GEOTECHNICAL EVALUATION
PROJECT NO. STP-0399 ( )
DES. NO. 0300059
PEDESTRIAN BRIDGE
MONON GREENWAY OVER CARMEL DRIVE
CARMEL, INDIANA

Prepared for

UNITED CONSULTING ENGINEERS & ARCHITECTS
1625 NORTH POST ROAD
INDIANAPOLIS, INDIANA 46219-1995

By

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March 4, 2004

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Mr. Kurt Fowerbaugh, P.E.
United Consulting Engineers & Architects
1625 North Post Road
Indianapolis, IN 46219-1995

Re: Geotechnical Evaluation
Project No. STP-0399 ( )
Des. No. 0300059
Pedestrian Bridge
Monon Greenway over Carmel Drive
Carmel, Indiana
EEI Project No. 1-03-071

Dear Mr. Fowerbaugh:

We are pleased to submit our geotechnical evaluation for the above-referenced project. This report presents the results of our subsurface exploration and provides geotechnical recommendations for design and construction of the proposed bridge and earth retention structures. The work for this project was formally authorized by Mr. Dave Richter, of United Consulting Engineers & Architects (UCEA) on September 16, 2003, via acceptance of Earth Exploration, Inc. (EEI) Proposal No. P1-02-539. This final report supercedes the report dated November 25, 2003.

The opinions and recommendations submitted herein are based in part on the interpretation of the subsurface conditions revealed by the test borings as shown on the location plans in Appendix C. Understandably, this report does not reflect variations in the subsurface conditions between or beyond these borings. Variations in soil conditions can be expected between the boring locations, and fluctuation of groundwater levels may occur over time. The nature and extent of the variations may not become evident until the time of construction. If subsurface variations become apparent at a later date, it may be necessary for EEI to re-evaluate the recommendations of this report. Important information regarding this evaluation is contained in Appendix A.

PROJECT DESCRIPTION

We understand that the city of Carmel is planning to construct a pedestrian bridge carrying the Monon Greenway over Carmel Drive. The bridge is planned to consist of three-spans with lengths of approximately 60, 86, and 60 ft. A deep foundation scheme has been preliminarily proposed for support of the structure, and structural loads are not available and at this time.

The approach ramps leading up to the bridge are planned to consist of drilled-in-place soldier piles with precast concrete panels to retain the engineered fill. Steel cross ties are planned to tie the opposing soldier pile walls together. A cast-in-place grade beam is planned to be constructed just below the finished grade to provide support for the brick facing. Metal brick ties are planned to secure the brick facing to the precast concrete panels. The retaining walls are planned to extend approximately 500 ft north and south of the bridge along the alignment. The existing ditch on the northwest side of the existing alignment is scheduled to be filled to provide an access path from Carmel Drive to the approach ramp on the north side of the bridge. Extension of some minor drainage structures that will be buried beneath the created green space beneath the bridge is also planned. Additional information regarding the project such as construction schedule is not known.

FIELD EXPLORATION AND LABORATORY TESTING

General

Subsurface conditions were explored by performing: four test borings at the bridge structure (designated TB-1 through TB-4) to depths ranging from 45 to 60 ft and six test borings along the retaining MSE wall structures (designated RW-1 through RW-6) to depths ranging from 35 to 15 ft below existing grade. Refer to the General Site Plan and Test Boring Location Plan in Appendix C for a layout of the project, bridge structure and boring locations. The number, location and depth of the borings were selected by EEI, from information provided by UCEA, and were approved by INDOT. The borings were located in the field by EEI personnel referencing identifiable features shown on plans provided by UCEA. In addition, elevations at the borings were interpolated to the nearest ½ ft based on topographic information shown on the previously-mentioned plans. The boring locations and elevations should be considered accurate only to the degree implied by the methods used.

Exploratory drilling was performed by EEI during the period of October 9 through October 13, 2003. In general, exploratory activities were performed using hollow stem augers to advance the boreholes. Representative samples of the soil conditions using Standard Penetration Test (SPT) procedures (AASHTO T 206) were obtained at predetermined intervals. After obtaining final groundwater observations, each borehole was backfilled with auger cuttings, bentonite chip plug and a concrete patch placed at the surface. (i.e., in accordance with the "Aquifer Protection Guidelines" [revised October 30, 1996] developed by INDOT). Select borings were left open for 24-hr water level readings. Additional details of the drilling and sampling procedures are provided in Appendix B.

Following the exploratory drilling activities, the soil samples were visually classified by an engineering technician and reviewed by a geotechnical engineer. After visually classifying the soils, representative samples were selected for index property testing. These tests included: moisture content (AASHTO T 265), grain size analysis (AASHTO T 88), Atterberg limits (AASHTO T 89 and T 90), unconfined compression (AASHTO T 208), hand penetrometer readings and soil pH. The results of the tests are provided on the boring logs in Appendix D and/or respective summary sheets in Appendix E.

Following the completion of the laboratory testing, final boring logs were then prepared. Soil descriptions on the boring logs are in general accordance with the AASHTO system [AASHTO designation, e.g., A-4(0)] and the INDOT Standard Specifications (ISS[1]) (textural classification, e.g., loam). The final boring logs represent our interpretation of the individual samples and field logs and results of the laboratory tests. The stratification lines on the boring logs represent the approximate boundary between soil types; although, the transition may actually be gradual.

SITE CONDITIONS

Surface Conditions

The project site is generally located along the existing Monon Greenway where the trail intersects Carmel Drive in the city of Carmel. From our observations, the ground surface along the existing trail was relatively level with an elevation change of approximately 1 to 2 ft along the alignment. The Monon Greenway is built upon the raised bed of the abandoned Monon Railroad line.

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[1]References the Indiana Department of Transportation (INDOT) Standard Specifications, 1999 Edition.

Mr. Kurt Fowerbaugh, P.E.
United Consulting Engineers & Architects

Soil Conditions

Based on the information gathered during our field activities, the subsurface profile along the project alignment was relatively similar and generally consisted of soil fill (i.e. railroad embankment) over natural interbedded cohesive and granular soils. The soil fill generally consisted of sandy and silty clay loam, clay loam, and loam to depths of about 4 to 7 ft below the existing ground surface. Beneath the soil fill, sandy and silty clay loam, clay loam, loam, and clay interbedded with layers of sand and gravel and sand were encountered to the maximum explored depths. At several boring locations beneath the near surface sandy loam fill, soils with trace amounts of organic matter were also encountered. In Boring RW-6, possible buried topsoil was encountered at a depth of about 4 ft below the existing ground surface. Asphaltic concrete thicknesses at the boring locations ranged from 3 to 5 in., and crushed aggregate subbase thicknesses ranged from 3 to 19 in.

From our observations, the consistency of the cohesive soils (loam, silty clay loam, silty loam, and silty clay) (natural or fill soil) ranged from very soft to hard based on N-value criteria established by INDOT. Hand penetrometer readings generally ranged from ¼ to over 4½ tons/sq ft (tsf) with the majority of readings between 1 and 3 tsf. The majority of the ¼ to ¾ tsf readings were generally recorded within the near surface (upper 10 ft) soils. Moisture contents were typically on the order of 8 to 44 percent with the majority of these values between 10 and 27 percent. Two Loss on Ignition (LOI) tests were performed on near surface samples of silty clay loam with traces of organic matter from Borings RW-4 and TB-2. The results of the LOI tests indicate organic contents of 5.4 and 8.8 percent, respectively. For your information, the moisture content is directly related to the shear strength characteristics of cohesive soils, i.e., as the moisture content increases the strength decreases. The relative density of the sand and gravel, sandy loam, and sand was typically loose to dense with SPT N-values ranging from 4 to 38 blows/ft (bpf). The relative density of the granular soils generally increased with depth.

In addition, four unconfined compression tests were performed on split-spoon samples of the loam, silty clay loam, and silty clay. Results from these tests indicated peak undrained shear strengths (i.e. using the $\text{Ø}=0$ concept) ranging from 0.81 to 4.44 tsf at axial strains ranging from 13.6 to 15 percent. Based on a comparison of the moisture contents and Atterberg limits, the cohesive soils generally appeared to be of low to moderate plasticity and slightly over-consolidated. Furthermore, five samples were also tested for pH level, (i.e., hydrogen-ion content), and these results indicated that the pH levels ranged from 6.7 to 7.1. These results are provided in the Summary of Special Laboratory test in Appendix E.

Groundwater Conditions

Groundwater level observations made throughout the exploratory activities are noted at the bottom of the boring logs. Table 1 presents the groundwater levels observed throughout the exploratory activities.

TABLE 1. GROUNDWATER LEVEL OBSERVATIONS

Boring No.	Station	Ground Surface Elevation	Observed Groundwater Level		
			During	At completion	24-Hour
RW-1	51+84	830	11 (819)	13.5 (816.5)	10 (820)
RW-2	52+84	831	8.5 (822.5)	10 (821)	10 (821)
RW-3	53+78	831	7 (824)	11 (820)	9.5 (821.5)
TB-1	54+84	831	6 (825)	10.5 (820.5)	9 (822) *
TB-2	55+44	831	9.5 (821.5)	10 (821)	10 (821) *
TB-3	56+30	831	11 (820)	29.5 (801.5)	--
TB-4	56+90	831	6 (825)	11 (820)	9.5 (821.5) *
RW-4	57+81	831	12 (819)	11.5 (819.5)	--
RW-5	58+90	831	9.5 (821.5)	11.5 (819.5)	--
RW-6	59+90	831	9 (822)	12 (819)	--

* Water introduced during exploration to reduce heaving at bottom of augers.

Based on the observed groundwater levels, we estimate the long-term groundwater level at the time of our exploratory operations is at about Elevation 822. Perched or trapped groundwater may also be encountered in discontinuous sand seams and layers at shallower depths. It should also be noted that groundwater levels can vary due to changes in precipitation, infiltration, run-off, and other hydrogeological characteristics.

DISCUSSION AND RECOMMENDATIONS

Based upon the test boring information and our understanding of the proposed construction, as mentioned in this report, the following geotechnical recommendations are presented. If the design information discussed in this report is incorrect or changed subsequent to our reporting, or if conditions during construction are observed to be significantly different from those encountered in our borings, we should be contacted so that we may re-evaluate our recommendations.

We understand that an existing fiber optic utility that currently extends along the length of the project may or may not be relocated during construction. Based on the subsurface conditions and the anticipated loads applied by the retained fill for the approach ramps, settlement is anticipated to be a concern. Soils at and below the bearing elevation for the proposed approach ramps, which are anticipated to be at or just above the buried depth of the fiber optic utility, are not considered suitable for support of structures via a shallow foundations scheme. We estimate that approximately 1 to 1½ in. of settlement could occur where fill placement is the highest (i.e., near the bridge abutments). Settlement of this magnitude would likely cause excessive cracking of the brick façade.

Based on these conditions and the anticipated loads, two options have been considered. Option 1, removal and replacement (on the order of 4 to 5 ft) would be required. As a consequence, removal and replacement would also likely require the relocation of the fiber optic utility and add a significant cost to the project. Option 2 consists of drilled-in-place soldier piles with precast concrete panels to retain the engineered fill. This retaining wall system would alleviate the need for significant removal and replacement. However, the anticipated settlement could affect the existing fiber optic utility.

Bridge Structure Foundations

We understand that deep foundations are proposed for support of the bridge. Based on the prevalence of underground utilities in the area of the interior bents of the bridge, we believe driven piling would be suitable for support of the proposed bridge.

From information obtained at the test boring locations, we anticipate that the piles will primarily be established in soils of glacial origin (loam and sand and gravel). Given the subsurface conditions, we anticipate that the piles will achieve their capacity through a combination of skin friction and end bearing. In our opinion, a suitable pile type would be a 14-in diameter closed-end pipe pile filled with concrete following installation. From our experience, a pile of this type is anticipated to achieve the required capacity at a depth less than a low-displacement pile such as an H-pile. It should be noted that if higher pile capacities are required, then deeper exploratory borings would be required.

Estimates of the pile tip elevations were made using guidelines entitled "General Instructions for Bridge Structure Investigations" (January 1992) by INDOT and a microcomputer program entitled *SPILE* developed by the Federal Highway Administration. Based on our previous experience with similar type/size structures, piles with a working capacity of 40 tons (using a safety factor of 2.5) was considered in our analysis. Table 2 provides a summary of our analysis.

TABLE 2. SUMMARY OF ESTIMATED PILE TIP ELEVATIONS

Location	Tip Elevation for 14-in Pipe Pile Working Pile Capacity - 40 tons
Bent No. 1 (TB-1)	786
Bent No. 2 (TB-2)	784
Bent No. 3 (TB-3)	791
Bent No. 4 (TB-4)	786

Based on the pH values as indicated in Appendix E, corrosion protection is generally not anticipated. Without a creek or river, scour is not applicable and down drag friction is anticipated to be negligible. Table 3 provides a summary of anticipated loading conditions for use in evaluating pile capacity during the driving process

TABLE 3. SUMMARY OF ANTICIPATED PILE LOADING CONDITIONS

Condition	Bent Locations 1 through 4
Design Load (tons)	40
Factor of Safety	2.5
Factored Design Load (tons)	100
Friction in Scour Zone	Not Applicable
Down Drag Friction	Negligible
Ultimate Load (tons)	100
Pile Driving Criterion	Refer to INDOT Standard Specifications, Section 701.06 (b)

We recommend that EEI be retained during the driving operations to verify that the construction proceeds in compliance with the design concepts, specifications and recommendations.

Earth Retaining Structures

To avoid the need for acquiring additional right-of-way for construction of the approach ramps, anchored retaining walls consisting of drilled-in-placed soldier piles with precast concrete panels and a brick facade are proposed to reduce the footprint. We understand that the soldier piles will be set in a pre-drilled hole and grouted in place in order to control the alignment of the wall (i.e., plumb and straightness). Alignment control would most likely not be possible with driven piles. During subgrade preparation, we suggest that an

EEI geotechnical engineer observe the subgrade to verify that the soil conditions are suitable for the support of the engineered backfill.

The soldier piles are anticipated to extend to a depth of about 10 to 15 ft below the existing ground surface. The soldier piles must also resist lateral loads applied by the granular backfill placed behind the precast concrete panels during and upon completion of construction activities. In order to control horizontal movement of the soldier piles, steel cross ties will connect opposing soldier piles thereby creating gravity type wall structure. The depth of embedment of the soldier piles is anticipated to depend on the flexural rigidity and spacing of these elements as well as the active and passive lateral resistance of the soil adjacent to the pile below the finished ground surface. Design of the earth retaining walls should take into consideration the earth pressures and potential pile movement during construction prior to the installation of the steel cross ties. We recommend the following earth pressures be considered for design of the retaining walls.

TABLE 4. RECOMMENDED EARTH PRESSURES

Retained Granular Fill				
Soil Unit Weight Most/Saturated (pcf)	Angle of Internal Friction (degrees)	At-Rest Earth Pressure (pcf)	Active Earth Pressure (pcf)	Passive Earth Pressure (pcf)
120/125	32	60	40	400
Below Existing Grade				
Soil Unit Weight Moist/Saturated (pcf)	Angle of Internal Friction (degrees)	At-Rest Earth Pressure (pcf)	Active Earth Pressure (pcf)	Passive Earth Pressure (pcf)
115/120	29	NA	40	350
Earth pressures are expressed as Equivalent Fluid Pressures				

The soldier piles and precast concrete panels are planned to retain the engineered fill and support a cast-in-place grade beam and brick facing. Based on the anticipated depths of embedment (i.e. 10 to 15 ft below existing grade) bearing capacity is not anticipated to be an issue. Considering that the wall is anticipated to behave as a gravity-type structure, net allowable bearing pressures of up to 9,000 psf for the 14-ft wide structure are anticipated. Due to the presence of near-surface soft/loose conditions, it should be noted that the fill is anticipated to settle during construction. However, we anticipate that settlement of the near-surface soils and the engineered fill should have little effect on the soldier piles and precast concrete panels. Estimated total settlement of the near-surface soils and the existing fill (based on Test Boring RW-5 for the proposed structure configuration) could be on the order of 1 to 1½ in.

CONSTRUCTION CONSIDERATIONS

Prior to pile installation, we recommend that subgrade preparation consist of thoroughly compacting the subgrade of the retaining wall area. We recommend that the footprint of the approach ramps be proofrolled to identify any areas of near surface unsuitable soil. In areas where subgrade soils do not perform suitably under proofroll testing, we recommend a maximum of 2 ft be removed and replaced with engineered fill. In addition to the subgrade preparation mentioned above, where granular soils are encountered in the subgrade they should be compacted prior to construction of the wall. We recommend that granular soils be compacted to a minimum of 100 percent of the maximum dry density in accordance with AASHTO T-99.

Fill Placement

Engineered fill placed beneath and within the approach ramps should consist of a well-graded granular material with less than 8 percent passing the No. 200 sieve. We recommend that the engineered fill be compacted to 95 percent of the maximum dry density in accordance with AASHTO T-99. Care should be exercised when compacting the engineered fill along the interior of the retaining wall near the precast concrete panels to prevent overstressing and damaging the panels. Some lateral movement of the soldier piles should be expected. If movements of greater than 1 in. at the top of the piles are realized during fill placement, then temporary lateral support should be provided or placement of the steel cross tie should be considered. Construction of the approach ramps should be in general accordance with ISS Section 203.

Excavations

Excavations for this project will require slopes cut to prevent cave-ins/subsidence for safe construction operation. The soils encountered on this project within any given excavation area are anticipated to consist of Type A, B or C (according to OSHA) and should be treated accordingly.

The risk of a slope failure increases with an increase in excavation depth, added weight near the edge of the excavation from machinery and excavated soil, and the decrease in support resulting from the removal of soil. We recommend that excavated soil not be stockpiled immediately adjacent to the top of the excavation nor should equipment be allowed to operate too closely to excavations. The Contractor is solely responsible for the construction of temporary excavations including the use of shoring, bracing, sloping, and/or benching the sides of excavations.

The existing drainage ditch, northwest of the existing alignment, is planned to be backfilled to allow access to the bridge from Carmel Drive. During clearing and grubbing activities for the ditch, we recommend that any exposed subgrade areas of soft or loose soils be either compacted or removed and replaced with engineered fill. After clearing, grubbing, and improvement of the subgrade conditions within the ditch, slopes may be too steep to accept placement of new fill. Section 203 of ISS should be reviewed for procedures related to fill placement on slopes and in ditches.

Groundwater Control

Based on the subsurface information, it is likely that excavations extending to depths of about 9 ft or more will encounter groundwater. Groundwater may also be encountered at shallower depths in discontinuous sand seams and layers. In those areas where cohesive soils are encountered, the groundwater can likely be controlled using a pump and filtered sump, possibly in combination with collection trenches. In areas where granular soils are encountered, alternate dewatering methods such as perimeter wells or well points may be necessary.

CONCLUDING REMARKS

We recommend that EEI be provided the opportunity to review the contractor's design and construction procedures to confirm that foundation requirements have been properly interpreted and implemented in the design. We also recommend that EEI be retained to provide construction observation services during the appropriate phases of the project. This will allow us to verify that the construction proceeds in compliance with the design concepts and recommendations.

This evaluation has been conducted in accordance with generally accepted soil and foundation engineering practices. The recommendations in this report are based on the subsurface information from the relatively widely-spaced borings performed for this project. It is important to recognize that subsurface conditions can vary over relatively short distances. If unanticipated conditions are encountered during construction, we recommend that EEI be contacted to re-evaluate the conclusions and recommendations contained in this report.

Mr. Kurt Fowerbaugh, P.E.
United Consulting Engineers & Architects

We appreciate the opportunity to provide our services to you on this project. Please contact our office if you have any questions or need further assistance with the project.

Sincerely,

EARTH EXPLORATION, INC.

DARREN R. PLEIMAN REGISTERED No. 10200085 STATE OF INDIANA PROFESSIONAL ENGINEER

Darren R. Pleiman, P.E.
Senior Geotechnical Engineer

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Scott J. Ludlow, Ph.D., P.E.
Principal Engineer

Attachments –

APPENDIX A	-	Important Information about Your Geotechnical Report
APPENDIX B	-	Field Methods for Exploring and Sampling Soils and Rock
APPENDIX C	-	General Site Plan (Drawing No. 1-03-071.A1)
		Test Boring Location Plan (Drawing No. 1-03-071.B2)
APPENDIX D	-	Log of Test Boring - General Notes
		Log of Test Boring - Bridge Borings (4)
		Log of Test Boring – MSE Structure Borings (6)
APPENDIX E	-	Summary of Special Laboratory Test Results
		Summary of Classification Test Results
		Grain Size Distribution Curve (5)
		Unconfined Compression Test (4)
APPENDIX F	-	Subsurface Profile at Bridge Structure (Drawing No. 1-03-071.B3)
		Static Analyses For Pile Load Capacity
		Bearing Capacity Analysis
		Settlement Analysis for Proposed Embankment

APPENDIX A

Important Information About Your
Geotechnical Engineering Report

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one—not even you—*should apply the report for any purpose or project except the one originally contemplated.

Read the full report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions *only* at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an *opinion* about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject To Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce such risks, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations", many of these provisions indicate where geotechnical engineers responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Rely on Your Geotechnical Engineer for Additional Assistance

Membership in ASFE exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE

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APPENDIX B

Field Methods for Exploration and Sampling Soils

FIELD METHODS FOR EXPLORING AND SAMPLING SOILS AND ROCK

A. Boring Procedures Between Samples

The boring is extended downward, between samples, by a hollow stem auger (AASHTO* Designation T251-77), a continuous flight auger, driven and washed-out casing, or rotary boring with drilling mud or water.

B. Penetration Test and Split-Barrel Sampling of Soils
(AASHTO* Designation: T206-87)

This method consists of driving a 2-inch outside diameter split-barrel sampler using a 140 pound weight falling freely through a distance of 30 inches. The sampler is first seated 6-inches into the material to be sampled and then driven 12 inches. The number of blows required to drive the sampler the final 12 inches is known as the Standard Penetration Resistance or N-Value. The blow counts are reported on the Test Boring Records per 6 inch increment. Recovered samples are first classified as to texture by the driller. Later, in the laboratory the driller's classification is reviewed by a soils engineer who examines each sample.

C. Thin-walled Tube Sampling of Soils
(AASHTO* Designation: T207-87)

This method consists of pushing a 2-inch or 3-inch outside diameter thin wall tube by hydraulic or other means into soils, usually cohesive types. Relatively undisturbed samples are recovered.

D. Soil Investigation and Sampling by Auger Borings
(AASHTO* Designation: T203-82)

This method consists of augering a hole and removing representative soil samples from the auger flight or bucket at 5-foot intervals or with each change in the substrata. Relatively disturbed samples are obtained and its use is therefore limited to situations where it is satisfactory to determine approximate subsurface profile.

E. Diamond Core Drilling for Site Investigation
(AASHTO* Designation: T225-83)

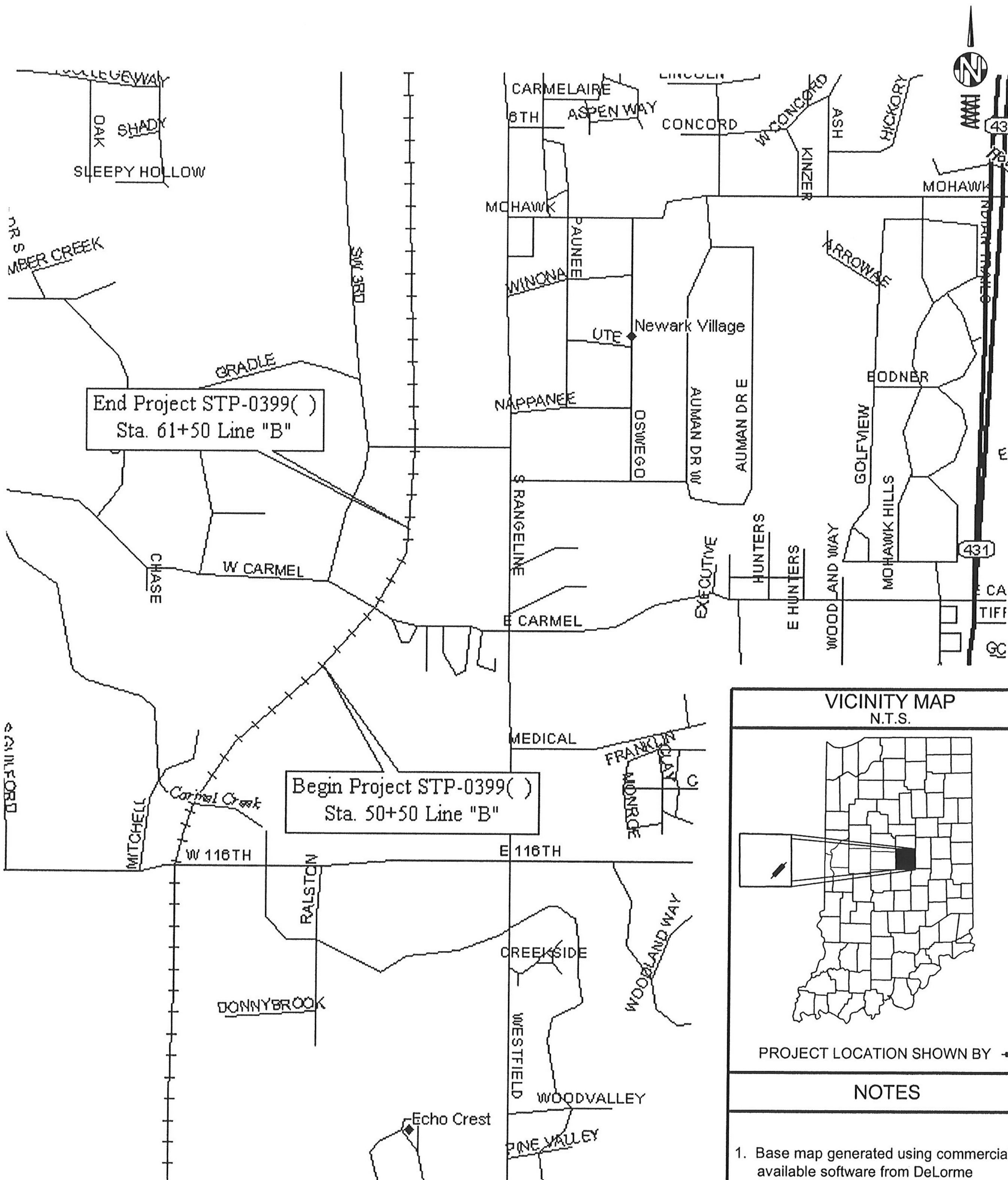
This method consists of advancing a hole in bedrock or other hard strata by rotating downward a single tube or double tube core barrel equipped with a cutting bit. Diamond, tungsten carbide, or other cutting agents may be used for the bit. Wash water is used to remove the cuttings. Normally, a 3-inch outside diameter by 2-inch inside diameter coring bit is used unless otherwise noted. The rock or hard material recovered within the core barrel is examined in the field and laboratory. Cores are stored in partitioned boxes and the length of recovered material is expressed as a percentage of the actual distance penetrated.

* American Association of State Highway and Transportation Officials, Washington D.C.

APPENDIX C

General Site Plan (Drawing No. 1-03-071.A1)

Test Boring Location Plan (Drawing No. 1-03-071.B2)



VICINITY MAP

N.T.S.

PROJECT LOCATION SHOWN BY

NOTES

1. Base map generated using commercially available software from DeLorme (Street Atlas ver. 3.0).

GENERAL SITE PLAN

PROJECT:	Monon Greenway over Carmel Drive
PROJECT NO.:	STP-0399( )
LOCATION:	Carmel, Indiana
CLIENT:	United Consulting Engineers & Architects
EEI PROJECT NO.:	1-03-071
SCALE:	1" = 0.20 mi.

PROJECT ENGINEER: DRP

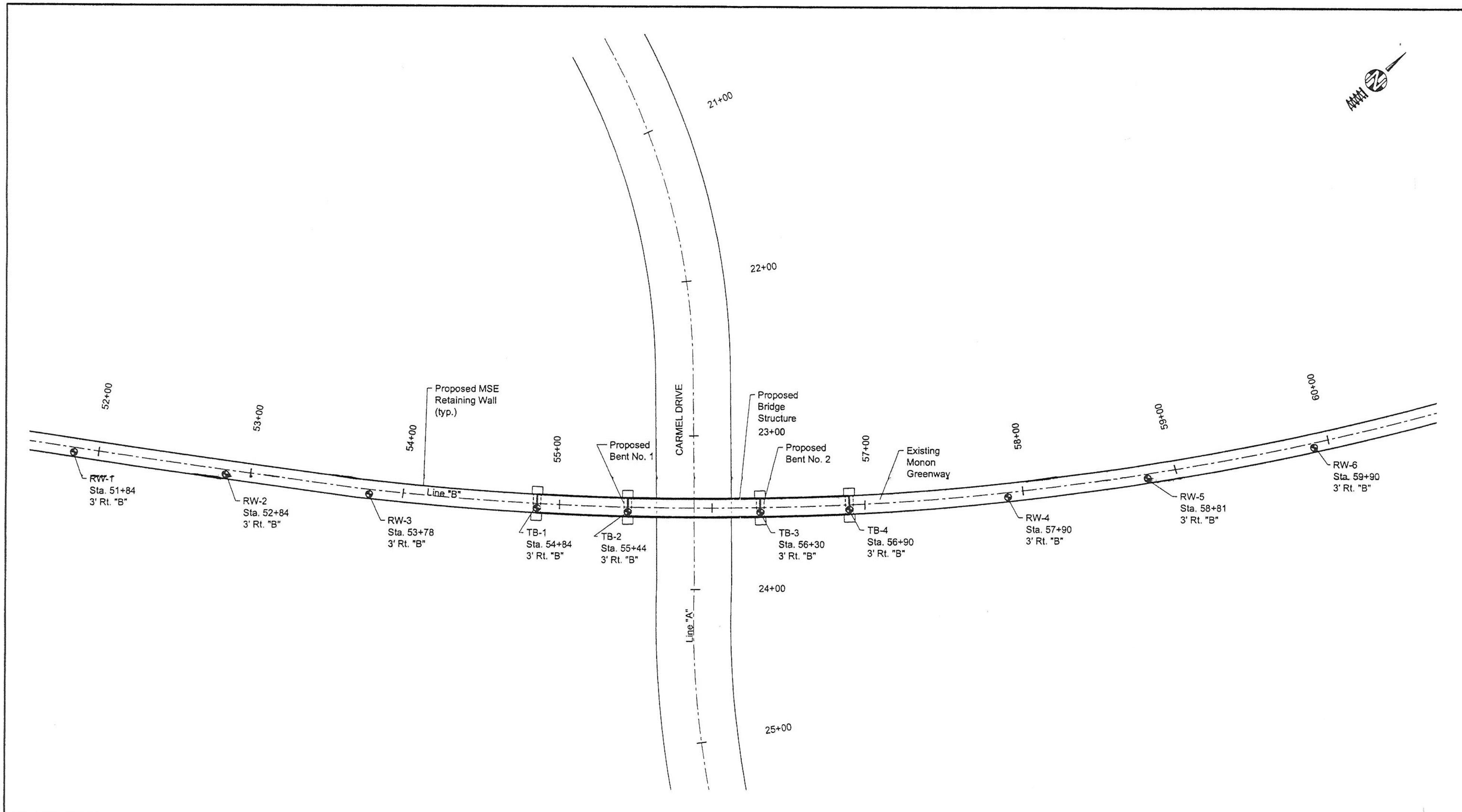
APPROVED BY: SJL

DRAWN BY: AJH

DATE AND TIME: 10-30-03 13:28:24

DRAWING NUMBER: 1-03-071.A1

EARTH EXPLORATION
7770 West New York Street
Indianapolis, IN 46214-2988
317-273-1690
(FAX) 317-273-2250



LEGEND

TB-1 Sta. 54+85 3' Rt. "B" — Test Boring Location, Designation, Station and Offset

NOTES

1. Base map developed from plans provided by United Consulting Engineers & Architects on September 5, 2003.
2. Refer to the Log of Test Boring (10) in Appendix D for a description of the subsurface conditions encountered at the test boring locations.
3. Borings were located in the field by Earth Exploration, Inc. on October 6, 2003.
4. Ground surface elevation at the test boring locations were interpolated to the nearest ½ ft based on topographic information provided on the previously mentioned plans.
5. Boring locations are approximate.

TEST BORING LOCATION PLAN

PROJECT:	Monon Greenway over Carmel Drive
PROJECT NO.:	STP-0399( )
LOCATION:	Carmel, Indiana
CLIENT:	United Consulting Engineers & Architects
EEI PROJECT NO.:	1-03-071
SCALE:	1" = 60'

PROJECT ENGINEER: DRP
APPROVED BY: SJL
DRAWN BY: AJH
DATE AND TIME: 10-30-03 10:32:25
DRAWING NUMBER: 1-03-071.B2

EARTH EXPLORATION
7770 West New York Street
Indianapolis, IN 46214-2988
317-273-1690
(FAX) 317-273-2250

APPENDIX D

Log of Test Boring - General Notes

Log of Test Boring – Bridge Structure Borings (4)

Log of Test Boring – MSE Structure Borings (6)

LOG OF TEST BORING - GENERAL NOTES

DESCRIPTIVE SOIL CLASSIFICATION

GRAIN SIZE TERMINOLOGY

Soil Fraction		Particle Size	US Standard Sieve Size
Boulders		Larger than 75 mm	Larger than 3"
Gravel		2.00 to 75 mm	#10 to 75 mm
Sand:	Coarse	0.425 to 2.00 mm	#40 to #10
	Fine	0.075 to 0.425 mm	#200 to #40
Silt		0.002 to 0.075 mm	Smaller than #200
Clay		Smaller than 0.002 mm	Smaller than #200

Plasticity characteristics differentiate between silt and clay.

GENERAL TERMINOLOGY

Physical Characteristics
- Color, moisture, grain shape, fineness, etc.

Major Constituents
- Clay, silt, sand, gravel

Structure
- Laminated, varved, fibrous, stratified, cemented, fissured, etc.

Geologic Origin
- Glacial, alluvial, eolian, residual, etc.

RELATIVE PROPORTIONS OF COHESIONLESS SOILS

Term	Defining Range by % of Weight
Trace	1 - 10%
Little	11 - 20%
Some	21 - 35%
And	36 - 50%

ORGANIC CONTENT BY COMBUSTION METHOD

Soil Description	LOI
w/ trace organic matter	1 - 6%
w/ little organic matter	7 - 12%
w/ some organic matter	13 - 18%
Organic Soil (A-8)	19 - 30%
Peat (A-8)	More than 30%

RELATIVE DENSITY

Term	"N" Value
Very loose	0 - 5
Loose	6 - 10
Medium dense	11 - 30
Dense	31 - 50
Very Dense	51+

CONSISTENCY

Term	"N" Value
Very soft	0 - 3
Soft	4 - 5
Med stiff	6 - 10
Stiff	11 - 15
Very Stiff	16 - 30
Hard	31+

PLASTICITY

Term	Plastic Index
None to slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High/Very High	Over 22

The penetration resistance, N, is the summation of the number of blows required to effect two successive 6-in. penetrations of the 2-in. split-barrel sampler. The sampler is driven with a 140-lb weight falling 30 in. and is seated to a depth of 6 in. before commencing the standard penetration test.

SYMBOLS

DRILLING AND SAMPLING

- AS - Auger Sample
- BS - Bag Sample
- C - Casing: Size 2½", NW; 4", HW
- COA - Clean-Out Auger
- CS - Continuous Sampling
- CW - Clear Water
- DC - Driven Casing
- DM - Drilling Mud
- FA - Flight Auger
- FT - Fish Tail
- HA - Hand Auger
- HSA - Hollow Stem Auger
- NR - No Recovery
- PMT - Borehole Pressuremeter Test
- PT - 3" O.D. Piston Tube Sample
- PTS - Peat Sample
- RB - Rock Bit
- RC - Rock Coring
- REC - Recovery
- RQD - Rock Quality Designation
- RS - Rock Sounding
- S - Soil Sounding
- SS - 2" O.D. Split-Barrel Sample
- 2ST - 2" O.D. Thin-Walled Tube Sample
- 3ST - 3" O.D. Thin-Walled Tube Sample
- VS - Vane Shear Test
- WPT - Water Pressure Test

LABORATORY TESTS

- qp - Penetrometer Reading, tsf
- qu - Unconfined Strength, tsf
- W - Moisture Content, %
- LL - Liquid Limit, %
- PL - Plastic Limit, %
- PI - Plasticity Index
- SL - Shrinkage Limit, %
- LOI - Loss on Ignition, %
- γ - Dry Unit Weight, pcf
- pH - Measure of Soil Alkalinity/Acidity

WATER LEVEL MEASUREMENT

- BF - Backfilled upon Completion
- NW - No Water Encountered

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

LOG OF TEST BORING

EARTH EXPLORATION INC

Project	Monon Greenway over Carmel Drive
Location	Carmel, Indiana
Client	United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No.	TB-1
Elevation	831.0
Datum	USC & GS
EEI Proj. No.	1-03-071
Sheet	1 of 2

Proj. No.	STP-0399 ( )	Struct. No.	---	Weather	Cloudy 70° F	Driller	B.J.
Des. No.	0300059	Station	54+84	Offset	3' Rt. "B"	Inspector	---

No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
					830	**ASPHALTIC CONCRETE** (5 in)							
						GRANULAR SUBBASE (crushed stone; 7 in)							
SS-1		55	6-6-7			**SANDY LOAM with Some Gravel**, medium dense, moist, brown, (fill), A-2-4, Lab No. 5747SL							
SS-2		55	3-5-6	5		**LOAM**, stiff, moist, dark gray, with trace wood and roots (fill; visual)	1.75			21.4			
SS-3		85	2-2-3		825	**LOAM**, soft, moist, gray, A-6, Lab No. 5745SL	0.5			17.4			
						SANDY LOAM, moist, gray (visual)							
SS-4		40	5-6-9	10		**SANDY LOAM**, medium dense, wet, brown (visual)							
SS-5		85	6-7-10		820								
SS-6		100	8-10-12	15	815	**SAND**, medium dense, wet, gray, with occasional silt seams (visual)							
SS-7		45	5-5-4	20	810		1.5			14.2			
SS-8		55	5-5-7	25	805	**LOAM**, medium stiff to stiff, moist, gray, A-4(1), Lab No. 5748SL	2.5 1.75			11.9	19	12	7
SS-9		55	4-6-7	30			0.75 2.0			13.6			

Continued Next Page

WATER LEVEL OBSERVATIONS

Depth ft	While Drilling	Upon Completion	24 hrs After Drilling
To Water	6	10½	9
To Cave-in		12	11

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 10/9/03 End 10/9/03 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks Grouted above the cave-in depth and concrete patch at surface. Water introduced at 11' to reduce heaving.

EARTH EXPLORATION INC

LOG OF TEST BORING

Project: Monon Greenway over Carmel Drive
Location: Carmel, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. TB-1
Elevation 831.0
Datum USC & GS
EEI Proj. No. 1-03-071

Proj. No.	STP-0399 ( )	Struct. No.	---	Weather	Cloudy 70° F	Driller	B.J.
Des. No.	0300059	Station	54+84	Offset	3' Rt. "B"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
					800								
SS-10	X	100	4-4-5	35	795	**LOAM**, medium stiff to stiff, moist, gray, A-4(1), Lab No. 5748SL	2.0 2.75			10.6			
SS-11	X	100	7-12-12	40	790	**SAND**, medium dense to dense, wet, gray (visual)							
SS-12	X	100	9-15-16	45									
						End of Boring at 45 ft							

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

EARTH EXPLORATION INC

LOG OF TEST BORING

Project: Monon Greenway over Carmel Drive
Location: Carmel, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. TB-2
Elevation 831.0
Datum USC & GS
EEI Proj. No. 1-03-071
Sheet 1 of 2

Proj. No.	STP-0399 ( )	Struct. No.	---	Weather	Cloudy 65° F	Driller	B.J.
Des. No.	0300059	Station	55+44	Offset	3' Rt. "B"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE (5 in)							
AS-1					830	**GRANULAR SUBBASE** (crushed stone; 9 in)							
						SANDY LOAM with Some Gravel, moist, dark gray, (fill), A-2-4, Lab No. 5747SL							
SS-2		85	2-3-4	5	825	**SILTY CLAY LOAM**, medium stiff, moist, dark gray, with trace to little organic matter (possible fill) SS-2 LOI = 8.8%, A-6, Lab No. 5744SL	1.0 1.75			44.5			
SS-3		85	2-2-3			**SILTY CLAY**, soft, moist, gray and brown, A-7-6, Lab No. 5746SL	1.0 1.25			24.4			
SS-4		85	2-2-4	10			0.5			24.3			
					820	**SANDY LOAM**, loose, wet, brown (visual)							
SS-5		100	5-10-10	15	815	**GRAVELLY SAND**, medium dense, wet, gray (visual)							
SS-6		100	4-5-7	20	810		1.75			11.1			
SS-7		85	3-5-6	25	805	**LOAM**, stiff, moist, gray, A-4, Lab No. 5748SL	1.75			10.7			
SS-8		85	3-3-8	30									

Continued Next Page

WATER LEVEL OBSERVATIONS

Depth ft	While Drilling	Upon Completion	24 hrs After Drilling
To Water	9½	10	10
To Cave-in		11	11

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 10/9/03 End 10/9/03 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks Grouted above the cave-in depth and concrete patch at surface. Water introduced at 48.5' to reduce heaving.

EARTH EXPLORATION INC

LOG OF TEST BORING

Project: Monon Greenway over Carmel Drive
Location: Carmel, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. TB-2
Elevation 831.0
Datum USC & GS
EEI Proj. No. 1-03-071
Sheet 2 of 2

Proj. No.	STP-0399 ( )	Struct. No.	---	Weather	Cloudy 65° F	Driller	B.J.
Des. No.	0300059	Station	55+44	Offset	3' Rt. "B"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
SS-9	X	100	7-7-5	35	**SAND**, medium dense, wet, gray, with occasional sandy loam and sand and gravel seams (visual)							
SS-10	X	85	8-10-12	40								
SS-11	X	100	6-7-9	45								
SS-12	X	85	10-18-18	50	**SAND AND GRAVEL**, dense, wet, gray (visual)							
SS-13	X	100	16-17-19	55								
SS-14	X	40	39-49-52	60	**LOAM**, hard, moist, gray, A-4, Lab No. 5748SL	>4.5			7.2			
					End of Boring at 60 ft							

Elevation scale: 800, 795, 790, 785, 780, 775

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

LOG OF TEST BORING

EARTH EXPLORATION INC

Project: Monon Greenway over Carmel Drive
Location: Carmel, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. TB-3
Elevation 831.0
Datum USC & GS
EEI Proj. No. 1-03-071

Proj. No.	STP-0399 ( )	Struct. No.	---	Weather	Sunny 75° F	Driller	B.J.
Des. No.	0300059	Station	56+30	Offset	3' Rt. "B"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE (3 in)							
					830	**GRANULAR SUBBASE** (9 in)							
SS-1		65	7-10-8			**SANDY LOAM with Some Gravel**, medium dense, moist, brown, (fill), A-2-4, Lab No. 5747SL							
SS-2		85	2-3-4	5	825	**SILTY CLAY LOAM**, medium stiff, moist, dark gray, with trace to little organic matter, A-6, Lab No. 5744SL	0.75 1.25			24.7			
SS-3		85	3-3-3			**LOAM**, medium stiff, moist, brown and gray, A-6, Lab No. 5745SL	1.25 0.75			20.4			
SS-4		85	5-5-6	10	820	**SANDY LOAM**, medium dense, wet, brown, with occasional silt seams and sand seams (visual)							
SS-5		100	8-12-13			**LOAM**, stiff to very stiff, moist, gray, with occasional wet sand and sandy loam seams, A-4, Lab No. 5748SL	2.25			11.1			
SS-6		100	6-7-7	15	815		3.5 >4.5	4.44	121.7	14.5			
SS-7		35	7-10-9	20	810		1.25			13.6			
SS-8		100	4-6-6	25	805		2.5			9.9			
SS-9		100	6-6-7	30			1.75			10.1			

Continued Next Page

WATER LEVEL OBSERVATIONS

Depth ft	While Drilling	Upon Completion	After Drilling
To Water	11	12	BF
To Cave-in		29½	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 10/13/03 End 10/13/03 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks Grouted above the cave-in depth and concrete patch at surface.

LOG OF TEST BORING

EARTH EXPLORATION INC

Project	Monon Greenway over Carmel Drive
Location	Carmel, Indiana
Client	United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No.	TB-3
Elevation	831.0
Datum	USC & GS
EEI Proj. No.	1-03-071
Sheet	2 of 2

Proj. No.	STP-0399 ( )	Struct. No.	---	Weather	Sunny 75° F	Driller	B.J.
Des. No.	0300059	Station	56+30	Offset	3' Rt. "B"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
SS-10	X	100	8-8-16		**LOAM**, stiff to very stiff, moist, gray, with occasional wet sand and sandy loam seams, A-4, Lab No. 5748SL	4.0 >4.5			9.5			
SS-11	X	100	13-19-19		**SAND**, dense to medium dense, wet, gray (visual)	2.0			10.5			
SS-12	X	100	9-12-14									
SS-13	X	100	8-12-12		**SAND AND GRAVEL**, medium dense to dense, wet, gray (visual)							
SS-14	X	100	8-12-19									
SS-15	X	85	12-15-24	60	**LOAM**, hard, moist, gray, A-4, Lab No. 5748SL	>4.5			8.9			
					End of Boring at 60 ft							

Depth scale: 35, 40, 45, 50, 55, 60 ft; Elev scale: 800, 795, 790, 785, 780, 775.

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

LOG OF TEST BORING

EARTH EXPLORATION INC

Project: Monon Greenway over Carmel Drive
Location: Carmel, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. TB-4
Elevation 831.0
Datum USC & GS
EEI Proj. No. 1-03-071
Sheet 1 of 2

Proj. No.	STP-0399 ( )	Struct. No.	---	Weather	Cloudy 70° F	Driller	B.J.
Des. No.	0300059	Station	56+90	Offset	3' Rt. "B"	Inspector	---

SAMPLE No.	Rec %	Blow Counts	Depth ft / Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
				ASPHALTIC CONCRETE (3 in)							
			830	**GRANULAR SUBBASE** (crushed stone; 3 in)							
SS-1	65	4-5-7		**SANDY LOAM with Some Gravel**, medium dense, moist, brown (fill)							
SS-2	0	3-4-5	5	**SILTY CLAY**, medium stiff, moist, brown and gray, A-7-6, Lab No. 5746SL	---			---			
SS-3	65	2-3-5	825		0.75	1.02	86.9	34.5			
				SANDY LOAM, loose, wet, brown (visual)							
SS-4	100	3-5-7	10	**GRAVELLY SAND**, medium dense, wet, brown (visual)							
SS-5	100	7-9-11	820								
				SANDY LOAM, medium dense, moist, brown to gray below 13½' (visual)							
SS-6	100	6-7-7	15		2.5			9.8			
			815	**LOAM**, stiff, moist, gray, A-4, Lab No. 5748SL							
SS-7	100	5-7-8	20		---			18.2			
			810	**SAND AND GRAVEL**, medium dense, wet, gray (visual)							
SS-8	100	4-5-7	25		2.0 1.75			11.4			
			805	**LOAM**, stiff to very stiff, moist, gray, with occasional sand seams, A-4, Lab No. 5748SL							
SS-9	100	8-10-10	30		1.75 2.5			11.0			

Continued Next Page

WATER LEVEL OBSERVATIONS

Depth ft	While Drilling	Upon Completion	24 hrs After Drilling
To Water	6	11	9½
To Cave-in		31	10½

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 10/10/03 End 10/10/03 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks Grouted above the cave-in depth and concrete patch at surface. Water introduced at 25' to reduce heaving.

EARTH EXPLORATION INC

LOG OF TEST BORING

Project: Monon Greenway over Carmel Drive
Location: Carmel, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No.: TB-4
Elevation: 831.0
Datum: USC & GS
EEI Proj. No.: 1-03-071

Proj. No.	STP-0399 ( )	Struct. No.	---	Weather	Cloudy 70° F	Driller	B.J.
Des. No.	0300059	Station	56+90	Offset	3' Rt. "B"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
					800								
SS-10	X	100	5-6-7	35	795	**LOAM**, stiff to very stiff, moist, gray, with occasional sand seams, A-4, Lab No. 5748SL	1.5 1.0			10.0			
SS-11	X	100	7-10-10	40	790	**SAND**, medium dense, wet, gray (visual)							
SS-12	X	65	8-10-11	45									
						End of Boring at 45 ft							

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

EARTH EXPLORATION INC

LOG OF TEST BORING

Project	Monon Greenway over Carmel Drive
Location	Carmel, Indiana
Client	United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No.	RW-1
Elevation	830.0
Datum	USC & GS
EEI Proj. No.	1-03-071
Sheet	1 of 1

Proj. No.	STP-0399 ( )	Struct. No.	---	Weather	Cloudy 65° F	Driller	B.J.
Des. No.	0300059	Station	51+84	Offset	3' Rt. "B"	Inspector	---

SAMPLE					DESCRIPTION/CLASSIFICATION and REMARKS	SOIL PROPERTIES						
No.	Type	Rec %	Blow Counts	Depth ft / Elev		q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
					ASPHALTIC CONCRETE (3 in)							
					GRANULAR SUBBASE (crushed stone; 3 in)							
SS-1	X	65	8-9-10		**SANDY LOAM with Some Gravel**, medium dense, moist, brown, (fill), A-2-4, Lab No. 5747SL	>4.5			18.2			
SS-2	X	50	6-7-7	5 / 825	**SILTY CLAY LOAM**, stiff, moist, gray, (possible fill), A-6, Lab No. 5744SL	>4.5			16.1			
SS-3	X	85	3-5-5		**SILTY CLAY**, medium stiff, moist, gray and brown, A-7-6, Lab No. 5746SL	2.0 1.75			24.3			
SS-4	X	100	3-4-4	10 / 820	**SILTY CLAY LOAM**, medium stiff, moist, gray and brown, A-6, Lab No. 5744SL	1.25 0.75			26.4			
					SAND, loose, wet, brown (visual)							
SS-5	X	100	3-6-8		**LOAM**, stiff, moist, gray, A-4, Lab No. 5748SL	1.5			10.0			
SS-6	X	100	4-6-7	15 / 815		2.25 2.0			11.9			

End of Boring at 15 ft

WATER LEVEL OBSERVATIONS

Depth ft	∇ While Drilling	▼ Upon Completion	∇ 24 hrs After Drilling
To Water	11	13½	10
To Cave-in		14	11½

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 10/10/03 End 10/10/03 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks Grouted above the cave-in depth and concrete patch at surface.

EARTH EXPLORATION INC

LOG OF TEST BORING

Project: Monon Greenway over Carmel Drive
Location: Carmel, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RW-2
Elevation 831.0
Datum USC & GS
EEI Proj. No. 1-03-071
Sheet 1 of 1

Proj. No.	STP-0399 ( )	Struct. No.	---	Weather	Cloudy 65° F	Driller	B.J.
Des. No.	0300059	Station	52+84	Offset	3' Rt. "B"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE (3 in)							
					830	**GRANULAR SUBBASE** (crushed stone; 3 in)							
SS-1		65	8-10-8			**SANDY LOAM with Some Gravel**, medium dense, moist, black to brown, (fill), A-2-4, Lab No. 5747SL							
SS-2		85	6-7-8	5		**SILTY CLAY LOAM**, stiff, moist, dark gray and brown, (fill), A-6, Lab No. 5744SL	---			14.2			
SS-3		100	4-5-5		825	**SILTY CLAY LOAM**, medium stiff to very soft, moist to very moist, brown and gray, with occasional silt partings, A-6(11), Lab No. 5744SL	2.0 1.25	1.55	101.7	24.1			
SS-4		100	2-1-2	10			0.5			27.3	31	16	15
SS-5		100	6-8-10		820	**SAND**, medium dense, wet, brown (visual)	2.5			10.4			
SS-6		65	4-6-10	15	815	**LOAM**, very stiff to stiff, moist, gray, A-4, Lab No. 5748SL	3.5 3.75			9.3			
SS-7		100	4-6-6	20	810	**SAND**, medium dense, wet, gray (visual)							
SS-8		100	7-7-8	25		**LOAM**, very stiff to stiff, moist, gray, A-4, Lab No. 5748SL	2.75 3.0			11.9			
						End of Boring at 25 ft							

WATER LEVEL OBSERVATIONS

Depth ft	While Drilling	Upon Completion	24 hrs After Drilling
To Water	8½	10	10
To Cave-in		14½	12

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 10/10/03 End 10/10/03 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks Grouted above the cave-in depth and concrete patch at surface.

EARTH EXPLORATION INC

LOG OF TEST BORING

Project: Monon Greenway over Carmel Drive
Location: Carmel, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RW-3
Elevation 831.0
Datum USC & GS
EEI Proj. No. 1-03-071

Proj. No.	STP-0399 ( )	Struct. No.	---	Weather	Cloudy 65° F	Driller	B.J.
Des. No.	0300059	Station	53+78	Offset	3' Rt. "B"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft / Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
					ASPHALTIC CONCRETE (3 in)							
				830	**GRANULAR SUBBASE** (9 in)							
SS-1	X	65	6-7-7		**SANDY LOAM with Some Gravel**, medium dense, moist, black to brown, (fill), A-2-4, Lab No. 5747SL							
SS-2	X	85	6-6-5	5	**LOAM**, stiff, moist, gray to dark gray and brown, (fill), A-6(3), Lab No. 5745SL	3.25 3.0			19.2			
SS-3	X	100	3-2-2	825		1.25			20.4	28	15	13
					SANDY LOAM, very loose, very moist, brown (visual)							
SS-4	X	100	2-2-3	10	**SILTY CLAY LOAM**, soft, very moist, brown and gray, with intermittent silt partings, A-6, Lab No. 5744SL	1.0 0.25			29.0			
SS-5	X	100	4-7-7	820	**LOAM**, stiff, moist, gray, A-4, Lab No. 5748SL	2.5			12.2			
SS-6	X	100	5-10-11			>4.5			9.3			
				15 / 815	**SAND**, medium dense, wet, gray (visual)							
SS-7	X	100	5-8-4	20		2.0 >4.5			11.2			
				810	**LOAM**, very stiff to medium stiff, moist, gray, A-4, Lab No. 5748SL							
SS-8	X	100	3-4-6	25		2.5 2.75			11.4			
				805								
SS-9	X	85	7-9-10	30	**GRAVELLY SAND**, medium dense, wet, gray (visual)							

Continued Next Page

WATER LEVEL OBSERVATIONS

Depth ft	▽ While Drilling	▼ Upon Completion	▽ 24 hrs After Drilling
To Water	7	11	9½
To Cave-in		28½	14

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 10/10/03 End 10/10/03 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks Grouted above the cave-in depth and concrete patch at surface.

Earth Exploration Inc

LOG OF TEST BORING

Project: Monon Greenway over Carmel Drive
Location: Carmel, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RW-3
Elevation 831.0
Datum USC & GS
EEI Proj. No. 1-03-071
Sheet 2 of 2

Proj. No.	STP-0399 ( )	Struct. No.	---	Weather	Cloudy 65° F	Driller	B.J.
Des. No.	0300059	Station	53+78	Offset	3' Rt. "B"	Inspector	---

SAMPLE					DESCRIPTION/CLASSIFICATION and REMARKS	SOIL PROPERTIES						
No.	Type	Rec %	Blow Counts	Depth ft Elev		q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
				800	**GRAVELLY SAND**, medium dense, wet, gray (visual)							
SS-10	X	65	4-4-6	35	**LOAM**, medium stiff, moist, gray, A-4, Lab No. 5748SL	1.25 1.5			10.7			
					End of Boring at 35 ft							

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

LOG OF TEST BORING

EARTH EXPLORATION INC

Project	Monon Greenway over Carmel Drive
Location	Carmel, Indiana
Client	United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No.	RW-4
Elevation	831.0
Datum	USC & GS
EEI Proj. No.	1-03-071
Sheet	1 of 2

Proj. No.	STP-0399 ( )	Struct. No.	---	Weather	Sunny 75° F	Driller	B.J.
Des. No.	0300059	Station	57+90	Offset	3' Rt. "B"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE (3 in)							
					830	**GRANULAR SUBBASE** (9 in)							
SS-1	X	85	8-9-10			**SANDY LOAM with Some Gravel**, medium dense, moist, brown, A-2-4, Lab No. 5747SL							
SS-2	X	35	11-4-5	5	825	**SILTY CLAY LOAM**, medium stiff, moist, dark gray, with trace organic matter, (fill) SS-2 LOI = 5.4%, A-6, Lab No. 5744SL	2.5			21.0			
SS-3	X	85	3-3-3			**SILTY CLAY**, medium stiff, moist, brown and gray, A-7-6(30), Lab No. 5746SL	1.0 0.5			30.5	48	18	30
SS-4	X	100	2-3-4	10	820	**SILTY CLAY LOAM**, medium stiff, moist, brown and gray, A-6, Lab No. 5744SL	1.0 1.25	0.81	98.7	26.4			
SS-5	X	100	5-8-9			**SANDY LOAM**, medium dense, wet, brown (visual)							
SS-6	X	100	4-4-5	15	815	**LOAM**, medium stiff to stiff, moist, gray, with wet sand seam near 33½', A-4, Lab No. 5748SL	0.5			11.9			
SS-7	X	100	4-6-8	20	810		2.0 1.5			10.1			
SS-8	X	100	4-6-7	25	805		3.0			13.1			
SS-9	X	100	5-6-7	30			3.5 2.25			10.1			

Continued Next Page

WATER LEVEL OBSERVATIONS

Depth ft	▽ While Drilling	▼ Upon Completion	▽ After Drilling
To Water	12	11½	BF
To Cave-in		14	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 10/13/03 End 10/13/03 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks Grouted above the cave-in depth and concrete patch at surface.

LOG OF TEST BORING

EARTH EXPLORATION INC

Project: Monon Greenway over Carmel Drive
Location: Carmel, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RW-4
Elevation 831.0
Datum USC & GS
EEI Proj. No. 1-03-071

Proj. No.	STP-0399 ( )	Struct. No.	---	Weather	Sunny 75° F	Driller	B.J.
Des. No.	0300059	Station	57+90	Offset	3' Rt. "B"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
					800	**LOAM**, medium stiff to stiff, moist, gray, with wet sand seam near 33½', A-4, Lab No. 5748SL							
SS-10	X	85	3-4-4	35			1.5			8.9			
						End of Boring at 35 ft							

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

EARTH EXPLORATION INC

LOG OF TEST BORING

Project: Monon Greenway over Carmel Drive
Location: Carmel, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RW-5
Elevation 831.0
Datum USC & GS
EEI Proj. No. 1-03-071
Sheet 1 of 1

Proj. No.	STP-0399 ( )	Struct. No.	---	Weather	Sunny 75° F	Driller	B.J.
Des. No.	0300059	Station	58+81	Offset	3' Rt. "B"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft / Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
				831.0	**ASPHALTIC CONCRETE** (3 in)							
				830	**GRANULAR SUBBASE** (crushed stone; 9 in)							
SS-1		85	7-9-7		**SANDY LOAM with Some Gravel**, medium dense to loose, moist, brown and dark gray, A-2-4(0), Lab No. 5747SL				6.6	20	15	5
SS-2		55	4-5-5	5								
SS-3		100	3-3-3	825	**SILTY CLAY**, medium stiff, moist, brown and gray, A-7-6, Lab No. 5746SL	0.5			30.1			
SS-4		85	3-4-5		**LOAM**, medium stiff, very moist, brown, A-6, Lab No. 5745SL	0.5			25.6			
				10	**SANDY LOAM**, loose, wet, brown (visual)							
SS-5		55	3-4-5	820	**LOAM**, medium stiff to very stiff, moist, gray, A-4, Lab No. 5748SL	1.25 2.5			11.2			
SS-6		100	5-6-7	15 / 815		2.25 3.25			8.3			
SS-7		100	5-5-7	20 / 810		2.0 1.75			10.7			
SS-8		100	5-8-8	25		3.25 2.5			10.3			
					End of Boring at 25 ft							

WATER LEVEL OBSERVATIONS

Depth ft	While Drilling	Upon Completion	After Drilling
To Water	9½	11½	BF
To Cave-in		12	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 10/13/03 End 10/13/03 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks Grouted above the cave-in depth and concrete patch at surface.

EARTH EXPLORATION INC

LOG OF TEST BORING

Project: Monon Greenway over Carmel Drive
Location: Carmel, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No.: RW-6
Elevation: 831.0
Datum: USC & GS
EEI Proj. No.: 1-03-071
Sheet 1 of 1

Proj. No.	STP-0399 ( )	Struct. No.	---	Weather	Sunny 75° F	Driller	B.J.
Des. No.	0300059	Station	59+90	Offset	3' Rt. "B"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft / Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
				830	**ASPHALTIC CONCRETE** (3 in)							
					GRANULAR SUBBASE (crushed stone; 9 in)							
SS-1		55	8-8-4		**SANDY LOAM with Some Gravel**, medium dense, moist, brown, (fill), A-2-4, Lab No. 5747SL	1.25			32.6			
SS-2		55	3-4-4	5	**SILTY CLAY LOAM**, medium stiff, moist, dark gray, A-6, Lab No. 5744SL	0.5 1.25			41.0			
				825	**SILTY LOAM**, medium stiff, moist, black, with little organic matter (possible buried topsoil; visual)							
SS-3		65	3-3-3		**SILTY CLAY LOAM**, medium stiff, moist, dark gray and gray, A-6, Lab No. 5744SL	1.75 1.0			27.4			
SS-4		85	5-6-7	10	**SILTY CLAY**, medium stiff, moist, brown and gray, A-7-6, Lab No. 5746SL	>4.5			14.1			
SS-5		100	5-8-8	820	**LOAM**, stiff to very stiff, moist, brown, with sandy loam seam near 9½', A-4, Lab No. 5748SL	>4.5			13.1			
SS-6		100	6-7-8	15	**SAND**, medium dense, wet, gray (visual)	4.25			11.1			

End of Boring at 15 ft

WATER LEVEL OBSERVATIONS

Depth ft	While Drilling	Upon Completion	After Drilling
To Water	9	12	BF
To Cave-in		13½	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 10/13/03 End 10/13/03 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks Grouted above the cave depth and concrete patch at surface.

APPENDIX E

Summary of Special Laboratory Test Results

Summary of Classification Test Results

Grain Size Distribution Curve (5)

Unconfined Compression Test (4)

SUMMARY OF SPECIAL LABORATORY TEST RESULTS

EARTH EXPLORATION INC

Project No.: STP-0399( )
Structure No.: ---
Des. No.: 0300059
Project: Monon Greenway over Carmel Drive
Location: Carmel, Indiana
Client: United Consulting Engineers & Architects
EEI Project No.: 1-03-071

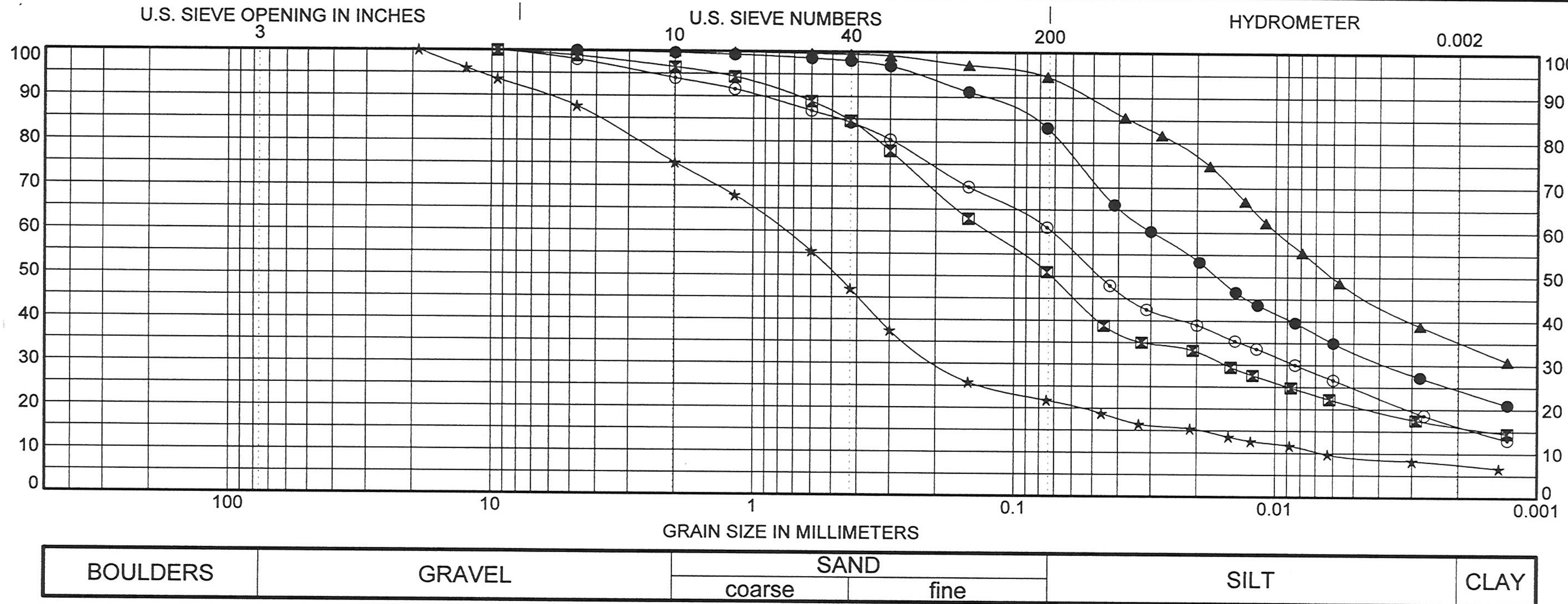
Laboratory Number	Test Boring No.	Sample Number	Sample Depth Interval, ft	Moisture Content, %	LOI	pH
5753SL	TB-1	SS-2	3.5-5	21.4		
5753SL	TB-1	SS-3	6-7.5	17.4		
5753SL	TB-1	SS-7	18.5-20	14.2		
5753SL	TB-1	SS-8	23.5-25	11.9		
5748SL	TB-1	SS-8	23.5-25			6.7
5753SL	TB-1	SS-9	28.5-30	13.6		
5753SL	TB-1	SS-10	33.5-35	10.6		
5753SL	TB-2	SS-2	3.5-5	44.5	8.8	
5753SL	TB-2	SS-3	6-7.5	24.4		
5753SL	TB-2	SS-4	8.5-10	24.3		
5753SL	TB-2	SS-6	18.5-20	11.1		
5753SL	TB-2	SS-7	23.5-25	10.7		
5753SL	TB-2	SS-14	58.5-60	7.2		
5753SL	TB-3	SS-2	3.5-5	24.7		
5753SL	TB-3	SS-3	6-7.5	20.4		
5753SL	TB-3	SS-5	11-12.5	11.1		
5753SL	TB-3	SS-7	18.5-20	13.6		
5753SL	TB-3	SS-8	23.5-25	9.9		
5753SL	TB-3	SS-9	28.5-30	10.1		
5753SL	TB-3	SS-10	33.5-35	9.5		
5753SL	TB-3	SS-11	38.5-40	10.5		
5753SL	TB-3	SS-15	58.5-60	8.9		
5753SL	TB-4	SS-3	6-7.5	19.6		
5753SL	TB-4	SS-6	13.5-15	9.8		
5753SL	TB-4	SS-7	18.5-20	18.2		
5753SL	TB-4	SS-8	23.5-25	11.4		
5753SL	TB-4	SS-9	28.5-30	11.0		
5753SL	TB-4	SS-10	33.5-35	10.0		
5753SL	RW-1	SS-1	1-2.5	18.2		
5753SL	RW-1	SS-2	3.5-5	16.1		
5753SL	RW-1	SS-3	6-7.5	24.3		
5753SL	RW-1	SS-4	8.5-10	26.4		
5753SL	RW-1	SS-5	11-12.5	10.0		
5753SL	RW-1	SS-6	13.5-15	11.9		
5753SL	RW-2	SS-2	3.5-5	14.2		
5753SL	RW-2	SS-4	8.5-10	27.3		

SUMMARY OF SPECIAL LABORATORY TEST RESULTS

Earth Exploration Inc.

Project No.: STP-0399( )
Structure No.: ---
Des. No.: 0300059
Project: Monon Greenway over Carmel Drive
Location: Carmel, Indiana
Client: United Consulting Engineers & Architects
EEI Project No.: 1-03-071

Laboratory Number	Test Boring No.	Sample Number	Sample Depth Interval, ft	Moisture Content, %	LOI	pH
5744SL	RW-2	SS-4	8.5-10			6.9
5753SL	RW-2	SS-5	11-12.5	10.4		
5753SL	RW-2	SS-6	13.5-15	9.3		
5753SL	RW-2	SS-8	23.5-25	11.9		
5753SL	RW-3	SS-2	3.5-5	19.2		
5753SL	RW-3	SS-3	6-7.5	20.4		
5746SL	RW-3	SS-3	6-7.5			7.1
5753SL	RW-3	SS-4	8.5-10	29.0		
5753SL	RW-3	SS-5	11-12.5	12.2		
5753SL	RW-3	SS-6	13.5-15	9.3		
5753SL	RW-3	SS-7	18.5-20	11.2		
5753SL	RW-3	SS-8	23.5-25	11.4		
5753SL	RW-3	SS-10	33.5-35	10.7		
5753SL	RW-4	SS-2	3.5-5	21.0	5.4	
5753SL	RW-4	SS-3	6-7.5	30.5		
5747SL	RW-4	SS-3	6-7.5			7.3
5753SL	RW-4	SS-6	13.5-15	11.9		
5753SL	RW-4	SS-7	18.5-20	10.1		
5753SL	RW-4	SS-8	23.5-25	13.1		
5753SL	RW-4	SS-9	28.5-30	10.1		
5753SL	RW-4	SS-10	33.5-35	8.9		
5753SL	RW-5	SS-1	1-2.5	6.6		
5747SL	RW-5	SS-1	1-2.5			6.9
5753SL	RW-5	SS-3	6-7.5	30.1		
5753SL	RW-5	SS-4	8.5-10	25.6		
5753SL	RW-5	SS-5	11-12.5	11.2		
5753SL	RW-5	SS-6	13.5-15	8.3		
5753SL	RW-5	SS-7	18.5-20	10.7		
5753SL	RW-5	SS-8	23.5-25	10.3		
5753SL	RW-6	SS-1	1-2.5	32.6		
5753SL	RW-6	SS-2	3.5-5	41.0		
5753SL	RW-6	SS-3	6-7.5	27.4		
5753SL	RW-6	SS-4	8.5-10	14.1		
5753SL	RW-6	SS-5	11-12.5	13.1		
5753SL	RW-6	SS-6	13.5-15	11.1		



Symbol	Lab No.	Boring	Station/Offset/Line	Sample No.	Depth ft	Classification	% Passing No.10	% Passing No.40	% Passing No.200	% Gravel	% Sand	% Silt	% Clay	% Coll.	LL	PL	PI	Opt. Moist.	γ max pcf	* CBR at 93%	* CBR at 97%
●	5744SL	RW-2	52+84 3' Rt. "B"	SS-4	8.5 - 10.0	SILTY CLAY LOAM A-6 (11)	99.6	98.0	83.2	0.4	16.4	58.7	24.5	18.4	31	16	15				
⊠	5745SL	RW-3	53+78 3' Rt. "B"	SS-3	6.0 - 7.5	LOAM A-6 (3)	96.4	84.6	50.9	3.6	45.5	34.8	16.1	14.8	28	15	13				
▲	5746SL	RW-4	57+90 3' Rt. "B"	SS-3	6.0 - 7.5	SILTY CLAY A-7-6 (30)	99.9	99.4	94.6	0.1	5.3	59.2	35.3	27.6	48	18	30				
★	5747SL	RW-5	58+81 3' Rt. "B"	SS-1	1.0 - 2.5	SANDY LOAM w/ some gravel A-2-4 (0)	75.1	46.9	21.7	24.9	53.4	14.4	7.3	6.2	20	15	5				
⊙	5748SL	TB-1	54+84 3' Rt. "B"	SS-8	23.5 - 25.0	LOAM A-4 (1)	94.0	84.2	61.0	6.0	33.0	44.7	16.3	11.4	19	12	7				

EARTH EXPLORATION llc

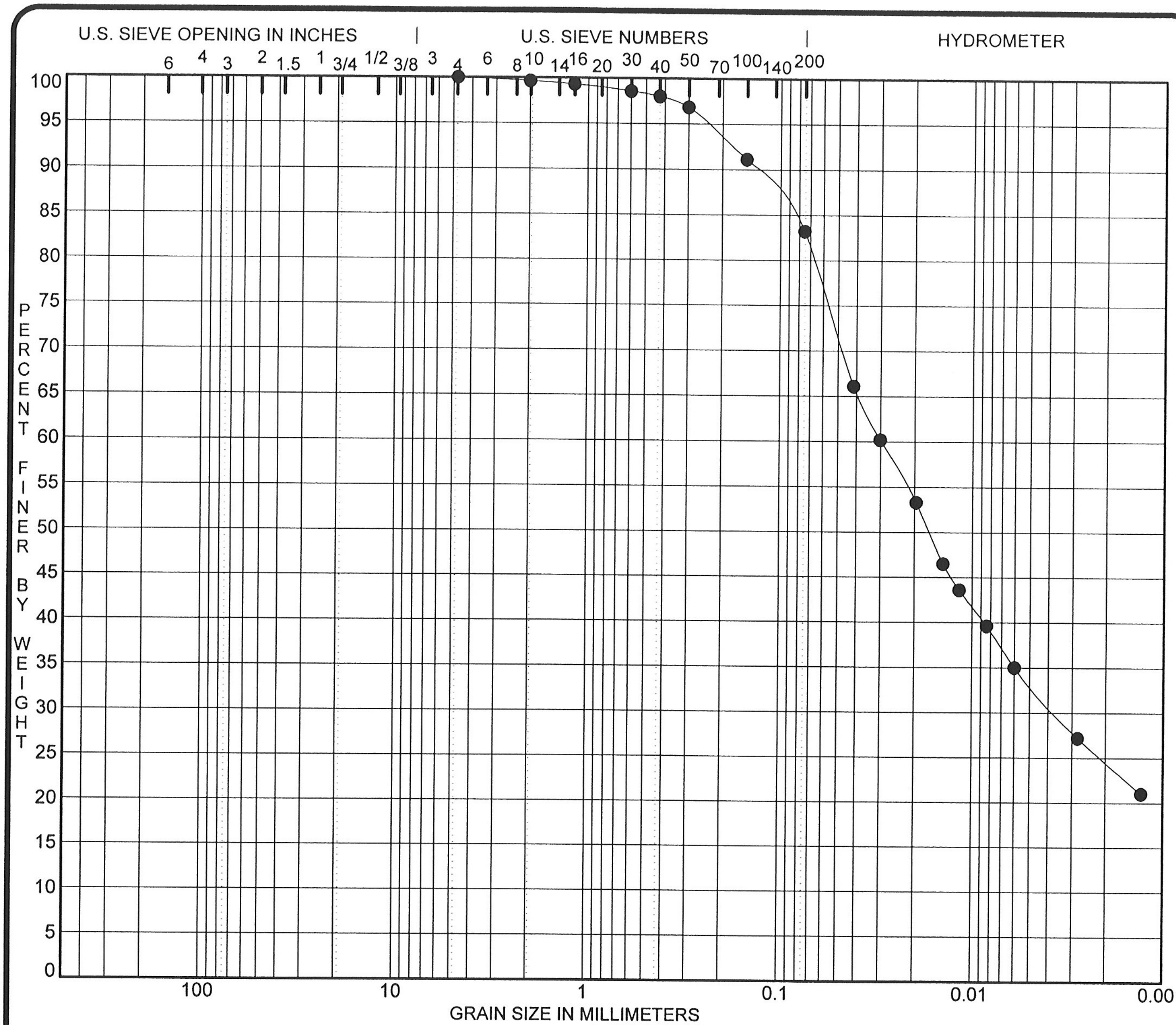
Project No. STP-0399 ( )
Structure No. ---
EEI Project No. 1-03-071

Project Monon Greenway over Carmel Drive
Location Carmel, Indiana
Client United Consulting Engineers & Architects

SUMMARY OF CLASSIFICATION TEST RESULTS

Earth Exploration, Inc.
7770 West New York Street Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

* See text for recommended values.



BOULDERS	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Sample Identification		Station / Offset / Line	Depth, ft.	Elevation, USCGS
●	RW-2	SS-4	52+84 3' Rt. "B"	8.5 - 10.0 ft.	822.5 - 821.0

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
5744SL	SILTY CLAY LOAM A-6 (11)	6.9	0.4	16.4	58.7	24.5	27.3	31	16	15

Remarks:

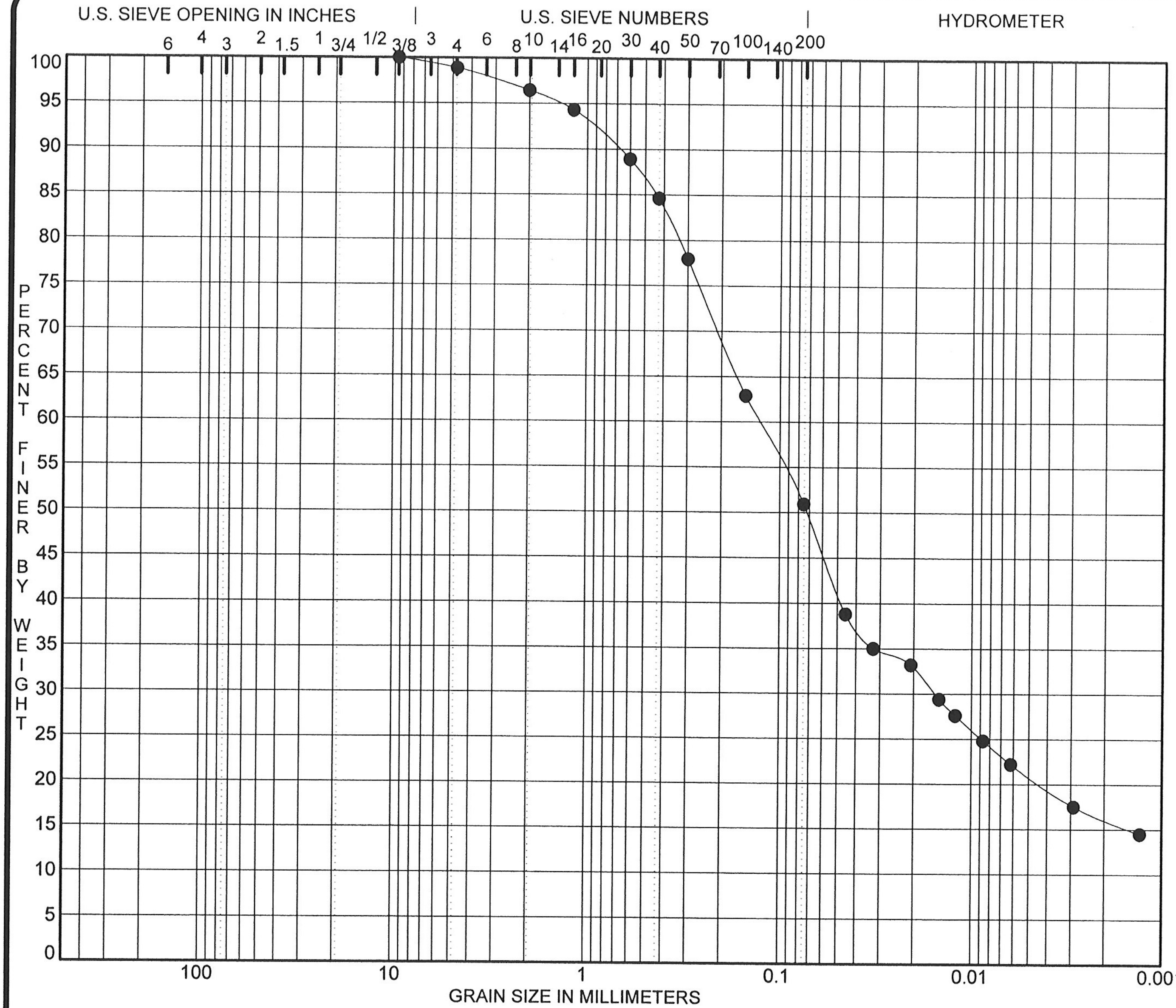
Earth Exploration Inc

Project No. STP-0399 ( )
Structure No. ---
EEI Proj. No. 1-03-071

Project Monon Greenway over Carmel Drive
Location Carmel, Indiana
Client United Consulting Engineers & Architects

GRAIN SIZE DISTRIBUTION CURVE

Earth Exploration, Inc.
7770 West New York Street Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)



BOULDERS	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Sample Identification		Station / Offset / Line	Depth, ft.	Elevation, USCGS
●	RW-3	SS-3	53+78 3' Rt. "B"	6.0 - 7.5 ft.	825.0 - 823.5

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
5745SL	LOAM A-6 (3)	7.1	3.6	45.5	34.8	16.1	20.4	28	15	13

Remarks:

EARTH EXPLORATION INC

Project No. STP-0399 ( )
Structure No. ---
EEI Proj. No. 1-03-071

Project Monon Greenway over Carmel Drive
Location Carmel, Indiana
Client United Consulting Engineers & Architects

GRAIN SIZE DISTRIBUTION CURVE

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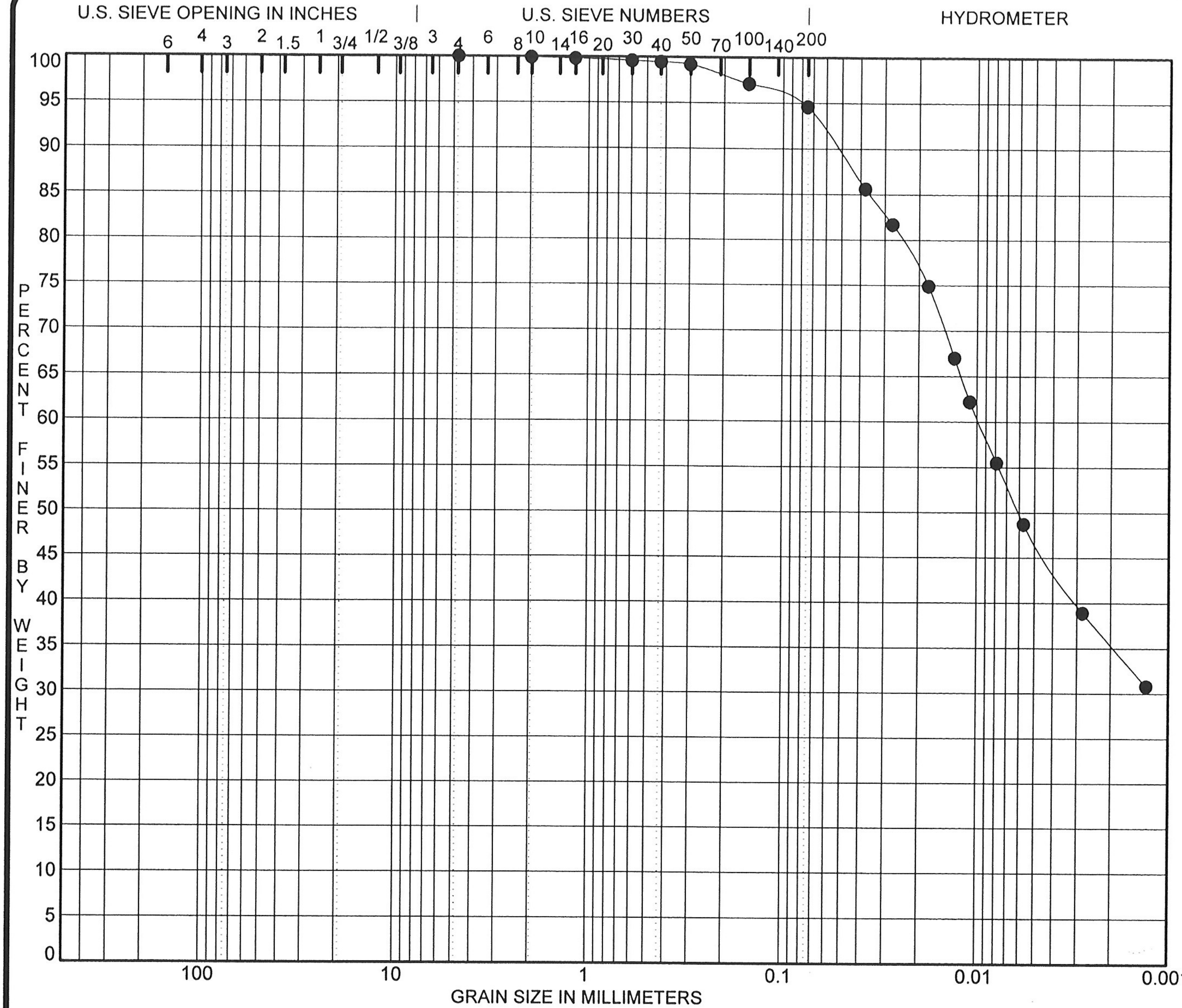

BOULDERS	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Sample Identification		Station / Offset / Line	Depth, ft.	Elevation, USCGS
●	RW-4	SS-3	57+90 3' Rt. "B"	6.0 - 7.5 ft.	825.0 - 823.5

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
5746SL	SILTY CLAY A-7-6 (30)	7.3	0.1	5.3	59.2	35.3	30.5	48	18	30

Remarks:

EARTH EXPLORATION INC

Project No. STP-0399 ( )
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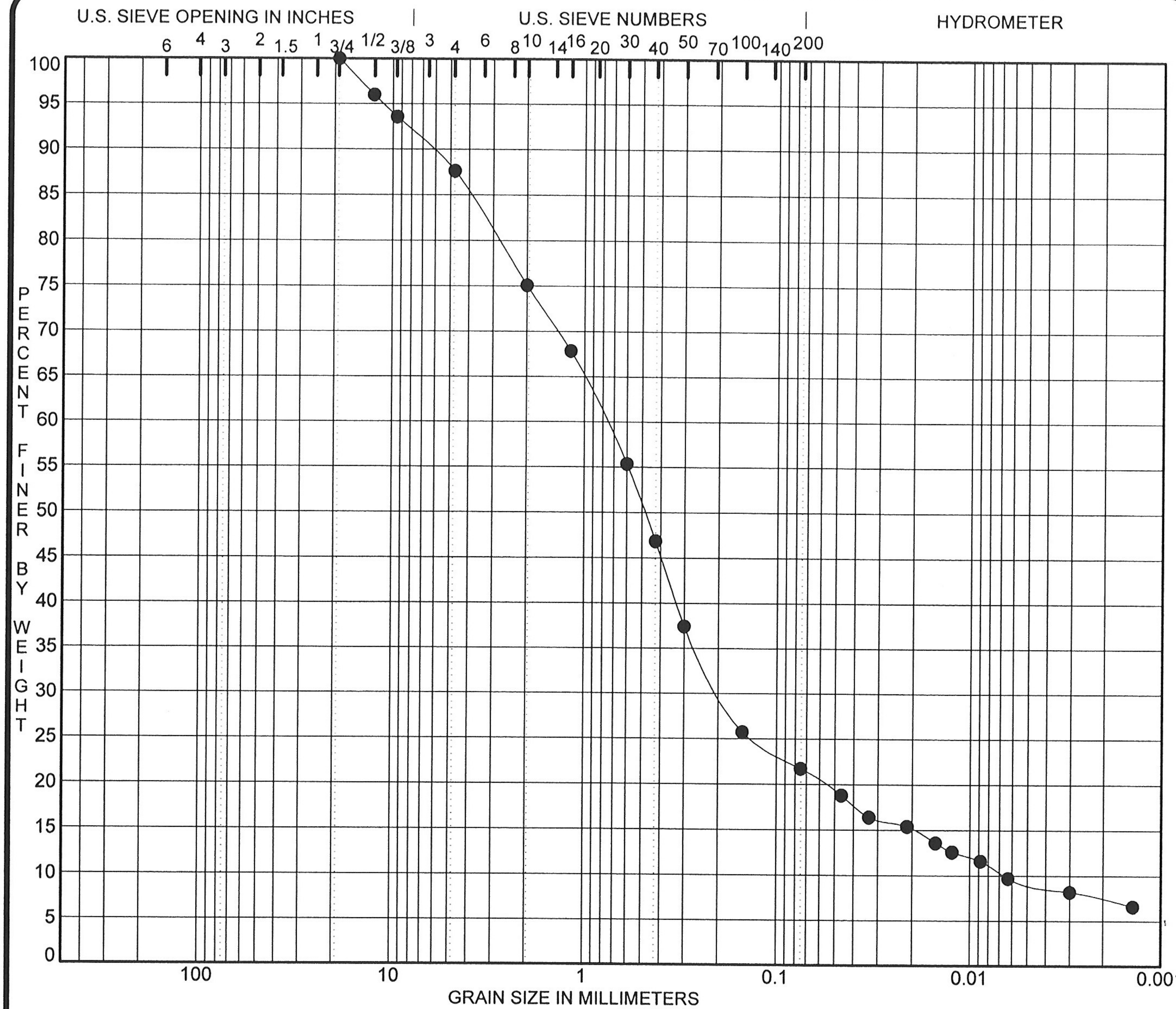

BOULDERS	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Sample Identification		Station / Offset / Line	Depth, ft.	Elevation, USCGS
●	RW-5	SS-1	58+81 3' Rt. "B"	1.0 - 2.5 ft.	830.0 - 828.5

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
5747SL	SANDY LOAM w/ some gravel A-2-4 (0)	6.9	24.9	53.4	14.4	7.3	6.6	20	15	5

Remarks:

EARTH EXPLORATION INC

Project No.	STP-0399 ( )	**Project**	Monon Greenway over Carmel Drive
Structure No.	---	**Location**	Carmel, Indiana
EEI Proj. No.	1-03-071	**Client**	United Consulting Engineers & Architects

GRAIN SIZE DISTRIBUTION CURVE

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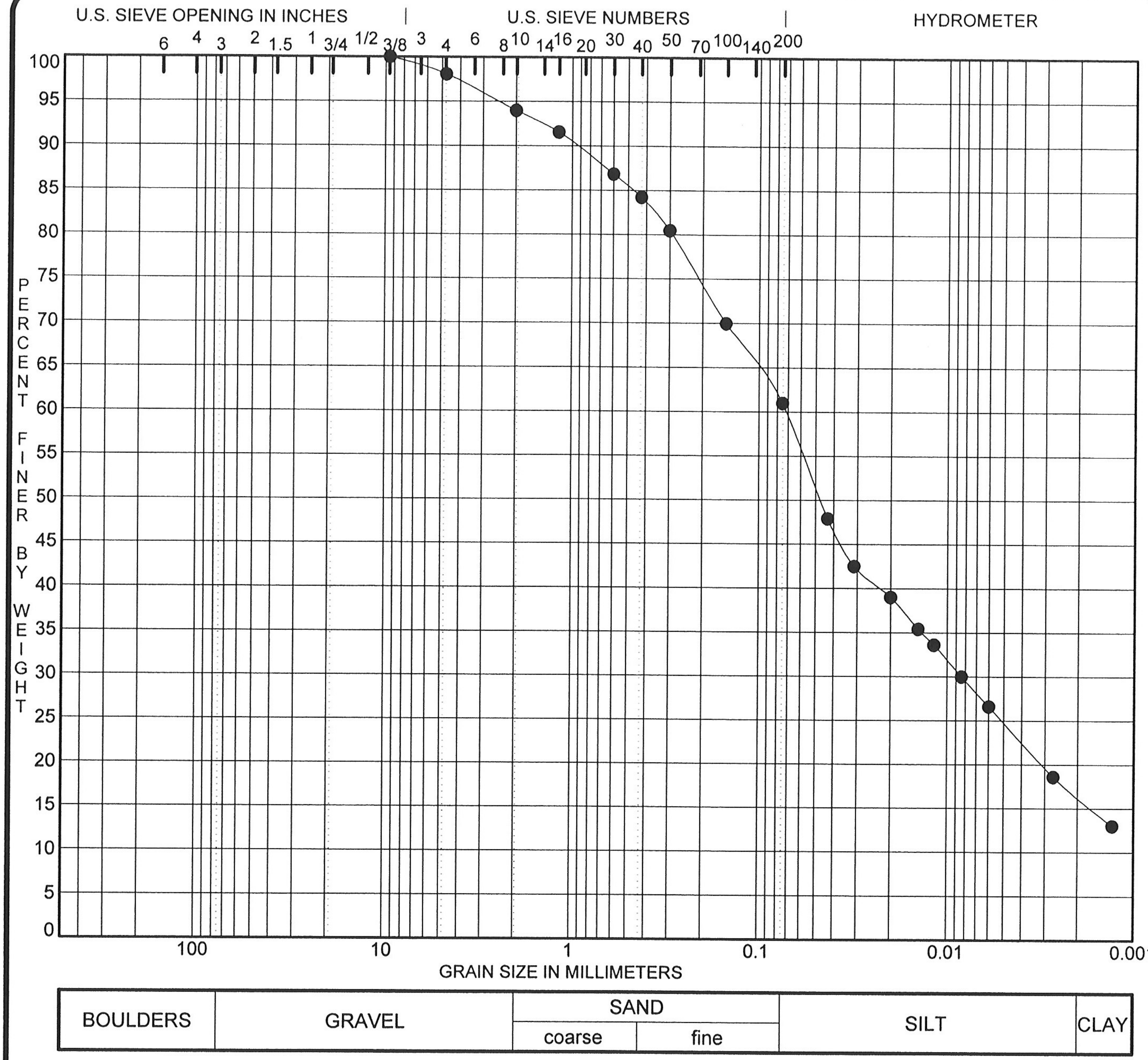

Sample Identification		Station / Offset / Line	Depth, ft.	Elevation, USCGS
● TB-1	SS-8	54+84 3' Rt. "B"	23.5 - 25.0 ft.	807.5 - 806.0

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
5748SL	LOAM A-4 (1)	6.7	6.0	33.0	44.7	16.3	11.9	19	12	7

Remarks:

EARTH EXPLORATION INC

Project No.	STP-0399 ( )	**Project**	Monon Greenway over Carmel Drive
Structure No.	---	**Location**	Carmel, Indiana
EEI Proj. No.	1-03-071	**Client**	United Consulting Engineers & Architects

GRAIN SIZE DISTRIBUTION CURVE

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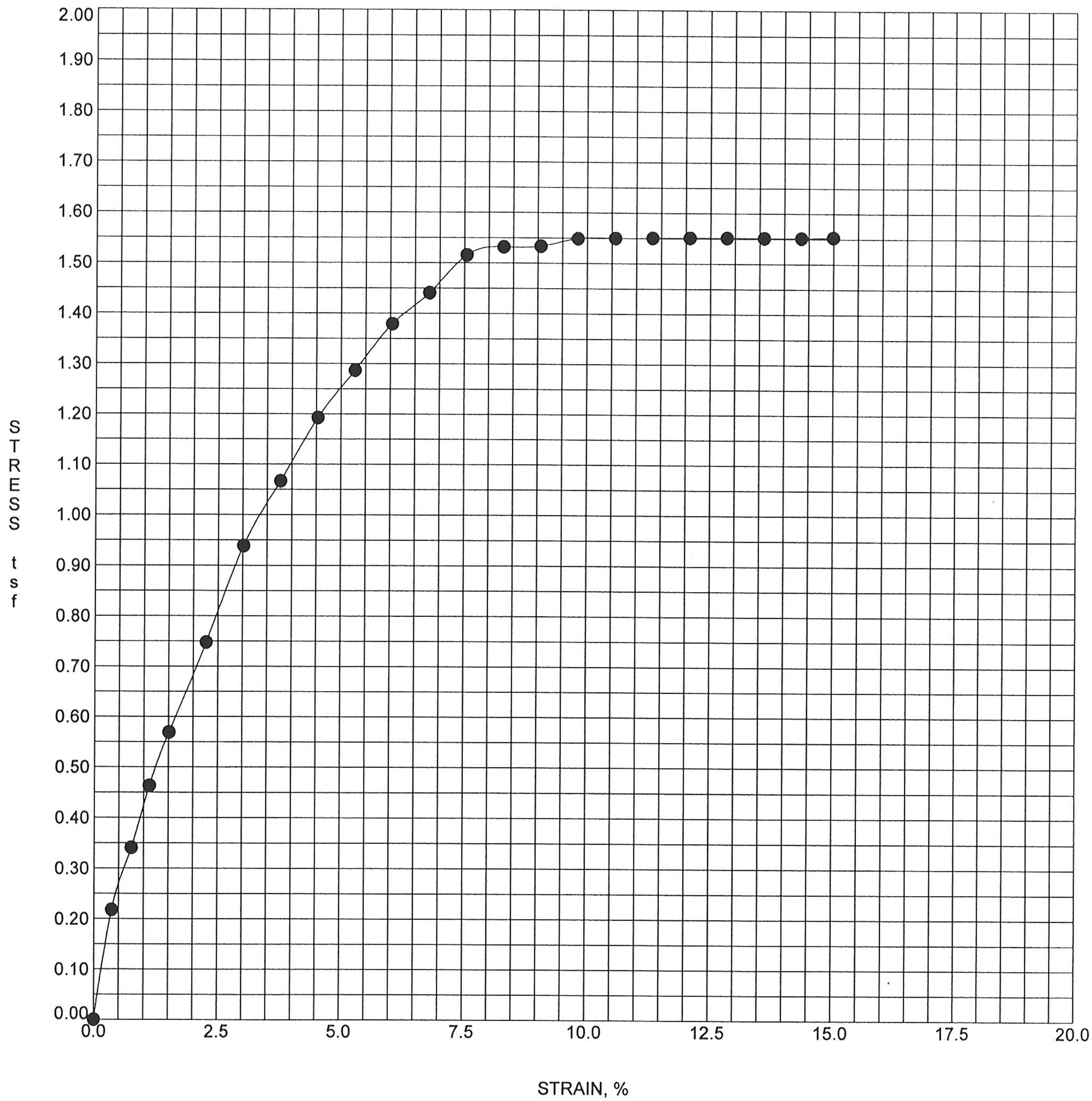


Sample Identification		Station / Offset / Line	Depth, ft	Classification
● RW-2	SS-3	52+84 3' Rt. "B"	6.0 - 7.5	SILTY CLAY LOAM

Lab No.	Sample Ht., mm	Sample Diam., mm	Initial M.C., %	Initial Wet Den, pcf	Initial Dry Den, pcf	Sat., %	Unc. Comp. Strength, tsf	Failure Strain, %	Rate of Strain to Failure, %
5749SL	70.6	34.5	24.1	126.2	101.7	98.1	1.55	15.0	1.5

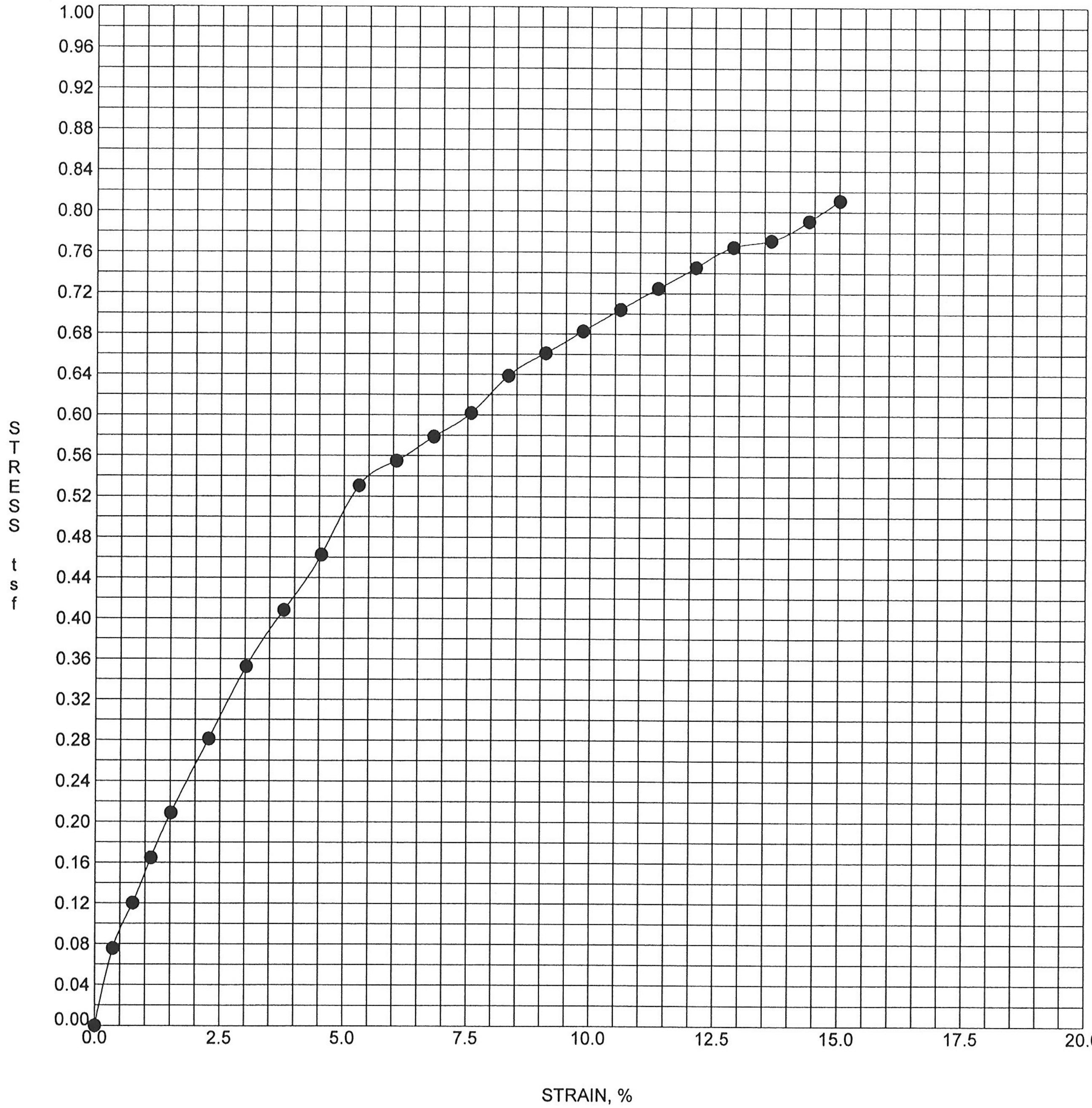
EARTH EXPLORATION Inc

Project No. STP-0399 ( )
Structure No. ---
EEI Proj. No. 1-03-071

Project Monon Greenway over Carmel Drive
Location Carmel, Indiana
Client United Consulting Engineers & Architects

UNCONFINED COMPRESSION TEST

Earth Exploration, Inc.
7770 West New York Street Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)



	Sample Identification		Station / Offset / Line	Depth, ft	Classification
●	RW-4	SS-4	57+90 3' Rt. "B"	8.5 - 10.0	SILTY CLAY LOAM

Lab No.	Sample Ht., mm	Sample Diam., mm	Initial M.C., %	Initial Wet Den, pcf	Initial Dry Den, pcf	Sat., %	Unc. Comp. Strength, tsf	Failure Strain, %	Rate of Strain to Failure, %
5750SL	70.4	35.1	26.4	124.7	98.7	99.5	0.81	15.0	1.5

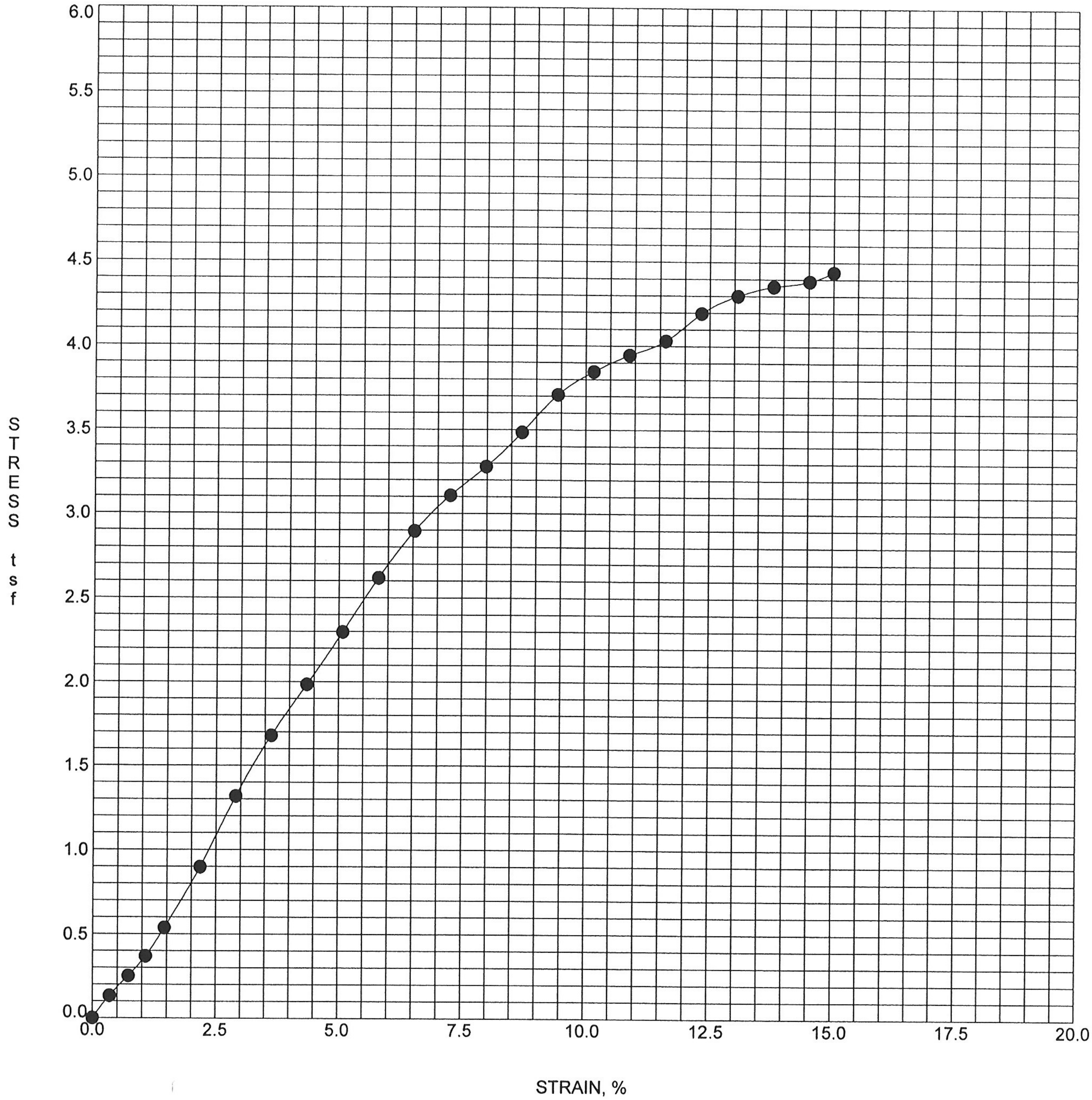
EARTH EXPLORATION INC

Project No. STP-0399 ( )
Structure No. ---
EEI Proj. No. 1-03-071

Project Monon Greenway over Carmel Drive
Location Carmel, Indiana
Client United Consulting Engineers & Architects

UNCONFINED COMPRESSION TEST

Earth Exploration, Inc.
7770 West New York Street Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)



Sample Identification		Station / Offset / Line	Depth, ft	Classification
● TB-3	SS-6	56+30 3' Rt. "B"	13.5 - 15.0	LOAM

Lab No.	Sample Ht., mm	Sample Diam., mm	Initial M.C., %	Initial Wet Den, pcf	Initial Dry Den, pcf	Sat., %	Unc. Comp. Strength, tsf	Failure Strain, %	Rate of Strain to Failure, %
5751SL	73.5	37.4	14.5	139.3	121.7	94.4	4.44	15.0	1.5

EARTH EXPLORATION INC

Project No. STP-0399 ( )
Structure No. ---
EEI Proj. No. 1-03-071

Project Monon Greenway over Carmel Drive
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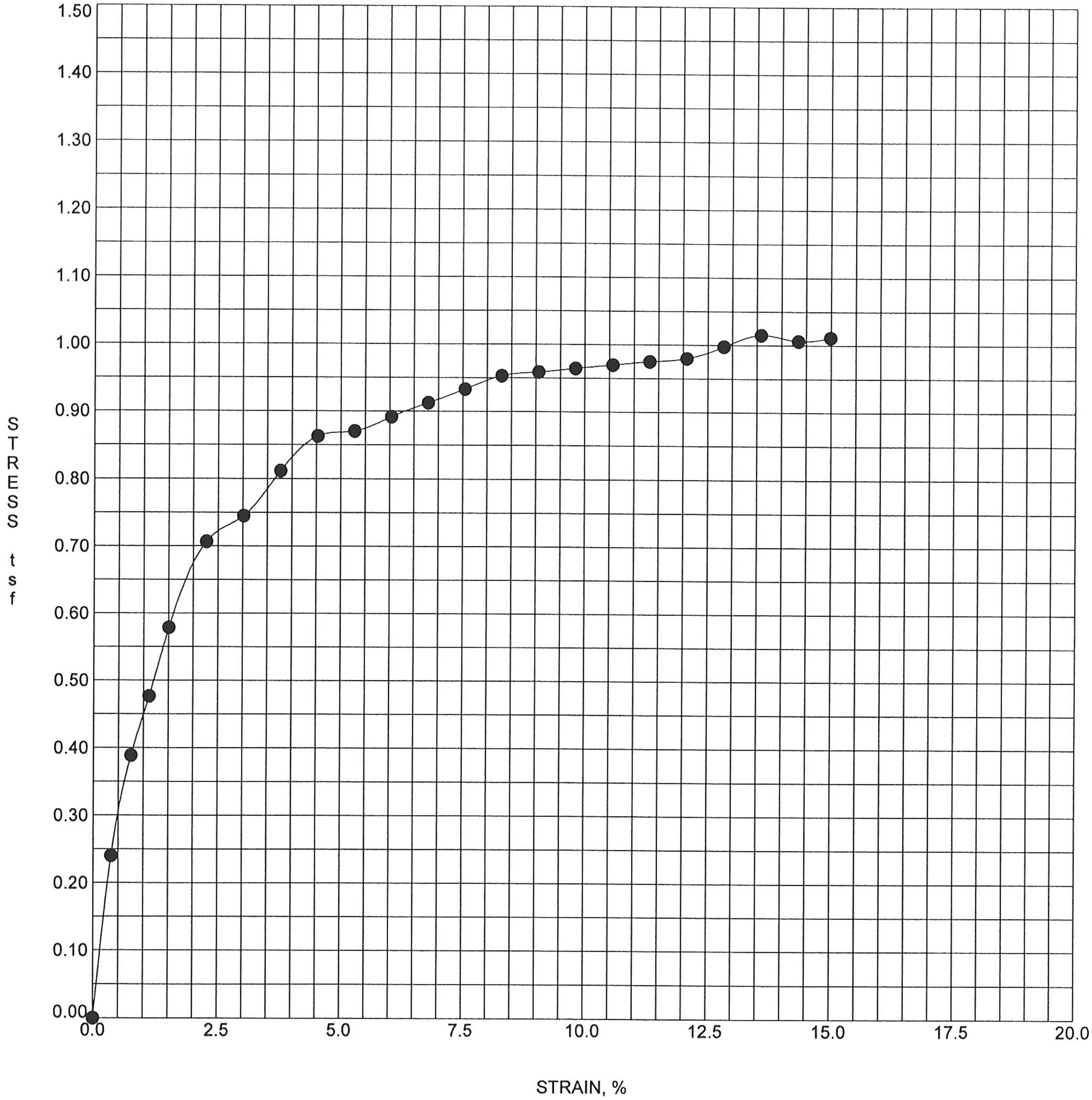

Sample Identification			Station / Offset / Line	Depth, ft	Classification
●	TB-4	SS-3	56+90 3' Rt. "B"	6.0 - 7.5	SILTY CLAY

Lab No.	Sample Ht., mm	Sample Diam., mm	Initial M.C., %	Initial Wet Den, pcf	Initial Dry Den, pcf	Sat., %	Unc. Comp. Strength, tsf	Failure Strain, %	Rate of Strain to Failure, %
5752SL	70.7	35.2	34.5	116.8	86.9	98.2	1.02	13.6	1.5

EARTH EXPLORATION INC

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Structure No. ---
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Client United Consulting Engineers & Architects

UNCONFINED COMPRESSION TEST

Earth Exploration, Inc.
7770 West New York Street Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

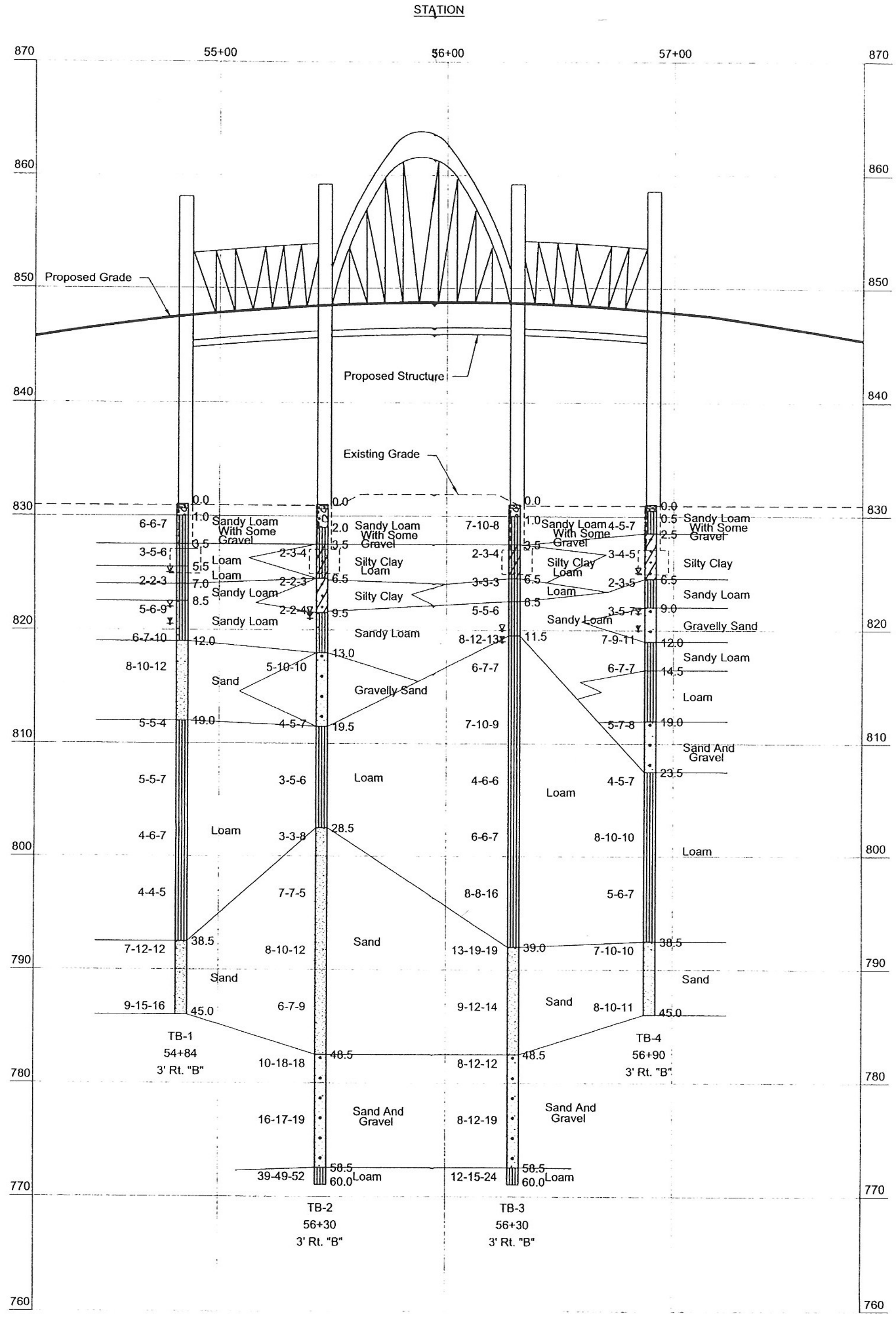
APPENDIX F

Subsurface Profile at Bridge Structure - (Drawing No. 1-03-071.B3)

Static Analyses for Pile Load Capacity

Bearing Capacity Analysis

Settlement Analysis for Proposed Embankment



LEGEND

A - B - C

D

A Blow Count per First 6-in. Increment

B Blow Count per Second 6-in. Increment

C Blow Count per Third 6-in. Increment

D Depth of Strata

Initial Water Level

24-hr. Water Level

Completion Water Level

NOTES

1. Base map developed from an electronic file provided by United Consulting Engineers & Architects on November 12, 2003.
2. Blow Counts refer to the number of blows required to drive a 2-in. I.D. split barrel sampler a distance of 6-in., using a 140-lb. hammer with a free fall height of 30-in.
3. Refer to the Test Boring Logs in Appendix C for additional subsurface information.

SUBSURFACE PROFILE AT BRIDGE STRUCTURE

PROJECT: Monon Greenway over Carmel Drive

PROJECT NO.: STP-0399( )

LOCATION: Carmel, Indiana

CLIENT: United Consulting Engineers & Architects

EEI PROJECT NO.: 1-03-071

SCALE: 1" = 10' V 1" = 50' H

PROJ. ENG.: DRP

APPR. BY: SJL

DRAWN BY: AJH

DATE AND TIME: 11-25-03 11:21:12

DRWG. NO.: 1-03-071.B3

Earth Exploration

7770 West New York Street
Indianapolis, IN 46214-2988
317-273-1690
(FAX) 317-273-2250

ULTIMATE STATIC PILE CAPACITY/Federal Highway Administration
Nordlund (1963, 1979) and Tomlinson (1979, 1980) methods

Project Name : Monon Trl oCarmel Dr Client : United Consult Engrs
Location : Bent No. 1 (TB-1) Project Manager : Darren Pleiman
Date : 11/12/10 Computed by : DRP

Depth of Top of Pile = 4.00 ft. Pile length = 41.00 ft.
Depth to Water Table = 10.00 ft. Pile Tip Elevation = 786.0
Diameter of pile = 14.00 in.
Type of Pile = Pipe Pile

SKIN FRICTION CONTRIBUTION

Layer	Soil Type	Thickness (ft)	Effective Stress (psf)	Internal Friction Angle	N-SPT	Pile Perimeter (ft)
1	Cohesive	5.00	780.00	---	--	3.67
2	Cohesionless	10.00	1405.40	32.00	--	3.67
3	Cohesive	20.00	2294.40	---	--	3.67
4	Cohesionless	6.00	3093.20	34.00	--	3.67

Layer	Soil Type	Undrained Shear Strength (psf)	Adhesion	Pile Taper	Sliding Friction Angle	Skin Resistance (Kips)
1	Cohesive	1000.00	700.00	----	-----	12.83
2	Cohesionless	--	--------	----	21.33	22.06
3	Cohesive	2000.00	1000.00	----	-----	73.30
4	Cohesionless	--	--------	----	22.66	35.36

Total Side Friction : 143.55

POINT RESISTANCE CONTRIBUTION

Effective Stress at pile Tip (psf)	Internal Friction Angle	SPT Value	Pile End Area (ft*ft)	Bearing Capacity Factor Nq	End Bearing Resistance (Kips)
3266.00	34.00	-----	1.07	55.60	122.67

Limiting End Bearing Resistance : 78.59

Ultimate Static Pile Capacity : 222.15

Hit arrow keys to display next screen. <F8> Print. <F10> Main Menu

ULTIMATE STATIC PILE CAPACITY/Federal Highway Administration
Nordlund (1963, 1979) and Tomlinson (1979, 1980) methods

Project Name : Monon Trl oCarmel Dr Client : United Consult Engrs
Location : Bent No. 2 (TB-2) Project Manager : Darren Pleiman
Date : 11/12/10 Computed by : DRP

Depth of Top of Pile = 4.00 ft. Pile length = 43.00 ft.
Depth to Water Table = 10.00 ft. Pile Tip Elevation = 784.0
Diameter of pile = 14.00 in.
Type of Pile = Pipe Pile

SKIN FRICTION CONTRIBUTION

Layer	Soil Type	Thickness (ft)	Effective Stress (psf)	Internal Friction Angle	N-SPT	Pile Perimeter (ft)
1	Cohesive	5.00	780.00	---	--	3.67
2	Cohesionless	10.00	1405.40	32.00	--	3.67
3	Cohesive	9.00	1950.10	---	--	3.67
4	Cohesionless	19.00	2731.50	31.00	--	3.67

Layer	Soil Type	Undrained Shear Strength (psf)	Adhesion	Pile Taper	Sliding Friction Angle	Skin Resistance (Kips)
1	Cohesive	1000.00	700.00	----	-----	12.83
2	Cohesionless	--	--------	----	21.33	22.06
3	Cohesive	1750.00	800.00	----	-----	26.39
4	Cohesionless	--	--------	----	20.66	73.04

Total Side Friction : 134.32

POINT RESISTANCE CONTRIBUTION

Effective Stress at pile Tip (psf)	Internal Friction Angle	SPT Value	Pile End Area (ft*ft)	Bearing Capacity Factor Nq	End Bearing Resistance (Kips)
3231.20	34.00	-----	1.07	55.60	121.24

Limiting End Bearing Resistance : 78.59

Ultimate Static Pile Capacity : 212.91

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ULTIMATE STATIC PILE CAPACITY/Federal Highway Administration
Nordlund (1963, 1979) and Tomlinson (1979, 1980) methods

Project Name : Monon Trl oCarmel Dr Client : United Consult Engrs
Location : Bent No. 3 (TB-3) Project Manager : Darren Pleiman
Date : 11/12/10 Computed by : DRP

Depth of Top of Pile = 4.00 ft. Pile length = 46.00 ft.
Depth to Water Table = 11.00 ft. Pile Tip Elevation = 784.0
Diameter of pile = 14.00 in.
Type of Pile = Pipe Pile

SKIN FRICTION CONTRIBUTION

Layer	Soil Type	Thickness (ft)	Effective Stress (psf)	Internal Friction Angle	N-SPT	Pile Perimeter (ft)
1	Cohesive	5.00	780.00	---	--	3.67
2	Cohesionless	2.00	1195.00	30.00	--	3.67
3	Cohesive	28.00	2186.40	---	--	3.67
4	Cohesionless	11.00	3379.60	34.00	--	3.67

Layer	Soil Type	Undrained Shear Strength (psf)	Adhesion	Pile Taper	Sliding Friction Angle	Skin Resistance (Kips)
1	Cohesive	1000.00	700.00	----	-----	12.83
2	Cohesionless	--	--------	----	19.99	2.98
3	Cohesive	2250.00	1100.00	----	-----	112.89
4	Cohesionless	--	--------	----	22.66	70.83

Total Side Friction : 199.53

POINT RESISTANCE CONTRIBUTION

Effective Stress at pile Tip (psf)	Internal Friction Angle	SPT Value	Pile End Area (ft*ft)	Bearing Capacity Factor Nq	End Bearing Resistance (Kips)
3696.40	34.00	-----	1.07	55.60	138.46

Limiting End Bearing Resistance : 78.59

Ultimate Static Pile Capacity : 278.12

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ULTIMATE STATIC PILE CAPACITY/Federal Highway Administration
Nordlund (1963, 1979) and Tomlinson (1979, 1980) methods

Project Name	: Monon Trl oCarmel Dr	Client	: United Consult Engrs
Location	: Bent No. 3 (TB-3)	Project Manager	: Darren Pleiman
Date	: 11/12/10	Computed by	: DRP

Depth of Top of Pile	= 4.00 ft.	Pile length	= 36.00 ft.
Depth to Water Table	= 11.00 ft.	Pile Tip Elevation	= 791.0
Diameter of pile	= 14.00 in.		
Type of Pile	= Pipe Pile		

SKIN FRICTION CONTRIBUTION

Layer	Soil Type	Thickness (ft)	Effective Stress (psf)	Internal Friction Angle	N-SPT	Pile Perimeter (ft)
1	Cohesive	5.00	780.00	---	--	3.67
2	Cohesionless	2.00	1195.00	30.00	--	3.67
3	Cohesive	28.00	2186.40	---	--	3.67
4	Cohesionless	1.00	3091.60	34.00	--	3.67

Layer	Soil Type	Undrained Shear Strength (psf)	Adhesion	Pile Taper	Sliding Friction Angle	Skin Resistance (Kips)
1	Cohesive	1000.00	700.00	----	-----	12.83
2	Cohesionless	--	--------	----	19.99	2.98
3	Cohesive	2250.00	1100.00	----	-----	112.89
4	Cohesionless	--	--------	----	22.66	5.89

Total Side Friction : 134.59

POINT RESISTANCE CONTRIBUTION

Effective Stress at pile Tip (psf)	Internal Friction Angle	SPT Value	Pile End Area (ft*ft)	Bearing Capacity Factor Nq	End Bearing Resistance (Kips)
3120.40	34.00	-----	1.07	55.60	117.52

Limiting End Bearing Resistance : 78.59

Ultimate Static Pile Capacity : 213.18

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ULTIMATE STATIC PILE CAPACITY/Federal Highway Administration
Nordlund (1963, 1979) and Tomlinson (1979, 1980) methods

Project Name	: Monon Trl oCarmel Dr	Client	: United Consult Engrs
Location	: Bent No. 4 (TB-4)	Project Manager	: Darren Pleiman
Date	: 11/12/10	Computed by	: DRP

Depth of Top of Pile	= 4.00 ft.	Pile length	= 41.00 ft.
Depth to Water Table	= 10.00 ft.	Pile Tip Elevation	= 786.0
Diameter of pile	= 14.00 in.		
Type of Pile	= Pipe Pile		

SKIN FRICTION CONTRIBUTION

Layer	Soil Type	Thickness (ft)	Effective Stress (psf)	Internal Friction Angle	N-SPT	Pile Perimeter (ft)
1	Cohesive	2.50	525.00	---	--	3.67
2	Cohesionless	7.50	1065.65	31.00	--	3.67
3	Cohesive	5.00	1419.40	---	--	3.67
4	Cohesionless	4.00	1681.10	31.00	--	3.67
5	Cohesive	15.50	2271.45	---	--	3.67
6	Cohesionless	6.50	2943.80	33.00	--	3.67

Layer	Soil Type	Undrained Shear Strength (psf)	Adhesion	Pile Taper	Sliding Friction Angle	Skin Resistance (Kips)
1	Cohesive	1000.00	700.00	----	-----	6.41
2	Cohesionless	--	--------	----	20.66	11.25
3	Cohesive	2500.00	1300.00	----	-----	23.82
4	Cohesionless	--	--------	----	20.66	9.46
5	Cohesive	2000.00	1100.00	----	-----	62.49
6	Cohesionless	--	--------	----	21.99	33.22

Total Side Friction : 146.66

POINT RESISTANCE CONTRIBUTION

Effective Stress at pile Tip (psf)	Internal Friction Angle	SPT Value	Pile End Area (ft*ft)	Bearing Capacity Factor Nq	End Bearing Resistance (Kips)
3131.00	33.00	-----	1.07	47.20	94.37

Limiting End Bearing Resistance : 53.45

Ultimate Static Pile Capacity : 200.11

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Project: Monon Greenway over Carmel Drive			
EEI Proj. No.: 1-03-071	Date: 2/5/04	By: DRP	Rev. By:

Earth Exploration

Bearing Capacity Analysis:

Boring TB-1 (Sta. 54+84)

Height of Fill = 17'   Width of Foundation = 14'

Depth of Embedment = 10' (Elev. 821±)

At 10' Sandy Loam, med dense $\gamma = 115$ pcf

$N_{Avg} = 16$ $\phi = 32°$

$N_q = 29.5$ $N_\gamma = 27.9$

$q_{ult} = \gamma D N_q + 0.5 \gamma B N_\gamma$

$= 115(10)(29.5) + 0.5(115)14(27.9)$

$q_{allow} = 56{,}400 / 3 = 18.8$ Ksf.

Assuming a high water table

$\gamma' = 55$ pcf

$q_{ult} = 55(10)(29.5) + 0.5(55)14(27.9)$

$q_{allow} = 27$ Ksf $/3 = 9$ Ksf

Applied load = $17 \cdot 125 = 2125$ psf or 2.1 Ksf

Project: Monon Greenway over Carmel Drive				EARTH EXPLORATION
EEI Proj. No.: 1-03-071	Date: 2/5/04	By: DRP	Rev. By:	

Settlement of fill placed within the retaining walls:

Boring RW-5 (Sta. 58+81)

Applied load: 125 pcf (10' High) = ρ = 1250 psf.

Soil Properties:

Soil Type	Thickness (in.)	W_c	γ_T (psf)	e_o	C_c	RR	z	a/z	b/z
SaLo	60	—	115	.8*	.023	.007	2.5	0	2.8
SiCl	24	30.1	115	.81	.162	.05	6	0	1.2
Lo	12	25.6	115	.69	.126	.044	7.5	0	.93
SaLo	24	—	115	.8*	.023	.007	9	0	.77

*Estimated from text books.

a = 0
b = 14/2 = 7'

$C_c = 0.75(e_o - 0.5)$ Low plasticity soils.

$C_c = 0.3(e_o - 0.27)$ $e_o = 2.7(W_c)$ $CR = C_c/1+e_o$ $RR = CR/1+e_o$

$P = 1250$ psf $\Delta P = I \cdot P \cdot 2$ (See fig 6, attached)

Soil Type	$\bar{P}_o$ (psf)	I	ΔP (psf)	RR	H (in)	3D Factor	H' (in)
SaLo	288	.49	1225	.007	60	.9	.27
SiCl	690	.44	1100	.05	24	.9	.45
Lo	863	.40	1000	.044	12	.9	.16
SaLo	1035	.36	900	.007	24	.9	.04
							0.92

Total Estimated Settlement
1 to 1½ inches.

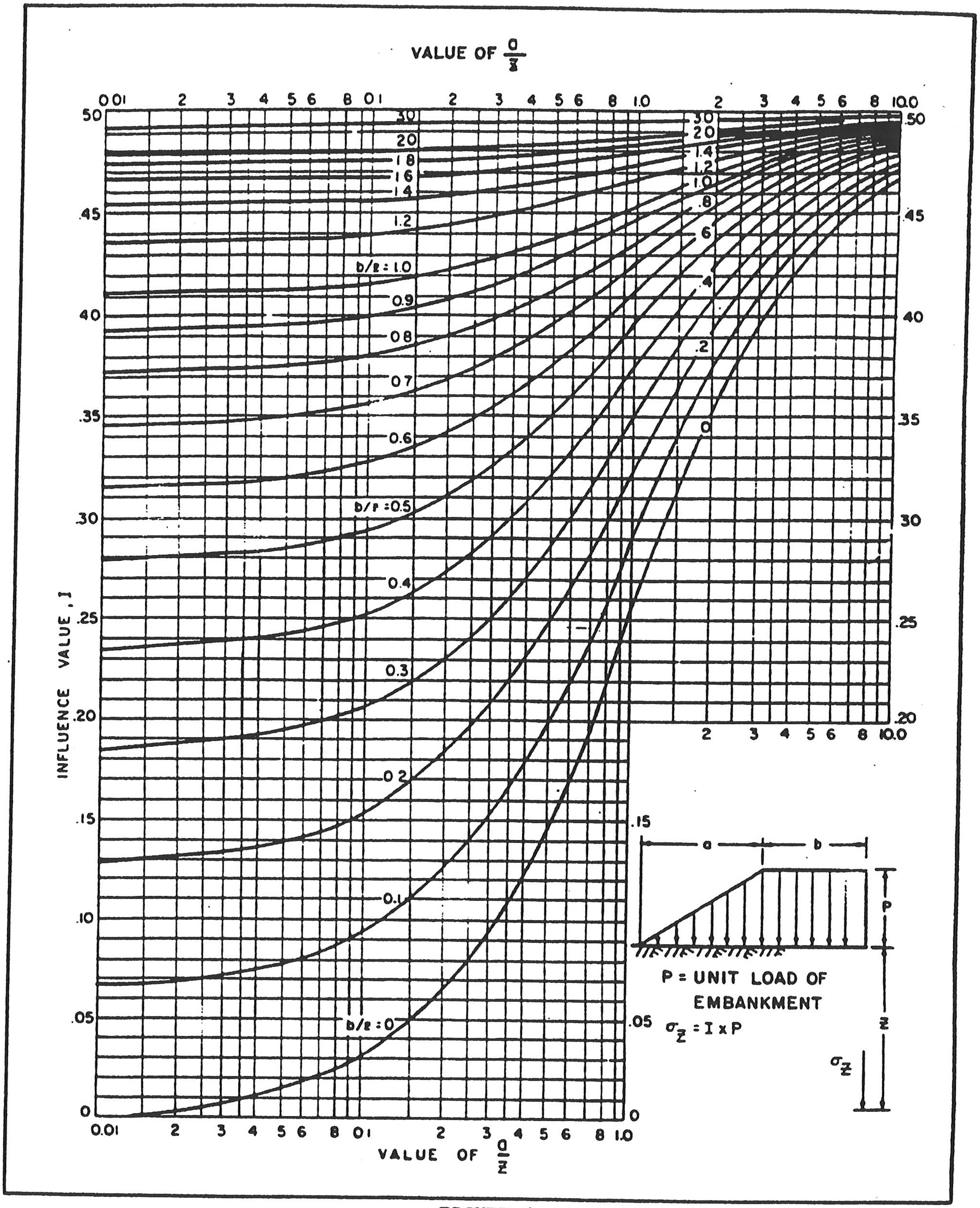

FIGURE 6
Influence Value for Vertical Stress Under Embankment Load of Infinite Length
(Boussinesq Case)