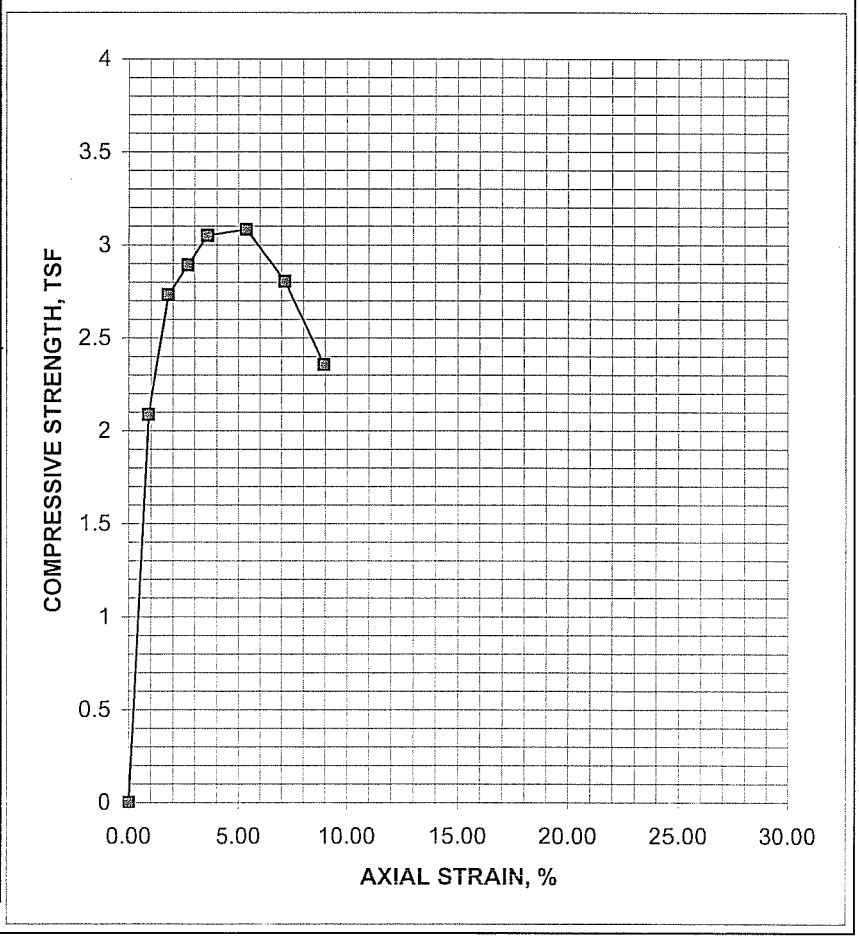
STRAIN RATE: 0.9 %/min. UNCONFINED COMPRESSIVE STRENTH: 3.08 tsf FAILURE STRAIN: 5.37 %

REMARKS:

AXIAL STRAIN %		COMPRESSIVE STRENGTH TSF
0.89		2.09
1.79		2.73
2.68		2.89
3.58		3.05
5.37		3.08
7.15		2.80
8.94		2.36

Sketch of Failure





Date Recieved: 4/28/10 Date Tested: 5/12/10 Tested By: DKS Submitted By: _____

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REPORT OF UNCONFINED COMPRESSION TEST, AASHTO T-208/ASTM D 2166

PROJECT: INDOT Des. No. 13790 Project No: 10IN202 REPORT: 1004048

LOCATION: Richmond, Wayne County, Indiana CLIENT: Indiana Department of Transportation DATE: 5/24/2010

SAMPLE ID: TS-2, 18.5-20 ft. bgs SOIL CLASSIFICATION: A-4(3)

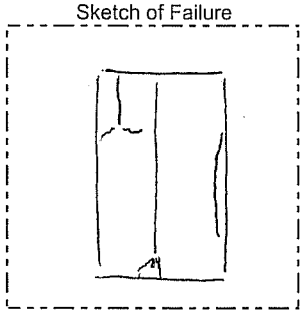
SPECIMEN DIA.: 1.493 in. SPECIMEN LENGTH: 2.767 in. MOISTURE CONTENT: 12% DRY DENSITY: 121 pcf

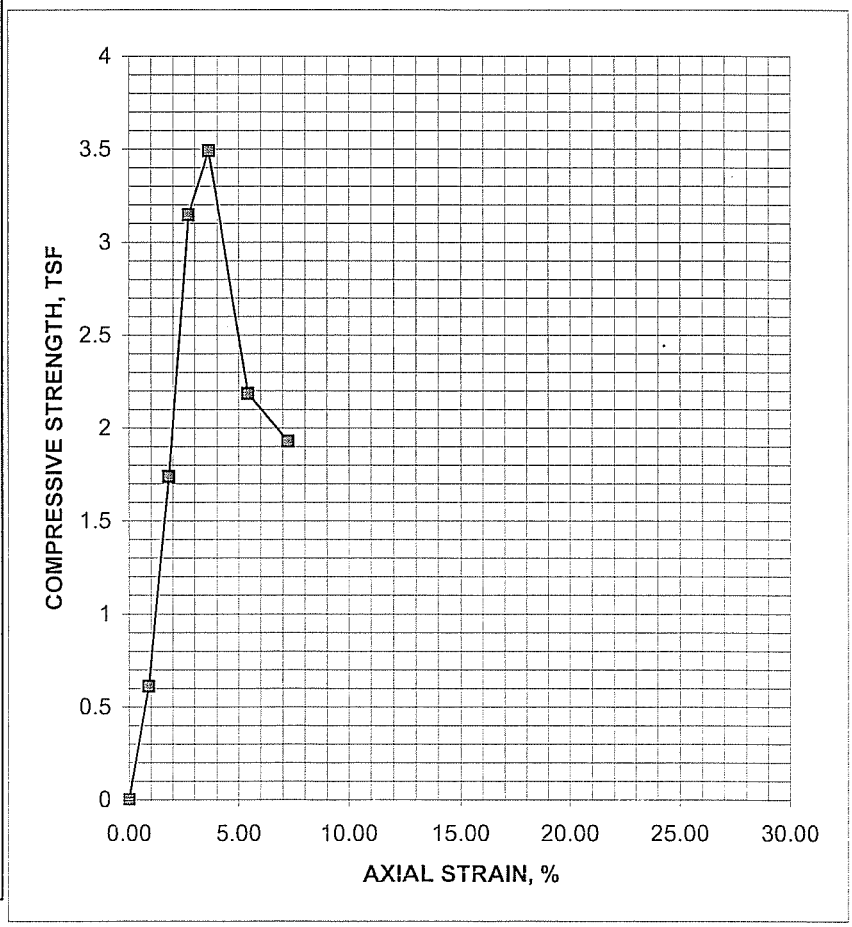
STRAIN RATE: 0.7 %/min. UNCONFINED COMPRESSIVE STRENTH: 3.49 tsf FAILURE STRAIN: 3.61 %

REMARKS:

AXIAL STRAIN %		COMPRESSIVE STRENGTH TSF
0.90		0.61
1.81		1.74
2.71		3.15
3.61		3.49
5.42		2.19
7.23		1.93

Sketch of Failure





Date Recieved: 4/28/10 Date Tested: 5/12/10 Tested By: DLS Submitted By: _____

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REPORT OF UNCONFINED COMPRESSION TEST, AASHTO T-208/ASTM D 2166

PROJECT: INDOT Des. No. 13790 Project No: 10IN202 REPORT: 1004052

LOCATION: Richmond, Wayne County, Indiana CLIENT: Indiana Department of Transportation DATE: 5/24/2010

SAMPLE ID: RB-5, 8.5-10 ft. bgs SOIL CLASSIFICATION: A-6

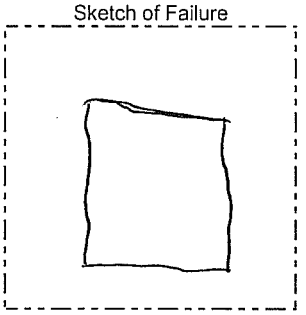
SPECIMEN DIA.: 1.372 in. SPECIMEN LENGTH: 2.757 in. MOISTURE CONTENT: 12% DRY DENSITY: 123 pcf

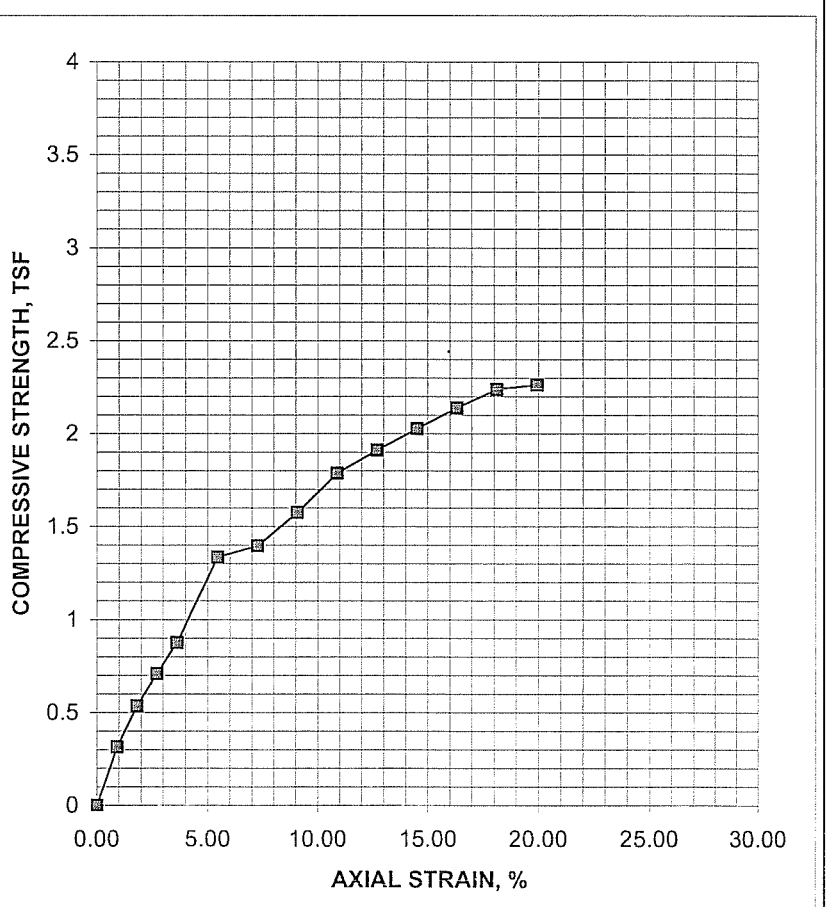
STRAIN RATE: 2.0 %/min. UNCONFINED COMPRESSIVE STRENTH: 2.26 tsf FAILURE STRAIN: 19.95 %

REMARKS:

AXIAL STRAIN %		COMPRESSIVE STRENGTH TSF
0.91		0.32
1.81		0.54
2.72		0.71
3.63		0.88
5.44		1.34
7.26		1.40
9.07		1.58
10.88		1.79
12.70		1.91
14.51		2.03
16.32		2.14
18.14		2.24
19.95		2.26

Sketch of Failure





Date Recieved: 4/28/10 Date Tested: 5/12/10 Tested By: DKS Submitted By: _____

Chicago Testing Laboratory, Inc.

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Summary of Laboratory Testing

Project: INDOT Des. No. 13790
Location: Richmond, Wayne County, Indiana
Client: Indiana Department of Transportation

Lab No.: 1004044
Date: 5/17/2010
Project No.: 10IN202

Determining pH of Soil for Use in Corrosion Testing
AASHTO T 289

Lab#	Source	Material	pH
1004044	RB-3, 2.5-4 ft. bgs	Brown Sand & Gravel, A-2-4(0)	9.1
1004045	RB-6, 1-2.5 ft. bgs	Brown Silty Clay LOAM, A-7-6(22)	8.1
1004046	TS-1, 18.5-20 ft. bgs	Brown & Grey CLAY, A-6(11)	7.7
1004047	TS-2, 13.5-15 ft. bgs	Grey SAND, A-3(0)	8.3
1004048	TS-2, 18.5-20 ft. bgs	Grey Silty LOAM, A-4(3)	7.9
1004049	TS-3, 8.5-10 ft. bgs	Brown Sandy LOAM w/ some gravel, A-2-6(0)	8.8
1004050	TS-4, 2.5-4 ft. bgs	Brown Silty Clay LOAM, A-6(13)	8.1
1004051	TS-6, 2.5-4 ft. bgs	Brown Clay LOAM, A-6(9)	6.8

Remarks:

Date Received: 4/28/10 Date Tested: 5/17/10 Tested By: DKS/DP Report Submitted By: _____

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LAB REPORT

ID # 1004044
CTL PROJECT # 10IN202

PROJECT NAME INDOT Des. No. 13790 CLIENT Indiana Department of Transportation
LOCATION Richmond, Wayne County, Indiana MATERIAL Soil

Report of Combined Sieve and Hydrometer Analysis

Date: 5/24/2010 Sample Type: Split Spoon Station: Offset:
Boring: RB-3 Sample No.: Depth: 2.5-4 ft. bgs
Total Sample Weight (g): 353.70

	Sieve Size:	Cum. Weight Retained	% Retained	% Passing	Total Passing (%)	Diameter (mm)
+ #10 sieve portion	1"	0.00	0.0	100.0	100.0	25.0000
	3/4"	0.00	0.0	100.0	100.0	19.0000
	1/2"	46.60	13.2	86.8	86.8	12.5000
	3/8"	60.70	17.2	82.8	82.8	9.5000
	No. 4	95.30	26.9	73.1	73.1	4.7500
	No. 10	144.30	40.8	59.2	59.2	2.0000
	No. 20	23.00	22.5	77.5	45.9	0.8500
- #10 sieve portion	No. 40	44.40	43.4	56.6	33.5	0.4200
	No. 100	69.80	68.3	31.7	18.8	0.1500
	No. 200	76.00	74.4	25.6	15.2	0.0750

Sample Weight at Start of Hydrometer (g): 102.20 Temperature: 22 °C
Blank Hydrometer Reading: 5.0
Specific Gravity: 2.731 actual

	Elapse Time (min.)	Uncorrected Hydrometer Reading	Corrected Hydrometer Reading	% Passing	Total Passing (%)	Diameter (mm)
Hydrometer Portion	1	30.0	25.4	24.6	14.6	0.0443
	2	27.0	22.4	21.7	12.8	0.0320
	5	25.0	20.4	19.7	11.7	0.0205
	15	22.0	17.4	16.8	10.0	0.0121
	30	20.0	15.4	14.9	8.8	0.0086
	60	18.0	13.4	13.0	7.7	0.0062
	120	16.0	11.4	11.0	6.5	0.0044
	250	15.0	10.4	10.1	6.0	0.0031
	1440	12.5	7.9	7.6	4.5	0.0013

Liquid Limit: 0 **Plastic Limit: 0** **Plasticity Index: 0** **Group Index: 0**

% Gravel : 41 **% Sand : 44** **% Silt : 10** **% Clay : 5**

AASHTO (INDOT) Soil Classification: **Sand & Gravel, A-2-4(0)**

Delivered By: Courier Tested By: DKS/DP Reviewed By:
Date Received: 4/28/10 Date Complete: 5/24 Date:

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LAB REPORT

ID # 1004045
CTL PROJECT # 10IN202

PROJECT NAME INDOT Des. No. 13790 CLIENT Indiana Department of Transportation
LOCATION Richmond, Wayne County, Indiana MATERIAL Soil

Report of Combined Sieve and Hydrometer Analysis

Date: 5/24/2010 Sample Type: Split Spoon Station: Offset:
Boring: RB-6 Sample No.: Depth: 1-2.5 ft. bgs
Total Sample Weight (g): 239.20

	Sieve Size:	Cum. Weight Retained	% Retained	% Passing	Total Passing (%)	Diameter (mm)
+ #10 sieve portion	1"	0.00	0.0	100.0	100.0	25.0000
	3/4"	0.00	0.0	100.0	100.0	19.0000
	1/2"	0.00	0.0	100.0	100.0	12.5000
	3/8"	1.10	0.5	99.5	99.5	9.5000
	No. 4	1.10	0.5	99.5	99.5	4.7500
	No. 10	1.30	0.5	99.5	99.5	2.0000
	No. 20	1.30	2.6	97.4	96.9	0.8500
- #10 sieve portion	No. 40	5.00	10.0	90.0	89.5	0.4200
	No. 100	7.00	14.0	86.0	85.8	0.1500
	No. 200	7.20	14.4	85.6	85.2	0.0750

Sample Weight at Start of Hydrometer (g): 50.10 Temperature: 22 °C
Blank Hydrometer Reading: 5.0
Specific Gravity: 2.692 actual

	Elapse Time (min.)	Uncorrected Hydrometer Reading	Corrected Hydrometer Reading	% Passing	Total Passing (%)	Diameter (mm)
Hydrometer Portion	1	45.0	40.4	79.8	79.4	0.0392
	2	40.5	35.9	70.9	70.5	0.0288
	5	35.0	30.4	60.0	59.7	0.0191
	15	28.5	23.9	47.2	46.9	0.0116
	30	26.0	21.4	42.3	42.0	0.0083
	60	23.0	18.4	36.3	36.1	0.0060
	120	22.0	17.4	34.4	34.2	0.0043
	250	19.5	14.9	29.4	29.3	0.0030
	1440	17.5	12.9	25.5	25.3	0.0013

Liquid Limit: 43 **Plastic Limit:** 17 **Plasticity Index:** 26 **Group Index:** 22

% Gravel : 1 **% Sand :** 14 **% Silt :** 58 **% Clay :** 27

AASHTO (INDOT) Soil Classification: **Silty Clay LOAM, A-7-6(22)**

Delivered By: Courier
Date Received: 4/28/10

Tested By: DKS/PP
Date Complete: 5/24

Reviewed By:
Date:

Chicago Testing Laboratory, Inc.
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LAB REPORT

ID # 1004046
CTL PROJECT # 10IN202

PROJECT NAME INDOT Des. No. 13790 CLIENT Indiana Department of Transportation
LOCATION Richmond, Wayne County, Indiana MATERIAL Soil

Report of Combined Sieve and Hydrometer Analysis

Date: 5/24/2010 Sample Type: Split Spoon Station: Offset:
Boring: TS-1 Sample No.: Depth: 18.5-20 ft. bgs
Total Sample Weight (g): 134.50

	Sieve Size:	Cum. Weight Retained	% Retained	% Passing	Total Passing (%)	Diameter (mm)
+ #10 sieve portion	1"	0.00	0.0	100.0	100.0	25.0000
	3/4"	0.00	0.0	100.0	100.0	19.0000
	1/2"	6.80	5.1	94.9	94.9	12.5000
	3/8"	9.30	6.9	93.1	93.1	9.5000
	No. 4	10.70	8.0	92.0	92.0	4.7500
	No. 10	13.30	9.9	90.1	90.1	2.0000
- #10 sieve portion	No. 20	1.20	2.4	97.6	87.9	0.8500
	No. 40	2.60	5.3	94.7	85.3	0.4200
	No. 100	7.00	14.3	85.7	77.2	0.1500
	No. 200	10.20	20.8	79.2	71.3	0.0750

Sample Weight at Start of Hydrometer (g): 48.99 Temperature: 22 °C
Blank Hydrometer Reading: 5.0
Specific Gravity: 2.791 actual

	Elapse Time (min.)	Uncorrected Hydrometer Reading	Corrected Hydrometer Reading	% Passing	Total Passing (%)	Diameter (mm)
Hydrometer Portion	1	42.0	37.4	75.5	68.0	0.0403
	2	41.0	36.4	73.5	66.2	0.0284
	5	38.0	33.4	67.4	60.8	0.0186
	15	35.0	30.4	61.4	55.3	0.0110
	30	32.5	27.9	56.3	50.7	0.0079
	60	30.0	25.4	51.3	46.2	0.0057
	120	27.0	22.4	45.2	40.7	0.0041
	250	25.5	20.9	42.2	38.0	0.0029
	1440	22.0	17.4	35.1	31.7	0.0012

Liquid Limit: 37 **Plastic Limit: 19** **Plasticity Index: 18** **Group Index: 11**

% Gravel : 10 **% Sand : 19** **% Silt : 36** **% Clay : 35**

AASHTO (INDOT) Soil Classification: **CLAY, A-6(11)**

Delivered By: Courier Tested By: DKS/DP Reviewed By:
Date Received: 4/28/10 Date Complete: 5/24 Date:

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LAB REPORT

ID # 1004047
CTL PROJECT # 10IN202

PROJECT NAME INDOT Des. No. 13790 CLIENT Indiana Department of Transportation
LOCATION Richmond, Wayne County, Indiana MATERIAL Soil

Report of Combined Sieve and Hydrometer Analysis

Date: 5/24/2010 Sample Type: Split Spoon Station: Offset:
Boring: TS-2 Sample No.: Depth: 13.5-15 ft. bgs
Total Sample Weight (g): 282.10

	Sieve Size:	Cum. Weight Retained	% Retained	% Passing	Total Passing (%)	Diameter (mm)
+ #10 sieve portion	1"	0.00	0.0	100.0	100.0	25.0000
	3/4"	0.00	0.0	100.0	100.0	19.0000
	1/2"	0.00	0.0	100.0	100.0	12.5000
	3/8"	2.30	0.8	99.2	99.2	9.5000
	No. 4	5.40	1.9	98.1	98.1	4.7500
	No. 10	12.70	4.5	95.5	95.5	2.0000
	No. 20	4.60	4.5	95.5	95.5	0.8500
- #10 sieve portion	No. 40	17.10	16.7	83.3	83.3	0.4200
	No. 100	77.40	75.8	24.2	24.2	0.1500
	No. 200	90.60	90.0	10.0	10.0	0.0750

Sample Weight at Start of Hydrometer (g): 102.10 Temperature: 22 °C
Blank Hydrometer Reading: 5.0
Specific Gravity: 2.703 actual

	Elapse Time (min.)	Uncorrected Hydrometer Reading	Corrected Hydrometer Reading	% Passing	Total Passing (%)	Diameter (mm)
Hydrometer Portion	1	15.0	10.4	10.1	9.6	0.0488
	2	13.0	8.4	8.1	7.8	0.0349
	5	12.0	7.4	7.2	6.8	0.0222
	15	11.0	6.4	6.2	5.9	0.0129
	30	11.0	6.4	6.2	5.9	0.0091
	60	10.0	5.4	5.2	5.0	0.0065
	120	9.0	4.4	4.3	4.1	0.0046
	250	8.0	3.4	3.3	3.1	0.0032
	1440	7.0	2.4	2.3	2.2	0.0013

Liquid Limit: 0 **Plastic Limit:** 0 **Plasticity Index:** 0 **Group Index:** 1

% Gravel : 5 **% Sand :** 85 **% Silt :** 7 **% Clay :** 3

AASHTO (INDOT) Soil Classification: **SAND, A-3(0)**

Delivered By: Owner Tested By: DLCS/DP Reviewed By:
Date Received: 4/28/10 Date Complete: 5/24 Date:

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LAB REPORT

ID # 1004048
CTL PROJECT # 10IN202

PROJECT NAME INDOT Des. No. 13790 CLIENT Indiana Department of Transportation
LOCATION Richmond, Wayne County, Indiana MATERIAL Soil

Report of Combined Sieve and Hydrometer Analysis

Date: 5/24/2010 Sample Type: Split Spoon Station: Offset:
Boring: TS-2 Sample No.: Depth: 18.5-20 ft. bgs
Total Sample Weight (g): 181.70

	Sieve Size:	Cum. Weight Retained	% Retained	% Passing	Total Passing (%)	Diameter (mm)
+ #10 sieve portion	1"	0.00	0.0	100.0	100.0	25.0000
	3/4"	0.00	0.0	100.0	100.0	19.0000
	1/2"	0.00	0.0	100.0	100.0	12.5000
	3/8"	1.30	0.7	99.3	99.3	9.5000
	No. 4	3.10	1.7	98.3	98.3	4.7500
	No. 10	4.70	2.6	97.4	97.4	2.0000
	No. 20	1.10	2.2	97.8	95.3	0.8500
- #10 sieve portion	No. 40	2.20	4.3	95.7	93.2	0.4200
	No. 100	5.60	11.0	89.0	86.7	0.1500
	No. 200	8.00	15.7	84.3	82.1	0.0750

Sample Weight at Start of Hydrometer (g): 50.84 Temperature: 22 °C
Blank Hydrometer Reading: 5.0
Specific Gravity: 2.699 actual

	Elapse Time (min.)	Uncorrected Hydrometer Reading	Corrected Hydrometer Reading	% Passing	Total Passing (%)	Diameter (mm)
Hydrometer Portion	1	44.0	39.4	76.6	74.7	0.0396
	2	40.0	35.4	68.9	67.1	0.0290
	5	33.5	28.9	56.2	54.8	0.0193
	15	26.0	21.4	41.6	40.5	0.0118
	30	22.0	17.4	33.8	33.0	0.0085
	60	17.0	12.4	24.1	23.5	0.0062
	120	14.0	9.4	18.3	17.8	0.0045
	250	12.0	7.4	14.4	14.0	0.0031
	1440	9.0	4.4	8.6	8.3	0.0013

Liquid Limit: 22 **Plastic Limit:** 15 **Plasticity Index:** 7 **Group Index:** 3

% Gravel : 3 **% Sand :** 15 **% Silt :** 71 **% Clay :** 11

AASHTO (INDOT) Soil Classification: **Silty LOAM, A-4(3)**

Delivered By: Courier
Date Received: 4/28/10
Tested By: DLCS/DP
Date Complete: 5/24
Reviewed By:
Date:

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LAB REPORT

ID # 1004049
CTL PROJECT # 10IN202

PROJECT NAME INDOT Des. No. 13790 CLIENT Indiana Department of Transportation
LOCATION Richmond, Wayne County, Indiana MATERIAL Soil

Report of Combined Sieve and Hydrometer Analysis

Date: 5/24/2010 Sample Type: Split Spoon Station: Offset:
Boring: TS-3 Sample No.: Depth: 8.5-10 ft. bgs
Total Sample Weight (g): 328.90

	Sieve Size:	Cum. Weight Retained	% Retained	% Passing	Total Passing (%)	Diameter (mm)
+ #10 sieve portion	1"	0.00	0.0	100.0	100.0	25.0000
	3/4"	0.00	0.0	100.0	100.0	19.0000
	1/2"	5.40	1.6	98.4	98.4	12.5000
	3/8"	16.20	4.9	95.1	95.1	9.5000
	No. 4	54.60	16.6	83.4	83.4	4.7500
	No. 10	103.00	31.3	68.7	68.7	2.0000
	No. 20	10.40	20.4	79.6	54.7	0.8500
- #10 sieve portion	No. 40	18.50	36.3	63.7	43.8	0.4200
	No. 100	28.70	56.3	43.7	30.0	0.1500
	No. 200	32.60	63.9	36.1	24.8	0.0750

Sample Weight at Start of Hydrometer (g): 51.00 Temperature: 22 °C
Blank Hydrometer Reading: 5.0
Specific Gravity: 2.762 actual

	Elapse Time (min.)	Uncorrected Hydrometer Reading	Corrected Hydrometer Reading	% Passing	Total Passing (%)	Diameter (mm)
Hydrometer Portion	1	22.0	17.4	33.7	23.2	0.0468
	2	21.0	16.4	31.8	21.8	0.0333
	5	19.0	14.4	27.9	19.2	0.0213
	15	17.0	12.4	24.0	16.5	0.0125
	30	15.0	10.4	20.2	13.9	0.0089
	60	13.5	8.9	17.3	11.9	0.0064
	120	12.5	7.9	15.3	10.5	0.0045
	250	12.0	7.4	14.4	9.9	0.0031
	1440	10.0	5.4	10.5	7.2	0.0013

Liquid Limit: 25 **Plastic Limit: 13** **Plasticity Index: 12** **Group Index: 0**

% Gravel : 31 **% Sand : 44** **% Silt : 16** **% Clay : 9**

AASHTO (INDOT) Soil Classification: **Sandy LOAM with some gravel, A-2-6(0)**

Delivered By: Cooper
Date Received: 4/28/10
Tested By: DKS/DP
Date Complete: 5/24
Reviewed By:
Date:

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LAB REPORT

ID # 1004050
CTL PROJECT # 10IN202

PROJECT NAME INDOT Des. No. 13790 CLIENT Indiana Department of Transportation
LOCATION Richmond, Wayne County, Indiana MATERIAL Soil

Report of Combined Sieve and Hydrometer Analysis

Date: 5/24/2010 Sample Type: Split Spoon Station: Offset:
Boring: TS-4 Sample No.: Depth: 2.5-4 ft. bgs
Total Sample Weight (g): 215.20

	Sieve Size:	Cum. Weight Retained	% Retained	% Passing	Total Passing (%)	Diameter (mm)
+ #10 sieve portion	1"	0.00	0.0	100.0	100.0	25.0000
	3/4"	0.00	0.0	100.0	100.0	19.0000
	1/2"	0.00	0.0	100.0	100.0	12.5000
	3/8"	1.40	0.7	99.3	99.3	9.5000
	No. 4	7.50	3.5	96.5	96.5	4.7500
	No. 10	11.90	5.5	94.5	94.5	2.0000
	No. 20	1.80	3.6	96.4	91.1	0.8500
- #10 sieve portion	No. 40	4.80	9.6	90.4	85.4	0.4200
	No. 100	8.70	17.4	82.6	78.1	0.1500
	No. 200	10.90	21.8	78.2	73.9	0.0750

Sample Weight at Start of Hydrometer (g): 50.10 Temperature: 22 °C
Blank Hydrometer Reading: 5.0
Specific Gravity: 2.707 actual

	Elapse Time (min.)	Uncorrected Hydrometer Reading	Corrected Hydrometer Reading	% Passing	Total Passing (%)	Diameter (mm)
Hydrometer Portion	1	41.5	36.9	72.9	68.9	0.0404
	2	39.0	34.4	68.0	64.2	0.0292
	5	33.0	28.4	56.1	53.0	0.0194
	15	27.0	22.4	44.2	41.8	0.0117
	30	24.0	19.4	38.3	36.2	0.0084
	60	21.0	16.4	32.4	30.6	0.0061
	120	19.0	14.4	28.4	26.9	0.0044
	250	17.0	12.4	24.5	23.1	0.0031
	1440	14.0	9.4	18.6	17.5	0.0013

Liquid Limit: 38 **Plastic Limit:** 19 **Plasticity Index:** 19 **Group Index:** 13

% Gravel : 6 **% Sand :** 21 **% Silt :** 54 **% Clay :** 20

AASHTO (INDOT) Soil Classification: **Silty Clay LOAM, A-6(13)**

Delivered By: Courier Tested By: DLS/DP Reviewed By:
Date Received: 4/28/10 Date Complete: 5/24 Date:

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LAB REPORT

ID # 1004051
CTL PROJECT # 10IN202

PROJECT NAME INDOT Des. No. 13790 CLIENT Indiana Department of Transportation
LOCATION Richmond, Wayne County, Indiana MATERIAL Soil

Report of Combined Sieve and Hydrometer Analysis

Date: 5/24/2010 Sample Type: Split Spoon Station: Offset:
Boring: TS-6 Sample No.: Depth: 2.5-4 ft. bgs
Total Sample Weight (g): 185.40

	Sieve Size:	Cum. Weight Retained	% Retained	% Passing	Total Passing (%)	Diameter (mm)
+ #10 sieve portion	1"	0.00	0.0	100.0	100.0	25.0000
	3/4"	0.00	0.0	100.0	100.0	19.0000
	1/2"	0.00	0.0	100.0	100.0	12.5000
	3/8"	0.00	0.0	100.0	100.0	9.5000
	No. 4	2.40	1.3	98.7	98.7	4.7500
	No. 10	6.20	3.3	96.7	96.7	2.0000
	No. 20	2.40	4.9	95.1	91.9	0.8500
- #10 sieve portion	No. 40	5.30	10.8	89.2	86.2	0.4200
	No. 100	11.40	23.2	76.8	74.2	0.1500
	No. 200	16.10	32.8	67.2	65.0	0.0750

Sample Weight at Start of Hydrometer (g): 49.10 Temperature: 22 °C
Blank Hydrometer Reading: 5.0
Specific Gravity: 2.789 actual

	Elapse Time (min.)	Uncorrected Hydrometer Reading	Corrected Hydrometer Reading	% Passing	Total Passing (%)	Diameter (mm)
Hydrometer Portion	1	36.0	31.4	63.2	61.1	0.0423
	2	34.0	29.4	59.2	57.2	0.0304
	5	32.0	27.4	55.2	53.3	0.0195
	15	29.0	24.4	49.1	47.5	0.0115
	30	27.0	22.4	45.1	43.6	0.0083
	60	25.0	20.4	41.1	39.7	0.0059
	120	23.0	18.4	37.1	35.8	0.0042
	250	21.5	16.9	34.0	32.9	0.0030
	1440	18.0	13.4	27.0	26.1	0.0013

Liquid Limit: 34 **Plastic Limit:** 16 **Plasticity Index:** 18 **Group Index:** 9

% Gravel : 3 **% Sand :** 32 **% Silt :** 36 **% Clay :** 30

AASHTO (INDOT) Soil Classification: **Clay LOAM, A-6(9)**

Delivered By: Courier
Date Received: 4/28/10
Tested By: DICS/DP
Date Complete: 5/24
Reviewed By:
Date:

Resilient Modulus AASHTO T307

Lab No.	10-RM007	Des.	0013790	Sample Type I or II	II		
Proj. Name (Rd.)	US 40	Location (Co.)	WAYNE	Boring	TS-4	Depth	2.5'-4'
Textural Class.	Silty Clay Loam			AASHTO Class.	A-6 (13)		
Specific Gravity	2.707	Liquid Limit	38.0	Plastic Limit	19.0		

Compaction AASHTO T-99 Method A

Maximum Wet Density	139.3	pcf
Maximum Dry Density	125.7	pcf
Optimum Moisture	10.8%	
Optimum Moisture +2	12.8%	

Hygroscopic Moisture

Wet Weight with Tare	186.3
Dry Weight with Tare	185.3
Tare Weight	65.2
Percent Moisture	**0.8%**

Grams of Air Dry Soil: 1500 — Evaporation expected: 0.30%

Mixing @ Optimum Moisture

Soil Required	**1512**	grams
Water Required	**154**	grams

Molding Moisture Before Test

Wet Weight with Tare	173.3
Dry Weight with Tare	162.2
Tare Weight	60.6
Percent Moisture	**10.9%**

5 Layers @ **264.7** grams of soil per layer

9 Blows per Layer

Mass of Soil with Mold	1948	
Mass of Specimen	1312	grams

Mixing @ 2.0% above Optimum Moisture

Soil Required	**1512**	grams
Water Required	**184**	grams

Molding Moisture Before Test

Wet Weight with Tare	192.6
Dry Weight with Tare	177.9
Tare Weight	62.9
Percent Moisture	**12.8%**

5 Layers @ **264.7** grams of soil per layer

9 Blows per Layer

Mass of Soil with Mold	1943	
Mass of Specimen	1307	grams

Mold Identification (enter A,B,C or D) **B**

Length 22.930 cms — Inside Diameter 7.320 cms — Mass 636 gms

Before Test

Height of Extruded Specimen: 14.559 cms

Molded Wet Density: **133.7** pcf, 4% **ALERT**

Molded Dry Density: 120.5 pcf

After Test

Mass of Specimen: 1307 grams

Final Moisture on 1/4 Specimen

Wet Weight with Tare	514.0
Dry Weight with Tare	484.6
Tare Weight	208.0
Percent Moisture	**10.6%**

Before Test

Height of Extruded Specimen: 14.315 cms

Molded Wet Density: **135.4** pcf, 2.8%

Molded Dry Density: 120.1 pcf

After Test

Mass of Specimen: 1302 grams

Final Moisture on 1/4 Specimen

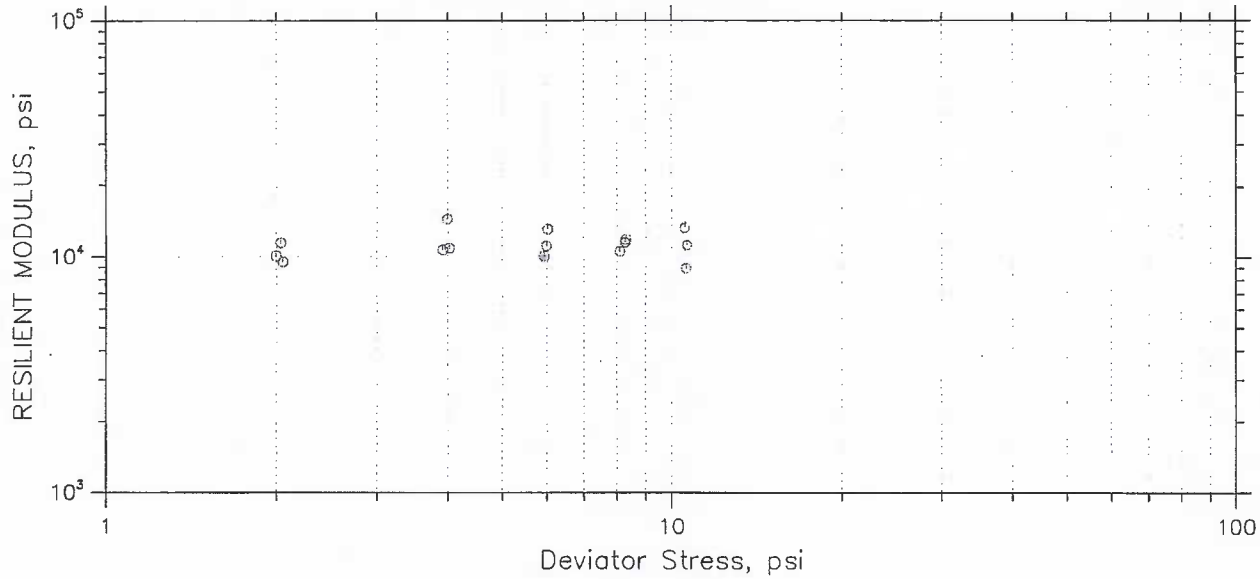
Wet Weight with Tare	561.9
Dry Weight with Tare	522.5
Tare Weight	207.9
Percent Moisture	**12.5%**

tested by: mgd

RESILIENT MODULUS TEST DATA

SUMMARY REPORT

$Mr = 686.31 * Pa * (B/Pa)^{0.295} * (Sd/Pa)^{-0.0578}$ $r = 0.70997$



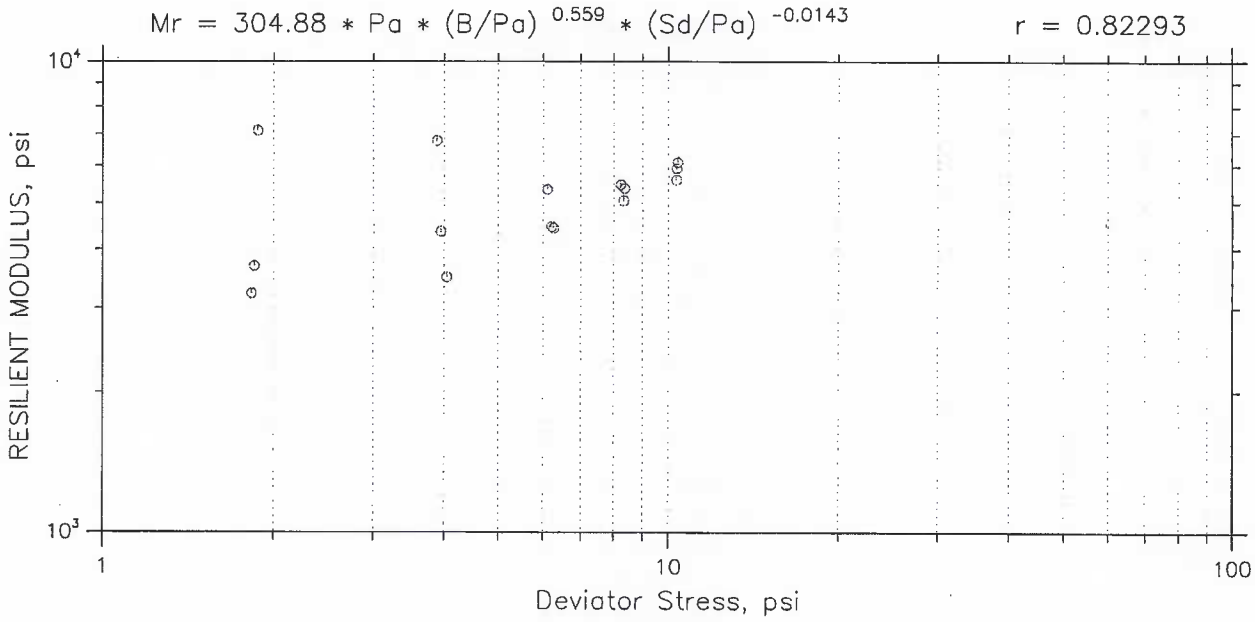
Confining Stress S3 (psi)	Nom. Max. Deviator Stress (psi)	Mean Deviator Stress (psi)	Std. Dev. Deviator Stress (psi)	Mean Bulk Stress (psi)	Mean Resilient Strain (%)	Std. Dev. Resilient Strain (%)	Mean Resilient Modulus (psi)	Std. Dev. Resilient Modulus (psi)
5.996	2	2.034	0.0327	20.02	0.02	0.00	11488	1275.8
6.019	4	3.994	0.1618	22.05	0.03	0.00	14512	1630.5
6.014	6	6.02	0.1945	24.06	0.04	0.00	13186	631.14
6.003	8	8.298	0.1983	26.31	0.06	0.00	11904	566.42
5.992	10	10.56	0.2443	28.53	0.07	0.00	13411	300.88
3.974	2	2.05	0.0261	13.97	0.02	0.00	9536.9	835.53
4.009	4	4.024	0.0829	16.05	0.03	0.00	10925	648.45
4.002	6	5.994	0.2190	18	0.05	0.00	11180	373.35
4.004	8	8.28	0.2734	20.29	0.06	0.00	11583	137.68
3.982	10	10.65	0.1594	22.6	0.09	0.00	11288	259.98
2.078	2	1.995	0.0490	8.228	0.02	0.00	10121	735.66
2.049	4	3.915	0.1326	10.06	0.03	0.00	10719	680.78
2.046	6	5.937	0.1964	12.08	0.05	0.00	10113	378.96
2.058	8	8.1	0.3549	14.28	0.07	0.00	10595	322.98
2.08	10	10.61	0.0788	16.85	0.11	0.00	8985.3	188.32

Project: US 40	Location: Wayne Co.	Project No.: Des 0013790
Boring No.: TS-4	Tested By: MGD	Checked By:
Sample No.: 10-RM007~1	Test Date: 05/10/2010	Depth: 2.5' - 4'
Test No.: # 1	Sample Type: Remolded	Elevation:
Description: Silty Clay Loam A-6 (13).....Maximum Dry Density 125.7 pcf and 10.8% Optimum Moisture		
Remarks: Tested at Optimum Moisture Content. (Permanent Strain = 0.48555% after Conditioning Sequence)		
File: C:\Users\INDOT\Documents\Geocomp\RM\2010 RM wNew Cal\10-RM007~1.dat		

Wed, 26-MAY-2010 10:33:40

RESILIENT MODULUS TEST DATA

SUMMARY REPORT



Confining Stress S3 (psi)	Nom. Max. Deviator Stress (psi)	Mean Deviator Stress (psi)	Std. Dev. Deviator Stress (psi)	Mean Bulk Stress (psi)	Mean Resilient Strain (%)	Std. Dev. Resilient Strain (%)	Mean Resilient Modulus (psi)	Std. Dev. Resilient Modulus (psi)
5.991	2	1.874	0.0463	19.85	0.02	0.00	7111.7	719.45
5.949	4	3.881	0.1174	21.73	0.05	0.00	6774.3	295.57
5.946	6	6.106	0.0766	23.94	0.10	0.00	5338.4	81.16
5.984	8	8.235	0.1211	26.19	0.14	0.00	5463.9	160.43
5.994	10	10.39	0.1681	28.37	0.15	0.00	6097	265.61
4.049	2	1.848	0.0502	14	0.05	0.00	3687.3	219.52
4.016	4	3.942	0.1160	15.99	0.08	0.00	4360.1	121.01
3.977	6	6.202	0.1055	18.13	0.13	0.00	4462.9	103.77
3.998	8	8.368	0.1657	20.36	0.14	0.00	5367.2	181.18
4.043	10	10.34	0.2549	22.47	0.16	0.00	5915.3	98.512
2.086	2	1.827	0.0592	8.084	0.05	0.00	3220.3	266.53
2.024	4	4.036	0.0497	10.11	0.10	0.00	3493	123.11
2.025	6	6.256	0.0622	12.33	0.13	0.00	4424.7	158.95
2.061	8	8.331	0.1811	14.51	0.15	0.00	5055.3	186.11
2.019	10	10.33	0.3187	16.39	0.17	0.00	5601.1	90.471

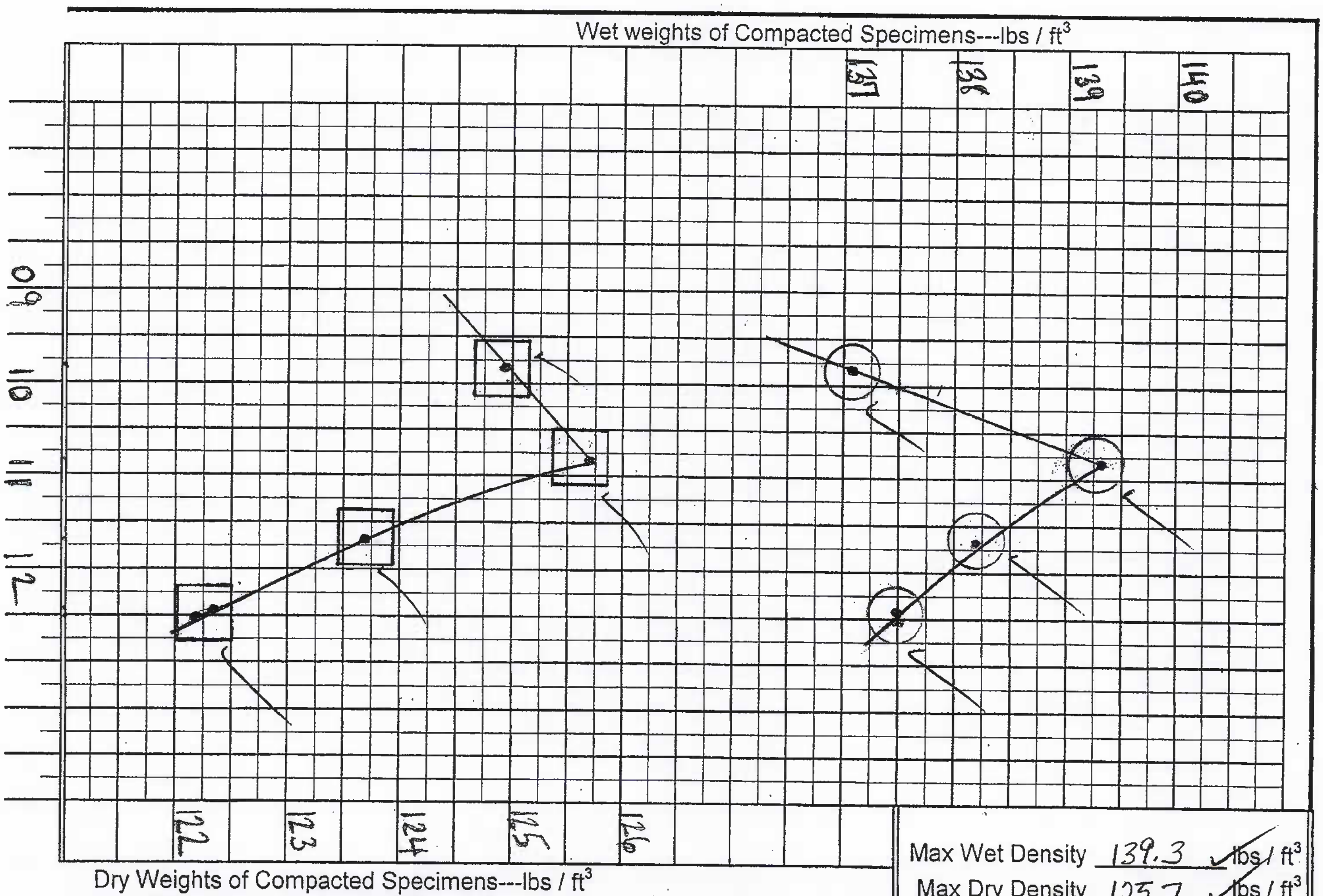
Project: US 40	Location: Wayne Co.	Project No.: Des 0013790
Boring No.: TS-4	Tested By: MGD	Checked By:
Sample No.: 10-RM007~2	Test Date: 05/10/2010	Depth: 2.5' - 4'
Test No.: # 2	Sample Type: Remolded	Elevation:
Description: Silty Clay Loam A-6 (13).....Maximum Dry Density 125.7 pcf and 10.8% Optimum Moisture		
Remarks: Tested at 2% Above Optimum Moisture Content. (Permanent Strain = 1.1983% after Conditioning Sequence)		
File: C:\Users\INDOT\Documents\Geocomp\RM\2010 RM wNew Cal\10-RM007~2.dat		

Wed, 26-MAY-2010 10:34:23

Prepared by mgd 5/6/10

10-RM007	REVISED 11/05	Soil Compaction, (T-99), 4" Mold								(Method "A")	
Mass Of Mold =	4240	Wet Mass	Gross	Gross	Moisture	Tare	Net Dry	Percent	Dry Mass	Average	Average
Mass of Cyl and Soil	Wet Mass	Lbs/cu ft	Wet Mass	Dry Mass	Loss	Mass	Mass-Soil	Moisture	(Lbs/cu-ft)	Moisture	Dry Mass
6313	2073	137.1	195.4	183.8	11.6	65.8	118.0	9.8	124.9		
			191.6	180.4	11.2	66.3	114.1	9.8	124.9		
6346	2106	139.3	192.3	179.8	12.5	64.3	115.5	10.8	125.7		
			188.9	176.5	12.4	61.4	115.1	10.8	125.7		
6330	2090	138.2	196.7	182.9	13.8	64.7	118.2	11.7	123.7		
			194.9	181.1	13.8	62.9	118.2	11.7	123.7		
6319	2079	137.5	213.9	197.3	16.6	64.9	132.4	12.5	122.2		
			205.6	190.0	15.6	64.4	125.6	12.4	122.3		
0	-4240	-280.4	0.0	0.0	0.0	0.0	0.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
			0.0	0.0	0.0	0.0	0.0	#DIV/0!	#DIV/0!		
0	-4240	-280.4	0.0	0.0	0.0	0.0	0.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
			0.0	0.0	0.0	0.0	0.0	#DIV/0!	#DIV/0!		
0	-4240	-280.4	0.0	0.0	0.0	0.0	0.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
			0.0	0.0	0.0	0.0	0.0	#DIV/0!	#DIV/0!		
0	-4240	-280.4	0.0	0.0	0.0	0.0	0.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
			0.0	0.0	0.0	0.0	0.0	#DIV/0!	#DIV/0!		
0	-4240	-280.4	0.0	0.0	0.0	0.0	0.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
			0.0	0.0	0.0	0.0	0.0	#DIV/0!	#DIV/0!		

VBD



Max Wet Density 139.3 ✓ lbs / ft³
Max Dry Density 125.7 ✓ lbs / ft³
Optimum Moisture 10.8 ✓ %

T-99 4" mold VBD

BEARING CAPACITY ANALYSIS FOR SPREAD FOOTINGS AND WINGWALLS
(Refer to Boring Logs and Section 4.1)

Structure Nos.	Traffic Signals and Light poles
Project:	13790
Location.:	US 40
Des. No.:	13790
County:	Wayne

DATA

1. Typical Traffic Signal Foundation

2. The bottom of footings for wingwall is expected to be at 8 to 12 feet below the surface unless extended.

SOIL BEARING CAPACITY

Generally Loose to Medium Dense to Dense Sand and Gravel.

1. Foundations on compacted granular Soil:

   Estimated Phi = 30 deg., C = 0, G = 120 pcf & G_{sub} = 110 - 62 = 48 pcf

2. Water expected above footings (longterm)

3. Assume depth of footings, D_f = At 10' below the grade, and B = 3'

Nominal Bearing Resistance, Qn = c Nc + (Gsub Df Nq) + (0.5 Gsub B NGamma)
Factored Bearing Resistance, QR = (øb) (Qn) As specified in AASHTO Eq (10.6.3.1.1-1)
Resistance Factor øb = 0.45 As specified in AASHTO article 10.5.5.2.2 in Table 10.5.5.2.2-1

Phi (degrees)	c (psf)	N_c	N_q	N_{Gamma}	D_f (feet)	B	G (pcf)	G_{sub} (pcf)	Q_n (psf)	**Q_R (psf)**
30	0	30.10	18.40	15.70	6	3	120	58	7769	**3496**

N_c, N_q, N_{Gamma} AASHTO Table 10.6.3.1.2a-1

SOIL BEARING CAPACITY ANALYSIS
(Refer to TB-1 & TB-2)

Structure:	N/A
Project:	13790
Location.:	U.S.40
Des. No.:	13790
County:	Wayne

DATA

1. The foundation invert will be at approximately 10' below the surface.

2. Groundwater is expected during construction of foundation.

SOIL BEARING CAPACITY

The soils below the foundation consist of silty clay loam to loam.

Unconfined Compression value is estimated at Qu = 4000 psf

Cu = 4,000 / 2 = 2,000 psf
For Phi = 0, Nc = 5.14 (Meyerhof)

Ultimate Bearing Capacity, qult = c Nc = 5.14 x 2,000 = 10,280 psf
Allowable Bearing Capacity, qall = qult / FS = 10,280 / 3.0 = 3,426 psf **USE qall =3,000 psf**