The Indiana Department of Transportation

Office of Geotechnical Engineering
120 South Shortridge Road P.O. Box 19389
Indianapolis, Indiana 46219-0389
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Driving Indiana's Economic Growth

January 11, 2006

Mr. Gerald Mroczka, Chief
Design Division
N642 - IGCN

Attn: Ms. Tamera Stoakes
Project Coordinator

Subject: Subsurface Investigation – Addendum 2
Des No: 8354420
Project No: STP-4320 (7)
SR 15 from 0.34 Mi. S. of US 20 to 1.92 Mi. N. of US 20
County: Elkhart
District: Fort Wayne

Gentlemen:

The additional Geotechnical Investigation for the subject project has been completed and copies of the Geotechnical Report are being forwarded to those listed below.

If you have any questions concerning this matter, please call us.

Very truly yours,

Steve Morris

for Athar A. Khan.
Chief Geotechnical Engineer

S. S. Hiremath

Somanath S. Hiremath
Geotechnical Engineering Group Leader

SSH/SS
cc: Mr. T. Seeman – Attn: Mr. W. Smith - Attachment
Mr. R. Alderman – Attn: Mr. J. Keefer – Attachment (2)
Mr. D. Cohen – Attachment
Ms. J. Somers – Attachment
✓ Mr. J. Paauwe - Attachment
File
H:SSH/SS/8354420-2.doc

SUBSURFACE INVESTIGATION
ADDENDUM 2

DES. NO.: 8354420
PROJECT NO.: STP-4320(7)
SR 15 FROM 0.34 MI. S. OF US 20 TO 1.92 MI. N. OF US 20
ELKHART COUNTY, INDIANA
CTL PROJECT NO.: 05050045IND

PREPARED FOR:

INDIANA DEPARTMENT OF TRANSPORTATION
MATERIALS AND TESTS DIVISION
120 SOUTH SHORTRIDGE ROAD
INDIANAPOLIS, INDIANA 46219

PREPARED BY:

CTL ENGINEERING OF INDIANA, INC.
6848 HILLSDALE COURT
INDIANAPOLIS, INDIANA 46250

NOVEMBER 23, 2005

CTL ENGINEERING

CTL Engineering of Indiana, Inc.
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Phone: 317/585-8277 • Fax: 317/585-8621
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AN EMPLOYEE OWNED COMPANY

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Established 1927

November 23, 2005

Indiana Department of Transportation
Materials and Tests Division
120 South Shortridge Road
Indianapolis, Indiana 46219

Attention: Mr. Athar Khan, P.E.
Chief Geotechnical Engineer

Reference: Subsurface Investigation – Addendum 2
Des. No.: 8354420
Project No.: STP-4320(7)
SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20
Elkhart County, Indiana
CTL Project No.: 05050045IND

Dear Mr. Khan:

In accordance with your authorization to proceed, CTL Engineering, Inc. has completed the subsurface investigation on the above referenced site.

The report includes the results of our field and laboratory testing, and our analyses and recommendations for the foundations and earth related phases of the project.

Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact our office at (317) 585-8277.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.
Principal Engineer

cc: Mr. Shahid Siddiqui, INDOT - Materials and Tests Division

SUMMARY OF SUBSURFACE INVESTIGATION

A subsurface investigation report for the roadway reconstruction on SR 15 and US 20 was prepared and submitted on August 15, 2001. Also, a subsurface investigation – Addendum 1 report was prepared and submitted on March 2, 2004 for the proposed sewer lines. This report is being submitted as an addendum 2. Under this addendum, the project involves the design and construction of one culvert on SR 15 and a culvert extension on US 20 as described below.

Location	Structure No.	Station	Line	Box Culvert Size	Boring No.	Flow Line Elevation	
						Up Stream	Down Stream
SR 15	62	13+885	"B" & "C"	25m of 1194mm x 1804mm Pipe	TB-1 & TB-2	249.00	248.67
US 20	69	5+694	"S-US20-B"	6.0 m of 3910mm x 2235mm Multi Plate Box Culvert (Extension)	TB-3	N/A	N/A

A subsurface investigation for the subject sites has been completed and a summary of our findings and recommendations is reported below. Detailed foundation recommendations and construction considerations are provided in the subsurface investigation report.

FINDINGS

Test borings TB-1 and TB-2, drilled at Structure No. 62, encountered fill material to depths of 3.5 feet (1.07m) and 8.5 feet (2.59m). The fill is described as sand and gravel, sand, sandy loam and/or loam containing varying amounts of roots, organic matter and/or brick fragments. Below the fill, both test borings encountered sand deposits. Boring TB-3, drilled at Structure No. 69, encountered possible fill material over creek sediments to a depth of 8.5 feet (2.59m). Below, layers of clay loam, sand and silt were encountered throughout the drilled depth

Structure No. 62 on SR 15

The borings encountered very loose sand or on very stiff sandy loam fill at the culvert invert elevation. Groundwater is expected during excavation and placement of this culvert. It is recommended that all fill material and very loose sand be removed to a depth of 2 feet (600mm) and replaced with "B" Borrow material or No. 53 aggregate to provide a uniform subgrade below the culvert. A layer of geogrid Type 1 would be needed at the bottom of the excavation. The excavation should extend for a horizontal distance of 5 feet (1.5m) beyond the limits of the culvert.

Structure No. 69 on US 20

Very soft creek sediments containing organic matter was encountered at the proposed culvert extension invert elevation. Surface runoff and/or seepage water could be encountered. It is recommended that the soft creek sediments and/or soil containing organic matter be removed and replaced with "B" Borrow material or No. 53 aggregate. It is estimated that the excavation could extend to a depth of 2.5 feet (750mm) below the proposed invert elevation of the culvert. A layer of geogrid Type 1 would be needed at the bottom of the excavation. Removal of the undesirable soil deposits should extend for a horizontal distance of 5 feet (1.5m) beyond the limits of the culvert.

Wingwall footings may be designed using the soil parameters provided in the geotechnical report.

This summary is provided for general information only, and it should not be used as the only source for any design, estimating or bidding. Detailed recommendations are provided in the geotechnical report.

GTL ENGINEERING

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I. PROJECT LOCATION AND DESCRIPTION

The project is identified as SR 15 from 0.34 miles south of US 20 to a point 1.92 miles north of US 20 in Elkhart County, Indiana. The project involves the design and construction of two culverts as described in Table 1.

Table 1 – Culverts

Location	Structure No.	Station	Line	Box Culvert Size	Boring No.	Flow Line Elevation	
						Up Stream	Down Stream
SR 15	62	13+885	"B" & "C"	25m of 1194mm x 1804mm Pipe	TB-1 & TB-2	249.00	248.67
US 20	69	5+694	"S-US20-B"	6.0 m of 3910mm x 2235mm Multi Plate Box Culvert (Extension)	TB-3	N/A	N/A

Note that a subsurface investigation report for the roadway reconstruction on SR 15 and US 20 was prepared and submitted on August 15, 2001. Also, a subsurface investigation – Addendum 1 report was prepared and submitted on March 2, 2004 for the proposed sewer lines. This report is being submitted as an addendum 2.

II. SUBSURFACE INVESTIGATION

Three (3) test borings, designated as TB-1, TB-2 and TB-3, were drilled near the proposed culverts to a depth of 20 feet (6.10m) each. TB-1 and TB-2 were drilled for Structure No. 62 and TB-3 was drilled for Structure 69. Locations of the test borings are shown on the Boring Location Plans in Appendix A.

The test borings were advanced with an All-Terrain Vehicle (ATV) drilling rig utilizing hollow stem augers (HSA) on October 25, 2005. Standard Penetration tests were conducted using a 140-pound automatic hammer falling 30 inches to drive a 2-inch O.D. split barrel sampler for 18 inches.

Soil samples obtained from the drilling operation were preserved in glass jars and visually classified in the field and laboratory. Representative soil samples were tested for Natural Moisture Content, pH, Loss on Ignition, Atterberg Limits and Grain Size Distribution.

Drilling, soil sampling and laboratory testing have been performed following INDOT, AASHTO and current ASTM procedures. Results from field and laboratory tests are shown in Appendix B and Appendix C.

Stations, offsets and surface elevations of the test borings were interpolated from the site plans and cross sections provided to us by INDOT.

III. FINDINGS

A. Soil Profile

Test boringsTB-1 and TB-3 encountered 10 to 12 inches of topsoil at the surface. Boring TB-2 encountered 5 inches of asphalt concrete over 4 inches of cement concrete.

Below the surface cover, TB-1 and TB-2 encountered fill material to depths of 3.5 feet (1.07m) and 8.5 feet (2.59m). The fill is described as sand and gravel, sand, sandy loam and/or loam containing varying amounts of roots, organic matter and/or brick fragments. Below the fill, both test borings encountered sand deposits. A layer of clay loam was encountered in TB-1 at a depth of 19 to 20 feet (5.79m to 6.10 m).

Below the surface cover in test boring TB-3, possible fill material was encountered to a depth of 4 feet (1.22m). Below, silty clay and sandy loam deposits were encountered to a depth of 8.5 feet (2.59m). These deposits are described as creek sediments, which contain traces to little organic matter. Below, layers of clay loam, sand and silt were encountered throughout the drilled depth of 20 feet (6.10m).

Detailed information of soil types, natural moisture content and standard penetration tests are shown on the enclosed test boring records in Appendix B and appended soil profile sheets in Appendix D and E.

B. Groundwater

Groundwater and/or seepage water was encountered in TB-1 and TB-2 at depths of 4.0 feet (1.22m) and 5.6 feet (1.70m), respectively. Groundwater was encountered in TB-3 at a depth of 13 feet (3.96m). Refer to the attached test boring records in Appendix B for detailed groundwater readings.

IV. DISCUSSION AND RECOMMENDATIONS

Based upon the soil data obtained from field and laboratory testing, foundation recommendations for each culvert are provided in the following paragraphs.

A. Structure No. 62 on SR 15

The borings encountered very loose sand or on very stiff sandy loam fill at the culvert invert elevation. Groundwater is expected during excavation and placement of this culvert.

Based upon the above findings, it is recommended that all fill material and very loose sand be removed to a depth of 2 feet (600mm) and replaced with "B" Borrow material or No. 53 aggregate to provide a uniform subgrade below the culvert. A layer of geogrid Type 1 would most likely be needed at the bottom of the excavation. The excavation should extend for a horizontal distance of 5 feet (1.5m) beyond the limits of the culvert.

B. Structure No. 69 on US 20

Very soft creek sediments containing organic matter were encountered at the invert elevation of the proposed culvert extension. Surface runoff and/or seepage water could be encountered depending upon the time of construction and amounts of precipitation.

Based upon the above findings, it is recommended that the soft creek sediments and/or soil containing organic matter be removed and replaced with "B" Borrow material or No. 53 aggregate. It is estimated that the excavation could extend to a depth of 2.5 feet (750mm) below the proposed invert elevation of the culvert. A layer of geogrid Type 1 would most likely be needed at the bottom of the excavation. Removal of the undesirable soil deposits should extend for a horizontal distance of 5 feet (1.5m) beyond the limits of the culvert.

Foundation and earthwork recommendations for both culverts are provided in the following paragraphs.

1. The recommended allowable soil bearing pressures and the soil parameters required for the design of footings and wingwalls are provided in Table 2. These values apply to all design loads. Additional soil information may be found in the enclosed Test Boring Records in Appendix B and the soil profiles in Appendix D and E. Note that the allowable soil bearing pressures provided in Table 2 are based on the assumption that the wingwall footings will be placed at 4 feet (1.3m) below the proposed flowline.

2. Settlements of footings may vary at the culvert location due to variations in soil composition, void ratio and loading. It is estimated that total and differential settlements would be within tolerable limits.

3. The pH values obtained from the laboratory testing ranged from 8.4 to 8.7.

4. Temporary excavations in excess of 5.0 feet in depth should be sloped, braced and/or shored according to OSHA requirements. Excavation to bottom of the recommended footing depth and in fill areas may be accomplished using standard excavation equipment.

5. Prior to placement of footings, the recommended soil bearing pressure should be verified and approved by a qualified Engineering Technician under the supervision of a Geotechnical Engineer. Soft and/or loose soils not meeting the recommended soil pressure, should be removed, dried and recompacted or undercut and replaced with lean concrete, No. 53 aggregate, or as otherwise directed by the Engineer.

6. Groundwater and/or surface runoff is expected during construction at Structure 62. At this Structure, the sand deposits containing groundwater extend to Elevation 244.2±. Surface runoff and/or seepage water could be encountered at Structure 69 depending upon the time of construction and amounts of precipitation. Dewatering, if needed, may be accomplished using construction sump pump(s), or any dewatering system approved by the engineer.

7. Borrow type and placement, and drainage structure installations including footings should be in accordance with INDOT Standard Specifications and the culvert manufacturer recommendations.

Table 2 – Soil Parameters for Wingwall Design

Soil Parameters	Estimated Values	
	Structure 62	Structure 69
Allowable Soil Bearing Pressure, psf *	**	1000 ***
Angle of Internal Friction of Foundation Soil (ϕ), degrees	30	0
Friction Angle between Foundation Soil and Concrete (δ), degrees	20	0
Ultimate Cohesion of Foundation Soil (C), psf	0	600
Ultimate Adhesion between Footings and Foundation Soil (C_a), psf	0	400
Friction Angle of Backfill Material, degrees	30	30
Friction Angle between Wall and Backfill (δ_f), degrees	20	20
Unit Weight of Foundation Soil, pcf	115	110

* Allowable soil bearing pressures are provided at a depth of 4 feet below the culvert invert elevations.

**

Width of Footings (feet)	Allowable Soil Bearing pressure (psf)
2	700
3	800
4	900
5	1000
6	1100

*** Undrained shear method used. Recommended soil bearing pressure is estimated for the clay loam encountered between a depth of 2.69 m and 3.96m.

V. CONCLUDING REMARKS

A. Changed Conditions

Should plans for the proposed culverts be changed from those used in preparing this report, CTL Engineering of Indiana, Inc. (CTL) should be notified to make the necessary modifications to our recommendations to account for the changed conditions.

B. Testing and Observation

Experience shows that the subsurface soil conditions in an area sometimes vary from the ones indicated in the test borings at their specific locations. It is therefore recommended that an Engineering Technician, under the supervision of a qualified Professional Engineer be retained on the site to monitor the construction of spread footings and earthwork operations.

C. Closure

CTL has prepared this report for your use in accordance with generally accepted soil and foundation engineering practices. Analyses, conclusions, recommendations and other work product of CTL are instruments of service for this project only.

CTL assignment does not include, nor does this geotechnical report address the environmental aspects of this site.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.
Principal Engineer
Indiana Reg. No. 60900551

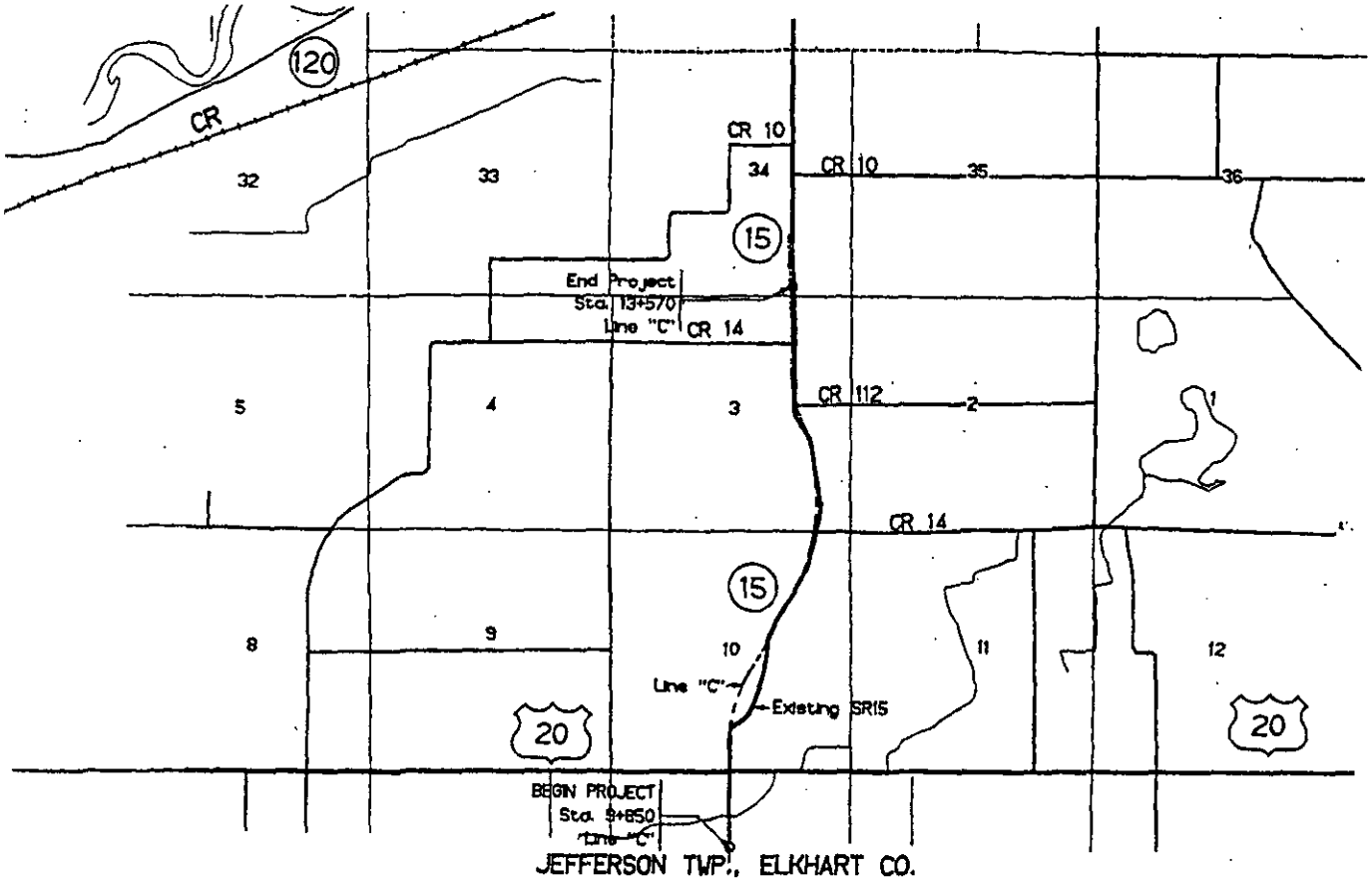
ALI H. KARAKI
REGISTERED
No.
900551
STATE OF
INDIANA
PROFESSIONAL ENGINEER

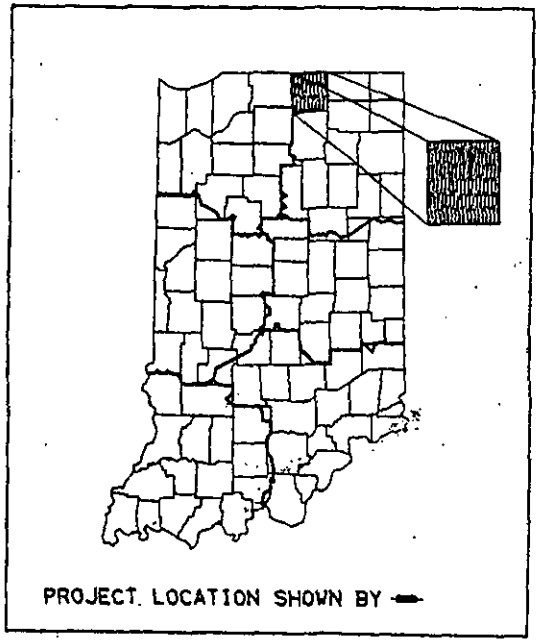
Paul L. Douglass, P.E.
Principal Engineer
Indiana Reg. No. 60012388

CTL ENGINEERING

APPENDIX A

GENERAL SITE PLAN
BORING LOCATION PLANS





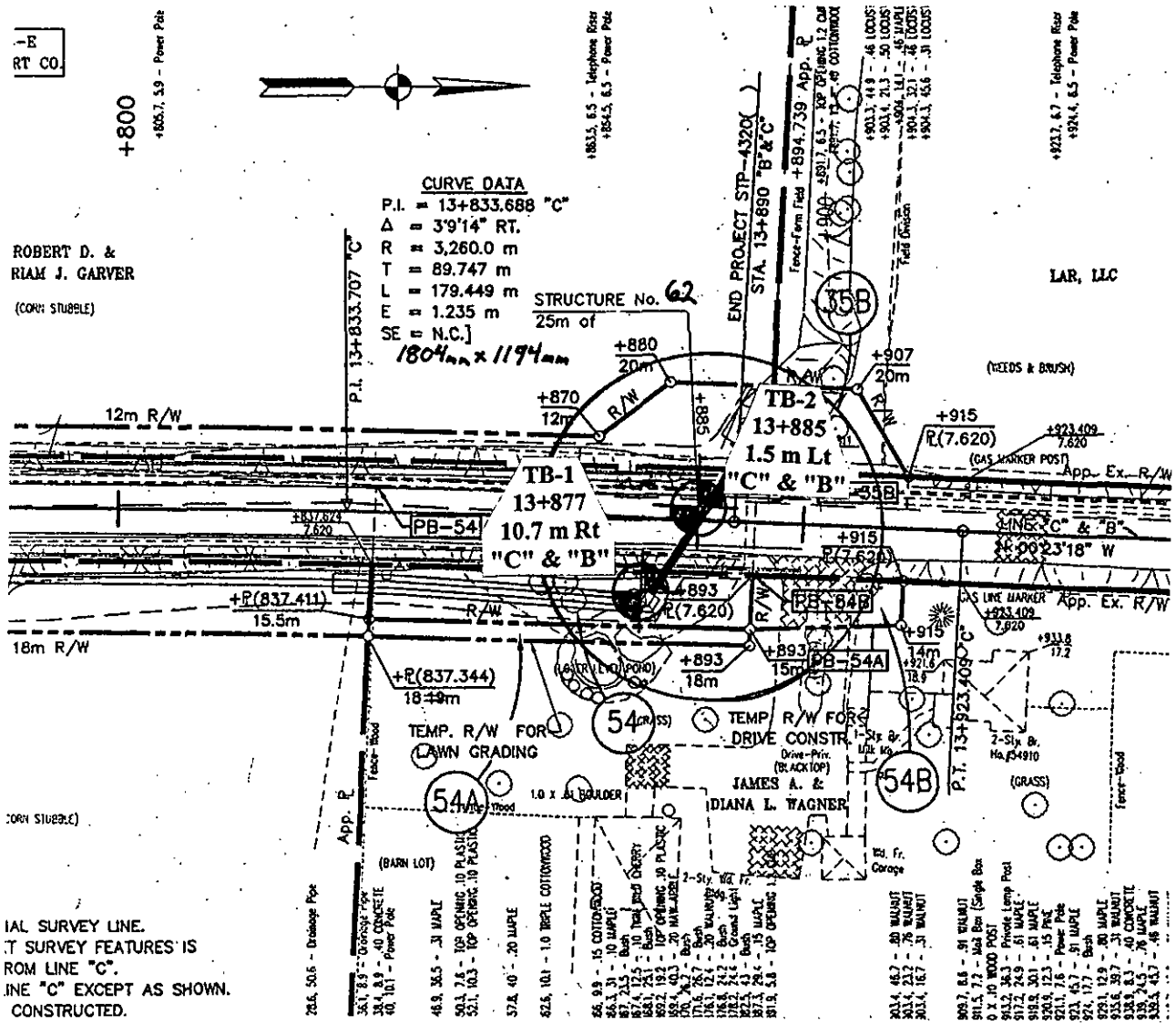
GENERAL SITE PLAN

SR 15/ US 20 Improvement

SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20

Des. No.: 8354420, Project No.:: STP-4320(7)

Elkhart County, Indiana



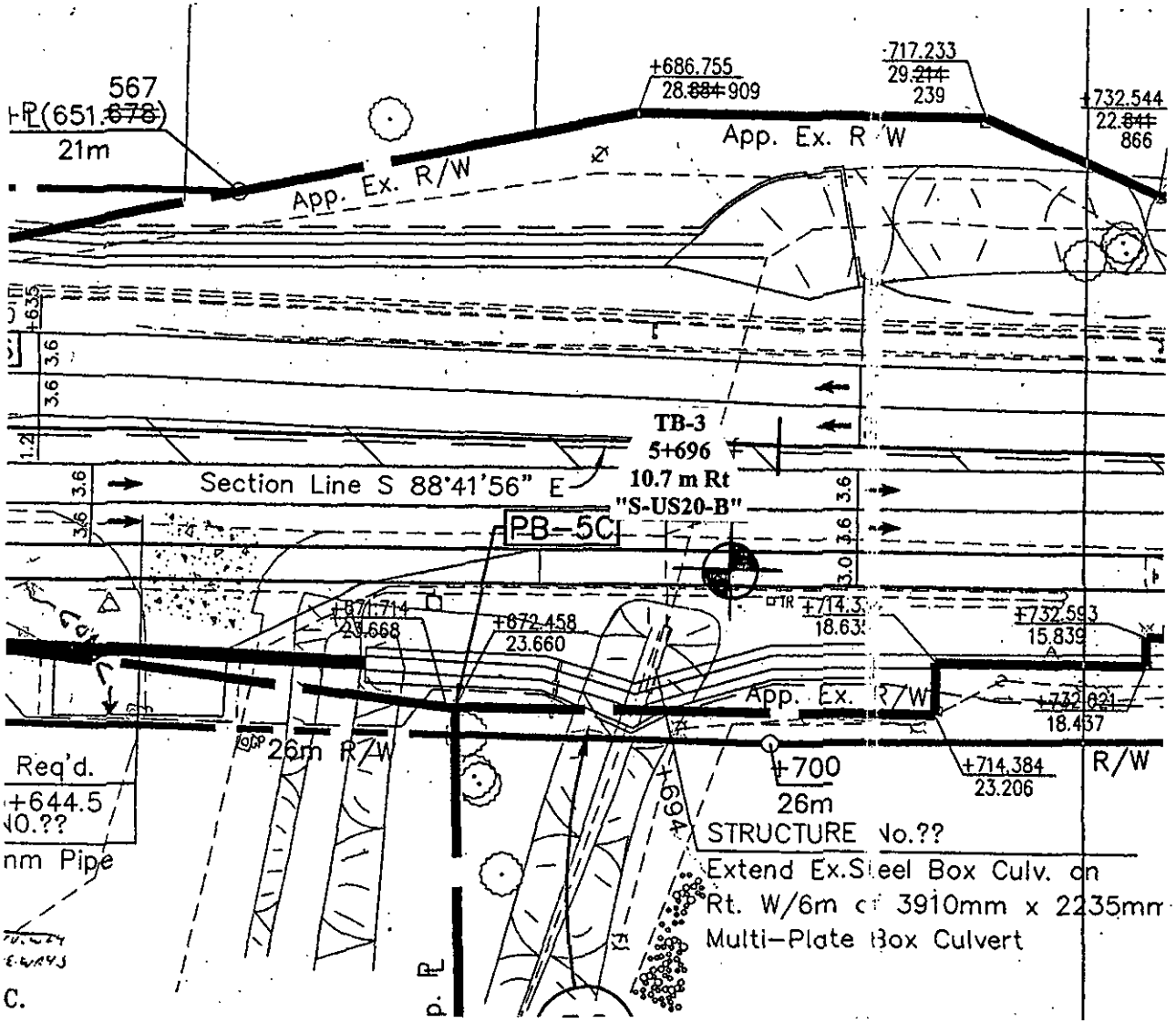
BORING LOCATION PLAN

SR 15/ US 20 Improvement

SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20

Des. No.: 8354420, Project No.:: STP-4320(7)

Elkhart County, Indiana



BORING LOCATION PLAN

SR 15/ US 20 Improvement

SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20

Des. No.: 8354420, Project No.:: STP-4320(7)

Elkhart County, Indiana

APPENDIX B

TEST BORING RECORDS

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20
LOCATION : Elkhart County, Indiana
DES NO. : 8354420; Project No.: STP-4320; CTL No.: 05050045IND

BORING NO.: TB-1
SHEET 1 OF 1
DATE STARTED : 10-25-05
DATE COMPLETED : 10-25-05

BORING ELEVATION	: 250.00 m (USC&GS)	BORING METHOD	: HSA	HAMMER	: Automatic
STATION	: 13+877	RIG TYPE	: CME-550 ATV	DRILLER	: ED
OFFSET	: 10.7m Rt	CASING DIA.	: 83 mm I.D.	TEMPERATURE	: 50° F
LINE	: "C" & "B"	CORE SIZE	: ---	WEATHER	: Cloudy
DEPTH	: 6.10 m				

GROUNDWATER: ▼ Encountered at 1.22 m ▼ At Completion 1.22 m ▣ Caved in at 1.37 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
249.70		**TOPSOIL** (305mm) (Visual)	0.30										
		Brownish Black, Moist, Soft, **LOAM** with Traces of Roots and Organic Matter **(FILL)** (Visual)		SS-1	2 2 3	5	89	23					
248.93			1.07										
	1.5			SS-2	2 2 2	4	89						
				SS-3	3 4 6	10	100						
	3.0			SS-4	6 7 7	14	89						
		Brown, Wet, Very Loose to Medium Dense, **SAND** with Traces of Gravel Visual)											
	4.5			SS-5	4 5 7	12	100						
244.21			5.79										
	6.0	Gray, Moist, Very Stiff, **CLAY LOAM (TILL)** A-4 As Lab 2		SS-6	11 13 17	30	100	15					
243.90			6.10										
		Bottom of Boring at 6.10 meters											
		Boring performed for Structure No. 62.											
		Boring backfilled with soil cuttings.											

CTL ENGINEERING
CTL Engineering of Indiana, Inc.
Phone: 317-585-8277

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20
LOCATION : Elkhart County, Indiana
DES NO. : 8354420; Project No.: STP-4320; CTL No.: 05050045IND

BORING NO.: TB-2
SHEET 1 OF 1
DATE STARTED : 10-25-05
DATE COMPLETED : 10-25-05

BORING					
ELEVATION	250.70 m (USC&GS)	BORING METHOD	HSA	HAMMER	Automatic
STATION	13+885	RIG TYPE	CME-550 ATV	DRILLER	ED
OFFSET	1.5m Lt	CASING DIA.	83 mm I.D.	TEMPERATURE	50° F
LINE	"C" & "B"	CORE SIZE	—	WEATHER	Sunny
DEPTH	6.10 m				

GROUNDWATER: ▼ Encountered at 2.74 m ▼ At Completion 1.70 m ▣ Caved in at 2.44 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
250.57		ASPHALT CONCRETE (127mm) (Visual)	0.13										
250.47		CEMENT CONCRETE (102mm) (Visual)	0.23										
		Brown, Slightly Moist, Medium Dense, **SAND & GRAVEL (FILL)** (Visual)		SS-1	8 9 10	19	78						
249.63			1.07										
	1.5	Brownish Gray, Moist, Medium Dense, **SAND** with Traces of Brick Fragments **(FILL)** (Visual)		SS-2	8 8 6	14	89						
248.87			1.83										
		Brown, Moist, Very Stiff, **SANDY LOAM** with Traces of Brick Fragments **(FILL)** A-4 As Lab 1		SS-3	11 14 16	30	33	14					
248.11			2.59										
	3.0			SS-4	8 10 12	22	100						
	4.5	Brown, Moist to Wet, Medium Dense, **SAND** (Visual)		SS-5	6 8 9	17	100						
	6.0			SS-6	4 5 6	11	100						
244.60			6.10										
		Bottom of Boring at 6.10 meters											
		Boring performed for Structure No. 62. Two attempts made on SS-3 due to low soil recovery. Boring backfilled with soil cuttings, and pavement restored with concrete patch.											

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CTL Engineering of Indiana, Inc.
Phone: 317-585-8277

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20
LOCATION : Elkhart County, Indiana
DES NO. : 8354420; Project No.: STP-4320; CTL No.: 05050045IND

BORING NO.: TB-3
SHEET 1 OF 1
DATE STARTED : 10-25-05
DATE COMPLETED : 10-25-05

BORING ELEVATION	: 261.15 m (USC&GS)	BORING METHOD	: HSA	HAMMER	: Automatic
STATION	: 5+696	RIG TYPE	: CME-550 ATV	DRILLER	: ED
OFFSET	: 10.7m Rt	CASING DIA.	: 83 mm I.D.	TEMPERATURE	: 50° F
LINE	: "S-US20-B"	CORE SIZE	: ---	WEATHER	: Cloudy
DEPTH	: 6.10 m				

GROUNDWATER: ▼ Encountered at 3.96 m ▼ At Completion 5.49 m ▨ Caved in at 5.56 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
260.90		**TOPSOIL** (254mm) (Visual)	0.25										
		Brown, Moist, Very Loose, **SAND** with Traces of Roots (Possible Fill) (Visual)		SS-1	2 2 2	4	78						
259.93			1.22	SS-2T	2	3	89						
	1.5	Dark Brownish Black, Moist, Very Soft, **SILTY CLAY** with Little Organic Matter (Creek Sediments) (Visual)		SS-2B	1 2			47					
259.32		Organic Matter = 10.8%	1.83										
		Brown with Gray Streaks, Very Moist, Soft, **SANDY LOAM** with Traces of Roots (Creek Sediments) A-4 (0) Lab 1		SS-3	2 2 2	4	78	12			NP	NP	NP
258.56			2.59										
	3.0	Gray, Moist, Soft, **CLAY LOAM** (TILL) A-4 (3) Lab 2		SS-4	2 2 3	5	78	14			22	12	10
257.19 ▼			3.96										
	4.5	Gray, Wet, Medium Dense, **SAND** (Visual)		SS-5	3 5 6	11	100						
255.97			5.18										
		Gray, Moist, Medium Dense, **SILT** (Visual)		SS-6	4 6 8	14	100	18					
255.05	6.0		6.10										
		Bottom of Boring at 6.10 meters Boring performed for Structure No. 69. Boring backfilled with soil cuttings.											

CTL ENGINEERING
CTL Engineering of Indiana, Inc.
Phone: 317-585-8277

BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	- Hollow Stem Auger	SS	- Split Spoon Sample	*	- Hand Penetrometer
SFA	- Solid Flight Auger	ST	- Shelby Tube Sample	LL	- Liquid Limit
RC	- Rock Coring	CR	- Rock Core Sample	PL	- Plastic Limit
MD	- Mud Drilling	BS	- Bag Sample	PI	- Plasticity Index
WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

APPENDIX C

LABORATORY TEST RESULTS

Summary of Classification Test Results
Grain Size Distribution Curves
Summary of Special Laboratory Test Results

Boring No.	Lab No.	Station	Offset	Line	Sample No.	Depth	Soil Classification	AASHTO Group	Percent Passing (Sieve No.)			Grain Size Distribution (%)				WC	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture Content (%)	Resilient Modulus (psi)
									10	40	200	Gravel	Sand	Silt	Clay							
TB-3	Lab 1	5+696	10.7m Rt	"S-US20-B"	SS-3	1.83-2.29	Sandy Loam	A-4 (0)	88.3	77.3	40.6	11.7	47.7	29.2	11.4	12	NP	NP	NP			
TB-3	Lab 2	5+696	10.7m Rt	"S-US20-B"	SS-4	2.59-3.05	Clay Loam	A-4 (3)	97.5	90.6	63.4	2.5	34.0	40.4	23.1	14	22	12	10			

SUMMARY OF CLASSIFICATION TEST RESULTS

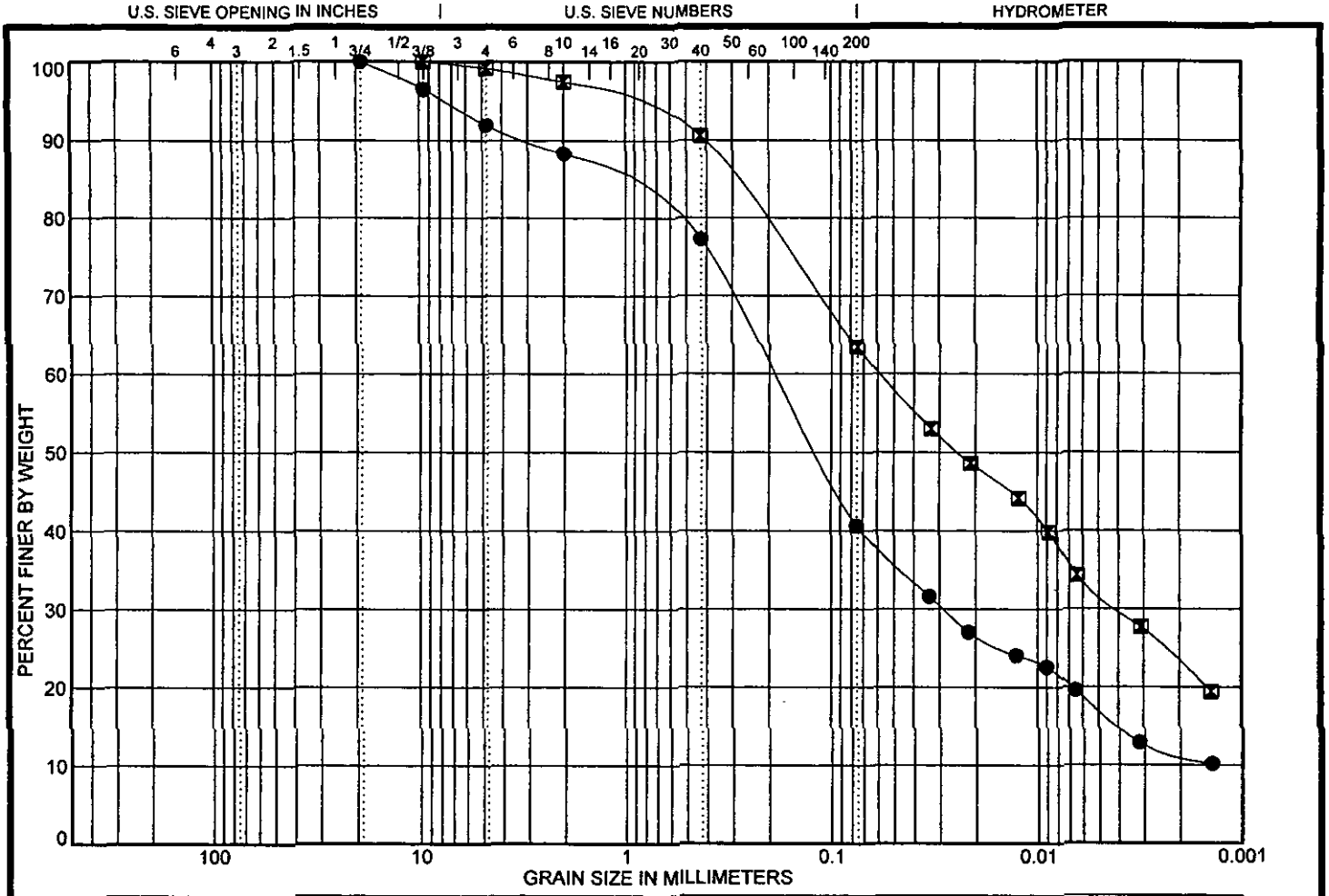
CTL ENGINEERING

CTL Engineering of Indiana, Inc.
Phone: (317) 585-8277

Project: SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20

Location: Elkhart County, Indiana

Des. No.: 8354420; Project No.: STP-4320; CTL No.: 05050045IND



Cobbles	Gravel	Sand	Silt	Clay

Boring No.	TB-3	TB-3			
Sample	SS-3	SS-4			
Depth	1.83 - 2.29	2.59 - 3.05			
Station	5+696	5+696			
Offset	10.7m Rt	10.7m Rt			
Line	"S-US20-B"	"S-US20-B"			
Curve Designation	●	⊠			
Moisture Content	**12**	**14**			
Liquid Limit	**NP**	**22**			
Plastic Limit	**NP**	**12**			
Plasticity Index	**NP**	**10**			
% Gravel	**11.7**	**2.5**			
% Sand	**47.7**	**34.0**			
% Silt	**29.2**	**40.4**			
% Clay	**11.4**	**23.1**			
Classification	**Sandy Loam**	**Clay Loam**			
AASHTO Group	**A-4 (0)**	**A-4 (3)**			
Lab No.	**Lab 1**	**Lab 2**			

CTL ENGINEERING
CTL Engineering of Indiana, Inc.
Phone: 317-585-8277

GRAIN SIZE DISTRIBUTION

Project: SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20

Location: Elkhart County, Indiana

Des. No.: 8354420; Project No.: STP-4320; CTL No.: 05050045IND

Boring No.	Station	Offset	Line	Sample No.	Depth (m)	Moisture Content (%)		Loss on Ignition (%)	pH
TB-1	13+877	10.7m Rt	"C" & "B"	SS-1	0.30-0.76	23			
TB-1	13+877	10.7m Rt	"C" & "B"	SS-6	5.64-6.10	15			
TB-2	13+885	1.5m Lt	"C" & "B"	SS-3	1.83-2.29	14			
TB-3	5+696	10.7m Rt	"S-US20-B"	SS-2B	1.22-1.52	47		10.8	
TB-3	5+696	10.7m Rt	"S-US20-B"	SS-3	1.83-2.29	12			8.4
TB-3	5+696	10.7m Rt	"S-US20-B"	SS-4	2.59-3.05	14			8.7
TB-3	5+696	10.7m Rt	"S-US20-B"	SS-6	5.64-6.10	18			

CTL ENGINEERING
CTL Engineering of Indiana, Inc.
Phone: (317) 585-8277

SUMMARY OF SPECIAL LABORATORY TEST RESULTS

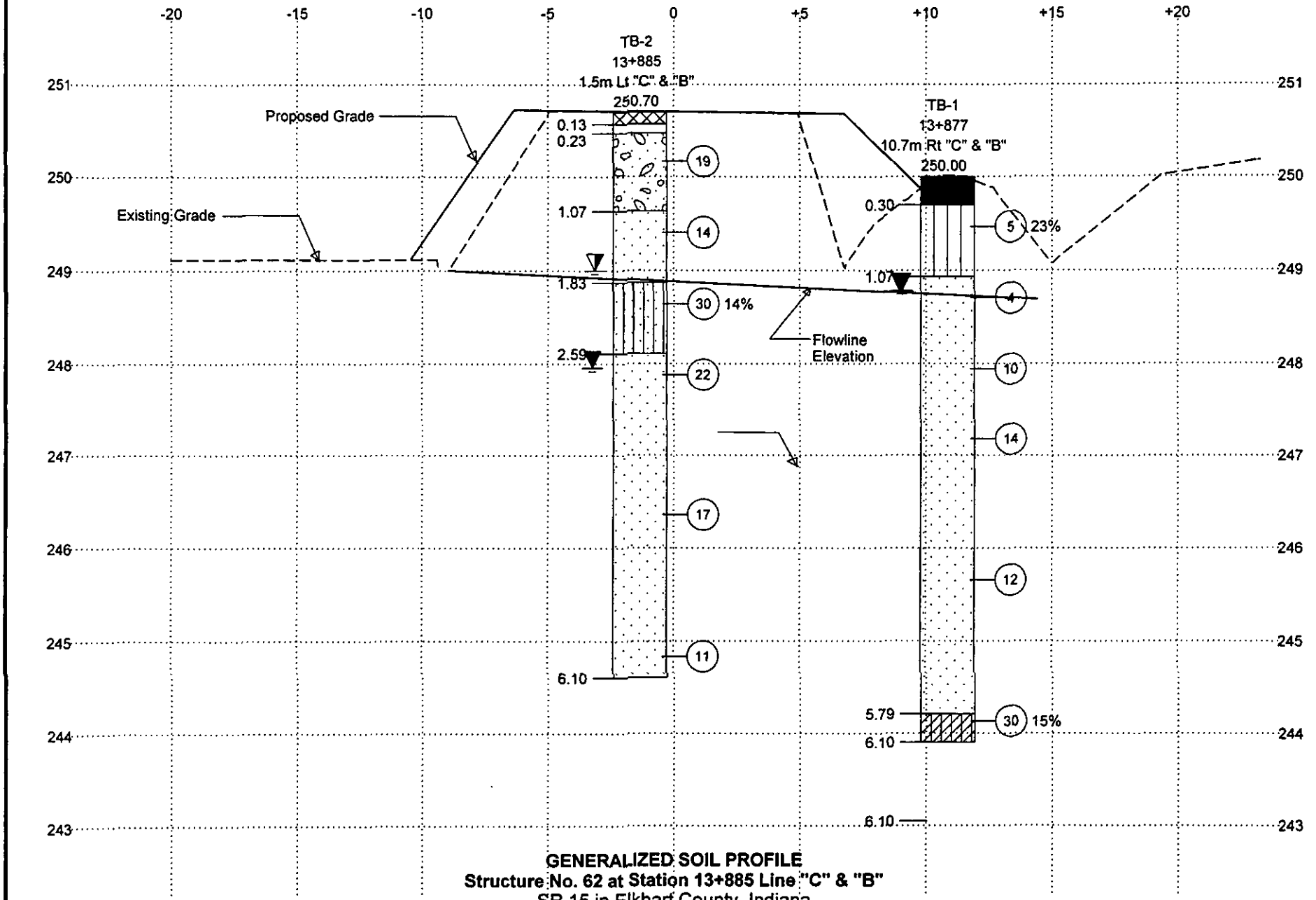
Project: SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20

Location: Elkhart County, Indiana

Des. No.: 8354420; Project No.: STP-4320; CTL No.: 05050045IND

APPENDIX D

Structure No. 62
Generalized Soil Profile
Soil Bearing Capacity Analysis



GENERALIZED SOIL PROFILE
Structure No. 62 at Station 13+885 Line "C" & "B"
SR 15 in Elkhart County, Indiana
Des. No.: 8354420; Project No.: STP-4320; CTL No.: 05050045IND

BEARING CAPACITY ANALYSES

Culvert.: Box Culvert
Location: SR 15 in Elkhart County
Structure No.: 62, 25m of 1194mm x 1804m Pipe **(Boring No. TB-1 and TB-2)**
Des. No.: 8354420
CTL No.: 05050045IND

SOIL BEARING CAPACITY

1. Very loose sand or very stiff sandy loam in-place fill exist below the proposed culvert. It is recommended that the in-place fill be removed and replaced with "B" Borrow to maintain uniform base for the culvert. Note that the 30 bpf encountered in the sandy loam fill may be due to striking on brick fragments. This value may not be represent the consistency of the entire in-place fill.

1. Footings for wingwalls would be founded on loose to medium dense sand with:
   N = 4 to 22 bpf
   Estimated Phi = 29 deg., C = 0, G = 115 pcf & G_{sub} = 115 - 62 = 53 pcf

2. Water expected above footings (longterm)

3. Assume depth of footings, D_f = At 4' below flow line, and
   B = 2'
   B = 3'
   B = 4'
   B = 5'
   B = 6'

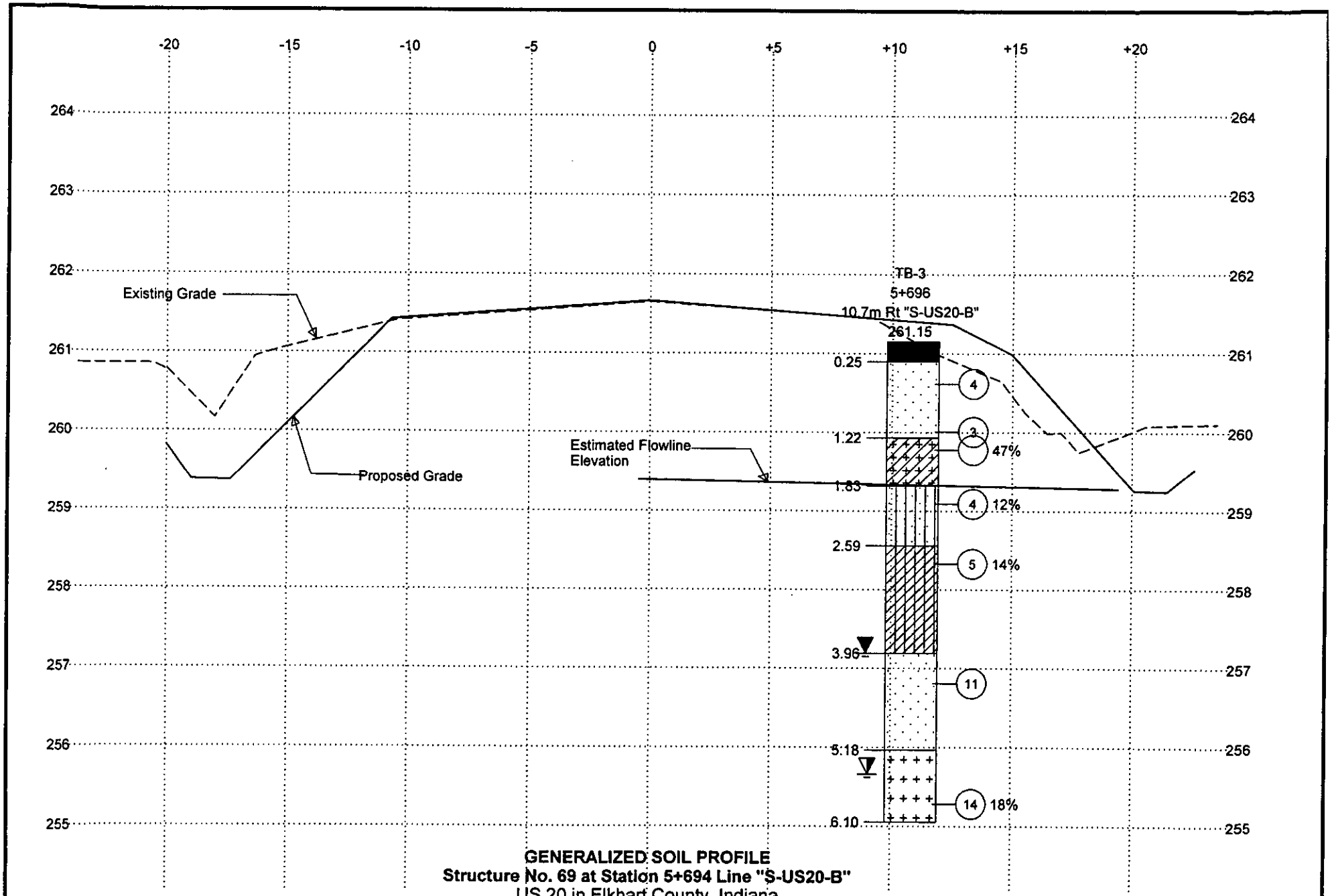
Ultimate Bearing Capacity, qult = c Nc + (Gsub Df Nq) + (0.5 Gsub B NGamma)
Allowable Bearing Capacity, qall = (qult - Gsub Df) / FS

Phi (degrees)	c (psf)	N_c	N_q	N_{Gamma}	D_f (feet)	B	G (pcf)	G_{sub} (pcf)	FS	Q_{ult} (psf)	Q_{all} (psf)	**USE Qall (psf)**
29	0	27.86	16.44	19.34	4	2	115	53	3	4510	1433	**1400**
29	0	27.86	16.44	19.34	4	3	115	53	3	5023	1604	**1600**
29	0	27.86	16.44	19.34	4	4	115	53	3	5535	1845	**1800**
29	0	27.86	16.44	19.34	4	5	115	53	3	6048	2016	**2000**
29	0	27.86	16.44	19.34	4	6	115	53	3	6560	2187	**2100**

N_c, N_q, N_{Gamma} after Meyerhof

APPENDIX E

Structure No. 69
Generalized Soil Profile
Soil Bearing Capacity Analysis



GENERALIZED SOIL PROFILE
Structure No. 69 at Station 5+694 Line "S-US20-B"
US 20 in Elkhart County, Indiana
Des. No.: 8354420; Project No.: STP-4320; CTL No.: 05050045IND

BEARING CAPACITY ANALYSES

Culvert.:	Box Culvert
Location:	US 20 in Elkhart County
Structure No.:	69, 6.0m of 3910mm x 2235mm Multi Plate Box Culvert **(Boring No.: TB-3)**
Des. No.:	8354420
CTL No.:	05050045IND

DATA

1. Box Culvert extending 6.0 meters to the right of Line "S-US20-B"

2. Invert Elevation = 260.3 (assumed). It is recommended that all creek sediment and/or soils with organic matter be removed to Elevation 258.5. The excavation should be backfilled with compacted No. 53 aggregate. A layer of geogrid Type 1 would be needed at the bottom of the excavation.

3. Groundwater is not expected. However, runoff and/or seepage water could be present.

SOIL BEARING CAPACITY

The soil bearing capacity provided below could be used for wingwall footings. It is assumed that footings will be constructed onto the clay loam soils.

Qu = 1200 psf (Estimated based on blowcounts).
Cu = 1200 / 2 = 600 psf
For Phi = 0, Nc = 5.14 (Meyerhof)

Ultimate Bearing Capacity, qult = c Nc = 600 x 5.14 = 3084 psf
Allowable Bearing Capacity, qall = qult / FS = 3084 / 3.0 = 1028 psf **USE qall = 1000 psf**

Indiana Department of Transportation

Materials and Tests Division

120 South Shortridge Road P. O. Box 19389
Indianapolis, Indiana 46219-0389
Phone: (317) 610-7251 Fax: (317) 356-9351

March 3, 2004

Mr. Gerald Mroczka, Chief
Design Division
N642 - IGCN

Attn: Ms. Sally Chesney
Project Coordinator

Subject: Subsurface Investigation – Addendum 1
Des No: 8354420
Project No: STP-4320 (3)
Proposed Storm Sewer Line, SR 15 Road Rehabilitation
County: Elkhart
District: Fort Wayne

Gentlemen:

The additional Geotechnical Investigation for the subject project has been completed and copies of the Geotechnical Report are being forwarded to those listed below.

If you have any questions concerning this matter, please call us.

Very truly yours,

Athar A. Khan.
Chief Geotechnical Engineer

S. S. Hiremath
Somanath S. Hiremath
Geotechnical Engineering Group Leader

SSH/SS
cc: Mr. T. Seeman – Attn: Mr. W. Smith - Attachment
Mr. D. Sturtz – Attn: Mr. J. Keefer – Attachment (2)
Mr. D. Cohen – Attachment
Ms. J. Somers – Attachment
Mr. J. Paauwe - Attachment
File
H:SSH/SS/8354420-1.doc

SUBSURFACE INVESTIGATION

ADDENDUM 1
DES. NO.: 8354420
PROJECT NO.: STP-4320 (3)
PROPOSED STORM SEWER LINE
SR 15 FROM 0.56 KM S. OF US 20 TO
A POINT 3.10 KM N. OF US 20
ELKHART COUNTY
CTL PROJECT NO.: 00-050061

PREPARED FOR:

INDIANA DEPARTMENT OF TRANSPORTATION
MATERIALS AND TESTS DIVISION
120 SOUTH SHORTRIDGE ROAD
INDIANAPOLIS, INDIANA 46219

PREPARED BY:

CTL ENGINEERING OF INDIANA, INC.
6848 HILLSDALE COURT
INDIANAPOLIS, INDIANA 46250

FEBRUARY, 2004

CTL ENGINEERING

CTL Engineering of Indiana, Inc.
6848 Hillsdale Court, Indianapolis, Indiana 46250
Phone: 317/585-8277 • Fax: 317/585-8621
e-mail: ctlin@ctleng.com

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Established 1927

February 4, 2004

Indiana Department of Transportation
Materials and Tests Division
120 South Shortridge Road
Indianapolis, Indiana 46219

Attention: Athar Khan, P.E.
Chief Geotechnical Engineer

Reference: Subsurface Investigation – Addendum 1
Des. No.: 8354420
Project No.: STP-4320 (3)
Proposed Storm Sewer Line
SR 15 from 0.56 km S. of US 20 to a point 3.10 km N. of US 20
Elkhart County
CTL Project No. 00-050061

Dear Mr. Khan:

In accordance with your authorization to proceed, CTL Engineering, Inc. has completed the subsurface investigation study on the above referenced site.

This addendum report includes the results of our field and laboratory testing, analyses and estimated soil parameters for the proposed storm sewer line.

Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact our office at (317) 585-8277.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.
Principal Engineer

cc: Mr. Mr. Som Hiremath, P.E., INDOT - Materials and Tests Division

SUMMARY OF SUBSURFACE INVESTIGATION - ADDENDUM 1

The project is located on the west side of SR 15 between 283m (929') south of US 20 and 220m (722') north of US 20 in Elkhart County. The project involves design and construction of a new storm sewer line approximately 503m (1650') in length placed at depths of approximately 0.5m to 5.0m (2' to 16.5') beneath existing grade. The storm sewer will be 900mm to 1050mm in diameter.

A subsurface investigation for the subject project has been completed and a summary of our findings and recommendations is reported below. Detailed foundation recommendations and construction considerations are provided in the subsurface investigation report.

1. The test borings indicate that the underlying soil conditions are suitable for the construction of the proposed storm sewer line which would bear on sandy loam tills, and on sand at the outlet location.

2. Excavation into the underlying soils to the proposed invert elevations may be accomplished using conventional excavation equipment.

3. The test borings indicated that groundwater or trapped water is contained in the sand seams or layers embedded within the till deposits.

4. Groundwater may be encountered in isolated locations depending upon the depth of the sand layers within the till deposits. Note that the test borings were drilled in October where the groundwater may have been at its lowest level. Therefore, the groundwater may be encountered at higher elevations depending upon time of construction and amount of precipitation. Dewatering in open cut excavations may be accomplished using a dewatering system suggested by the Contractor and approved by the engineer.

5. For open cut methods, excavations in excess of 4.0 feet in depth should be sloped and or shored according to OSHA requirements. Preliminary analysis indicates that excavations extending to the proposed invert elevations may be laid back at a slope rate no steeper than 3/4:1 (Horizontal to Vertical). If excavations cannot be sloped as recommended, the excavated sidewalls should be shored using a trench box system using the estimated soil parameters shown in Table 2 of the subsurface investigation report.

6. On-site excavated soils, except topsoil, are considered suitable for use for backfill provided proper moisture content is maintained during placement.

7. Pipe installation, trench width, bedding and backfill compaction should be performed in accordance with ISS.

8. Directional drilling should be possible at this site. Additional test borings may be needed to confirm the soil conditions.

GTL ENGINEERING

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III.	FINDINGS	2
IV.	ANALYSES AND RECOMMENDATIONS	3
V.	CHANGED CONDITIONS	5
VI.	TESTING AND OBSERVATION	5
VII.	CLOSURE	5

APPENDIX A	GENERAL SITE PLAN BORING LOCATION PLAN
APPENDIX B	TEST BORING RECORDS
APPENDIX C	LABORATORY TEST RESULTS
APPENDIX D	GENERALIZED SOIL PROFILE

I. PROJECT LOCATION AND DESCRIPTION

The project is located on the west side of SR 15 between 283m (929') south of US 20 and 220m (722') north of US 20 in Elkhart County, Indiana. The project involves the design and construction of a new storm sewer line between stations 10+117 and 10+620 for approximately 503m (1650'). The storm sewer will be 900mm to 1050mm in diameter.

Based upon the site plans provided by INDOT, the proposed storm sewer line will be constructed at invert elevations ranging from 260.95m at station 10+620 to 257.35 at station 10+117. Review of available X-sections for this project revealed that the storm sewer will be installed at depths of approximately 0.5m to 5.0m (2' to 16.5') beneath existing grade. We have assumed the storm sewer line will be constructed using conventional open cut excavation method. Also, we assumed directional drilling may be used where the storm line crosses US 20.

II. SUBSURFACE INVESTIGATION

Three (3) additional soil test borings, designated as SSL-1, SSL-2 and SSL-3, were drilled for this supplemental investigation at the locations shown on the enclosed test boring records. These test borings were drilled to depths ranging from 4.57m to 9.14m (15' to 30'). We have included in this report 5 borings that were drilled in 2001 for SR15/US20 roadway improvements and for a box culvert at station 10+122. These borings are designated as RB-3, RB-4, RB-5, TB-1 and TB-2,

The current test borings were advanced with an All-Terrain-Vehicle (ATV) mounted drilling machine utilizing hollow stem augers (HSA) on October 23, 2003. Standard Penetration tests were conducted using a 140-pound automatic hammer falling 30 inches to drive a 2-inch O.D. split barrel sampler for 18 inches.

Drilling, sampling, field and laboratory testing have been performed according to standard geotechnical engineering practices, INDOT and current ASTM procedures. Results from field and laboratory tests are shown on the enclosed boring records and soil profile.

Soil samples obtained from the drilling operation were preserved in glass jars, visually classified in the field and laboratory. Representative soil samples were tested for natural moisture content, Atterberg limits, grain size distribution, unconfined compression and pH.

Locations and ground surface elevations of the test borings were interpolated from the site plans provided by INDOT.

III. FINDINGS

The subsurface findings presented in this section are based upon the test borings drilled in 2003. The test borings drilled in 2001 are included in this report for additional information.

The test borings drilled along the proposed storm sewer line exhibited 3 to 12 inches (75 to 150mm) of topsoil at the surface.

Beneath the surface cover, SSL-1 through SSL-3 encountered mainly glacial till deposits described as sandy loam. Seams and/or layers of sand were encountered in isolated locations within the till deposits. TB-2 drilled near the proposed line outlet exhibited sand deposits throughout the drilled depth.

Standard penetration blowcount values ranged from 4 to 31 blows per foot (bpf) with natural moisture content values of 7 to 22 percent.

Groundwater and soil cave-in depths were recorded during the field investigation as shown in Table 1. Refer to the enclosed test boring records for information about the soils and groundwater encountered during this investigation.

Table 1 – Groundwater Level

Boring No.	During Drilling		At Completion		At 24-Hours		Cave-in Depth (m)
	Depth (m)	Elevation (m)	Depth (m)	Elevation (m)	Depth (m)	Elevation (m)	
RB-3	Dry	---	1.75	259.7	Dry	---	1.78
RB-4	0.91*	174.0*	2.51*	262.5*	0.91	264.1*	1.68
RB-5	Dry	---	Dry	---	Dry	---	2.29
TB-1	1.68	256.0	1.83	255.8	1.83	255.8	3.58
TB-2	1.83	255.2	1.52	255.5	0.91	256.1	1.22
SSL-1	Dry	---	Dry	---	Dry	---	---
SSL-2	8.53	256.0	5.64	258.9	5.49	259.0	---
SSL-3	3.96	258.5	1.68	260.8	1.52	261.0	2.44

* Possible trapped water in gravel base due to rain or surface runoff

IV. ANALYSIS AND RECOMMENDATIONS

The test borings indicate that the underlying soil conditions are suitable for the construction of the proposed storm sewer line. Generally, the storm sewer pipe would bear on sandy loam tills or sand at the outlet location. Based upon the above considerations and the soil data obtained from the field testing, the following recommendations are provided.

1. Excavation into the underlying soils to the proposed invert elevations may be accomplished using conventional excavation equipment. Generally, the soils at the proposed invert elevations of the pipe are expected to be medium stiff to stiff. However, due to removal of 16 feet of soil overburden, soft or loose soils may be encountered at or below the invert level in a form of soil swelling and/or liquefaction "boiling condition". In such an event, the soft/loose soils should be compacted or removed and replaced with suitable fill materials, or as otherwise directed by the Engineer.

2. The test borings indicated that groundwater or trapped water is contained in the sand seams or layers embedded within the till deposits. Based upon the groundwater levels observed during the field investigation and natural moisture content values of the recovered soil samples, groundwater may be encountered in isolated locations depending upon the depth of the sand layers within the till deposits. Note that the test borings were drilled in October where the groundwater may be at its lowest level. Therefore, the groundwater may be encountered at higher elevations depending upon time of construction and amount of precipitation. Dewatering in open cut excavations may be accomplished using sump pumps, well point system, or any dewatering system suggested by the Contractor and approved by the engineer.

3. For open cut methods, excavations in excess of 4.0 feet in depth should be sloped and or shored according to OSHA requirements. Preliminary analysis indicates that excavations extending to the proposed invert elevations may be laid back at a slope rate no steeper than 3/4:1 (Horizontal to Vertical).

   The recommended slope rates may be modified during construction depending upon groundwater levels and sand deposits within the glacial tills. The excavated side slope should be observed and approved during construction by an experienced Registered Engineer.

   If excavations cannot be sloped as recommended, the excavated sidewalls should be shored using a trench box system, or equivalent. The estimated soil parameters shown in Table 2 below may be used in designing the shoring system. The effects of surcharge loads from construction equipment, traffic and soil stockpiled adjacent to the excavated sidewalls should be considered in the design of the shoring system.

Table 2 – Estimated Soil Parameters for Shoring Design

Soil Parameters	Materials Type		
	In-place Fill	Sand Loam (Till)	Sand/Sand & Gravel
Total Unit Weight, pcf (kg/m^3)	120 (1925)	135 (2160)	125 (2000)
Undrained Shear Strength where Ø = 0°, psf (kN/m^2)	0	3000 (145)	0
Cohesion, psf (kN/m^2)	0	600 (29)	0
Angle of Internal Friction (Ø), Degrees	30	25	32
At Rest Pressure, Ko	0.50	0.58	0.47
Active Pressure, Ka	0.33	0.41	0.31
Passive Pressure, Kp	3.00	2.46	3.25

5. On-site excavated soils, except topsoil, are considered suitable for use for backfill provided proper moisture content is maintained during placement. A portion of the excavated soils may exhibit natural moisture content values above the optimum moisture. Such soils may require air-drying or other methods. Additional fill, if required, may consist of sandy silt, sand and gravel materials, flowable fill, or as otherwise directed by the Engineer.

6. Backfill materials should be placed and compacted in accordance with INDOT Standard Specifications. The engineered fill should not be placed in a frozen condition or over a frozen subgrade.

7. Pipe installation, trench width, bedding and backfill compaction should be performed in accordance with ISS.

8. Directional drilling should be possible at this site. Additional test borings may be needed to confirm the soil conditions in the area of the directional drilling operations are similar to those encountered in borings SSL-1 and SSL-2.

V. CHANGED CONDITIONS

Should details of the proposed storm sewer line be changed from those used in preparing this report, CTL should be notified to make the necessary modifications in our recommendations to account for the changed conditions.

VI. TESTING AND OBSERVATION

Experience shows that underlying soil conditions in an area sometimes vary from the ones indicated in the borings at their specific locations. It is therefore recommended that a Soils Engineering Technician, under the supervision of a qualified Geotechnical Engineer, be retained on site to observe all excavations, soils at bottom of excavations and placement of backfill.

VII. CLOSURE

CTL has prepared this report for your use in accordance with generally accepted soil and foundation engineering practices. Analysis, conclusions and other work product of CTL are instruments of service for this project only.

Soil samples will be retained in our laboratory for 60 days, after which they will be discarded unless instructions are received from you as to their disposal.

CTL's assignment does not include, nor does this geotechnical report address, the environmental aspects of the particular site.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.
Principal Engineer
Indiana Reg. No. 60900551

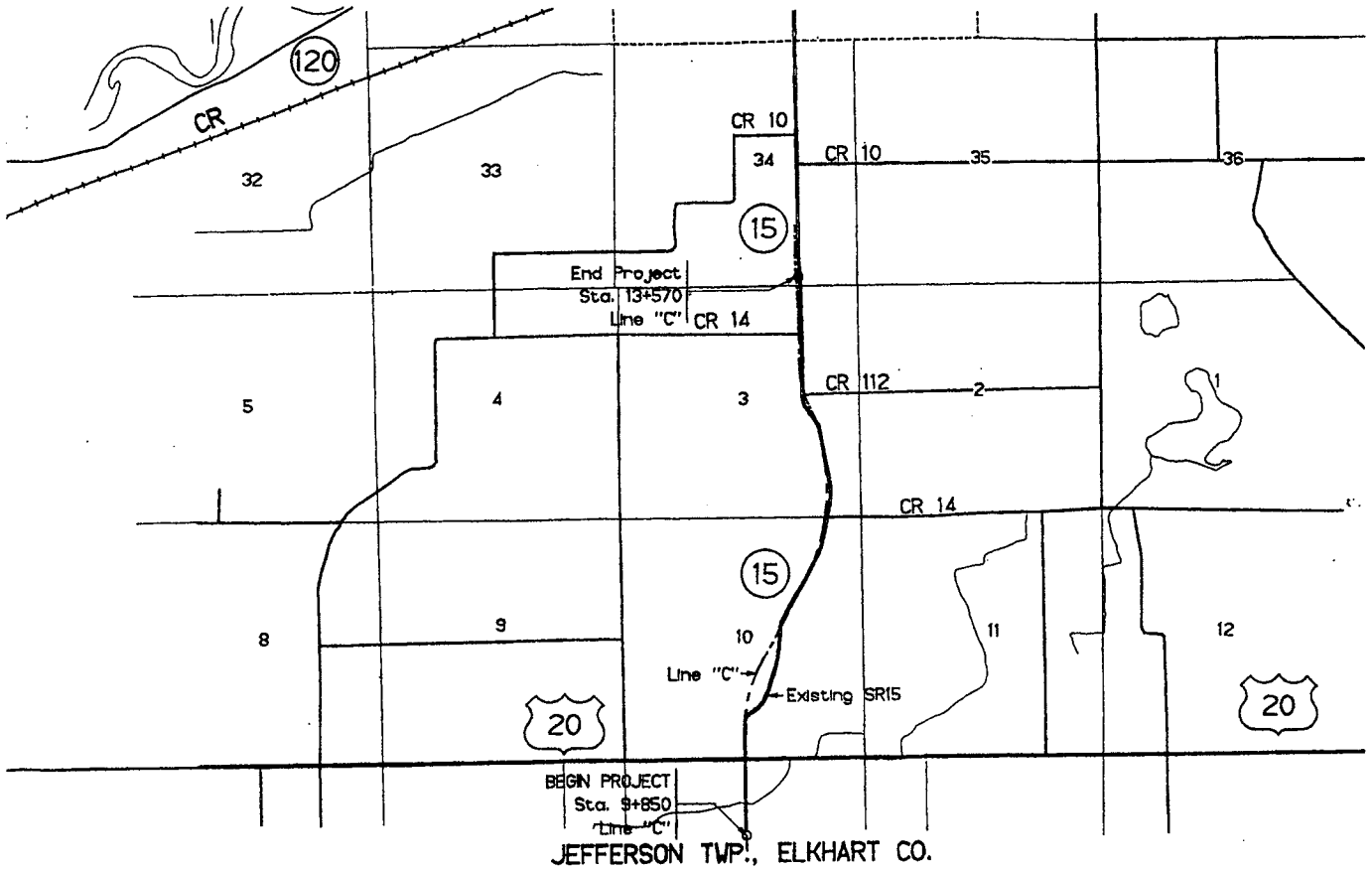
ALI H. KARAKI
REGISTERED
No.
900551
STATE OF
INDIANA
PROFESSIONAL ENGINEER

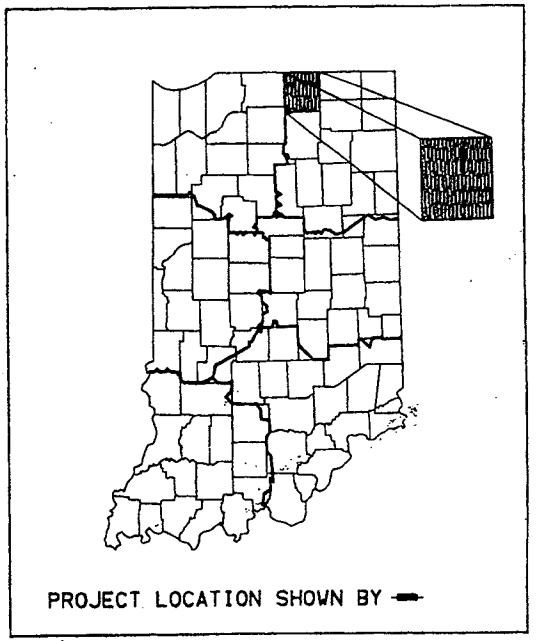
Paul L. Douglass, P.E.
Principal Engineer
Indiana Reg. No. 60012388

CTL ENGINEERING

APPENDIX A

GENERAL SITE PLAN





GENERAL SITE PLAN

SR 15/ US 20 Improvement

SR 15 from 0.56 km S. of US 20 to 3.10 km N. of US 20

Des. No.: 8354420, Project No.: STP-4320 (3)

Elkhart County, Indiana

APPENDIX B

TEST BORING RECORDS

SOIL DESCRIPTION

NON-COHESIVE SOIL DESCRIPTION	STANDARD PENETRATION BLOWCOUNTS PER FOOT (BPF)
Very Loose	0 - 5
Loose	6 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	Over 50

COHESIVE SOIL DESCRIPTION	STANDARD PENETRATION BLOWCOUNTS PER FOOT (BPF)
Very Soft	0 - 3
Soft	4 - 5
Medium Stiff	6 - 10
Stiff	11 - 15
Very Stiff	16 - 30
Hard	Over 30

GRADATION COMPONENT	SIZE
Boulders	Retained on 8"
Cobbles	Passing 8" Retained on 3"
Gravel	Passing 3" Retained on #10
Coarse Sand	Passing #10 Retained on #40
Fine Sand	Passing on #40 Retained on #200
Silt	0.075 mm to 0.002 mm
Clay	Smaller than 0.002 mm

MOISTURE TERMS	DESCRIPTION
Dry	Powdery
Slightly Moist	Below Plastic
Moist	Above Plastic, Below Liquid
Very Moist	At Liquid
Wet	Above Liquid

GTL ENGINEERING

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : Proposed Storm Sewer Line
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: SSL-1
SHEET 1 OF 1
DATE STARTED : 10-23-03
DATE COMPLETED : 10-24-03

BORING ELEVATION : 262.5 m USC&GS
STATION : 10+293
OFFSET : 15 m Lt
LINE : "B"
DEPTH : 1.67 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : TN
TEMPERATURE : High 60's ° F
WEATHER : Cloudy

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry ▽ 24 hours Reading Dry Caved in at m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
262.35		**TOPSOIL** (150mm) (Visual)	0.15										
		Brown, Slightly Moist, Medium Stiff to Very Stiff, **SANDY LOAM** with Gray Streaks in SS-2 A-4 (1) Lab 1		SS-1	4 4 6	10	100	13			22	12	10
	1.5			SS-2	5 8 11	19	100						
260.67			1.83										
				SS-3	5 7 9	16	100	11			22	12	10
	3.0			SS-4	5 7 10	17	100	11	2235	383 @ 15.0%			
		Brown Changing to Gray, Damp, Very Stiff to Stiff, **SANDY LOAM (TILL)** A-4 (1) Lab 2											
	4.5			SS-5	4 6 7	13	100	12					
257.32			5.18										
		Gray, Moist, Medium Stiff, **CLAY LOAM** (Visual)		SS-6	5 3 5	8	100	22					
257.01			5.49										
		Bottom of Boring at 5.14 meters (18')											
		NOTES 1. Temporary slotted PVC pipe set at 18 feet 2. Boring backfilled with soil cuttings.											
	6.0												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	- Hollow Stem Auger	SS	- Split Spoon Sample	*	- Hand Penetrometer
SFA	- Solid Flight Auger	ST	- Shelby Tube Sample	LL	- Liquid Limit
RC	- Rock Coring	CR	- Rock Core Sample	PL	- Plastic Limit
MD	- Mud Drilling	BS	- Bag Sample	PI	- Plasticity Index
WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : Proposed Storm Sewer Line
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: SSL-2
SHEET 1 OF 2
DATE STARTED : 10-23-03
DATE COMPLETED : 10-24-03

BORING ELEVATION : 264.5 m USC&GS
STATION : 10+473
OFFSET : 15 m Lt
LINE : "B"
DEPTH : 2.79 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : TN
TEMPERATURE : High 60's ° F
WEATHER : Cloudy

GROUNDWATER: ▼ Encountered at 8.53 m ▼ At Completion 5.64 m ▽ 24 hours Reading 5.49 m Caved in at m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
264.35		**TOPSOIL** (150mm) (Visual)	0.15										
				SS-1	2 3 7	10	100	11					
				SS-2	6 7 10	17	100	11	2120	569 @ 11.1%			
	1.5	Brown, Slightly Moist, Medium Stiff to Very Stiff, **SANDY LOAM (TILL)** with Sand Seams in SS-4 A-4 As Lab 2		SS-3	5 7 11	18	67						
				SS-4	3 5 7	12	67	12					
	3.0												
260.23			4.27										
	4.5	Gray, Slightly Moist to Moist, Medium Stiff to Hard, **SANDY LOAM (TILL)** A-4 As Lab 2		SS-5	4 3 10	13	100						
				SS-6	4 3 4	7	100	19					
	6.0												

Continued on next page

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

BORING NO.: SSL-2

PROJECT : Proposed Storm Sewer Line

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m^3)	Unconfined Compression (kN/m^2)	Atterberg Limits LL	PL	PI
	7.5	Gray, Slightly Moist to Moist, Medium Stiff to Hard, **SANDY LOAM (TILL)** A-4 As Lab 2		SS-7	13 16 15	31	33						
255.81			8.69										
255.51	9.0	Brown, Wet, Medium Dense, **SAND** (Visual)	8.99	SS-8	5 7 15	22	100	12					
255.36		Gray, Wet, Very Stiff, **SANDY LOAM (TILL)** (Visual)	9.14										
		Bottom of Boring at 9.14 meters (30')											
	10.5												
	12.0												
	13.5												

NOTES

1. Temporary slotted PVC pipe set at 6.9 meters (22.5')
2. Boring backfilled with soil cuttings.

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : Proposed Storm Sewer Line
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: SSL-3
SHEET 1 OF 1
DATE STARTED : 10-23-03
DATE COMPLETED : 10-24-03

BORING ELEVATION : 262.5 m USC&GS
STATION : 10+600
OFFSET : 20 m Lt
LINE : "B"
DEPTH : 1.39 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : TN
TEMPERATURE : High 60's ° F
WEATHER : Cloudy

GROUNDWATER: ▼ Encountered at 3.96 m ▼ At Completion 1.68 m ▽ 24 hours Reading 1.52 m Caved in at 2.44 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
262.42		TOPSOIL (75mm) (Visual)	0.08										
		Brown, Moist, Medium Dense, **SAND & GRAVEL (FILL)** (Visual)		SS-1	10 14 15	29	100						
261.28			1.22		4								
	1.5 ▽	Brown Changing to Brownish Black, Moist, Medium Stiff, **SANDY LOAM** with Traces of Organics **(Possible Fill)** (Visual)		SS-2	4 5	9	33	20					
260.52			1.98		4								
		Brown, Moist, Medium Stiff, **SANDY LOAM** A-4 As Lab 1		SS-3	3 4	7	100	7					
259.91			2.59		1								
259.60	3.0	Brown, Wet, Very Loose, **SAND** (Visual)	2.90	SS-4	1 3	4	44						
		Brown, Wet to Moist, Soft to Stiff, **SANDY LOAM** A-4 As Lab 2											
				SS-5	4 8 5	13	100						
257.93	4.5	**Bottom of Boring at 4.57 meters (15.0')**	4.57										
		Boring backfilled with soil cuttings.											
	6.0												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

Test Boring Records drilled in 2001
Within the Limits of the Proposed Storm Sewer Line

CTL ENGINEERING

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20
PROJECT NO. : STP-4320 (7), CTL No.: 00-050061

BORING NO.: RB-3
SHEET 1 OF 1
DATE STARTED : 05-15-01
DATE COMPLETED : 05-15-01

BORING
ELEVATION : 261.40 USC&GS
STATION : 10+240
OFFSET : 10 m Rt
LINE : "C"
DEPTH : 2.29 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▽ At Completion 1.75 m ▽ At 24 Hours Dry Caved in at 1.78 m

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 15cm	BLOWS per 30 cm	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, Kg/m³	UNCONF. COMP., kN/m²	ATTERBERG LIMITS LL	PL	PI
261.25		**TOPSOIL** (152 mm) (Visual)	0.15										
		Brown, Moist, Loose, **SANDY LOAM** with Traces of Roots A-4 As Lab 3		SS-1	5 5 5	10	89	16					
260.64			0.76										
		Brown, Slightly Moist, Medium Stiff to Very Stiff, **SANDY CLAY LOAM** A-4 (0) Lab 1		SS-2	3 3 4	7	100						
	1.5			SS-3	6 9 10	19	100	10			18	11	7
259.11			2.29										
		Bottom of Boring at 2.29 meters Boring backfilled with soil cuttings.											
	3.0												
	4.6												
	6.1												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	RC - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20
PROJECT NO. : STP-4320 (7), CTL No.: 00-050061

BORING NO.: RB-4
SHEET 1 OF 1
DATE STARTED : 06-20-01
DATE COMPLETED : 06-20-01

BORING ELEVATION : 265.00 USC&GS
STATION : 10+360
OFFSET : 10 m Rt
LINE : "C"
DEPTH : 3.05 m

BORING METHOD : HSA
RIG TYPE : CME 550 ATV
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 80° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 0.91 m ▽ At Completion 2.51 m ▽ At 24 Hours 0.91 m ⊠ Caved in at 1.68 m

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 15cm	BLOWS per 30 cm	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, Kg/m³	UNCONF. COMP., kN/m²	ATTERBERG LIMITS LL	PL	PI
264.85		**GRAVEL (Fill)** (152 mm) (Visual)	0.15										
		Gray, Moist, Loose, **SANDY LOAM** A-4 As Lab 3		SS-1	7 5 2	7	433	15					
264.39			0.61										
		Brown with Gray Streaks, Moist, Medium Stiff to Stiff, **SANDY CLAY LOAM** A-4 As Lab 1		SS-2	2 2 5	7	522	18					
	1.5			SS-3	4 6 9	15	556						
262.71			2.29										
		Brown, Slightly Moist, Stiff, **LOAM** A-4 As Lab 5		SS-4	4 5 7	12	556						
261.95	3.0		3.05										
		Bottom of Boring at 3.05 meters Boring backfilled with soil cuttings. **NOTE:** The 24-hours groundwater reading may be due to rain accumulated in the borehole.											
	4.6												
	6.1												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	RC - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20
PROJECT NO. : STP-4320 (7), CTL No.: 00-050061

BORING NO.: RB-5
SHEET 1 OF 1
DATE STARTED : 05-15-01
DATE COMPLETED : 05-15-01

BORING
ELEVATION : 264.50 USC&GS
STATION : 10+480
OFFSET : 5 m Rt
LINE : "C"
DEPTH : 3.05 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▽ At Completion Dry ▽ At 24 Hours Dry Caved in at 2.29 m

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 15cm	BLOWS per 30 cm	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, Kg/m³	UNCONF. COMP., kN/m²	ATTERBERG LIMITS LL	PL	PI
264.14		**ASPHALT CONCRETE** (356 mm) (Visual)	0.36										
		Gray changing to Brown, Slightly Moist, Medium Dense, **SANDY LOAM** A-4 As Lab 3		SS-1	6 8 5	13	100	13					
263.59			0.91										
	1.5			SS-2	3 6 10	16	72	11					
		Brown with Gravel Streaks, Slightly Moist, Very Stiff, **LOAM (TILL)** A-4 As Lab 5		SS-3	4 7 10	17	100						
				SS-4	3 7 9	16	100						
261.45	3.0	**Bottom of Boring at 3.05 meters**	3.05										
		Boring backfilled with soil cuttings and pavement restored with concrete patch.											
	4.6												
	6.1												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	RC - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20
PROJECT NO. : STP-4320 (7), CTL No.: 00-050061

BORING NO.: TB-1
SHEET 1 OF 1
DATE STARTED : 05-22-01
DATE COMPLETED : 05-22-01

BORING ELEVATION : 257.65 USC&GS
STATION : 10+128
OFFSET : 20 m Rt
LINE : "C"
DEPTH : 4.57 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 1.68 m ▽ At Completion 1.83 m ▽ At 24 Hours 1.83 m Caved in at 3.58 m

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 15cm	BLOWS per 30 cm	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, Kg/m³	UNCONF. COMP., kN/m²	ATTERBERG LIMITS LL	PL	PI
257.19		**TOPSOIL**(457 mm) (Visual)	0.46										
		Black to Dark Gray, Moist, Very Loose, **SANDY LOAM** A-4 As Lab 3		SS-1	2 2 1	3	94	28					
				SS-2	0 1 1	2	67						
256.13	1.5	Black to Dark Gray, Moist, Loose, **SAND** A-1-b As Lab 4	1.52										
255.67			1.98	SS-3	4 5 4	9	67						
	3.0	Brownish Gray, Wet, Medium Dense, **SAND** (Visual)		SS-4	4 5 6	11	67						
				SS-5	5 8 13	21	89						
253.08	4.6	**Bottom of Boring at 4.57 meters**	4.57										
	6.1	Boring backfilled with soil cuttings. Dozer used to pull drilling rig.											

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BORING METHOD
HSA - Hollow Stem Auger
SFA - Solid Flight Auger
RC - Rock Coring
MD - Mud Drilling
WD - Wash Drilling
HA - Hand Auger

SAMPLING METHOD
SS - Split Spoon Sample
ST - Shelby Tube Sample
RC - Rock Core Sample
BS - Bag Sample
AC - Auger Cuttings

ABBREVIATIONS
* - Hand Penetrometer
LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index
SPT - Standard Penetration Test

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20
PROJECT NO. : STP-4320 (7), CTL No.: 00-050061

BORING NO.: TB-2
SHEET 1 OF 1
DATE STARTED : 05-11-01
DATE COMPLETED : 05-11-01

BORING ELEVATION : 257.00 USC&GS
STATION : 10+126.5
OFFSET : 20 m Lt
LINE : "C"
DEPTH : 6.10 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 1.83 m ▽ At Completion 1.52 m ▽ At 24 Hours 0.91 m Caved in at 1.22 m

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 15cm	BLOWS per 30 cm	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, Kg/m³	UNCONF. COMP., kN/m²	ATTERBERG LIMITS LL	PL	PI
256.70		**TOPSOIL**(305 mm) (Visual)	0.30	SS-1T	3	4	67						
		Dark Gray to Black, Moist, Very Loose, **SAND** with Little Roots (Visual)		SS-1B	2 2			21					
256.24			0.76										
	1.5 ▽			SS-2	8 24 7	31	72						
				SS-3	6 6 6	12	72						
	3.0	Brownish Gray, Wet, Dense to Loose, **SAND** with Bouldery Zone at 1.52 m (Visual) 25 gallons of water was used to keep sand from heaving at 4.57 m		SS-4	8 10 8	18	89						
	4.6			SS-5	3 4 5	9	83						
				SS-6	8 3 5	8	100						
250.90	6.1	**Bottom of Boring at 6.10 meters** Boring backfilled with soil cuttings.	6.10										

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BORING METHOD
HSA - Hollow Stem Auger
SFA - Solid Flight Auger
RC - Rock Coring
MD - Mud Drilling
WD - Wash Drilling
HA - Hand Auger

SAMPLING METHOD
SS - Split Spoon Sample
ST - Shelby Tube Sample
RC - Rock Core Sample
BS - Bag Sample
AC - Auger Cuttings

ABBREVIATIONS
* - Hand Penetrometer
LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index
SPT - Standard Penetration Test

APPENDIX C

LABORATORY TEST RESULTS

Summary of Classification Test Results
Grain Size Distribution Curves
Unconfined Compression Test Results
Summary of Special Laboratory Test Results

GTL ENGINEERING

Lab No.	Boring No.	Station	Offset	Line	Sample No.	Depth	Soil Classification	AASHTO Group	Percent Passing (Sieve No.)			Grain Size Distribution (%)				WC	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture Content (%)	CBR @ 93%	CBR @ 97%
									10	40	200	Gravel	Sand	Silt	Clay								
Lab 1	SSL-1	10+293	15 m Lt	"B"	SS-1	0.30-0.76	SANDY LOAM	A-4 (1)	91.5	73.3	42.1	8.5	49.4	26.4	15.7	13	22	12	10				
Lab 2	SSL-1	10+293	15 m Lt	"B"	SS-3	1.83-2.29	SANDY LOAM	A-4 (1)	92.5	76.0	45.6	7.5	46.9	28.1	17.5	11	22	12	10				

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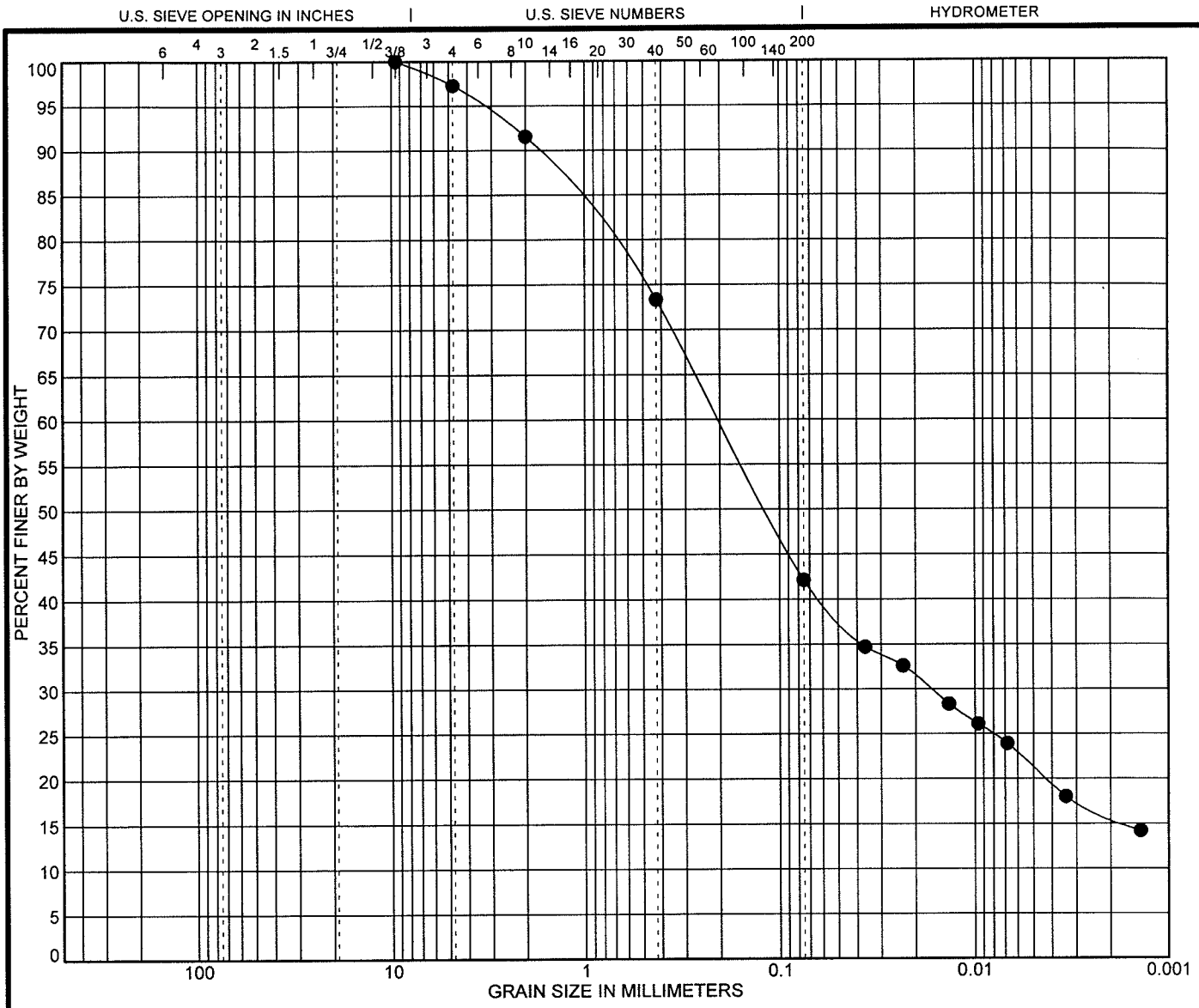
SUMMARY OF CLASSIFICATION TEST RESULTS

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Project No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Boring No.	SSL-1	Classification	MC	LL	PL	PI	Cc	Cu
Sample	SS-1	SANDY LOAM	13	22	12	10		
Depth	0.30-0.76	A-4(1)						
Station	10+293	Lab 1						
Offset	15 m Lt							
Line	"B"							

Remarks

D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
9.5	0.202	0.116	0.017		8.5	49.4	26.4	15.7

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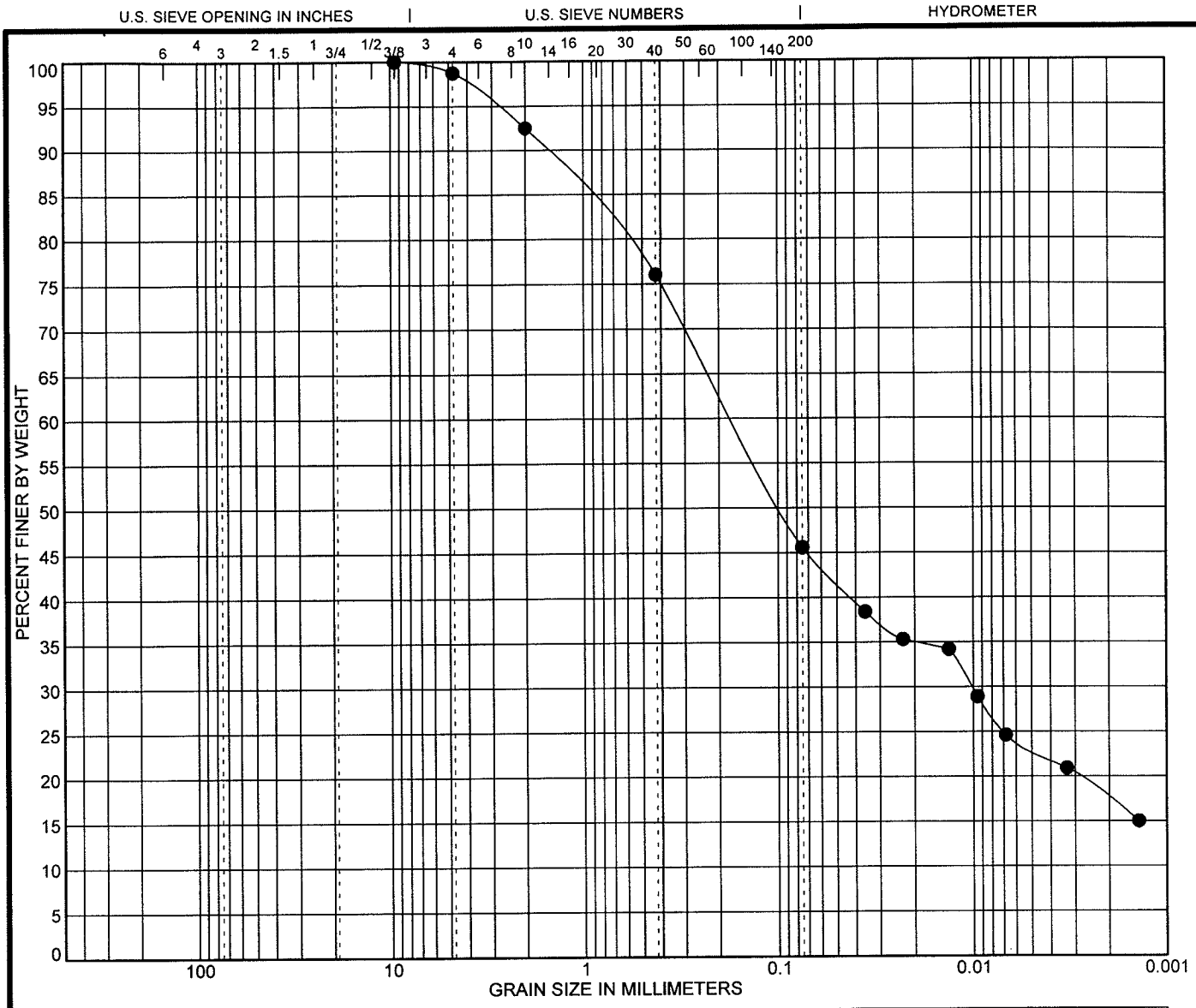
GRAIN SIZE DISTRIBUTION

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Boring No.	SSL-1	Classification	MC	LL	PL	PI	Cc	Cu
Sample	SS-3	SANDY LOAM	11	22	12	10		
Depth	1.83-2.29	A-4(1)						
Station	10+293	Lab 2						
Offset	15 m Lt							
Line	"B"							

Remarks	D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
	9.5	0.17	0.096	0.01		7.5	46.9	28.1	17.5

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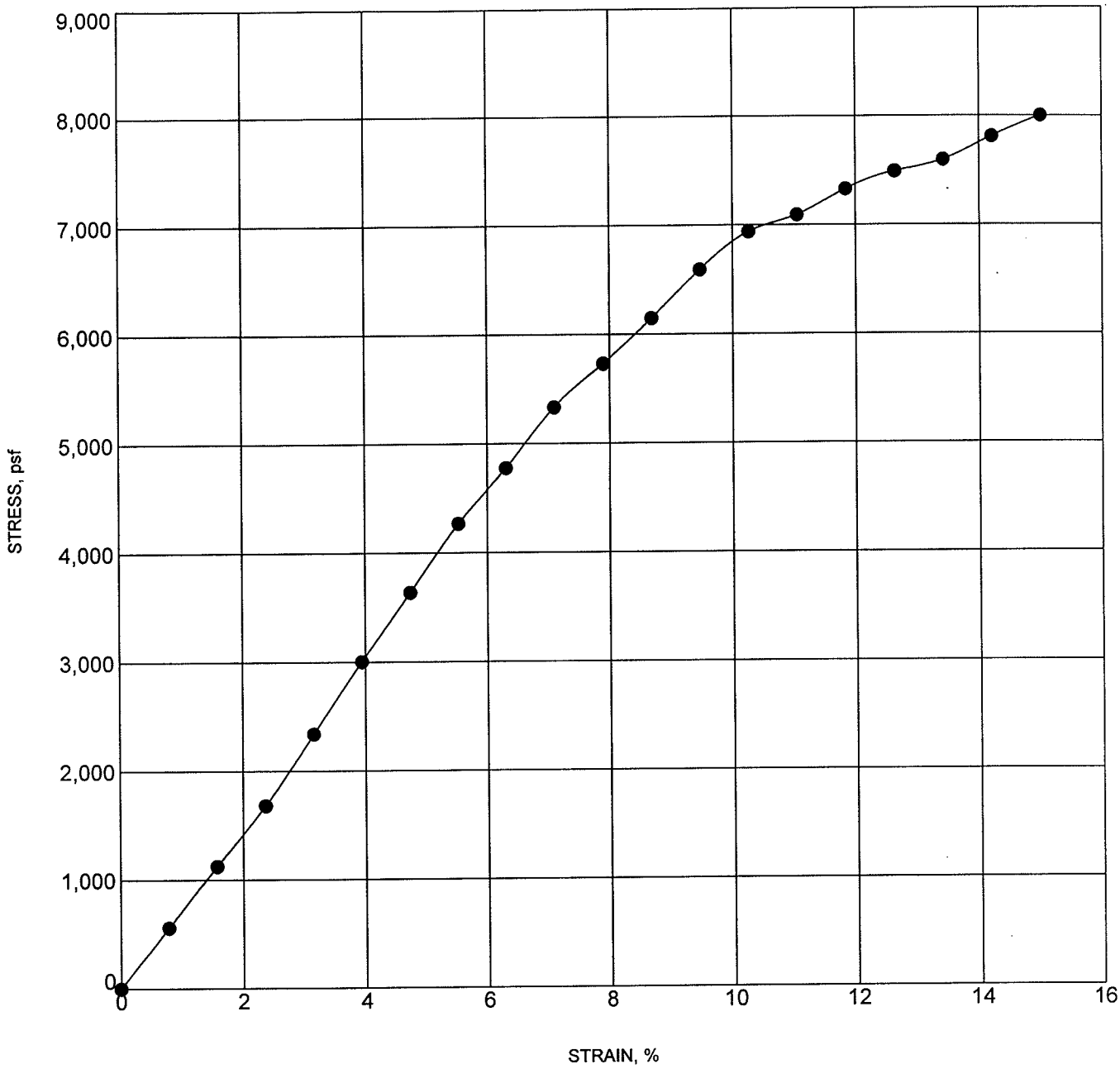
GRAIN SIZE DISTRIBUTION

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061



Boring Information		Test Results	English	Metric
Boring No.	**SSL-1**	Natural Moisture Content, %	**11**	**11**
Sample	**SS-4**	Natural Wet Density, pcf (kg/m^3)	**139.4**	**(2235)**
Depth	**2.59 - 3.05**	Natural Dry Density, pcf (kg/m^3)	**125.3**	**(2008)**
Station	**10+293**	Unconfined Compression Strength, psf (kN/m^2)	**8003**	**(383)**
Offset	**15 m Lt**	Failure Strain, %	**15.0**	**15.0**
Line	**"B"**	SOIL DESCRIPTION		

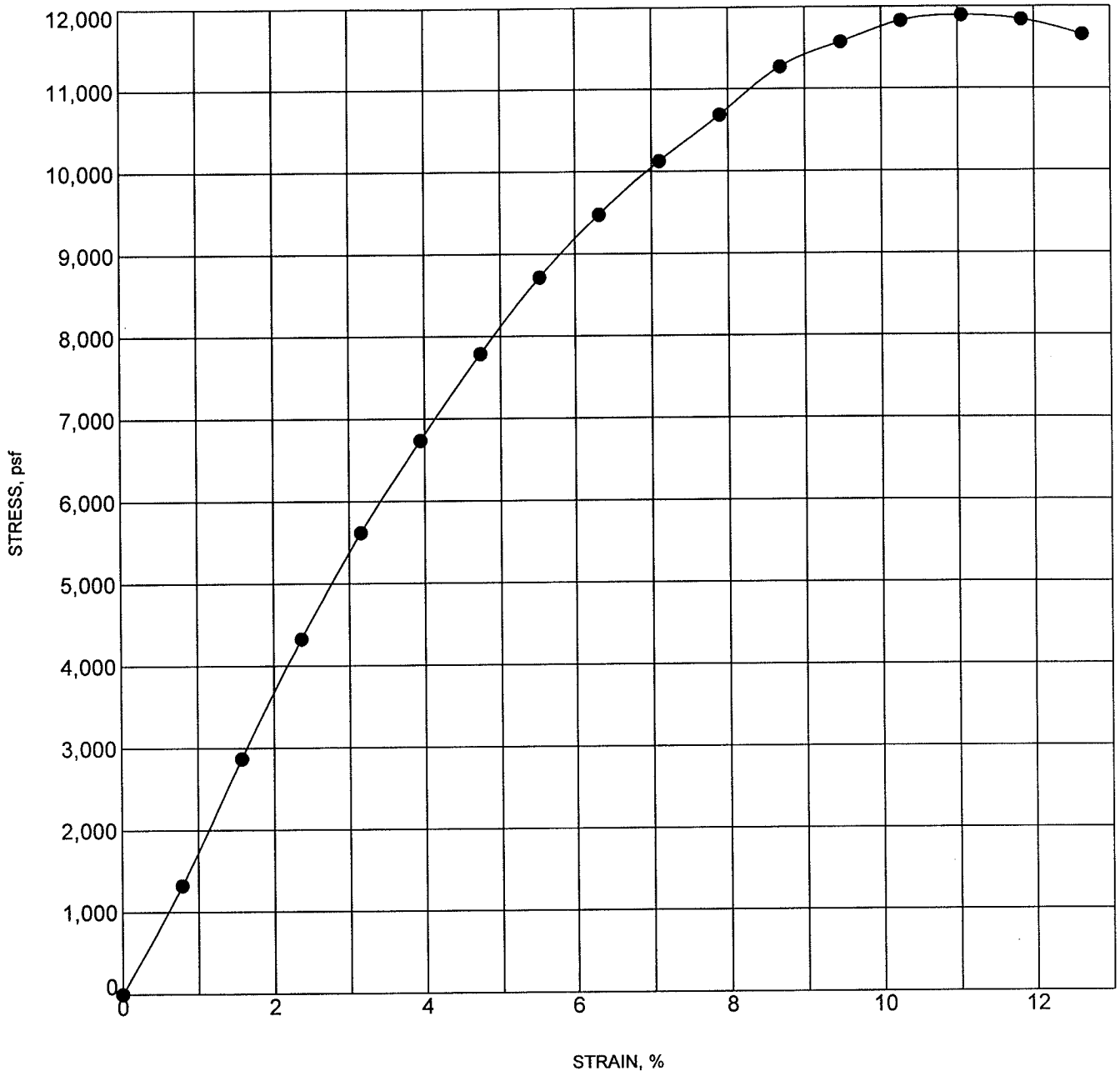
CTL Engineering of Indiana, Inc.
6848 Hillsdale Court
Indianapolis, Indiana 46250
Phone: 317-585-8277
Fax: 317-585-8621
e-mail: ctlin@ctleng.com

UNCONFINED COMPRESSION TEST

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061



Boring Information		Test Results	English	Metric
Boring No.	**SSL-2**	Natural Moisture Content, %	**11**	**11**
Sample	**SS-2**	Natural Wet Density, pcf (kg/m^3)	**132.3**	**(2120)**
Depth	**1.07 - 1.53**	Natural Dry Density, pcf (kg/m^3)	**118.8**	**(1904)**
Station	**10+473**	Unconfined Compression Strength, psf (kN/m^2)	**11893**	**(569)**
Offset	**15 m Lt**	Failure Strain, %	**11.1**	**11.1**
Line	**"B"**	SOIL DESCRIPTION		

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UNCONFINED COMPRESSION TEST

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

Boring No.	Station	Offset	Line	Sample No.	Depth (m)	Moisture Content (%)	Wet Density (pcf)	Dry Density (pcf)	Unconfined Compression (psf)	Failure Strain (%)	Loss on Ignition (%)	pH
SSL-1	10+293	15 m Lt	"B"	SS-1	0.30-0.76	13						8.34
SSL-1	10+293	15 m Lt	"B"	SS-3	1.83-2.29	11						8.39
SSL-1	10+293	15 m Lt	"B"	SS-4	2.59-3.05	11	139.4	125.3	8003	15.0		
SSL-1	10+293	15 m Lt	"B"	SS-5	4.11-4.57	12						
SSL-1	10+293	15 m Lt	"B"	SS-6	5.03-5.49	22						
SSL-2	10+473	15 m Lt	"B"	SS-1	0.30-0.76	11						
SSL-2	10+473	15 m Lt	"B"	SS-2	1.07-1.52	11	132.3	118.8	11893	11.1		
SSL-2	10+473	15 m Lt	"B"	SS-4	2.59-3.05	12						
SSL-2	10+473	15 m Lt	"B"	SS-6	5.64-6.10	19						
SSL-2	10+473	15 m Lt	"B"	SS-8	8.69-9.14	12						
SSL-3	10+600	20 m Lt	"B"	SS-2	1.07-1.52	20						
SSL-3	10+600	20 m Lt	"B"	SS-3	1.83-2.29	7						
TB-2	10+126.5	20m Lt	"C"	SS-1B	0.30-0.61	21						

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SUMMARY OF SPECIAL LABORATORY TEST RESULTS

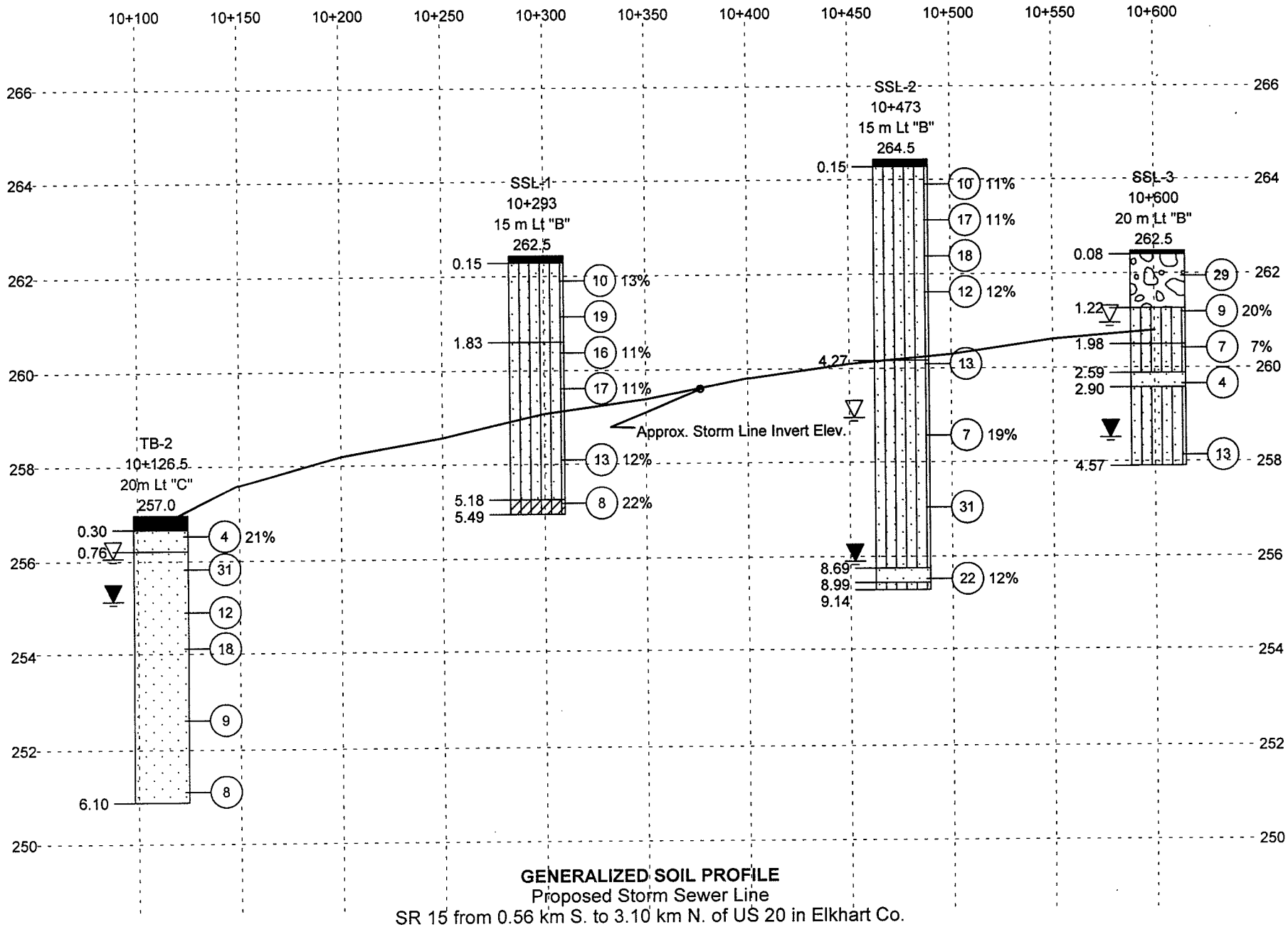
Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Project No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

APPENDIX D

GENERALIZED SOIL PROFILE



GENERALIZED SOIL PROFILE
Proposed Storm Sewer Line
SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.
Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

IN_PROFILE_MET 00-61.GPJ CTLMET.GDT 2/3/04

CTL Engineering of Indiana, Inc.
6330 East 75th Street, Suite 176, Indianapolis, Indiana 46250
Phone: 317/585-8277 · Fax: 317/585-8621
e-mail: ctlin@ctleng.com

August 17, 2001

Indiana Department of Transportation
Materials and Tests Division
120 South Shortridge Road
Indianapolis, Indiana 46219

Attention: Mr. Athar Khan, P.E.
Chief Geotechnical Engineer

Reference: Subsurface Investigation
Des. No.: 8354420
Project No.: STP-4320 (7)
SR 15 from 0.56 km S. of US 20 to a point 3.10 km N. of US 20
Elkhart County
CTL Project No. 00-050061

Dear Mr. Khan:

CTL engineering has completed the subsurface investigation on the above referenced project. Enclosed are ten (10) copies of the report.

Thank you for giving us the opportunity to assist on this project. If you have any questions, please call me at 585-8277.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.
Principal Engineer

SUBSURFACE INVESTIGATION

DES. NO.: 8354420
PROJECT NO.: STP-4320 (7)
SR 15 FROM 0.56 KM S. OF US 20 TO A POINT 3.10 KM N. OF US 20
ELKHART COUNTY
CTL PROJECT NO. 00-050061

PREPARED FOR:

INDIANA DEPARTMENT OF TRANSPORTATION
MATERIALS AND TESTS DIVISION
120 SOUTH SHORTRIDGE ROAD
INDIANAPOLIS, INDIANA 46219

PREPARED BY:

CTL ENGINEERING OF INDIANA, INC.
6330 EAST 75TH STREET, SUITE 176
INDIANAPOLIS, INDIANA 46250

JULY 19, 2001
Revised August 15, 2001

SUMMARY OF SUBSURFACE INVESTIGATION

The project site is located on State Route 15 from 0.56 km south of US 20 to a point 3.10 km north of US 20, in Elkhart County, Indiana. The project involves roadway improvement on SR 15, US 20, CR 14 and CR 112 for a total roadway length of 5267.00 meters.

- On SR 15, the proposed improvement involves roadway relocation, widening and/or full depth pavement replacement. The new roadway profile will be constructed near the existing grade, on newly placed fill or in cut areas with maximum cut and fill of ±31 feet (9.5 m) and ±26 feet (8 m), respectively. A precast concrete box culvert will be constructed at Station 10+122, along with a number of pipe culverts.

- On US 20, CR 14 and CR 112 and Line "H", the proposed improvement involves roadway widening and full depth pavement replacement. The new roadway profile will be constructed near the existing grade, on newly placed fill or in cut areas.

A subsurface investigation for the subject project has been completed, and a summary of our findings and recommendations is reported below. Detailed foundation recommendations and construction considerations are provided in the enclosed report.

BOX CULVERT

1. The box culvert at Station 10+122 may be placed on existing soils provided that all loose sand are densified with a vibratory roller or removed and replaced with "B" Borrow or No. 53 aggregate to a minimum depth of 24 inches (600 mm)

2. Excavation into the underlying soils to the proposed invert elevations may be accomplished using conventional excavation equipment.

3. The culvert wingwalls may be supported on conventional foundation systems constructed on the sand deposits. The foundation units may be proportioned using the allowable soil bearing capacities and the estimated soil parameters shown in Table 1 and 2 of this report.

4. The wingwall footings should be constructed at a minimum depth of 4 feet (1.2 m) below the lowest flow line elevation. The recommended depths of footings do not account for any scour. If scour is of concern, the bottom of footings should be constructed below the anticipated scour elevation and/or as recommended by INDOT Hydraulics Division.

5. Borrow type and placement, and drainage structure installations should conform to INDOT specifications.

DRAINAGE PIPE STRUCTURES

Borrow type and placement, and drainage structure installations of major and minor pipe culverts should conform to INDOT specifications.

ROADWAY

1. Pavement Considerations

a. In fill areas, it is recommended that the proposed pavement including shoulders be constructed over 24 inches (600 mm) of subgrade treatment.

b. In cut areas, at grade and in cut to fill transition, one of the following alternatives may be used.

Alternative 1: An in-place chemical soil modification 16 inches (400 mm) in thickness following INDOT Standard Specifications Section 215.

Alternative 2: Undercut and replace with a layer of 12 inches (300 mm) of No. 53 aggregate.

Alternative 3: Where granular soils of A-1, A-2 or A-3 exist, a 24-inch (600 mm) of subgrade treatment may be used.

c. The proposed pavement may be designed using an estimated CBR value of 2.7 based on engineering judgement and data bank from INDOT.

d. Pavement subsurface drains with screened outlets should be installed in areas where the subgrade soils are cohesive (sandy clay loam or loam), and in areas where cohesive soils are placed in the upper 3 feet of the embankments. However, the subsurface drains may be omitted in sections where the subgrade soil consists of sand. If the proposed borrow is similar to the soils encountered on this project, filter fabric for the subsurface drains may not be required.

e. Interceptor drains should be installed in areas of cut to fill transition.

2. Embankments

a. Backfill materials required for embankment construction should be placed and compacted according to INDOT Standard Specifications.

b. Embankment side slopes, in cut or fill, constructed at a rate no steeper than 3:1 (horizontal to vertical) are considered safe against sliding and slope failure. Exposed slopes consisting of sandy soils should be encased with a minimum of 12 inches (300 mm) of topsoil.

c. New embankments constructed on or adjacent to existing natural slopes or existing embankments should be benched according to INDOT Standard Specifications.

d. It is estimated that total settlement under maximum embankment fill is on the order of 5.9 inches (300 mm). Therefore, settlement plates should be installed at 100 ft. (30 m) c/c staggered intervals from Station 11+730 to Station 11+850, line "C" and from Station 12+700 to Station 12+790, line "C" and monitored per INDOT requirements.

e. Drainage ditches sloping at a rate of 3 percent or greater should be seeded and/or protected with riprap or other erosion protection.

f. Temporary excavation more than 4 feet (1.2 m) in depth should be sloped and/or shored according to OSHA requirements.

g. Groundwater may be encountered at or above the proposed subgrade elevations in cut areas depending upon time of construction and amount of precipitation. The side ditches proposed in these locations are considered adequate to maintain the subgrade in a relatively dry condition.

Please refer to the enclosed Geotechnical report for additional information.

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I. PROJECT LOCATION AND DESCRIPTION

The project site is located on State Route 15 from 0.56 km south of US 20 to a point 3.10 km north of US 20, in Elkhart County, Indiana. The project involves roadway improvement on SR 15, US 20, CR 14 and CR 112 as summarized below.

- On SR 15, the proposed improvement involves roadway relocation, widening and/or full depth pavement replacement between Stations 9+850 and 13+570, Line "C", for approximately 3,720 meters. The new roadway profile will be constructed near the existing grade, on newly placed fill or in cut areas. Embankments and drainage ditches will be constructed with maximum cut and fill of ±31 feet (9.5 m) and ±26 feet (8 m), respectively.

  Additionally, a box culvert 3600mm x 1800mm x 57m will be constructed at Station 10+122, with invert elevations ranging between 256.40 at upstream and 256.20 at downstream. Also, a pipe culvert 48.5-m long by 1200 mm in diameter will be constructed at Station 12+63, with invert elevations ranging between 256.56 at upstream and 255.25 at downstream. The flow line of this culvert ranges between 248.620 at upstream and 248.478 at downstream. Additionally, a number of minor culverts of 900 mm or smaller will be constructed along the proposed roadway.

- On US 20, the proposed improvement involves roadway widening and full depth pavement replacement between Stations 4+974 and 5+821, Line "S-ÚS20-B", for approximately 847 meters. The new roadway profile will be constructed near the existing grade, on newly placed fill or in cut areas. Embankments and drainage ditches will be constructed with maximum cut and fill of ±1.5 feet to ±3 feet.

- On CR 14, the proposed improvement involves roadway widening and full depth pavement replacement between Stations 4+945.224 and 5+080.00 Line "S-1-B", and between Station 5+065.000 and 5+190.532 Line "S-3-B", for approximately 260 meters. The new roadway profile will be constructed near the existing grade, on newly placed fill or in cut areas. Embankments and drainage ditches will be constructed with maximum cut and fill of ±10 feet to ±3 feet, respectively.

- On CR 112, the proposed improvement involves roadway widening and full depth pavement replacement between Stations 4+945.224 and 5+185, Line "S-2-B", for approximately 240 meters. The new roadway profile will be constructed in cut areas or near the existing grade. The proposed profile will be constructed with maximum cut of ±20 feet (6.2 m).

- On Line "H", the proposed improvement involves full depth pavement replacement between Stations 1+004.367 and 1+203.00 for approximately 200 meters. The new roadway profile will be constructed in cut areas or near the existing grade. The proposed profile will be constructed with maximum cut of ±15 feet (4.5 m).

II. SUBSURFACE INVESTIGATION

Forty (40) soil test borings, designated as RB-1 through RB-40, were drilled along the roadway profile to depths ranging from 7.5 to 45.0 feet (2.29 m to 13.72 m). Additionally, two (2) borings, designated as TB-1 and TB-2, were drilled for the proposed box culvert, and one (1) boring, designated as TB-3, was drilled for the proposed pipe culvert. These borings were extended to depths ranging from 15 to 20 feet (4.57 m to 6.10 m). Locations of the test borings are shown on the attached test boring records.

The test borings were advanced with a truck or an ATV mounted drilling rig utilizing hollow stem augers (HSA) on May 9 through June 21, 2001. Standard Penetration tests were conducted using a 140- pound hammer falling 30 inches to drive a 2-inch O.D. split barrel sampler for 18 inches.

Drilling, soil sampling and laboratory testing have been performed following standard geotechnical engineering practices, INDOT and current ASTM procedures. Results from field tests are shown on the enclosed boring records.

Soil samples obtained from the drilling operation were preserved in glass jars and visually classified in the field and laboratory. Representative soil samples were tested for natural moisture content, Atterberg Limits, grain size analysis, unconfined compression and pH.

Soil bag samples were obtained at boring RB-7 at a depth of 0.5 to 3.0 feet beneath the existing grade. The recovered soils were tested for grain size analysis, Atterberg limits, moisture density relation (Modified Proctor) and California Bearing Ratio (CBR).

The stations, offsets and surface elevations of the test borings were interpolated from the site plans provided by INDOT.

III. FINDINGS

Test borings RB-1, RB-5, RB-14, RB-23, RB-24, RB-25, RB-28 through RB-31, drilled within the pavement limits of SR 15, exhibited 5 to 36 inches (127 to 914 mm) of asphalt concrete, averaging approximately 13.75 inches (351 mm) in thickness. RB-2, RB-18, RB-19 and RB-20 exhibited 3 to 6 inches (76 to 152 mm) of asphalt concrete over 5 to 19 inches (127 to 483 mm) of Portland cement concrete. A layer of asphalt concrete, 3 inches (76 mm) in thickness was encountered beneath the Portland cement concrete in RB-20. RB-4 drilled outside the pavement limits of SR 15 exhibited 6 inches (152 mm) of gravel base at the surface. RB-6, RB-7 and RB-40 were bare at the surface due to construction activities that took place prior to drilling operation. Similarly, RB-8 and RB-22 were bare at the surface due to using a dozer prior to drilling. The remaining borings drilled along SR 15 exhibited topsoil averaging approximately 6 inches (152 mm) in thickness.

Test borings RB-32, RB-33 and RB-36, drilled on US 20, exhibited 2 to 3 inches (51 to 76 mm) of asphalt concrete pavement over 4 to 12 inches (102 to 305 mm) of Portland cement concrete. A layer of asphalt concrete, 2 inches (51 mm) in thickness was encountered beneath the cement concrete in RB-36. Beneath the pavement, RB-32 and RB-36 exhibited a layer of base course 4 and 8 inches in thickness, respectively. RB-34 and RB-35, drilled outside the existing pavement limits of US 20, exhibited gravel base or sand fill.

Test borings RB-37, RB-38 and RB-39, drilled on CR 14 and CR 112, exhibited 4 to 7 inches (127 to 178 mm) of asphalt concrete pavement over 3 to 6 inches (76 to 152 mm) of base course.

Beneath the pavement or topsoil, the test borings encountered clay, sandy clay loam, loam sandy, loam, and/or sand of A-6, A-4 and A-1-b soil categories. Standard penetration blowcount values in the soil overburden ranged from 0 to 37 blows per foot (bpf), with natural moisture content values ranging from 5 to 34 percent.

Standard moisture density tests indicated that the clay soils from boring RB-7 may attain a maximum dry density of 118.2 pcf (1890 kg/m^3) at 13.7 percent optimum moisture content.

The pH of representative soil samples ranged from 7.94 to 8.87.

Groundwater was encountered in the test borings as shown on the enclosed test boring records.

IV. ANALYSIS AND RECOMMENDATIONS

A. BOX CULVERT (3600mm x 1800mm (12' x 6')

1. The box culvert at Station 10+122 may be placed on existing soils provided that all loose sand are densified with a vibratory roller or removed and replaced with "B" Borrow or No. 53 aggregate to a minimum depth of 24 inches (600 mm)

2. Excavation into the underlying soils to the proposed invert elevations may be accomplished using conventional excavation equipment.

3. The culvert wingwalls may be supported on conventional foundation systems constructed on the sand deposits. The foundation units may be proportioned using the allowable soil bearing capacity shown in Table 1, and the estimated soil parameters shown in Table 2.

Table 1 – Allowable Bearing Capacity vs. Footing Width

Proposed Footing Width		Allowable Bearing Capacity	
Feet	Meters	psf	kPa
2	0.6	1500	70
3	0.9	1700	80
4	1.2	1800	90
5	1.5	2000	100

Table 2 – Soil Parameters

Soil Parameters	Estimated Value
Allowable Soil Bearing Pressure, psf (kPa)	See Table 1
Angle of Internal Friction of Foundation Soil (ϕ), degrees	30
Friction Factor (f) of Foundation Soil	0.58
Ultimate Cohesion of Foundation Soil (C), psf (kPa)	0
Ultimate Adhesion between Footings and Foundation Soil (C_a), psf (kPa)	0
Friction Angle Between Wingwall and Backfill Material, degrees	18

4. The wingwall footings should be constructed at a minimum depth of 4 feet (1.2 m) below the flow line elevation to offset the effects of frost penetration. The recommended depths of footings do not account for any scour. If scour is of concern, the bottom of footings should be constructed below the anticipated scour elevation and/or as recommended by INDOT Hydraulics Division.

5. Borrow type and placement, and drainage structure installations should conform to INDOT specifications along with the following recommendations.

   - Where hand compactors are used, the backfill should be placed in layers not exceeding 6 inches (150 mm) in loose thickness. When larger compaction equipment is used, it should run parallel to the axis of the structure starting at the outside edge of the excavation and progressing toward the structure.

   - When the level of fill reaches the top of the structure, two lifts should be carefully spread and hand compacted over the structure without traversing the structure with heavy equipment. Compaction with heavy equipment should not begin until a minimum of two lifts have been placed, hand compacted, and tested. The compaction equipment should traverse the drainage structure perpendicular to the axis in accordance with the culvert manufacturer recommendations.

   - Riprap and a permeable filter fabric should be used at the ends of the structure to protect the exposed structure backfill above the existing ground.

6. Groundwater, surface water and/or seepage water is anticipated during placement of the culverts. A dewatering system as determined by the contractor and approved by the engineer will be required to maintain the exposed surface in a working condition.

7. The pH values obtained from the laboratory testing indicate that the in-situ soils have minor to no corrosion effect on the proposed culverts.

8. Temporary excavations in excess of 1.2 m (4.0 feet) in depth should be sloped or shored according to OSHA requirements.

9. Removal of existing structures and wingwalls, and existing pavement should be performed according to INDOT Specifications.

B. DRAINAGE PIPE STRUCTURES

Borrow type and placement, and drainage structure installations of major and minor pipe culverts should conform to INDOT specifications.

C. ROADWAY

Based upon the roadway plans, visual observation and the soil data obtained from the field and laboratory testing, the following conclusions are made.

- The proposed pavement along SR 15, US 20, CR 14 and CR112 will be constructed at or near the existing grade, on newly placed fill of 3 feet to 26.25 feet in height, and/or in cut areas up to 31 feet in height.

- The predominant soils at the proposed subgrade are described as sandy clay loam, loam or sand.

- A CBR test was performed on soil samples obtained from RB-7, and the test results are attached in Appendix C.

Based upon the above conclusions, pavement considerations, embankment and site preparation recommendations are provided in the following paragraphs.

1. Pavement Considerations

a. In fill areas, it is recommended that the proposed pavement including shoulders be constructed over 24 inches (600 mm) of subgrade treatment.

b. In cut areas, at grade and in cut to fill transition, one of the following alternatives may be used.

Alternative 1: An in-place chemical soil modification 16 inches (400 mm) in thickness following INDOT Standard Specifications Section 215.

Alternative 2: Undercut and replace with a layer of 12 inches (300 mm) of No. 53 aggregate.

Alternative 3: Where granular soils of A-1, A-2 or A-3 exist, a 24-inch (600 mm) of subgrade treatment may be used.

c. Based on the judgement and data bank from INDOT, we recommend that the proposed pavement may be designed using an estimated CBR value of 2.7.

d. Pavement subsurface drains with screened outlets should be installed in areas where the subgrade soils are cohesive (sandy clay loam or loam), and in areas where cohesive soils are placed in the upper 3 feet of the embankments. However, the subsurface drains may be omitted in sections where the subgrade soil consists of sand. If the proposed borrow is similar to the soils encountered on this project, filter fabric for the subsurface drains may not be needed.

e. Interceptor drains should be installed in areas of cut to fill transition such as at stations 10+300, 1+500, 10+640, 1+980, 11+00, etc.

2. Embankments

a. In Fill Areas

- Backfill materials required for embankment construction should be placed and compacted according to INDOT Standard Specifications.

- Embankments constructed on or adjacent to existing natural slopes or existing embankments should be benched according to INDOT Standard Specifications.

- Embankment side slopes constructed at a rate no steeper than 3:1 (Horizontal to Vertical) are considered safe against sliding and slope failure.

- Settlement of the new roadway embankments may vary with height and type of the proposed fill, and type of underlying soils. Settlement analysis at Station 12+760 where the proposed embankment height is ±20.8 feet (6.3 m) indicated that a total settlement of 5.9 inches (150 mm) may take placed under the new fill. To limit amount of future settlement of the pavement, we recommend that settlement plates be installed and monitored in areas where the fill height is 15 feet to 20 feet.

settlement plates should be installed at 100 ft. [30 m] c/c staggered intervals from Station 11+730 to Station 11+850, line "C" and from Station 12+700 to Station 12+790, line "C". Installation and monitoring of the settlement plates should follow INDOT requirements. A waiting period of up to 10 weeks may be needed prior to placement of any pavement structure. However, the settlement readings should not exceed 0.1 foot (3 mm) for four (4) consecutive weeks per INDOT specifications.

b. In cut areas

Slope stability analysis was performed at Station 11+080 where the new embankment will be constructed in cut of ±33 feet (10 m) in height. This analysis indicated that embankment side slopes constructed at a rate no steeper than 3:1 (horizontal to vertical) are considered safe against sliding and slope failure.

c. In fill and cut areas, exposed slopes consisting of sandy soils should be encased with a min8mum of 12 inches (300 mm) of soils suitable for vegetation growth. Also, the exposed slopes, wherever applicable, should be seeded and growth of vegetation permitted to limit soil erosion and sloughing.

d. Drainage ditches sloping at a rate of 3 percent or greater should be seeded and/or protected with riprap or other erosion protection.

e. Temporary excavation more than 4 feet (1.2 m) in depth should be sloped and/or shored according to OSHA requirements.

f. Seepage water may be encountered at or above the proposed subgrade elevations in cut areas depending upon time of construction and amount of precipitation. The side ditches proposed in these locations are considered adequate to maintain the subgrade in a relatively dry condition.

3. Site Preparation & Earthwork

a. All surface objects, vegetation, trees, tree stumps, topsoil and roots located within the construction limits, should be cleared and grubbed. Removal of the existing pavement, wherever needed, should be performed according to INDOT Standard Specifications, Section 203.22 and related sections.

On SR 15, it is estimated that an average of 13.75 inches (351 mm) of asphalt concrete will require removal. In some locations along SR 15, it is estimated that 5 to 19 inches (127 to 483 mm) of Portland cement concrete will require removal in addition to 3 to 6 inches of asphalt concrete. Elsewhere, it is estimated that 6 inches (152 mm) of topsoil will require removal.

On US 20, it is estimated that 2 to 3 inches of asphalt concrete and 4 to 12 inches of Portland cement concrete will require removal.

Please refer to the attached test boring records for pavement thickness and type.

b. Subsequent to removal of existing pavement and topsoil and excavation to the bottom of the proposed subgrade treatment, the exposed soils should be compacted using a minimum of 20-ton vibratory roller in sand subgrade and proofrolled in cohesive soils according to INDOT Specifications.

c. Soft and/or loose soils may be encountered beneath the new embankment between stations 10+510 and 10+550 Right of Line "C". Ponding water was observed at all times in this area during the field testing. Also, soft or loose soils may be encountered between stations 13+300 and 13+360 left of Line "C" due to an adjacent man-made pond. Also, soft soils may be encountered beneath in the leachfiled between stations 12+600 and 12+700 Right of Line "C". All soft or loose soils encountered in these locations should be removed and replaced with compacted fill.

d. Portland cement concrete slabs were encountered in the area of stations 10+600 to 10+15 in RB-6, RS-6A, RS-6B and RS-C. These slabs, wherever encountered beneath the proposed embankment and ditches, should be removed as necessary, and replaced with engineered fill. Note that the concrete slabs may extend north and south of stations 10+600 to 10+615.

e. During earthwork operations, adequate drainage should be provided on the surface soils. Absorption of heavy rainfall, accumulations of water and heavy construction traffic may result in softening these soils, hence, severely weakening the strength of the subgrade soils.

f. Temporary excavation more than 4 feet (1.2 m) in depth should be sloped and/or shored according to OSHA requirements.

g. Excavation into the underlying soils to the proposed subgrade elevations may be accomplished using conventional excavation equipment.

h. Groundwater may be encountered in excavations extending to or below a depth of 3 feet (1 m) beneath the proposed subgrade such as in RB-7 and RB-30. Seepage water may be encountered elsewhere depending upon time of construction and amount of precipitation.

V. CHANGED CONDITIONS

Should the layout plans for the proposed culverts and roadway be changed from those used in preparing this report, CTL Engineering should be notified to make the necessary modifications in our recommendations to account for the changed conditions.

VI. TESTING AND OBSERVATION

Experience shows that the subsurface soil conditions in an area sometimes vary from the ones indicated by the borings at their specific locations. It is therefore recommended that an Engineering Soil Technician, under the supervision of a qualified Geotechnical Engineer, be retained on the site to monitor the recommended soil bearing capacity and earthwork activities.

VII. CLOSURE

CTL Engineering, Inc. has prepared this report for your use in accordance with generally accepted soil and foundation engineering practices. Analysis, conclusions and other work product of CTL Engineering are instruments of service for this project only.

Soil samples will be retained in our laboratory for 60 days, after which they will be discarded unless instructions are received from you as to their disposal.

CTL Engineering assignment does not include, nor does this geotechnical report address the environmental aspects of this site.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

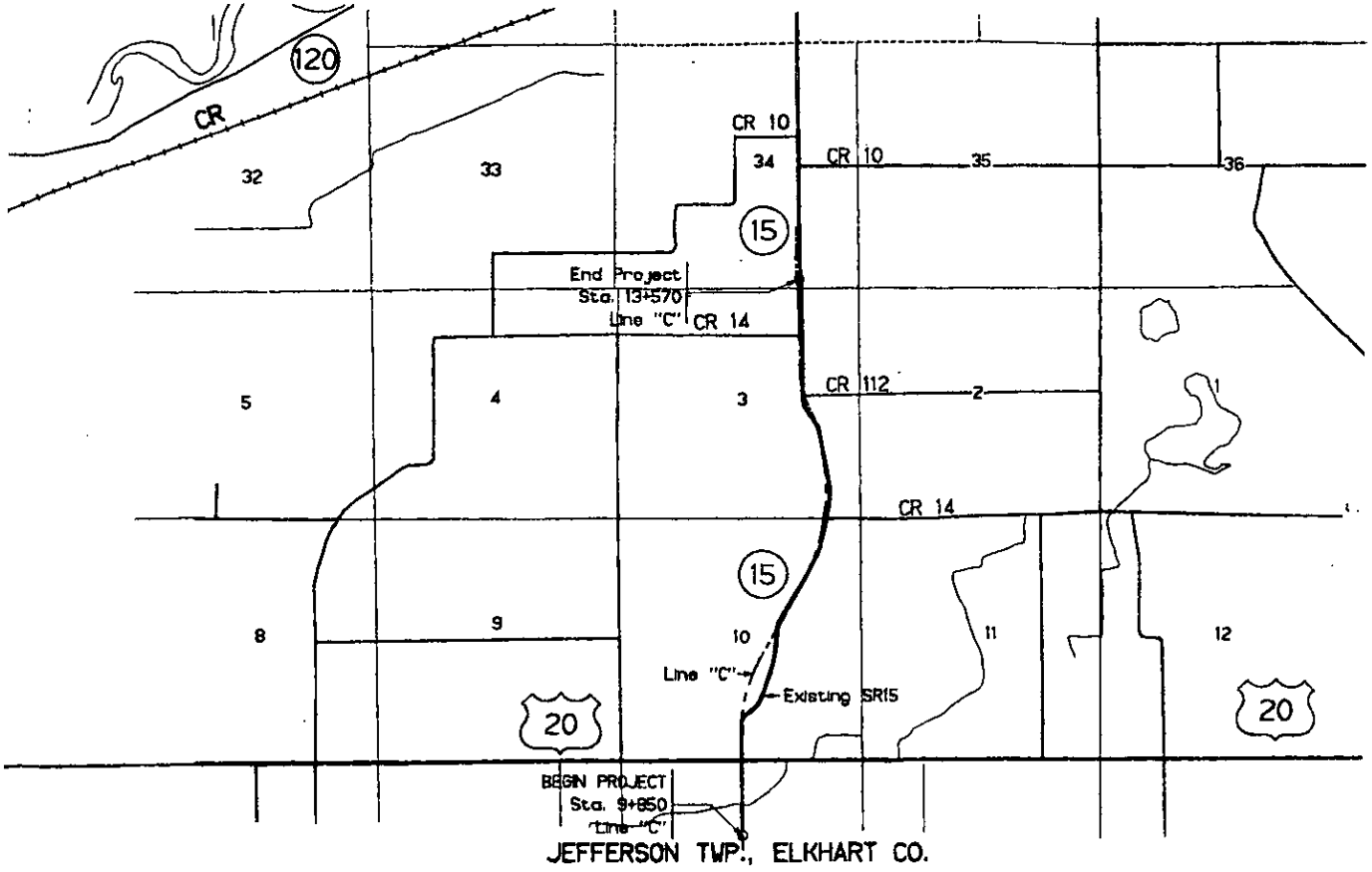
Ali Karaki, P.E.
Principal Engineer
Registration No. 60900551

Paul L. Douglass, P.E.
Principal Engineer
Registration No. 60012388

CTL ENGINEERING

APPENDIX A

GENERAL SITE PLAN
BORING LOCATION PLAN



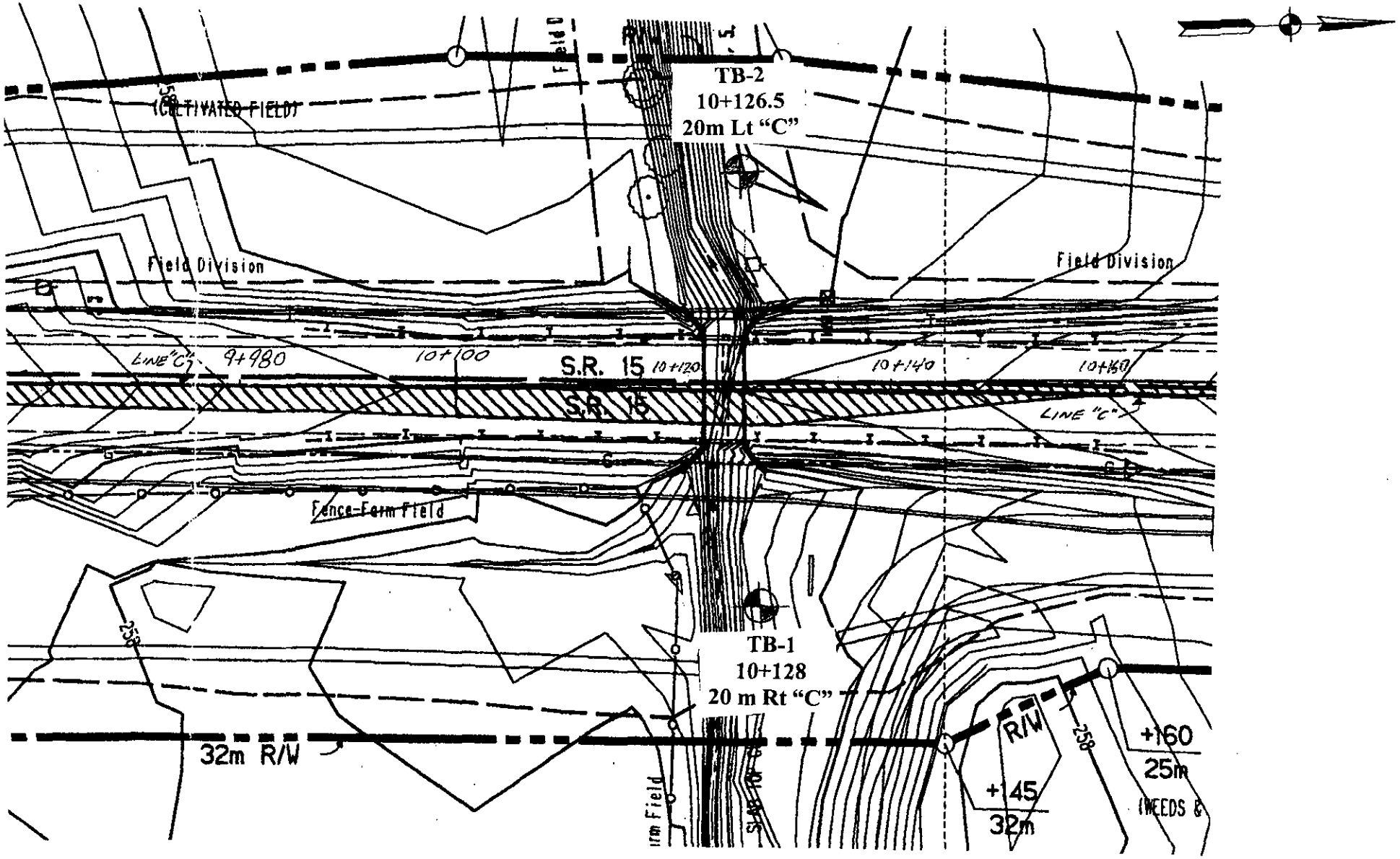
GENERAL SITE PLAN

SR 15/ US 20 Improvement

SR 15 from 0.56 km S. of US 20 to 3.10 km N. of US 20

Des. No.: 8354420, Project No.: STP-4320 (3)

Elkhart County, Indiana



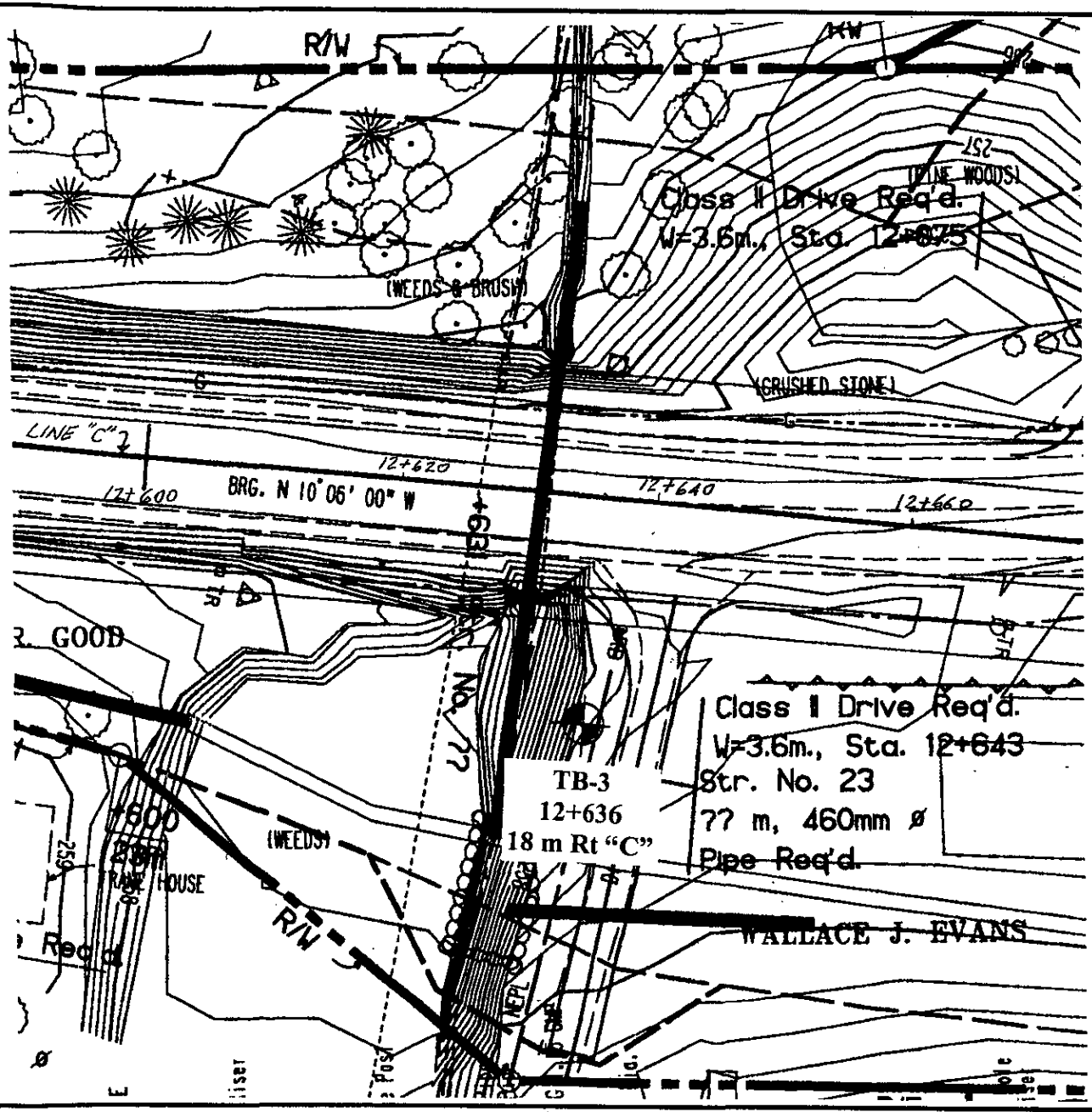
BRIDGE BORING LOCATION PLAN

SR 15/ US 20 Improvement

57 m of Precast Concrete Box Culvert at Station 10+122

Des. No.: 8354420, Project No.: STP-4320 (3)

Elkhart County, Indiana



BRIDGE BORING LOCATION PLAN

SR 15/ US 20 Improvement

48.5 m of 1200 mm Pipe Culvert at Station 12+630

Des. No.: 8354420, Project No.: STP-4320 (3)

Elkhart County, Indiana

APPENDIX B

TEST BORING RECORDS

SOIL DESCRIPTION

NON-COHESIVE SOIL DESCRIPTION	STANDARD PENETRATION BLOWCOUNTS PER FOOT (BPF)
Very Loose	0 - 5
Loose	6 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	Over 50

COHESIVE SOIL DESCRIPTION	STANDARD PENETRATION BLOWCOUNTS PER FOOT (BPF)
Very Soft	0 - 3
Soft	4 - 5
Medium Stiff	6 - 10
Stiff	11 - 15
Very Stiff	16 - 30
Hard	Over 30

GRADATION COMPONENT	SIZE
Boulders	Retained on 3"
Gravel	Passing 3" Retained on #10
Coarse Sand	Passing #10 Retained on #40
Fine Sand	Passing on #40 Retained on #200
Silt	0.075 mm to 0.002 mm
Clay	Smaller Than 0.002 mm

MOISTURE TERMS	DESCRIPTION
Dry	Powdery
Slightly Moist	Below Plastic
Moist	Above Plastic, Below Liquid
Very Moist	At Liquid
Wet	Above Liquid

CTL ENGINEERING

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-1
SHEET 1 OF 1
DATE STARTED : 05-21-01
DATE COMPLETED : 05-21-01

BORING ELEVATION : 268.80 m (USC&GS)
STATION : 9+880
OFFSET : 3.5 m Rt
LINE : "C"
DEPTH : 2.29 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: Encountered at Dry At Completion Dry 24 hours Reading 2.00 m Caved in at 0.91 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
268.34		**ASPHALT CONCRETE** (457 mm) (Visual)	0.46										
		Brown, Slightly Moist, Very Loose, **SAND AND GRAVEL** (Visual)		SS-1	0 0 0	0	67						
267.58	1.5		1.22	SS-2	4 4 4	8	89						
		Light Brown, Slightly Moist, Loose to Medium Dense, **SAND** (Visual)		SS-3	7 8 8	16	89						
266.51		**Bottom of Boring at 2.29 meters**	2.29										
	3.0	Boring backfilled with soil cuttings and pavement restored with concrete patch.											
		NOTE: The 24-hours groundwater reading may be due to rain accumulated in the borehole.											
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-2
SHEET 1 OF 1
DATE STARTED : 05-21-01
DATE COMPLETED : 05-21-01

BORING ELEVATION : 262.50 m (USC&GS)
STATION : 10+000
OFFSET : 3.5 m Lt
LINE : "C"
DEPTH : 3.05 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 2.74 m ▼ At Completion Dry ▽ 24 hours Reading 0.61 m Caved in at 0.91 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
262.12		**ASPHALT CONCRETE** (152 mm) over **PORTLAND CEMENT CONCRETE (229 mm)** (Visual)	0.38		9								
		Brown, Slightly Moist, Medium Dense to Loose, **SAND** A-1-b As Lab 4		SS-1	9 13	22	94						
261.13	1.5		1.37	SS-2	3 5	8	100						
		Brown, Slightly Moist, Medium Stiff to Stiff, **SANDY CLAY LOAM** A-4 As Lab 1		SS-3	5 6 9	15	100	18					
260.21		Brown, Wet, Medium Dense, **SAND** (Visual)	2.29	SS-4	4 9 10	19	78						
259.45	3.0	**Bottom of Boring at 3.05 meters**	3.05										
	4.5												
	6.0												

Boring backfilled with soil cuttings and pavement restored with concrete patch.

NOTE: The 24-hours groundwater reading may be due to rain accumulated in the borehole.

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	- Hollow Stem Auger	SS	- Split Spoon Sample	*	- Hand Penetrometer
SFA	- Solid Flight Auger	ST	- Shelby Tube Sample	LL	- Liquid Limit
RC	- Rock Coring	CR	- Rock Core Sample	PL	- Plastic Limit
MD	- Mud Drilling	BS	- Bag Sample	*PI*	- *Plasticity Index*
WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-3
SHEET 1 OF 1
DATE STARTED : 05-15-01
DATE COMPLETED : 05-15-01

BORING ELEVATION : 261.40 m (USC&GS)
STATION : 10+240
OFFSET : 10 m Rt
LINE : "C"
DEPTH : 2.29 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▽ At Completion 1.75 m ▽ 24 hours Reading Dry Caved in at 1.78 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
261.25		**TOPSOIL** (152 mm) (Visual)	0.15										
		Brown, Moist, Loose, **SANDY LOAM** with Traces of Roots A-4 As Lab 3		SS-1	5 5 5	10	89	16					
260.64			0.76										
	1.5	Brown, Slightly Moist, Medium Stiff to Very Stiff, **SANDY CLAY LOAM** A-4 (0) Lab 1		SS-2	3 3 4	7	100						
				SS-3	6 9 10	19	100	10			18	11	7
259.11		**Bottom of Boring at 2.29 meters**	2.29										
		Boring backfilled with soil cuttings.											
	3.0												
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-4
SHEET 1 OF 1
DATE STARTED : 06-20-01
DATE COMPLETED : 06-20-01

BORING ELEVATION : 265.00 m (USC&GS)
STATION : 10+360
OFFSET : 10 m Rt
LINE : "C"
DEPTH : 3.05 m

BORING METHOD : HSA
RIG TYPE : CME 550 ATV
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 80° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 0.91 m ▼ At Completion 2.51 m ▽ 24 hours Reading 0.91 m Caved in at 1.68 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
264.85		GRAVEL (Fill) (152 mm) (Visual)	0.15										
		Gray, Moist, Loose, **SANDY LOAM** A-4 As Lab 3		SS-1	7 5 2	7	78	15					
264.24			0.76										
	1.5	Brown with Gray Streaks, Moist, Medium Stiff to Stiff, **SANDY CLAY LOAM** A-4 As Lab 1		SS-2	2 2 5	7	94	18					
				SS-3	4 6 9	15	100						
262.71			2.29										
		Brown, Slightly Moist, Stiff, **LOAM** A-4 As Lab 5		SS-4	7 5 7	12	100						
261.95	3.0	**Bottom of Boring at 3.05 meters**	3.05										
		Boring backfilled with soil cuttings.											
		NOTE: The 24-hours groundwater reading may be due to rain accumulated in the borehole.											
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-5
SHEET 1 OF 1
DATE STARTED : 05-15-01
DATE COMPLETED : 05-15-01

BORING ELEVATION : 264.50 m (USC&GS)
STATION : 10+480
OFFSET : 5 m Rt
LINE : "C"
DEPTH : 3.05 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▽ At Completion Dry ▽ 24 hours Reading Dry Caved in at 2.29 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
264.14		**ASPHALT CONCRETE** (356 mm) (Visual)	0.36										
		Gray changing to Brown, Slightly Moist, Medium Dense, **SANDY LOAM** A-4 As Lab 3		SS-1	6 8 5	13	100	13					
263.59			0.91										
	1.5	Brown with Gray Streaks, Slightly Moist, Very Stiff, **LOAM (TILL)** A-4 As Lab 5		SS-2	3 6 10	16	67	11					
				SS-3	4 7 10	17	100						
				SS-4	3 7 9	16	100						
261.45	3.0	**Bottom of Boring at 3.05 meters**	3.05										
		Boring backfilled with soil cuttings and pavement restored with concrete patch.											
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-6
SHEET 1 OF 1
DATE STARTED : 05-14-01
DATE COMPLETED : 05-14-01

BORING ELEVATION : 263.00 m (USC&GS)
STATION : 10+600
OFFSET : 10 m Lt
LINE : "C"
DEPTH : 1.22 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▽ At Completion Dry ▽ 24 hours Reading Dry Caved in at 1.22 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
262.85		TOPSOIL (152 mm) (Visual)	0.15										
		Dark Gray, Slightly Moist, Medium Dense, SAND AND GRAVEL with Brick and Asphalt Concrete Fragments (FILL) (Visual)		SS-1	5 4 8	12	83						
262.09		PORTLAND CEMENT CONCRETE (Visual)	0.91		50/5"								
261.78		Bottom of Boring at 1.22 meters Auger Refusal @ 1.22 meters.	1.22	SS-2									
	1.5	Boring terminated on possible old concrete slab.											
		Boring backfilled with soil cuttings.											
	3.0												
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RS-06A
SHEET 1 OF 1
DATE STARTED : 05-14-01
DATE COMPLETED : 05-14-01

BORING ELEVATION : 263.00 m (USC&GS)
STATION : 10+605
OFFSET : 10 m Lt
LINE : "C"
DEPTH : 0.94 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry ▣ Caved in at 0.91 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
262.85		TOPSOIL (152 mm) (Visual)	0.15										
		Dark Gray, Slightly Moist, Medium Dense, **SAND AND GRAVEL** with Brick and Asphalt Concrete Fragments (FILL) (Visual)											
262.09			0.91										
262.06		PORTLAND CEMENT CONCRETE (Visual)	0.94										
		Bottom of Boring at 0.94 meters											
	1.5	Auger Refusal @ 0.94 meters.											
		Boring terminated on possible old concrete slab.											
		Boring backfilled with soil cuttings.											
	3.0												
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RS-06B
SHEET 1 OF 1
DATE STARTED : 05-14-01
DATE COMPLETED : 05-14-01

BORING ELEVATION : 263.00 m (USC&GS)
STATION : 10+610
OFFSET : 10 m Lt
LINE : "C"
DEPTH : 0.94 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry Caved in at 0.91 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT / 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
262.85		TOPSOIL (152 mm) (Visual)	0.15										
		Dark Gray, Slightly Moist, Medium Dense, **SAND AND GRAVEL** with Brick and Asphalt Concrete Fragments (FILL) (Visual)											
262.09			0.91										
262.06		PORTLAND CEMENT CONCRETE (Visual)	0.94										
		Bottom of Boring at 0.94 meters											
		Auger Refusal @ 0.94 meters.											
	1.5	Boring terminated on possible old concrete slab.											
		Boring backfilled with soil cuttings.											
	3.0												
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RS-06C
SHEET 1 OF 1
DATE STARTED : 06-21-01
DATE COMPLETED : 06-21-01

BORING ELEVATION : 263.00 m (USC&GS)
STATION : 10+615
OFFSET : 10 m Lt
LINE : "C"
DEPTH : 0.76 m

BORING METHOD : HSA
RIG TYPE : v
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 80° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry 🖂 Caved in at 0.91 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
262.24		FILL (Visual)	0.76										
	1.5	**Bottom of Boring at 0.76 meters**											
	3.0	Auger Refusal @ 0.76 meters.											
	4.5	Boring terminated on possible old concrete slab.											
	6.0	Boring backfilled with soil cuttings.											

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-7
SHEET 1 OF 1
DATE STARTED : 05-14-01
DATE COMPLETED : 05-14-01

BORING ELEVATION : 269.00 m (USC&GS)
STATION : 10+720
OFFSET : 5 m Rt
LINE : "C"
DEPTH : 5.33 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 2.59 m ▼ At Completion 3.05 m ▽ 24 hours Reading 2.26 m ▣ Caved in at 3.05 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
					4								
				SS-1	8	19	94	17					
					11								
		Brown, Slightly Moist, Very Stiff, **CLAY** A-6 (7) Lab 2		BS-1				15			29	14	15
					6								
				SS-2	12	28	100	13					
					16								
	1.5												
267.17			1.83		10								
		Brown, Moist, Medium Dense, **SANDY LOAM** A-4 As Lab 3		SS-3	11	27	100						
					16								
266.56			2.44										
					9								
				SS-4	13	27	78						
	3.0				14								
		Brown, Wet, Medium Dense, **SAND** (Visual)											
265.19			3.81										
					4								
		Gray, Slightly Moist, Very Stiff to Stiff, **CLAY LOAM** (TILL) (Visual)		SS-5	13	28	100	19					
	4.5				15								
					4								
263.82			5.18	SS-6	6	15	89						
263.67		Gray, Wet, Medium Dense, **SAND** (Visual)	5.33		9								
		Bottom of Boring at 5.33 meters											
		Boring backfilled with soil cuttings.											
	6.0	Bag samples for Standard Proctor and CBR testing were obtained at .15m to .91m.											

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-8
SHEET 1 OF 1
DATE STARTED : 05-22-01
DATE COMPLETED : 05-22-01

BORING ELEVATION : 267.65 m (USC&GS)
STATION : 10+840
OFFSET : C/L
LINE : "C"
DEPTH : 4.57 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: Encountered at Dry At Completion Dry 24 hours Reading Dry Caved in at 3.96 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
		Brown, Moist, Medium Stiff to Very Stiff, **SANDY CLAY LOAM** A-4 As Lab 1		SS-1	3 4 4	8	89	9					
				SS-2	8 7 13	20	67						
265.82	1.5	Brown, Moist, Medium Dense, **SAND** A-1-b As Lab 4	1.83	SS-3	6 6 8	14	89						
265.21			2.44										
	3.0	Brown, Slightly Moist, Very Stiff, **SANDY CLAY LOAM** with Sand Layers A-4 As Lab 1		SS-4	4 9 15	24	100	15					
263.38			4.27		15								
263.08	4.5	Light Brown, Slightly Moist, Very Dense, **SAND** A-1-b As Lab 4	4.57	SS-5	20 17	37	83						
	6.0	**Bottom of Boring at 4.57 meters** Boring backfilled with soil cuttings.											

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT	: Indiana Department of Transportation	BORING NO.:	RB-9
PROJECT	: SR 15/US 20 Improvement	SHEET	1 OF 1
LOCATION	: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County	DATE STARTED	: 05-09-01
DES NO.	: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061	DATE COMPLETED	: 05-09-01

BORING ELEVATION	: 268.43 m (USC&GS)	BORING METHOD	: HSA	HAMMER	: Automatic
STATION	: 10+960	RIG TYPE	: CME 55 Truck	DRILLER	: KO
OFFSET	: C/L	CASING DIA.	: 83 mm	TEMPERATURE	: 70° F
LINE	: "C"	CORE SIZE	: ---	WEATHER	: Sunny
DEPTH	: 4.57 m				

GROUNDWATER: ▼ Encountered at 1.22 m ▼ At Completion 3.61 m ▽ 24 hours Reading 1.47 m ▣ Caved in at 2.59 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
268.28		TOPSOIL (152 mm) (Visual)	0.15										
		Brown, Slightly Moist, Very Loose, **SAND** (Visual)		SS-1	1 1 2	3	89						
267.82			0.61										
		Brown, Moist, Loose, **SANDY LOAM** with Wet Sand Seams A-4 As Lab 3		SS-2	3 4 5	9	94	15					
267.36			1.07										
	1.5			SS-3	2 3 5	8	100						
		Brown, Moist, Medium Stiff, **LOAM** (TILL) A-4 As Lab 5		SS-4	0 3 3	6	89	19					
				SS-5	7 6 8	14	89						
265.53	3.0		2.90										
		Brown, Wet, Medium Dense, **SAND** (Visual)		SS-6	6 7 10	17	78						
				SS-7	9 13 12	25	94						
264.01	4.5		4.42										
263.86		Brownish Gray, Moist, Very Stiff, **LOAM** (TILL) A-4 As Lab 5	4.57										
		Bottom of Boring at 4.57 meters											
		Boring backfilled with soil cuttings.											
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-10
SHEET 1 OF 2
DATE STARTED : 05-09-01
DATE COMPLETED : 05-09-01

BORING ELEVATION : 279.35 m (USC&GS)
STATION : 11+020
OFFSET : 20 m Lt
LINE : "C"
DEPTH : 13.72 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry ▽ 24 hours Reading 6.81 m Caved in at 6.83 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
279.20		TOPSOIL (152 mm) (Visual)	0.15										
				SS-1	6 5 5	10	89	14					
		Brown, Moist, Loose, **SANDY LOAM** with Sand Seams A-4 As Lab 3		SS-2	2 3 3	6	100						
	1.5												
277.37			1.98	SS-3	1 3 7	10	94	14					
				SS-4	4 8 8	16	94						
	3.0												
		Brown, Moist, Loose to Medium Dense, **SANDY LOAM** A- 4 (0) Lab 3		SS-5	3 4 6	10	100	14			14	13	1
	4.5												
273.41	6.0		5.94	SS-6	9 7 9	16	89						

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	- Hollow Stem Auger	SS	- Split Spoon Sample	*	- Hand Penetrometer
SFA	- Solid Flight Auger	ST	- Shelby Tube Sample	LL	- Liquid Limit
RC	- Rock Coring	CR	- Rock Core Sample	PL	- Plastic Limit
MD	- Mud Drilling	BS	- Bag Sample	PI	- Plasticity Index
WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

BORING NO.: RB-10

PROJECT : SR 15/US 20 Improvement

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
					5								
	7.5			SS-7	12	24	78						
					12								
					3								
	9.0			SS-8	11	26	78						
					15								
		Light Brown, Moist to Slightly Moist, Medium Dense to Loose, **SAND**											
		A-1-b											
		As Lab 4											
					5								
	10.5			SS-9	7	18	78						
					11								
					2								
	12.0			SS-10	4	10	72						
					6								
266.40			12.95										
		Light Brown, Slightly Moist, Medium Dense, **SAND** (Visual)											
	13.5			SS-11	1								
					6	23	78						
265.63			13.72		17								
		Bottom of Boring at 13.72 meters											
		Boring backfilled with soil cuttings.											

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	- Hollow Stem Auger	SS	- Split Spoon Sample	*	- Hand Penetrometer
SFA	- Solid Flight Auger	ST	- Shelby Tube Sample	LL	- Liquid Limit
RC	- Rock Coring	CR	- Rock Core Sample	PL	- Plastic Limit
MD	- Mud Drilling	BS	- Bag Sample	PI	- Plasticity Index
WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-11
SHEET 1 OF 2
DATE STARTED : 05-10-01
DATE COMPLETED : 05-10-01

BORING ELEVATION : 279.20 m (USC&GS)
STATION : 11+020
OFFSET : 20 m Rt
LINE : "C"
DEPTH : 13.72 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: Encountered at Dry At Completion Dry 24 hours Reading Dry Caved in at 6.55 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
279.05		TOPSOIL (152 mm) (Visual)	0.15										
		Brown, Slightly Moist, Loose to Very Loose, **SANDY LOAM** A-4 As Lab 3		SS-1	5 4 5	9	78						
				SS-2	2 3 2	5	72						
277.68	1.5		1.52										
		Brown, Moist, Medium Dense, **SAND** (Visual)		SS-3	5 4 8	12	89						
	3.0			SS-4	3 4 8	12	100						
275.39			3.81										
	4.5	Brown, Slightly Moist, Very Stiff, **CLAY** with Sand Seams A-6 As Lab 2		SS-5	5 6 12	18	100	17					
273.87			5.33										
	6.0	Light Brown, Moist Changing to Slightly Moist, Medium Dense to Very Dense, **SAND** A-1-b As Lab 4		SS-6	4 12 17	29	61						

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

PROJECT : SR 15/US 20 Improvement

BORING NO.: RB-11

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m^3)	Unconfined Compression (kN/m^2)	Atterberg Limits LL	PL	PI
					7								
	7.5			SS-7	18	37	100						
					19								
					18								
	9.0			SS-8	30	57	78						
					27								
		Light Brown, Moist Changing to Slightly Moist, Medium Dense to Very Dense, **SAND** A-1-b As Lab 4											
					5								
	10.5			SS-9	12	26	78						
					14								
					2								
	12.0			SS-10	5	12	94						
					7								
266.25			12.95										
		Light Brown, Slightly Moist, Medium Dense, **SAND** (Visual)			3								
	13.5			SS-11	7	20	89						
265.48			13.72		13								
		Bottom of Boring at 13.72 meters											
		Boring backfilled with soil cuttings.											

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-12
SHEET 1 OF 2
DATE STARTED : 05-10-01
DATE COMPLETED : 05-10-01

BORING ELEVATION : 280.30 m (USC&GS)
STATION : 11+080
OFFSET : 30 m Rt
LINE : "C"
DEPTH : 13.72 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▽ At Completion Dry ▽ 24 hours Reading Dry Caved in at 11.20 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
280.15		**TOPSOIL** (152 mm) (Visual)	0.15										
		Brown to Gray, Moist Loose, **SANDY LOAM** A-4 As Lab 3		SS-1	4 5 3	8	78						
279.54			0.76										
	1.5			SS-2	2 3 4	7	100						
		Brown, Moist to Slightly Moist, Soft to Very Stiff, **SANDY CLAY LOAM** A-4 As Lab 1		SS-3	0 0 4	4	94	14					
	3.0			SS-4	4 6 11	17	100	11	36345	314.016.7			
276.49			3.81										
	4.5	Gray, Moist, Very Stiff, **SANDY CLAY LOAM** A-4 As Lab 1		SS-5	6 8 11	19	56	12					
274.36	6.0		5.94	SS-6	5 5 9	14	78						

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	• - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

BORING NO.: RB-12

PROJECT : SR 15/US 20 Improvement

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m^3)	Unconfined Compression (kN/m^2)	Atterberg Limits LL	PL	PI
273.44		Brown, Slightly Moist, Stiff, **LOAM** with Sand Seams A-4 As Lab 5	6.86										
	7.5			SS-7	5 11 12	23	94						
	9.0			SS-8	2 7 10	17	100	5					
		Light Brown, Moist to Slightly Moist, Medium Dense, **SAND** A-1-b As Lab 4											
	10.5			SS-9	4 3 18	21	78						
	12.0			SS-10	3 8 10	18	89						
267.35			12.95										
	13.5	Light Brown, Slightly Moist, Medium Dense, **SAND** (Visual)		SS-11	5 11 19	30	100						
266.58			13.72										
		Bottom of Boring at 13.72 meters Boring backfilled with soil cuttings.											

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-13
SHEET 1 OF 2
DATE STARTED : 05-22-01
DATE COMPLETED : 05-22-01

BORING ELEVATION : 271.00 m (USC&GS)
STATION : 11+218
OFFSET : C/L
LINE : "C"
DEPTH : 7.62 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 2.74 m ▽ At Completion 6.10 m ▽ 24 hours Reading 2.13 m Caved in at 3.35 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
270.95		TOPSOIL (152 mm) (Visual)	0.05										
		Brown, Moist, Very Loose, **SAND** with Traces of Roots (Visual)		SS-1	2 2 2	4	100						
270.24			0.76										
	1.5			SS-2	1 2 3	5	89						
		Brown, Moist, Soft to Medium Stiff, **SANDY CLAY LOAM** A-5 As Lab 1		SS-3	3 3 3	6	100	18					
	3.0			SS-4	0 2 2	4	56						
267.19			3.81										
	4.5	Brown Changing to Gray, Moist, Medium Stiff to Stiff, **LOAM** A-4 As Lab 5		SS-5	3 4 5	9	100	11					
264.90	6.0		6.10	SS-6	4 5 8	13	89	10					

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

BORING NO.: RB-13

PROJECT : SR 15/US 20 Improvement

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m^3)	Unconfined Compression (kN/m^2)	Atterberg Limits LL	PL	PI
		Gray, Slightly Moist, Very Stiff, **LOAM** A-4 As Lab 5			4								
263.38	7.5		7.62	SS-7	10 14	24	94						
		Bottom of Boring at 7.62 meters Boring backfilled with soil cuttings. Dozer used to pull drilling rig.											
	9.0												
	10.5												
	12.0												
	13.5												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-14
SHEET 1 OF 2
DATE STARTED : 05-16-01
DATE COMPLETED : 05-16-01

BORING ELEVATION : 270.65 m (USC&GS)
STATION : 11+320
OFFSET : 3 m Rt
LINE : "C"
DEPTH : 6.10 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Rain

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry ▽ 24 hours Reading Dry Caved in at 5.33 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
270.37		**ASPHALT CONCRETE** (279 mm) (Visual)	0.28										
		Brown, Moist, Loose, **SANDY LOAM** A-4 As Lab 3		SS-1	4 3 4	7	100						
	1.5			SS-2	2 3 3	6	78	18					
268.97			1.68										
				SS-3	3 3 3	6	78						
	3.0	Brown, Moist, Medium Stiff to Soft, **SANDY CLAY LOAM** A-4 As Lab 1		SS-4	1 2 3	5	89	19					
	4.5			SS-5	1 2 3	5	89						
264.86			5.79										
	6.0	Light Brown, Slightly Moist, Medium Dense, **SAND** A-1-b As Lab 4		SS-6	4 7 11	18	100						
264.55			6.10										
		Bottom of Boring at 6.10 meters											

Continued on next page

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

PROJECT : SR 15/US 20 Improvement

BORING NO.: RB-14

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m^3)	Unconfined Compression (kN/m^2)	Atterberg Limits LL	PL	PI
	7.5	Boring backfilled with soil cuttings and pavement restored with concrete patch.											
	9.0												
	10.5												
	12.0												
	13.5												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-15
SHEET 1 OF 1
DATE STARTED : 05-16-01
DATE COMPLETED : 05-16-01

BORING ELEVATION : 268.63 m (USC&GS)
STATION : 11+440
OFFSET : C/L
LINE : "C"
DEPTH : 5.33 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry ▽ 24 hours Reading 1.22 m Caved in at 2.74 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
268.48		TOPSOIL (152 mm) (Visual)	0.15										
		Brown, with Gray Streaks, Moist, Medium Stiff, **SANDY CLAY LOAM** with Traces of Roots A-4 As Lab 1		SS-1	2 2 4	6	100	16					
267.56			1.07	SS-2	4 4 8	12	100						
	1.5			SS-3	5 10 13	23	100						
	3.0	Brown Changing to Gray, Moist to Slightly Moist, Very Stiff to Stiff, **LOAM** with Sand Seams (TILL) A-4 As Lab 5		SS-4	4 10 13	23	100						
	4.5			SS-5	2 5 6	11	100						
				SS-6	6 7 12	19	100						
263.30		**Bottom of Boring at 5.33 meters** Boring backfilled with soil cuttings.	5.33										
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-16
SHEET 1 OF 1
DATE STARTED : 05-23-01
DATE COMPLETED : 05-23-01

BORING ELEVATION : 270.61 m (USC&GS)
STATION : 11+570
OFFSET : C/L
LINE : "C"
DEPTH : 3.05 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 2.44 m ▼ At Completion 2.44 m ▽ 24 hours Reading 1.04 m Caved in at 1.50 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
270.46		TOPSOIL (152 mm) (Visual)	0.15										
		Dark Gray Changing to Light Gray, Very Moist, Medium Stiff to Hard, **SANDY CLAY LOAM** A-4 As Lab 1		SS-1	2 2 4	6	67	26					
				SS-2	5 11 25	36	78						
269.09	1.5		1.52										
		Brown Changing to Gray, Moist, Very Stiff to Medium Stiff, **LOAM** A-4 As Lab 5		SS-3	5 10 10	20	100						
				SS-4	2 4 6	10	100						
267.56	3.0	**Bottom of Boring at 3.05 meters**	3.05										
		Boring backfilled with soil cuttings.											
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-17
SHEET 1 OF 1
DATE STARTED : 05-23-01
DATE COMPLETED : 05-23-01

BORING ELEVATION : 269.63 m (USC&GS)
STATION : 11+680
OFFSET : C/L
LINE : "C"
DEPTH : 4.57 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 4.42 m ▼ At Completion 3.20 m ▽ 24 hours Reading 1.22 m Caved in at 2.44 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
269.48		TOPSOIL (152 mm) (Visual)	0.15										
		Brown with Black Streaks, Slightly Moist, Loose, **SANDY LOAM** A-4 As Lab 3		SS-1	2 3 3	6	89						
268.87			0.76										
	1.5			SS-2	4 5 7	12	100	11					
		Brown Changing to Gray, Slightly Moist to Moist, Medium Stiff to Stiff, **LOAM** (TILL) A-4 As Lab 5		SS-3	4 4 6	10	100						
	3.0			SS-4	2 6 7	13	94						
265.21	4.5		4.42	SS-5	2 4 9	13	100						
265.06		Brown, Wet, Medium Dense, **SAND** (Visual) **Bottom of Boring at 4.57 meters**	4.57										
		Boring backfilled with soil cuttings.											
	6.0												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	- Hollow Stem Auger	SS	- Split Spoon Sample	*	- Hand Penetrometer
SFA	- Solid Flight Auger	ST	- Shelby Tube Sample	LL	- Liquid Limit
RC	- Rock Coring	CR	- Rock Core Sample	PL	- Plastic Limit
MD	- Mud Drilling	BS	- Bag Sample	PI	- Plasticity Index
WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-18
SHEET 1 OF 2
DATE STARTED : 05-13-01
DATE COMPLETED : 05-13-01

BORING ELEVATION : 265.20 m (USC&GS)
STATION : 11+800
OFFSET : 5 m Lt
LINE : "C"
DEPTH : 10.67 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: Encountered at Dry At Completion Dry 24 hours Reading Dry Caved in at 7.92 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
265.07		ASPHALT CONCRETE (127 mm) (Visual)	0.13										
264.84		PORTLAND CEMENT CONCRETE (229 mm) (Visual)	0.36										
				SS-1	4 3 6	9	100						
	1.5	Gray Changing to Brown, Slightly Moist, Medium Stiff, **SANDY CLAY LOAM** A-4 As Lab 1		SS-2	7 5 5	10	100						
				SS-3	2 3 4	7	94	18					
262.76			2.44										
	3.0			SS-4	2 2 2	4	100	19					
		Brown, Very Moist, Soft to Medium Stiff, **LOAM** with Wet Sand Seams (TILL) A-4 As Lab 5											
	4.5			SS-5	2 3 5	8	100						
259.87			5.33										
	6.0	Brown, Moist, Loose, **SAND** (Visual)		SS-6	2 3 4	7	78						

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

BORING NO.: RB-18

PROJECT : SR 15/US 20 Improvement

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
258.34		Brown, Moist, Loose, **SAND** (Visual)	6.86										
	7.5			SS-7	2 3 5	8	89						
	9.0	Light Brown, Moist to Slightly Moist, Loose to Medium Dense, **SAND** A-1-6 As Lab 4		SS-8	3 5 7	12	67						
254.53	10.5		10.67	SS-9	8 13 13	26	67						
		Bottom of Boring at 10.67 meters Boring backfilled with soil cuttings and pavement restored with concrete patch.											
	12.0												
	13.5												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-19
SHEET 1 OF 1
DATE STARTED : 05-17-01
DATE COMPLETED : 05-17-01

BORING ELEVATION : 266.00 m (USC&GS)
STATION : 11+920
OFFSET : 4 m Rt
LINE : "C"
DEPTH : 3.05 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: Encountered at Dry At Completion Dry 24 hours Reading Dry Caved in at 2.59 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
265.92		ASPHALT CONCRETE (76 mm) (Visual)	0.08										
		PORTLAND CEMENT CONCRETE (483 mm) (Visual)											
265.44			0.56										
					6								
				SS-1	5	10	100						
					5								
					4								
				SS-2	5	13	94	12					
	1.5				8								
		Brown, Slightly Moist, Medium Stiff to Very Stiff, **LOAM** A-4 As Lab 5											
					7								
				SS-3	12	24	67						
					12								
					4								
				SS-4	8	18	100						
262.95	3.0		3.05		10								
		Bottom of Boring at 3.05 meters											
		Boring backfilled with soil cuttings and pavement restored with concrete patch.											
	4.5												
	6.0												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-20
SHEET 1 OF 2
DATE STARTED : 05-17-01
DATE COMPLETED : 05-17-01

BORING ELEVATION : 261.10 m (USC&GS)
STATION : 12+080
OFFSET : 2 m Lt
LINE : "C"
DEPTH : 7.62 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry ▽ 24 hours Reading Dry ▣ Caved in at 5.94 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
260.80		**ASPHALT CONCRETE** (102 mm) over **CEMENT CONCRETE** (127 mm) over **ASPHALT CONCRETE** (76 mm) (Visual)	0.30										
		Brown, Slightly Moist, Loose, **SANDY LOAM** A-4 As Lab 3		SS-1	4 4 3	7	100						
260.19			0.91										
		Brown, Slightly Moist, Medium Dense, **SAND** (Visual)		SS-2	3 9 9	18	100						
	1.5												
259.42			1.68										
				SS-3	1 2 3	5	89	15					
				SS-4	2 3 4	7	100						
	3.0	Brown, Moist, Soft to Medium Stiff, **SANDY CLAY LOAM** A-4 As Lab 1											
256.68	4.5		4.42	SS-5	2 3 4	7	94						
		Light Brown, Slightly Moist, Loose to Medium Dense, **SAND** A-1-b As Lab 4											
				SS-6	3 9 10	19	67						
	▣ 6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

BORING NO.: RB-20

PROJECT : SR 15/US 20 Improvement

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
		Light Brown, Slightly Moist, Loose to Medium Dense, **SAND** A-1-b As Lab 4			4 7 12	19	67						
253.48	7.5		7.62	SS-7									
		Bottom of Boring at 7.62 meters Boring backfilled with soil cuttings and pavement restored with concrete patch.											
	9.0												
	10.5												
	12.0												
	13.5												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-21
SHEET 1 OF 2
DATE STARTED : 05-22-01
DATE COMPLETED : 05-22-01

BORING ELEVATION : 257.60 m (USC&GS)
STATION : 12+170
OFFSET : 10 m Lt
LINE : "C"
DEPTH : 7.62 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 5.94 m ▼ At Completion Dry ▽ 24 hours Reading Dry Caved in at 4.11 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
		Brown, Slightly Moist, Very Loose, **SAND** (Visual)		SS-1	2 1 2	3	78						
				SS-2	3 2 2	4	67						
256.08	1.5		1.52										
				SS-3	5 3 4	7							
	3.0			SS-4	3 3 2	5	67						
		Light Brown to Brown, Slightly Moist to Wet, Loose to Medium Dense, **SAND** A-1-b As Lab 4 Tried many attempts at SS-3											
	4.5			SS-5	6 6 7	13	67						
				SS-6	2 5 6	11	33						
251.50	6.0		6.10										

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

BORING NO.: RB-21

PROJECT : SR 15/US 20 Improvement

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m^3)	Unconfined Compression (kN/m^2)	Atterberg Limits LL	PL	PI
		Light Brown to Brown, Slightly Moist to Wet, Loose, **SAND** A-1-b As Lab 4			5								
	7.5			SS-7	4	9	50						
249.98			7.62		5								
		Bottom of Boring at 7.62 meters Boring backfilled with soil cuttings. Dozer used to pull drilling rig.											
	9.0												
	10.5												
	12.0												
	13.5												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RS-21A
SHEET 1 OF 1
DATE STARTED : 05-24-01
DATE COMPLETED : 05-24-01

BORING ELEVATION : 256.50 m (USC&GS)
STATION : 12+200
OFFSET : 10 m Lt
LINE : "C"
DEPTH : 0.91 m

BORING METHOD : HA
RIG TYPE : ---
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : ---
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 0.30 m ▼ At Completion 0.30 m Caved in at 0.30 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
256.20		TOPSOIL (305 mm) (Visual)	0.30	AC-1			100						
				AC-2			100						
				AC-3			100	18					
		Dark Gray to Gray, Slightly Moist, SANDY LOAM (Visual)		AC-4			100						
255.74			0.76	AC-5			100						
255.59		Brown, Moist, SAND (Visual)	0.91	AC-6			100						
		Bottom of Boring at 0.91 meter											
		NOTE: Due to very soft soil condition at the surface, RS-21A was performed in the area where RB-21 was supposed to be drilled.											
	1.5												
	3.0												
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-22
SHEET 1 OF 1
DATE STARTED : 05-23-01
DATE COMPLETED : 05-23-01

BORING	ELEVATION : 260.00 m (USC&GS)	BORING METHOD : HSA		HAMMER : Automatic	
	STATION : 12+315	RIG TYPE : CME 55 Truck		DRILLER : KO	
	OFFSET : C/L	CASING DIA. : 83 mm		TEMPERATURE : 75° F	
	LINE : "C"	CORE SIZE : —		WEATHER : Sunny	
	DEPTH : 6.10 m				

GROUNDWATER: ▼ Encountered at 2.74 m ▼ At Completion 2.59 m ▽ 24 hours Reading 2.82 m Caved in at 2.95 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
				SS-1	2 2 2	4	100						
				SS-2	2 2 6	8	100						
	1.5	Brown, Slightly Moist to Moist, Very Loose to Medium Dense, **SAND** (Visual)		SS-3	9 11 7	18	89						
257.26			2.74	SS-4	2 2 4	6	89						
	3.0												
	4.5	Brown, Wet, Loose to Medium Dense, **SAND** A-1-b As Lab 4		SS-5	7 6 7	13	78						
	6.0			SS-6	11 10 13	23	89						
253.90		**Bottom of Boring at 6.10 meters** Boring backfilled with soil cuttings.	6.10										

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-23
SHEET 1 OF 1
DATE STARTED : 05-17-01
DATE COMPLETED : 05-17-01

BORING ELEVATION : 258.95 m (USC&GS)
STATION : 12+440
OFFSET : C/L
LINE : "C"
DEPTH : 3.05 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry ▽ 24 hours Reading Dry Caved in at 2.59 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
258.82		ASPHALT CONCRETE (127 mm) (Visual)	0.13										
		Dark Brown, Slightly Moist, Medium Dense, SAND (Visual)			7								
258.34			0.61	SS-1	8	13	78						
		Brown, Slightly Moist, Medium Dense to Very Loose, SANDY LOAM			5								
		A-4											
257.73		As Lab 3	1.22		3								
				SS-2	2	4	72						
	1.5				2								
		Brown to Light Gray, Slightly Moist, Very Loose to Medium Dense, SAND (Visual)			4								
				SS-3	6	12	78						
					6								
256.51			2.44										
		Brown, Slightly Moist, Medium Stiff, LOAM (TILL)			2								
		A-4 (1)		SS-4	4	10	94	13			20	13	7
255.90	3.0	Lab 5	3.05		6								
		Bottom of Boring at 3.05 meters											
		Boring backfilled with soil cuttings and pavement patch restored with concrete patch.											
	4.5												
	6.0												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	- Hollow Stem Auger	SS	- Split Spoon Sample	*	- Hand Penetrometer
SFA	- Solid Flight Auger	ST	- Shelby Tube Sample	LL	- Liquid Limit
RC	- Rock Coring	CR	- Rock Core Sample	PL	- Plastic Limit
MD	- Mud Drilling	BS	- Bag Sample	PI	- Plasticity Index
WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-24
SHEET 1 OF 2
DATE STARTED : 05-17-01
DATE COMPLETED : 05-17-01

BORING ELEVATION : 258.35 m (USC&GS)
STATION : 12+560
OFFSET : 4 m Lt
LINE : "C"
DEPTH : 7.62 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 40° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 5.94 m ▼ At Completion Dry ▽ 24 hours Reading Dry Caved in at 5.79 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
258.05		**ASPHALT CONCRETE** (305 mm) (Visual)	0.30										
				SS-1	8 10 16	26	100						
	1.5			SS-2	9 7 6	13	100						
				SS-3	6 4 5	9	100						
	3.0	Brown, Slightly Moist Changing to Moist, Medium Dense to Loose, **SAND** (Visual)		SS-4	6 4 3	7	100						
	4.5			SS-5	6 6 5	11	89						
252.41	6.0		5.94	SS-6	8 12 12	24	94						

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

BORING NO.: RB-24

PROJECT : SR 15/US 20 Improvement

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
		Light Brown, Moist to Wet, Medium Dense, **SAND** A-1-b As Lab 4		SS-7	7 6 5	11	78						
250.73	7.5	**Bottom of Boring at 7.62 meters** Boring backfilled with soil cuttings and pavement restored with concrete patch.	7.62										
	9.0												
	10.5												
	12.0												
	13.5												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-25
SHEET 1 OF 2
DATE STARTED : 05-23-01
DATE COMPLETED : 05-24-01

BORING ELEVATION	: 258.82 m (USC&GS)	BORING METHOD	: HSA	HAMMER	: Automatic
STATION	: 12+680	RIG TYPE	: CME 55 Truck	DRILLER	: KO
OFFSET	: C/L	CASING DIA.	: 83 mm	TEMPERATURE	: 75° F
LINE	: "C"	CORE SIZE	: ---	WEATHER	: Sunny
DEPTH	: 10.67 m				

GROUNDWATER: ▼ Encountered at 7.47 m ▼ At Completion 6.40 m ▽ 24 hours Reading 5.79 m Caved in at 6.40 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
257.91		ASPHALT CONCRETE (914 mm) (Visual)	0.91	SS-1									
	1.5			SS-2	3 3 5	8	100						
	3.0			SS-3	5 3 3	6	100						
		Brown, Slightly Moist, Loose to Medium Dense, SAND with Sandy Loam Layer @ 5.64 m to 5.94 m (Visual)		SS-4	6 3 5	8	100						
	4.5			SS-5	3 3 5	8	94						
252.72	6.0		6.10	SS-6	8 10 13	23	67						

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	- Hollow Stem Auger	SS	- Split Spoon Sample	*	- Hand Penetrometer
SFA	- Solid Flight Auger	ST	- Shelby Tube Sample	LL	- Liquid Limit
RC	- Rock Coring	CR	- Rock Core Sample	PL	- Plastic Limit
MD	- Mud Drilling	BS	- Bag Sample	PI	- Plasticity Index
WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

BORING NO.: RB-25

PROJECT : SR 15/US 20 Improvement

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
					5								
	7.5			SS-7	4	9	78						
					5								
		Brown, Slightly Moist to Wet, Loose to Medium Dense, **SAND** (Visual)											
					8								
	9.0			SS-8	6	13	89						
					7								
					4								
	10.5			SS-9	5	12	78						
248.15			10.67		7								
		Bottom of Boring at 10.67 meters											
		Boring backfilled with soil cuttings and pavement restored with concrete patch.											
	12.0												
	13.5												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	- Hollow Stem Auger	SS	- Split Spoon Sample	*	- Hand Penetrometer
SFA	- Solid Flight Auger	ST	- Shelby Tube Sample	LL	- Liquid Limit
RC	- Rock Coring	CR	- Rock Core Sample	PL	- Plastic Limit
MD	- Mud Drilling	BS	- Bag Sample	PI	- Plasticity Index
WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-26
SHEET 1 OF 2
DATE STARTED : 06-20-01
DATE COMPLETED : 06-20-01

BORING ELEVATION : 259.67 m (USC&GS)
STATION : 12+762
OFFSET : 5 m Rt
LINE : "C"
DEPTH : 12.19 m

BORING METHOD : HSA
RIG TYPE : CME 550 ATV
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 80° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 5.49 m ▼ At Completion Dry ▽ 24 hours Reading Dry Caved in at 7.01 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
259.61		TOPSOIL (64mm) (Visual)	0.06										
		GRAVEL FILL (Visual)											
259.21			0.46										
				SS-1	6 6 10	16	100						
	1.5			SS-2	11 14 18	32	100						
		Brown, Slightly Moist to Moist, Dense to Very Loose, **SAND** (Visual)		SS-3	8 8 6	14	89						
	3.0			SS-4	2 1 1	2	100						
256.01			3.66										
	4.5	Brown, Slightly Moist, Soft, **SANDY CLAY LOAM** A-4 As Lab 1		SS-5	2 2 3	5	100	18					
254.03			5.64										
	6.0	Light Brown to Brown, Wet, Medium Dense, **SAND** (Visual)		SS-6	8 8 7	15	33						

Continued on next page

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

PROJECT : SR 15/US 20 Improvement

BORING NO.: RB-26

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
252.81		Light Brown to Brown, Wet, Medium Dense, **SAND** (Visual)	6.86										
	7.5			SS-7	5 10 10	20	67						
	9.0	Brown, Wet, Medium Dense to Loose, **SAND** A-1-b As Lab 4		SS-8	3 4 5	9	67						
249.31	10.5		10.36	SS-9	5 6 8	14	89						
	12.0	Gray, Wet to Slightly Moist, Stiff to Very Stiff, **LOAM (TILL)** A-4 As Lab 5		SS-10	7 11 16	27	89						
247.48		**Bottom of Boring at 12.19 meters**	12.19										
	13.5	Boring backfilled with soil cuttings.											

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-27
SHEET 1 OF 2
DATE STARTED : 05-15-01
DATE COMPLETED : 05-15-01

BORING ELEVATION : 271.96 m (USC&GS)
STATION : 12+900
OFFSET : C/L
LINE : "C"
DEPTH : 6.71 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry ▽ 24 hours Reading Dry Caved in at 5.49 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
271.81		TOPSOIL (152 mm) (Visual)	0.15										
				SS-1	2 2 2	4	100						
	1.5	Brown, Slightly Moist, Very Loose, SAND (Visual)		SS-2	2 2 2	4	78						
269.98			1.98	SS-3	2 3 3	6	94						
	3.0	Brown, Slightly Moist, Loose to Very Loose, SANDY LOAM A-4 As Lab 3		SS-4	1 2 2	4	89						
268.30			3.66										
	4.5	Brown, Slightly Moist, Medium Stiff, LOAM A-4 As Lab 5		SS-5	5 5 5	10	100						
267.08			4.88										
	6.0	Light Brown, Slightly Moist, Loose, SAND A-1-b As Lab 4		SS-6	3 3 3	6	78						

Continued on next page

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

BORING NO.: RB-27

PROJECT : SR 15/US 20 Improvement

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m^3)	Unconfined Compression (kN/m^2)	Atterberg Limits LL	PL	PI
265.25		Light Brown, Slightly Moist, Loose, **SAND** A-1-b As Lab 4	6.71	SS-7	2 3 4	7	78						
		Bottom of Boring at 6.71 meters Boring backfilled with soil cuttings.											
	7.5												
	9.0												
	10.5												
	12.0												
	13.5												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-28
SHEET 1 OF 2
DATE STARTED : 05-23-01
DATE COMPLETED : 05-23-01

BORING ELEVATION	: 271.84 m (USC&GS)	BORING METHOD	: HSA	HAMMER	: Automatic
STATION	: 13+060	RIG TYPE	: CME 55 Truck	DRILLER	: KO
OFFSET	: C/L	CASING DIA.	: 83 mm	TEMPERATURE	: 75° F
LINE	: "C"	CORE SIZE	: —	WEATHER	: Sunny
DEPTH	: 7.62 m				

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry ▽ 24 hours Reading Dry Caved in at 6.71 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
271.48		**ASPHALT CONCRETE** (356mm) (Visual)	0.36										
		Brown, Moist, Loose, **SAND** (Visual)		SS-1	5 5 3	8	100						
270.93			0.91										
	1.5			SS-2	5 4 6	10	56	13					
		Brown, Slightly Moist, Medium Stiff to Very Stiff, **SANDY CLAY LOAM** A-4 As Lab 1		SS-3	3 6 9	15	100						
	3.0			SS-4	6 6 10	16	100						
267.57			4.27										
	4.5	Light Brown, Slightly Moist, Medium Dense, **SAND** (Visual)		SS-5	4 8 9	17	89						
266.05			5.79										
	6.0	Light Brown, Slightly Moist, Medium Dense, **SAND** A-1-b As Lab 4		SS-6	5 5 7	12	94						

Continued on next page

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

BORING NO.: RB-28

PROJECT : SR 15/US 20 Improvement

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
		Light Brown, Slightly Moist, Medium Dense, SAND A-1-b As Lab 4		SS-7	3 9 12	21	89						
264.22	7.5	**Bottom of the Boring at 7.62 meters** Boring backfilled with soil cuttings and pavement restored with concrete patch.	7.62										
	9.0												
	10.5												
	12.0												
	13.5												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
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MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-29
SHEET 1 OF 1
DATE STARTED : 05-17-01
DATE COMPLETED : 05-17-01

BORING ELEVATION : 265.15 m (USC&GS)
STATION : 13+200
OFFSET : 4 m Rt
LINE : "C"
DEPTH : 3.05 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry ▽ 24 hours Reading Dry Caved in at 2.51 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
264.79		**ASPHALT CONCRETE** (356 mm) (Visual)	0.36										
				SS-1	9 10 13	23	94						
	1.5	Brown, Moist to Slightly Moist, Medium Dense to Very Loose, **SAND** (Visual)		SS-2	6 4 2	6	100						
				SS-3	3 2 4	6	94						
262.10	3.0		3.05	SS-4	2 2 2	4	100						
		Bottom of Boring at 3.05 meters Boring backfilled with soil cuttings and pavement restored with concrete patch.											
	4.5												
	6.0												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	- Hollow Stem Auger	SS	- Split Spoon Sample	*	- Hand Penetrometer
SFA	- Solid Flight Auger	ST	- Shelby Tube Sample	LL	- Liquid Limit
RC	- Rock Coring	CR	- Rock Core Sample	PL	- Plastic Limit
MD	- Mud Drilling	BS	- Bag Sample	PI	- Plasticity Index
WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-30
SHEET 1 OF 1
DATE STARTED : 05-17-01
DATE COMPLETED : 05-17-01

BORING ELEVATION : 259.90 m (USC&GS)
STATION : 13+360
OFFSET : 4 m Rt
LINE : "C"
DEPTH : 2.29 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 1.37 m ▽ At Completion 1.42 m ▽ 24 hours Reading 1.22 m ▣ Caved in at 1.40 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
259.54		**ASPHALT CONCRETE** (356 mm) (Visual)	0.36										
		Gray, Moist, Loose, **SAND** to **SAND LOAM** (Visual)		SS-1	6 5 3	8	89						
258.53	1.5		1.37	SS-2	2 4 7	11	78						
		Brown, Wet, Medium Dense, **SAND** A-1-b As Lab 4		SS-3	6 12 11	23	89						
257.61		**Bottom of Boring at 2.29 meters** Boring backfilled with soil cuttings and pavement restored with concrete patch.	2.29										
	3.0												
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-31
SHEET 1 OF 1
DATE STARTED : 05-17-01
DATE COMPLETED : 05-17-01

BORING ELEVATION : 256.00 m (USC&GS)
STATION : 13+520
OFFSET : 4 m Lt
LINE : "C"
DEPTH : 2.29 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 1.98 m ▼ At Completion Dry ▽ 24 hours Reading 1.73 m Caved in at 1.76 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
255.59		**ASPHALT CONCRETE** (406 mm) (Visual)	0.41										
				SS-1	6 3 3	6	94						
	1.5	Dark Brown to Brown, Moist to Wet, Loose to Very Loose, **SAND** A-1-b As Lab 4		SS-2	3 3 1	4	67						
				SS-3	5 9 1	10	100						
253.71		**Bottom of Boring at 2.29 meters**	2.29										
	3.0	Boring backfilled with soil cuttings and pavement restored with concrete patch.											
	4.5												
	6.0												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
BORING NO.: RB-32
PROJECT : SR 15/US 20 Improvement
SHEET 1 OF 1
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DATE STARTED : 05-17-01
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061
DATE COMPLETED : 05-17-01

BORING	ELEVATION : 265.40 m (USC&GS)	BORING METHOD : HSA		HAMMER : Automatic	
	STATION : 5+100	RIG TYPE : CME 55 Truck		DRILLER : KO	
	OFFSET : 6 m Lt	CASING DIA. : 83 mm		TEMPERATURE : 70° F	
	LINE : S-US20-B	CORE SIZE : ---		WEATHER : Rain	
	DEPTH : 2.29 m				

GROUNDWATER: Encountered at Dry At Completion Dry 24 hours Reading Dry Caved in at 1.65 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
265.10		**ASPHALT CONCRETE** (51 mm) over **PORTLAND CEMENT CONCRETE**(152mm) over **BASE** (102 mm) (Visual)	0.30										
				SS-1	3 2 2	4	78	16					
	1.5	Brown, Moist, Soft to Medium Stiff, **SANDY CLAY LOAM** A-4 As Lab 1		SS-2	2 2 2	4	94	20					
263.11			2.29	SS-3	3 3 4	7	100						
		Bottom of Boring at 2.29 meters Boring backfilled with soil cuttings and pavement restored with concrete patch.											
	3.0												
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-33
SHEET 1 OF 1
DATE STARTED : 05-17-01
DATE COMPLETED : 05-17-01

BORING ELEVATION	: 263.70 m (USC&GS)	BORING METHOD	: HSA	HAMMER	: Automatic
STATION	: 5+240	RIG TYPE	: CME 55 Truck	DRILLER	: KO
OFFSET	: 6 m Rt	CASING DIA.	: 83 mm	TEMPERATURE	: 70° F
LINE	: S-US20-B	CORE SIZE	: —	WEATHER	: Rain
DEPTH	: 2.29 m				

GROUNDWATER: ▼ Encountered at 1.78 m ▼ At Completion 1.78 m ▽ 24 hours Reading 1.27 m Caved in at 1.68 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
263.32		**ASPHALT CONCRETE** (76 mm) over **PORTLAND CEMENT CONCRETE** (305 mm) (Visual)	0.38										
		Gray, Moist, Loose, **SAND** (POSSIBLE FILL) (Visual)		SS-1	5 4 4	8	100						
262.79			0.91										
	1.5	Gray with Brown Streaks, Moist, Medium Stiff, **SANDY CLAY LOAM** A-4 As Lab 1		SS-2	2 3 5	8	100	18					
262.02			1.68										
		Brown, Slightly Moist, Stiff, **LOAM** A-4 As Lab 5		SS-3	5 6 8	14	100						
261.41		**Bottom of Boring at 2.29 meters**	2.29										
		Boring backfilled with soil cuttings and pavement restored with concrete patch.											
	3.0												
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-34
SHEET 1 OF 1
DATE STARTED : 05-17-01
DATE COMPLETED : 05-17-01

BORING ELEVATION : 265.40 m (USC&GS)
STATION : 5+375
OFFSET : 13 m Lt
LINE : S-US20-B
DEPTH : 2.29 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Rain

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry ▽ 24 hours Reading Dry Caved in at 1.65 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
264.79		Dark Brown to Dark Gray, Slightly Moist, Medium Dense, **SAND** with Little Gravel (FILL) (Visual)	0.61	SS-1	5 8 4	12	67						
	1.5	Gray and Brown Changing to Brown, Slightly Moist to Moist, Very Stiff, **SANDY CLAY LOAM** A-4 As Lab 1		SS-2	9 12 14	26	78						
263.11			2.29	SS-3	9 9 10	19	67						
		Bottom of Boring at 2.29 meters Boring backfilled with soil cuttings.											
	3.0												
	4.5												
	6.0												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

TEST BORING RECORD

CLIENT	: Indiana Department of Transportation	BORING NO.:	RB-35
PROJECT	: SR 15/US 20 Improvement	SHEET	1 OF 1
LOCATION	: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County	DATE STARTED	: 05-17-01
DES NO.	: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061	DATE COMPLETED	: 05-17-01

BORING	ELEVATION : 263.95 m (USC&GS)	BORING METHOD	: HSA	HAMMER	: Automatic
	STATION : 5+480	RIG TYPE	: CME 55 Truck	DRILLER	: KO
	OFFSET : 7 m Rt	CASING DIA.	: 83 mm	TEMPERATURE	: 70° F
	LINE : S-US20-B	CORE SIZE	: —	WEATHER	: Rain
	DEPTH : 2.29 m				

GROUNDWATER: ▼ Encountered at 1.83 m ▽ 24 hours Reading Dry ▣ Caved in at 1.60 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
263.57		**GRAVEL BASE** (381 mm) (Visual)	0.38										
				SS-1	10 4 10	14	94						
		Dark Brown Changing to Brown, Moist to Wet, Medium Dense to Very Loose, **SAND** (Visual)		SS-2	2 2 2	4	78						
	1.5												
				SS-3	1 3 3	6	94						
261.66		**Bottom of Boring at 2.29 meters**	2.29										
		Boring backfilled with soil cuttings.											
	3.0												
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	• - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-36
SHEET 1 OF 1
DATE STARTED : 05-17-01
DATE COMPLETED : 05-17-01

BORING ELEVATION : 261.80 m (USC&GS)
STATION : 5+620
OFFSET : 7 m Lt
LINE : S-US20-B
DEPTH : 2.29 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Rain

GROUNDWATER: ▼ Encountered at Dry ▽ At Completion Dry ▽ 24 hours Reading 0.99 m ▣ Caved in at 1.68 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
261.39		**ASPHALT CONCRETE** (51 mm) over **PORTLAND CEMENT CONCRETE** (102 mm) over **ASPHALT CONCRETE** (51 mm) over **BASE** (203 mm) (Visual)	0.41										
		Gray and Brown Changing to Brown, Moist to Slightly Moist, Soft to Very Stiff, **SANDY CLAY LOAM** A-4 As Lab 1		SS-1	4 3 5	8	94	23					
	1.5			SS-2	2 3 2	5	83						
259.51			2.29	SS-3	4 7 9	16	100						
		Bottom of Boring at 2.29 meters											
		Boring backfilled with soil cuttings and pavement restored with concrete patch.											
	3.0	**NOTE:** The 24-hours groundwater reading may be due to rain accumulated in the borehole and/or seepage water trapped in the base course.											
	4.5												
	6.0												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-37
SHEET 1 OF 1
DATE STARTED : 05-14-01
DATE COMPLETED : 05-14-01

BORING ELEVATION : 261.60 m (USC&GS)
STATION : 5+020
OFFSET : 1 m Rt
LINE : S-1-B
DEPTH : 3.05 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry ▽ 24 hours Reading Dry Caved in at 2.36 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
261.27		**ASPHALT CONCRETE** (178 mm) over **GRAVEL BASE** (76 mm) over **SAND BASE** (76 mm) (Visual)	0.33										
				SS-1	4 6 6	12	89						
				SS-2	2 2 1	3	100						
	1.5	Dark Brown Changing to Brown, Moist, Medium Dense to Very Loose, **SAND** (Visual)											
				SS-3	2 2 3	5	100						
				SS-4	2 2 1	3	100						
258.55	3.0	**Bottom of Boring at 3.05 meters** Boring backfilled with soil cuttings and pavement restored with concrete patch.	3.05										
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-38
SHEET 1 OF 2
DATE STARTED : 05-15-01
DATE COMPLETED : 05-15-01

BORING ELEVATION : 271.15 m (USC&GS)
STATION : 5+060
OFFSET : 2 m Rt
LINE : S-2-B
DEPTH : 7.62 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry ▽ 24 hours Reading Dry Caved in at 6.02 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
270.85		**ASPHALT CONCRETE** (102 mm) over **BASE** (152 mm) (Visual)	0.30										
		Brown, Moist, Medium Dense to Very Loose, **SAND** (Visual)		SS-1	9 5 6	11	100						
	1.5			SS-2	2 2 2	4	100						
269.47			1.68										
		Brown, Moist, Medium Stiff, **SANDY CLAY LOAM** A-4 As Lab 1		SS-3	3 2 4	6	100	20					
268.71			2.44										
	3.0			SS-4	2 1 2	3	89						
		Brown, Moist, Very Loose to Medium Dense, **SAND** (Visual)		SS-5	5 10 13	23	78						
	4.5												
265.82			5.33										
		Light Brown, Slightly Moist, Medium Dense, **SAND** A-1-b As Lab 4		SS-6	4 10 15	25	89						
	6.0												

Continued on next page

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

BORING NO.: RB-38

PROJECT : SR 15/US 20 Improvement

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
263.53	7.5	Light Brown, Slightly Moist, Medium Dense, SAND A-1-b As Lab 4	7.62	SS-7	3 7 10	17	78						
		Bottom of Boring at 7.62 meters Boring backfilled with soil cuttings and pavement restored with concrete patch.											
	9.0												
	10.5												
	12.0												
	13.5												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	- Hollow Stem Auger	SS	- Split Spoon Sample	*	- Hand Penetrometer
SFA	- Solid Flight Auger	ST	- Shelby Tube Sample	LL	- Liquid Limit
RC	- Rock Coring	CR	- Rock Core Sample	PL	- Plastic Limit
MD	- Mud Drilling	BS	- Bag Sample	PI	- Plasticity Index
WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-39
SHEET 1 OF 1
DATE STARTED : 05-14-01
DATE COMPLETED : 05-14-01

BORING ELEVATION : 259.85 m (USC&GS)
STATION : 5+100
OFFSET : 2 m Rt
LINE : S-3-B
DEPTH : 2.29 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry ▽ 24 hours Reading Dry Caved in at 1.09 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
259.60		**ASPHALT CONCRETE** (127 mm) over **BASE COURSE** (127 mm) (Visual)	0.25										
		Brown to Dark Gray, Slightly Moist, Loose, **SAND** (Visual)		SS-1	3 4 3	7	100						
258.94			0.91										
	1.5	Brown with Gray Streaks, Moist, Medium Stiff to Stiff, **SANDY CLAY LOAM** A-4 As Lab 1		SS-2	2 2 5	7	89	24					
				SS-3	2 4 8	12	89						
257.56		**Bottom of Boring at 2.29 meters**	2.29										
		Boring backfilled with soil cuttings and pavement restored with concrete patch.											
	3.0												
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-40
SHEET 1 OF 2
DATE STARTED : 06-21-01
DATE COMPLETED : 06-21-01

BORING ELEVATION : 269.95 m (USC&GS)
STATION : 1+040
OFFSET : C/L
LINE : "H"
DEPTH : 7.01 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 4.27 m ▼ At Completion 4.88 m 🖂 Caved in at 5.79 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
		Brown and Gray, Slightly Moist, Stiff to Very Stiff, **SANDY CLAY LOAM** with Little Roots A-4 As Lab 1		SS-1	2 5 7	12	94						
268.88			1.07	SS-2	6 12 14	26	100						
	1.5			SS-3	5 14 18	32	100						
		Brown, Moist, Medium Dense to Dense, **SAND** with Silt (Visual)											
	3.0			SS-4	14 17 16	33	100						
266.29			3.66										
	4.5	Brown Changing to Gray, Moist, Very Stiff, **LOAM** (TILL) with Wet Sand Seams @ 4.27 m to 2.42 m A-4 As Lab 5		SS-5	7 7 10	17	100						
264.62			5.33										
	6.0	Light Brown, Wet, Medium Dense to Dense, **SAND** A-1-b As Lab 4		SS-6	7 14 16	30	100						

Continued on next page

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

BORING NO.: RB-40

PROJECT : SR 15/US 20 Improvement

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
262.94		Light Brown, Wet, Medium Dense to Dense, SAND A-1-b As Lab 4	7.01	SS-7	7 14 18	32	100						
		Bottom of Boring at 7.01 meters											
		Boring backfilled with soil cuttings.											
	7.5												
	9.0												
	10.5												
	12.0												
	13.5												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: TB-1
SHEET 1 OF 1
DATE STARTED : 05-22-01
DATE COMPLETED : 05-22-01

BORING ELEVATION : 257.65 m (USC&GS)
STATION : 10+128
OFFSET : 20 m Rt
LINE : "C"
DEPTH : 4.57 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 1.68 m ▼ At Completion 1.83 m ▽ 24 hours Reading 1.83 m Caved in at 3.58 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
257.19		TOPSOIL (457 mm) (Visual)	0.46										
		Black to Dark Gray, Moist, Very Loose, **SANDY LOAM** A-4 As Lab 3		SS-1	2 2 1	3	94	28					
256.13	1.5		1.52	SS-2	0 1 1	2	67						
		Black to Dark Gray, Moist, Loose, **SAND** A-1-b As Lab 4											
255.67			1.98	SS-3	4 5 4	9	67						
	3.0	Brownish Gray, Wet, Medium Dense, **SAND** (Visual)		SS-4	4 5 6	11	67						
253.08	4.5		4.57	SS-5	5 8 13	21	89						
		Bottom of Boring at 4.57 meters											
		Boring backfilled with soil cuttings.											
		Dozer used to pull drilling rig.											
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: TB-2
SHEET 1 OF 2
DATE STARTED : 05-11-01
DATE COMPLETED : 05-11-01

BORING				
ELEVATION	: 257.00 m (USC&GS)	BORING METHOD	: HSA	HAMMER : Automatic
STATION	: 10+126.5	RIG TYPE	: CME 55 Truck	DRILLER : KO
OFFSET	: 20 m Lt	CASING DIA.	: 83 mm	TEMPERATURE : 70° F
LINE	: "C"	CORE SIZE	: ---	WEATHER : Sunny
DEPTH	: 6.10 m			

GROUNDWATER: ▼ Encountered at 1.83 m ▽ At Completion 1.52 m ▽ 24 hours Reading 0.91 m ▣ Caved in at 1.22 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
256.54		**TOPSOIL** (305 mm) (Visual)	0.46	SS-1	3 2 2	4	67	21					
256.24		Dark Gray to Black, Moist, Very Loose, **SAND** with Little Roots (Visual)	0.76										
	1.5			SS-2	8 24 7	31	72						
	3.0			SS-3	6 6 6	12	72						
		Brownish Gray, Wet, Dense to Loose, **SAND** with Bouldery Zone at 1.52 m (Visual) 25 gallons of water was used to keep sand from heaving at 4.57 m		SS-4	8 10 8	18	89						
	4.5			SS-5	3 4 5	9	83						
	6.0			SS-6	8 3 5	8	100						
250.90		**Bottom of Boring at 6.10 meters**	6.10										

Continued on next page

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation BORING NO.: TB-2

PROJECT : SR 15/US 20 Improvement SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
		Boring backfilled with soil cuttings.											
	7.5												
	9.0												
	10.5												
	12.0												
	13.5												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	- Hollow Stem Auger	SS	- Split Spoon Sample	*	- Hand Penetrometer
SFA	- Solid Flight Auger	ST	- Shelby Tube Sample	LL	- Liquid Limit
RC	- Rock Coring	CR	- Rock Core Sample	PL	- Plastic Limit
MD	- Mud Drilling	BS	- Bag Sample	PI	- Plasticity Index
WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: TB-3
SHEET 1 OF 1
DATE STARTED : 05-22-01
DATE COMPLETED : 05-22-01

BORING ELEVATION : 258.15 m (USC&GS)
STATION : 12+636
OFFSET : 18 m Rt
LINE : "C"
DEPTH : 4.57 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▽ At Completion Dry ▽ 24 hours Reading Dry ▣ Caved in at 4.27 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
		Dark Gray, Moist, Very Loose, **SAND** with Little Traces of Roots (Visual)		SS-1	2 1 1	2	67						
256.93			1.22	SS-2	2 2 4	6	56						
	1.5			SS-3	3 2 2	4	67						
	3.0	Brown, Moist to Very Moist, Loose, **SAND** with **SANDY CLAY LOAM** between 1.98 m and 2.44 m (Visual)		SS-4	3 3 2	5	89						
253.58	4.5	**Bottom of Boring at 4.57 meters** Boring backfilled with soil cuttings.	4.57	SS-5	2 2 3	5	89						
	6.0												

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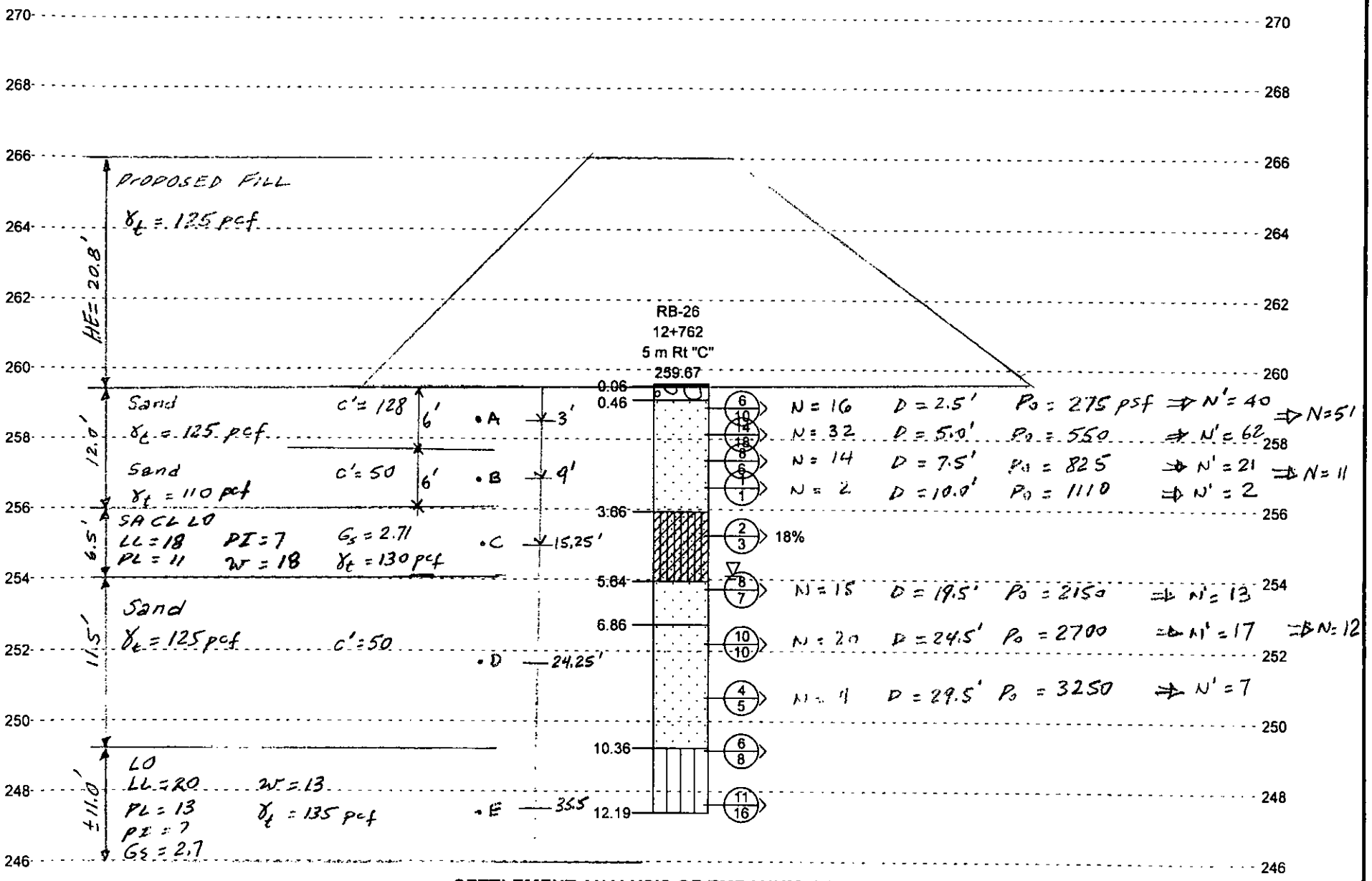
BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		



SETTLEMENT ANALYSIS OF EMBANKMENT

SR 15/US 20 Improvement

SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20

STP-4320 (7), CTL No.: 00-050061

INDOT_PROFILE_USE_5061.GPJ CTLMET.GDT 8/15/01

SETTLEMENT ANALYSIS OF EMBANKMENT

SR 15 / US 20 Improvement
Project No.: STP - 4320 (7)
CTL Project No.: 00-050061

Refer to attached Page 152

At C: LI = (w-PL)/PI = (18 -11) / 7 = 1.000 Normally Consolidated
e_o = (Gs * w) / 100 = (2.71*18) / 100 0.488
C_c = w / 100 = 18 / 100 = 0.180

At E: LI = (w-PL)/PI = (13 -13) / 7 = 0.000 Preconsolidated
e_o = (Gs * w) / 100 = (2.70*13) / 100 0.351
C_r = w / 1000 = 18 / 1000 = 0.013

Proposed Embankment:
Fill Height = 20.8 feet
Fill Unit Wt. = 125 pcf

Equations to calculate settlement:

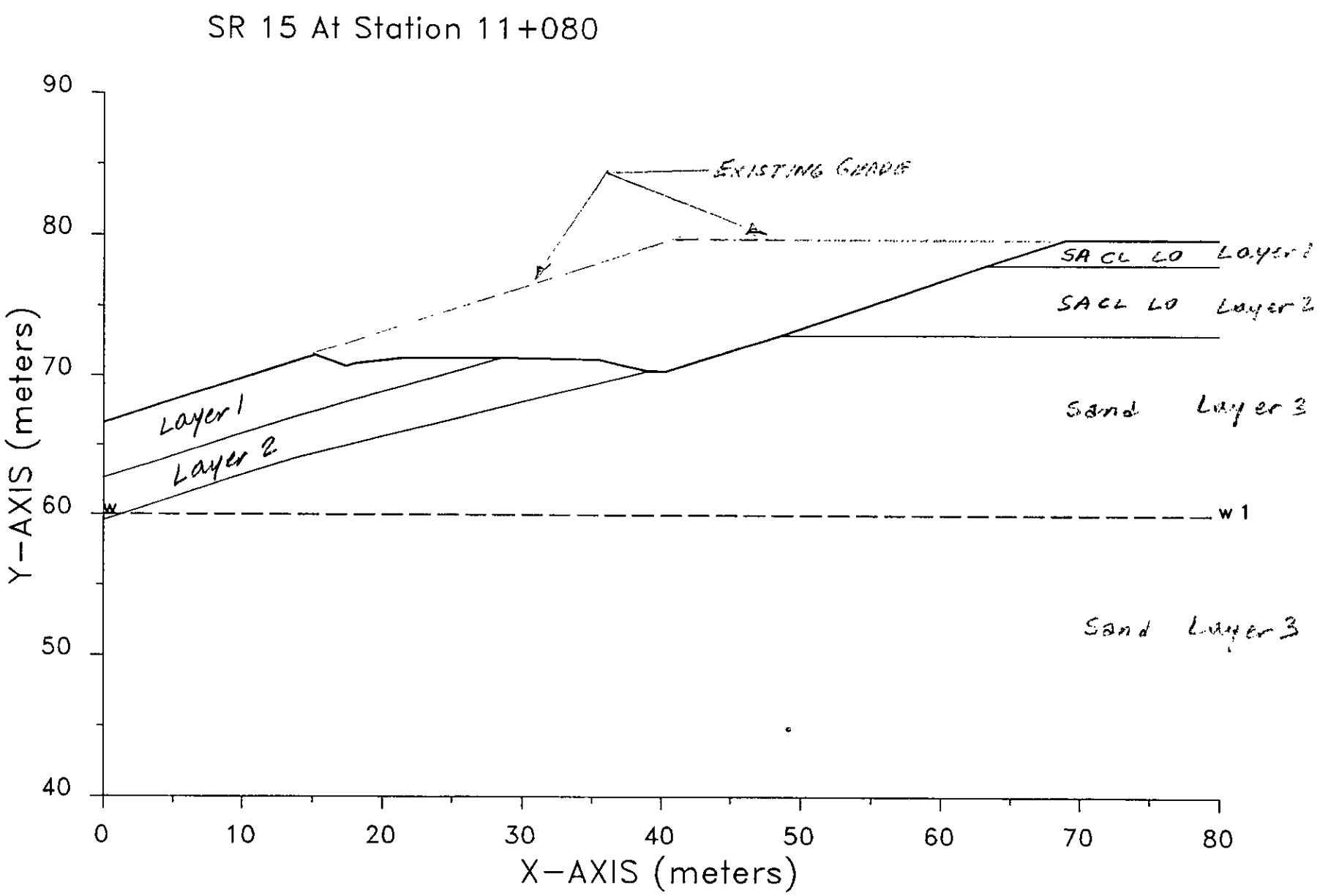
$\Delta H = H [1 / C'] \log [(P_o + P) / P_o)]$ Sand
$\Delta H = H [C_c / (1 / e_o)] \log [(P_o + P) / P_o)]$ Clay Normally Consolidated
$\Delta H = H [C_r / (1 / e_o)] \log [(P_o + P) / P_o)]$ Clay Preconsolidated

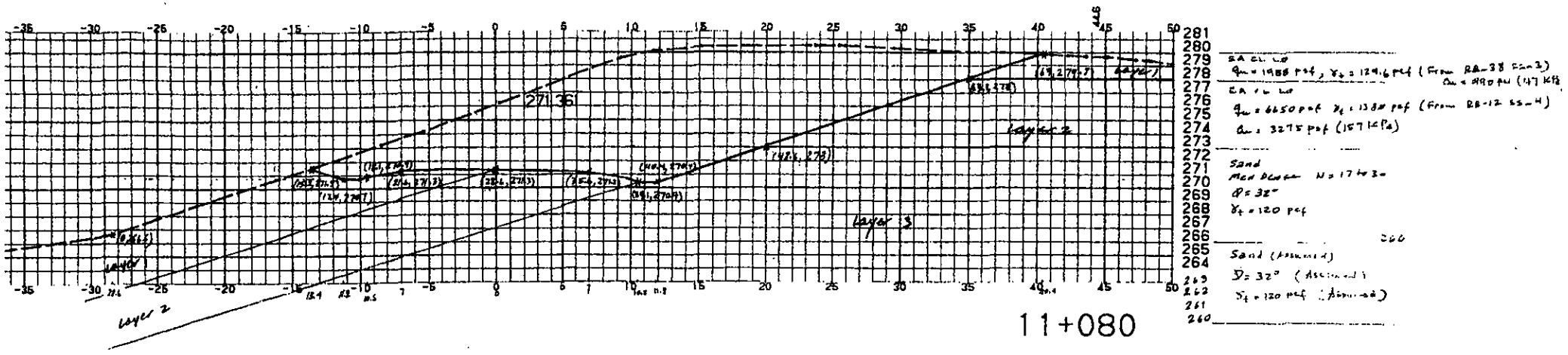
Point	Material Type	Layer Thickness H (feet)	Unit Weight (pcf)	C'	C_c or C_r	e_o	P_o (psf)	ΔP (psf)	P (psf)	ΔH (inches)	
										Sand	Clay
A	Sand	6.0	125	128			375	2600	375	0.5	
B	Sand	6.0	110	50			1080	2600	1080	0.8	
C	SA CL LO	6.5	130		0.180	0.488	1833	2600	1833		3.6
D	Sand	11.5	125	50			2974	2600	2974	0.8	
E	Loam	11.0	135		0.013	0.351	4435	2600	4435		0.3
TOTAL ESTIMATED SETTLEMENT										**5.9**	

APPENDIX F

SLOPE STABILTY ANALYSIS

61_3 8-17-01 9:23

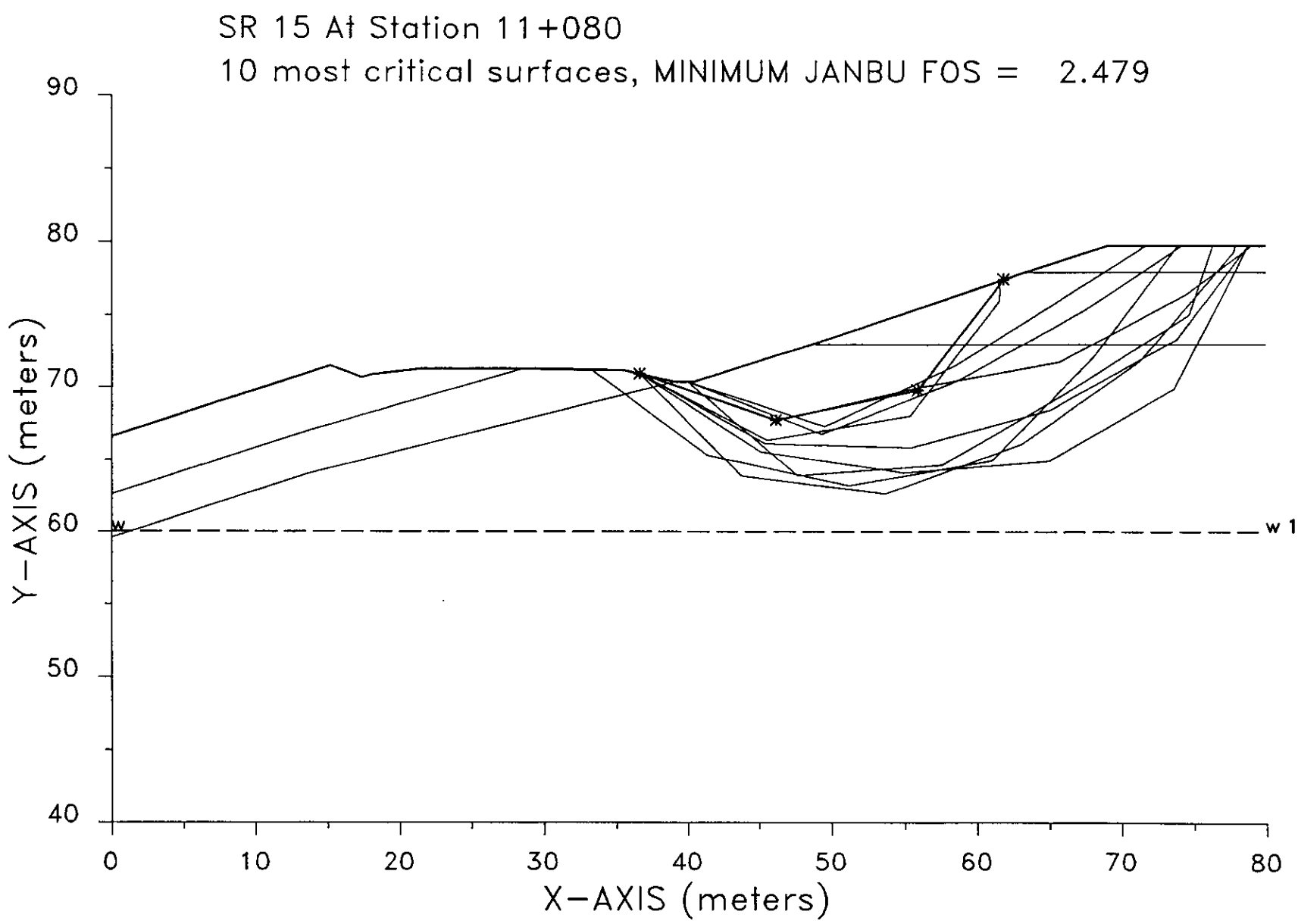




		INDIANA DEPARTMENT OF TRANSPORTATION	SCALE 1:100 / BRIDGE FILE
	DESIGNED: / DRAWN:		LINE C / DESIGNATION 8354420
	CECKED: / CHECKED:	CROSS SECTIONS	SURVEY BOOK 16478 / SHEETS 14 of
			CONTRACT / PROJECT STP-4320(3)

287

```
PROFIL                                        FILE: 61_3        8-17-01     9:23     m
SR 15 At Station 11+080
    18       12
       .0        66.6        15.2        71.5    1
     15.2        71.5        17.4        70.7    1
     17.4        70.7        18.1        70.9    1
     18.1        70.9        21.6        71.3    1
     21.6        71.3        28.6        71.3    1
     28.6        71.3        35.6        71.2    2
     35.6        71.2        39.1        70.4    3
     39.1        70.4        40.4        70.4    3
     40.4        70.4        48.6        73.0    3
     48.6        73.0        63.3        78.0    3
     63.3        78.0        69.0        79.8    1
     69.0        79.8        80.0        79.8    1
       .0        62.6        13.6        67.0    2
     13.6        67.0        28.6        71.3    2
     63.3        78.0        80.0        78.0    2
       .0        59.6        13.6        64.0    3
     13.6        64.0        39.1        70.4    3
     48.6        73.0        80.0        73.0    3
SOIL
  3
   20.4      24.0       47.0        .00      .000          .0     1
   21.7      25.6      157.0        .00      .000          .0     1
   18.9      20.8         .0      32.00      .000          .0     1
WATER
  1         9.81
     2
          .0          60.0
        80.0          60.0
RANDOM
    10       10
     10.0        40.0        30.0        80.0
       .0        10.0          .0          .0
```


SR 15 At Station 11+080
10 most critical surfaces, MINIMUM JANBU FOS = 2.479
90
80
70
60
50
40
Y-AXIS (meters)
w
w 1
0
10
20
30
40
50
60
70
80
X-AXIS (meters)

XSTABL File: 61_3 8-17-01 9:23

```
*******************************************
*              X S T A B L                *
*                                         *
*        Slope Stability Analysis         *
*               using the                 *
*           Method of Slices              *
*                                         *
*        Copyright (C) 1992 - 2000        *
*   Interactive Software Designs, Inc.    *
*        Moscow, ID 83843, U.S.A.         *
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*                                         *
*  Ver. 5.204                 96 - 1808   *
*******************************************
```

Problem Description : SR 15 At Station 11+080

SEGMENT BOUNDARY COORDINATES

---

12 SURFACE boundary segments

Segment No.	x-left (m)	y-left (m)	x-right (m)	y-right (m)	Soil Unit Below Segment
1	.0	66.6	15.2	71.5	1
2	15.2	71.5	17.4	70.7	1
3	17.4	70.7	18.1	70.9	1
4	18.1	70.9	21.6	71.3	1
5	21.6	71.3	28.6	71.3	1
6	28.6	71.3	35.6	71.2	2
7	35.6	71.2	39.1	70.4	3
8	39.1	70.4	40.4	70.4	3
9	40.4	70.4	48.6	73.0	3
10	48.6	73.0	63.3	78.0	3
11	63.3	78.0	69.0	79.8	1
12	69.0	79.8	80.0	79.8	1

6 SUBSURFACE boundary segments

Segment No.	x-left (m)	y-left (m)	x-right (m)	y-right (m)	Soil Unit Below Segment
1	.0	62.6	13.6	67.0	2
2	13.6	67.0	28.6	71.3	2
3	63.3	78.0	80.0	78.0	2
4	.0	59.6	13.6	64.0	3
5	13.6	64.0	39.1	70.4	3
6	48.6	73.0	80.0	73.0	3

ISOTROPIC Soil Parameters
---

3 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (kN/m3)	Unit Weight Sat. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (kPa)	Water Surface No.
1	20.4	24.0	47.0	.00	.000	.0	1
2	21.7	25.6	157.0	.00	.000	.0	1
3	18.9	20.8	.0	32.00	.000	.0	1

1 Water surface(s) have been specified

Unit weight of water = 9.81 (kN/m3)

Water Surface No. 1 specified by 2 coordinate points

****
PHREATIC SURFACE,
****

Point No.	x-water (m)	y-water (m)
1	.00	60.00
2	80.00	60.00

A critical failure surface searching method, using a random technique for generating IRREGULAR surfaces has been specified.

100 trial surfaces will be generated and analyzed.

10 Surfaces initiate from each of 10 points equally spaced along the ground surface between x = 10.0 m
and x = 40.0 m

Each surface terminates between x = 30.0 m
and x = 80.0 m

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = .0 m

10.0 m line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED JANBU METHOD * * * * *

The 10 most critical of all the failure surfaces examined are displayed below - the most critical first

Failure surface No. 1 specified by 4 coordinate points

Point No.	x-surf (m)	y-surf (m)
1	36.67	70.96
2	46.14	67.75
3	55.92	69.83
4	61.83	77.50

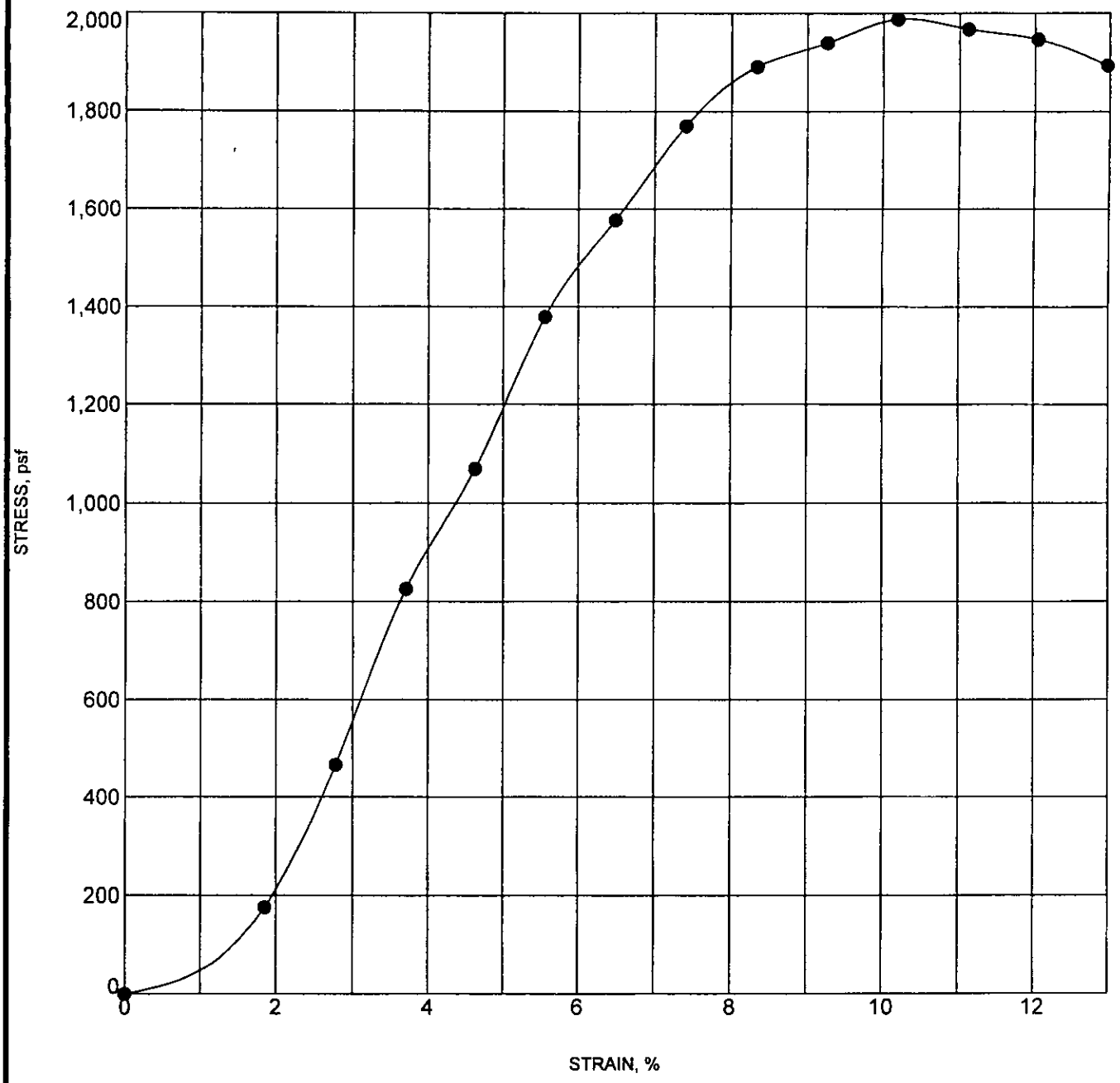
** Corrected JANBU FOS = 2.479 ** (Fo factor = 1.048)

The following is a summary of the TEN most critical surfaces

Problem Description : SR 15 At Station 11+080

	Modified JANBU FOS	Correction Factor	Initial x-coord (m)	Terminal x-coord (m)	Available Strength (kN)
1.	2.479	1.048	36.67	61.83	1.021E+03
2.	2.759	1.053	36.67	61.59	1.432E+03
3.	3.710	1.073	36.67	78.77	4.446E+03
4.	3.725	1.085	36.67	77.83	5.401E+03
5.	4.022	1.049	36.67	79.04	3.437E+03
6.	4.027	1.065	40.00	71.70	2.389E+03
7.	4.063	1.086	33.33	73.91	5.282E+03
8.	4.084	1.064	40.00	74.19	3.058E+03
9.	4.095	1.084	36.67	78.72	5.518E+03
10.	4.210	1.084	40.00	76.29	4.700E+03

* * * END OF FILE * * *



Boring Information		Test Results	
Boring No.	**RB-38**	Natural Moisture Content (%)	**20**
Sample	**SS-3**	Natural Wet Density, pcf (kg/m^3)	**129.6 (2076)**
Depth (m)	**1.83 - 2.29**	Natural Dry Density, pcf (kg/m^3)	**108.0 (1730)**
Station	**5+060**	Unconfined Compression Strength, psf (kN/m^2)	**1988 (95)**
Offset	**2 m Rt**	Failure Strain (%)	**10.2**
Line	**S-2-B**		

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UNCONFINED COMPRESSION TEST

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20

Project Number: STP-4320 (7), CTL No.: 00-050061

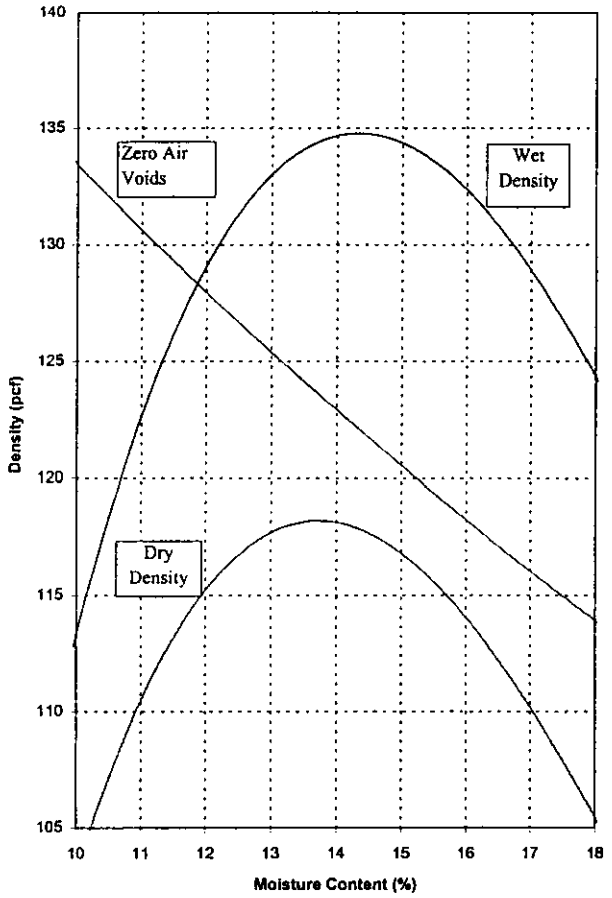
PROCTOR TEST RESULTS

CLIENT: Indiana Department of Transportation

PROJECT: SR 15 from 0.56 km S. of US 20 to
3.10 km N. of US 20
Elkhart County, Indiana

Sample ID: BS-1, Bag Sample - RB-7
Station: 10+720
Offset: 5 m Rt, Line "C"
Depth: 0.15 m - 0.91 m

Classification: CLAY A-6 (7)



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Project No. 00-050061
Lab Code No. 01-050762
Date Tested: 06/06/2001
Date Reported: 07/09/2001

Standard Proctor (AASHTO T 99)
Max. Dry Density (pcf) 118.2
Optimum Moisture (%) 13.7

Gradation (AASHTO T 88)

% Gravel 4.6
% Sand 28.3
% Silt 32.0
% Clay 35.1

Atterberg Limits (ASTHMA T 89 & T 90)

Liquid Limit 29
Plastic Limit 14
Plasticity Index 15

Moisture Content (ASTM D2216)
Natural Wc (%) 15

Classification:(AASHTO M 145)

A-6 (7)

Specific Gravity (ASTM D 854)

SG 2.72

Reviewed by:

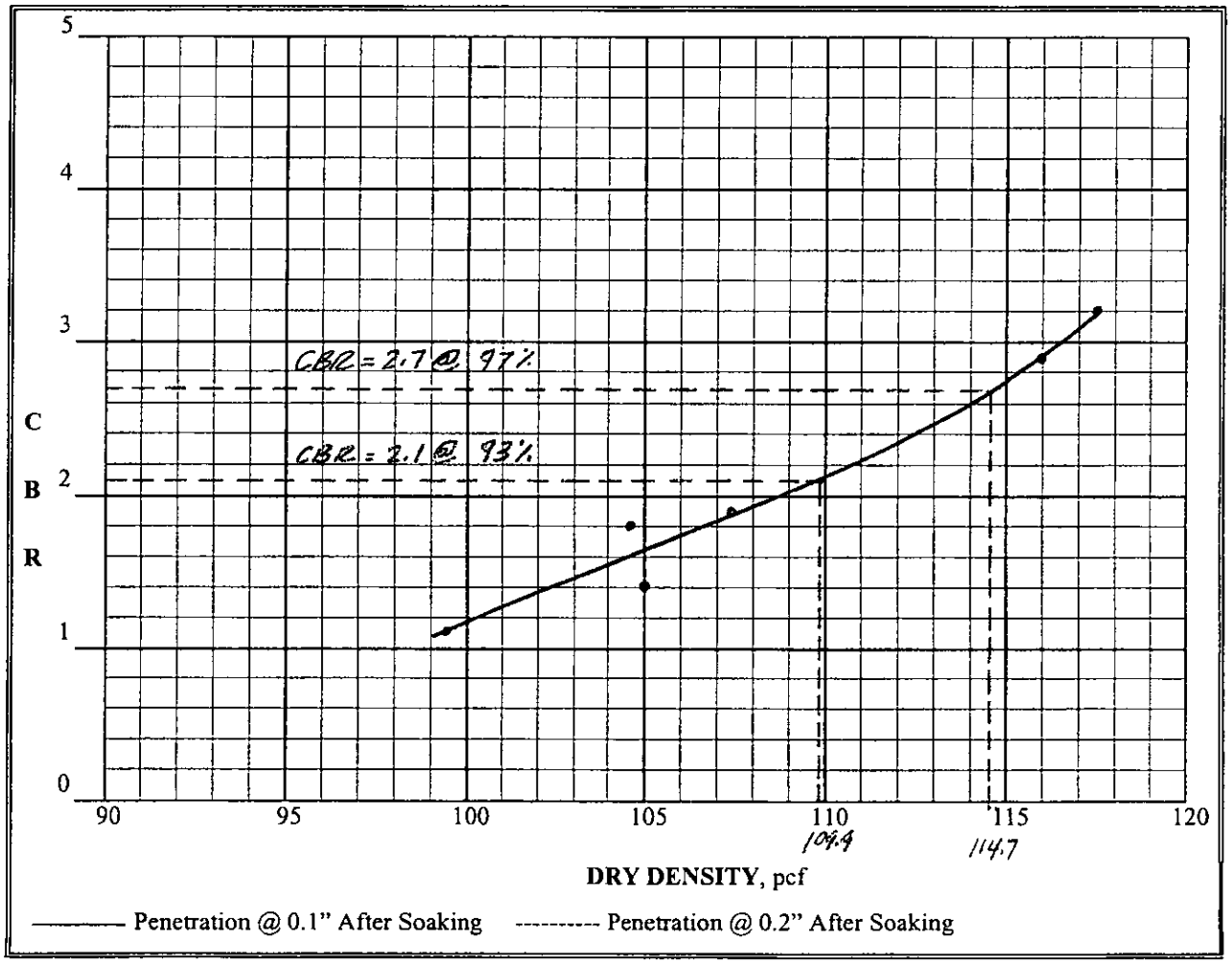
SUMMARY OF CBR TEST RESULTS

Client: Indiana Department of Transportation
Project: SR 15 from 0.56 km S. of US 20 to 3.10 km N. of US 20
Location: Elkhart County
Project No: 00-050061
Sample No.: BS-1, Soil bag sample at a depth ranging from 0.5' to 3.0' (0.15 m – 0.91 m) at RB-7
Soil Description: CLAY A-6 (7)

Maximum Wet Density, pcf: 134.4
Maximum Dry Density, pcf: 118.2
Optimum Moisture Content, %: 13.7
Surcharge Weight for Soaking, lbs: 25 (10 Kg)

CBR @ 93% = 2.1
CBR @ 97% = 2.7

Specimen No.14.5	Blows Per Layer	Average Water Content (%)		Initial Dry Density (pcf)	Percent Maximum Dry Density	Swell (%)	CBR (%)			
		As Molded	After Soaking				Before Saturation		After Saturation	
							0.1"	0.2"	0.1"	0.2"
1	15	15.0	19.4	104.8	88.6	0.8	7.1	6.4	1.8	1.8
2	15	13.2	19.2	99.4	84.1	1.2	7.3	6.9	1.1	0.9
3	30	13.3	20.4	105.0	88.8	1.5	9.1	8.6	1.4	1.4
4	30	13.0	20.8	107.4	90.9	2.0	11.1	10.1	1.9	1.9
5	65	13.4	19.2	117.5	99.4	1.2	13.8	13.2	3.2	2.9
6	51	12.7	19.8	116.0	98.1	2.0	19.1	17.2	2.9	2.6



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Boring No.	Station	Offset	Line	Sample No.	Depth	Moisture Content (%)	Wet Density (pcf)	Dry Density (pcf)	Unconfined Compression (psf)	Failure Strain (%)	Loss on Ignition (%)	pH
RB-10	11+020	20 m Lt	"C"	SS-1	0.15-0.61	14						
RB-10	11+020	20 m Lt	"C"	SS-3	1.68-2.13	14						
RB-10	11+020	20 m Lt	"C"	SS-5	4.11-4.57	14						8.29
RB-11	11+020	20 m Rt	"C"	SS-5	4.11-4.57	17	134.6	115.1	2651	9.3		
RB-12	11+080	30 m Rt	"C"	SS-3	1.68-2.13	14						
RB-12	11+080	30 m Rt	"C"	SS-4	2.59-3.05	11	141.5	127.5	6552	16.7		
RB-12	11+080	30 m Rt	"C"	SS-5	4.11-4.57	12						
RB-12	11+080	30 m Rt	"C"	SS-8	8.69-9.14	5						8.87
RB-12	11+080	30 m Rt	"C"	SS-11	13.26-13.72	18						
RB-13	11+218	C/L	"C"	SS-3	1.68-2.13	18						
RB-13	11+218	C/L	"C"	SS-5	4.11-4.57	11						
RB-13	11+218	C/L	"C"	SS-6	5.64-6.10	10						
RB-14	11+320	3 m Rt	"C"	SS-2	1.07-1.52	18						
RB-14	11+320	3 m Rt	"C"	SS-4	2.59-3.05	19						
RB-15	11+440	C/L	"C"	SS-1	0.15-0.61	16						
RB-16	11+570	C/L	"C"	SS-1	0.15-0.61	26						
RB-17	11+680	C/L	"C"	SS-2	0.91-1.37	11						
RB-18	11+800	5 m Lt	"C"	SS-3	1.83-2.29	18	141.6	120.0	1754	21.6		
RB-18	11+800	5 m Lt	"C"	SS-4	2.59-3.05	18						
RB-19	11+920	4 m Rt	"C"	SS-2	1.07-1.52	12						
RB-2	10+000	3.5 m Lt	"C"	SS-3	1.83-2.29	18						
RB-20	12+080	2 m Lt	"C"	SS-3	1.83-2.29	15						
RB-23	12+440	C/L	"C"	SS-4	2.59-3.05	13						8.49
RB-26	12+762	5 m Rt	"C"	SS-5	4.11-4.57	18						
RB-28	13+060	C/L	"C"	SS-2	1.07-1.52	13						
RB-3	10+240	10 m Rt	"C"	SS-1	0.15-0.61	16						
RB-3	10+240	10 m Rt	"C"	SS-3	1.83-2.29	10						8.64
RB-32	5+100	6 m Lt	S-US20-B	SS-1	0.30-0.76	16						
RB-32	5+100	6 m Lt	S-US20-B	SS-2	1.07-1.52	20						
RB-33	5+240	6 m Rt	S-US20-B	SS-2	1.07-1.52	18						
RB-36	5+620	7 m Lt	S-US20-B	SS-1	0.46-0.91	23						
RB-38	5+060	2 m Rt	S-2-B	SS-3	1.83-2.29	20	129.6	108.0	1988	10.2		
RB-39	5+100	2 m Rt	S-3-B	SS-2	1.07-1.52	34						
RB-4	10+360	10 m Rt	"C"	SS-1	0.15-0.61	15						

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SUMMARY OF SPECIAL LABORATORY TEST RESULTS

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20

Project Number: STP-4320 (7), CTL No.: 00-050061

Boring No.	Station	Offset	Line	Sample No.	Depth	Moisture Content (%)	Wet Density (pcf)	Dry Density (pcf)	Unconfined Compression (psf)	Failure Strain (%)	Loss on Ignition (%)	pH
RB-4	10+360	10 m Rt	"C"	SS-2	0.91-1.37	18						
RB-5	10+480	5 m Rt	"C"	SS-1	0.46-0.91	13						
RB-5	10+480	5 m Rt	"C"	SS-2	1.07-1.52	11						
RB-7	10+720	5 m Rt	"C"	SS-1	0.15-0.61	17						
RB-7	10+720	5 m Rt	"C"	BS-1	0.15-0.91	15						7.94
RB-7	10+720	5 m Rt	"C"	SS-2	0.91-1.37	13						
RB-7	10+720	5 m Rt	"C"	SS-5	4.11-4.57	19						
RB-8	10+840	C/L	"C"	SS-1	0.15-0.61	9						
RB-8	10+840	C/L	"C"	SS-4	2.59-3.05	15						
RB-9	10+960	C/L	"C"	SS-2	0.61-1.07	15						
RB-9	10+960	C/L	"C"	SS-4	1.83-2.29	19						
RS-21A	12+200	10 m Lt	"C"	AC-3	0.30-0.46	18						
TB-1	10+128	20 m Rt	"C"	SS-1	0.46-0.91	28						
TB-2	10+126.5	20 m Lt	"C"	SS-1B	0.30-0.61	21						

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SUMMARY OF SPECIAL LABORATORY TEST RESULTS

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20

Project Number: STP-4320 (7), CTL No.: 00-050061

APPENDIX D

GENERALIZED SUBSURFACE PROFILE ANALYSIS

For Box Culvert @ Station 10+122
For Pipe Culvert @ Station 12+630

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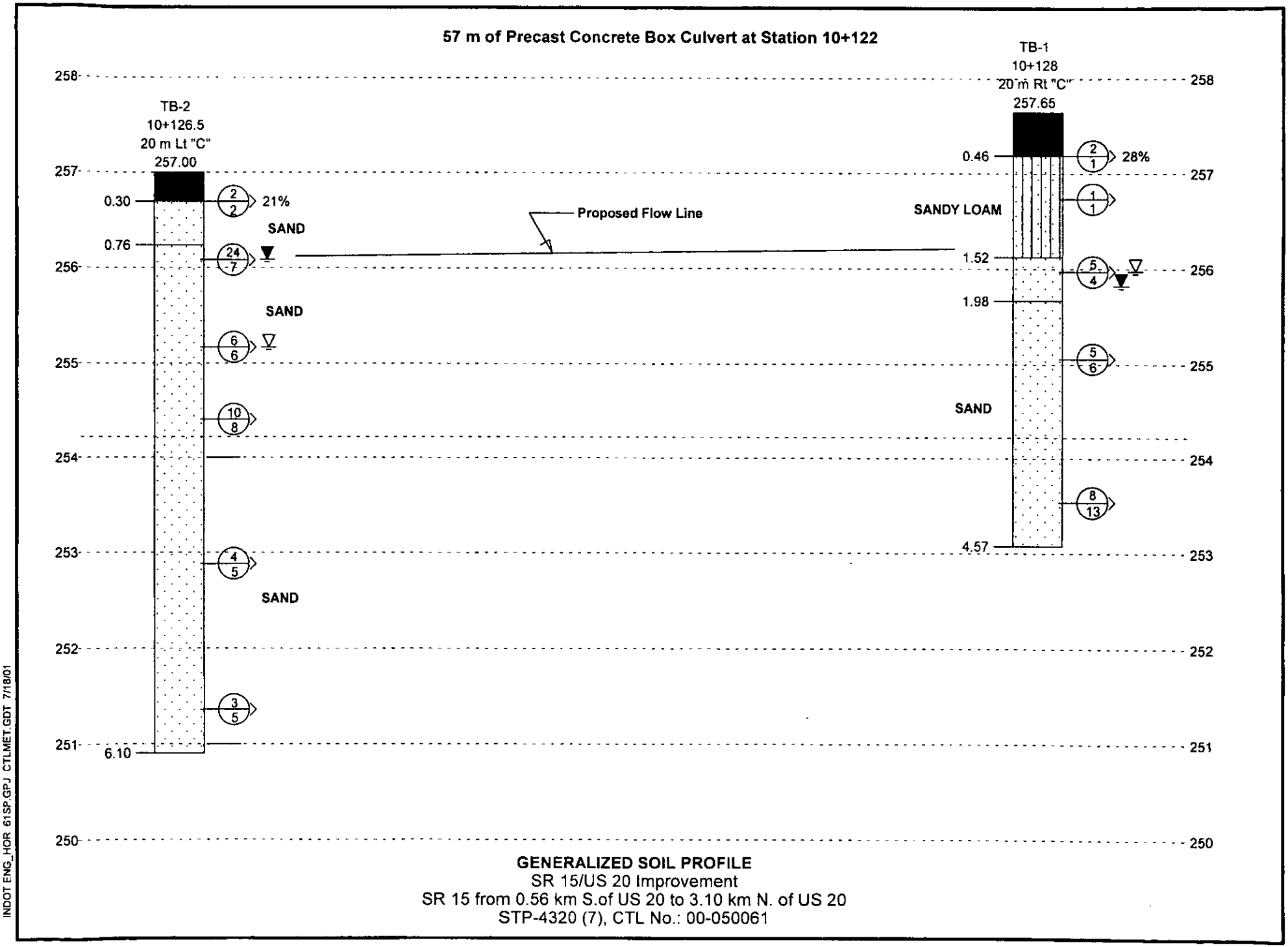

GENERALIZED SOIL PROFILE
SR 15/US 20 Improvement
SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20
STP-4320 (7), CTL No.: 00-050061

INDOT ENG_HOR 61SP.GPJ CTLMET.GDT 7/18/01

FOUNDATION RECOMMENDATIONS

Structure No.: 3600mm x 1800mm x 57 m of Precast Concrete Box Culvert @ Station 10+122
Location: SR 15/US 20 Improvement
Project No.: STP-4320 (3)
Des. No.: 8354420
CTL No.: 00-050061

DATA

1. Box Culvert 3600mm x 1800mm (12' x 6') to be placed at Station 10+122 with Flow Line @ Elev. 256.20 (downstream).

2. Assumed wingwalls placed on continuous footings at 4' (1.20 m) below flow line corresponding to elevations between 255.0. Wingwall footings will be placed on medium dense sand.

3. Surface water flowing through existing structure was observed during field investigation.

BOX CULVERT

1. The box culvert may be placed on existing soils provided that all loose sand are densified with a vibratory roller or removed and replaced with "B" Borrow or No. 53 aggregate to a minimum depth of 24 inches. The upper 24 inches should be compacted 100% of the maximum dry density.

2. Groundwater and surface water is expected during construction.

WINGWALLS

1. Footings are expected on medium dense sand with:
   N = 11 & 18 bpf
   Estimated $\phi = 30°$, $c = 0$, γ_t =110 pcf & γ_{sub} = 110-62.4 = 47.6 pcf

2. Water expected above footings (longterm)

3. Assume depth of footings, D_f = At ±4' below flow line, and
   B = 2'
   B = 3'
   B = 4'
   B = 5'

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ALLOWABLE BEARING CAPACITY

Ultimate Bearing Capacity, $q_{ult} = c\,N_c + \gamma_{sub}\,D_f\,N_q + 0.5\,\gamma_{sub}\,B\,N_\gamma$
Allowable Bearing Capacity, $q_{all} = (q_{ult} - \gamma_{sub}\,D_f) \div FS$

ϕ	c	N_c	N_q	N_γ	D_f	B	γ_t	γ_{sub}	FS	q_{ult}	q_{all}	**Recommended q_{all}**	
												psf	**kPa**
30	0	30.14	18.40	22.40	4	2	110	47.6	3	4570	1460	**1500**	**70**
30	0	30.14	18.40	22.40	4	3	110	47.6	3	5103	1701	**1700**	**80**
30	0	30.14	18.40	22.40	4	4	110	47.6	3	5636	1879	**1800**	**90**
30	0	30.14	18.40	22.40	4	5	110	47.6	3	6169	2056	**2000**	**100**

N_c, N_q, N_γ after Meyerhof

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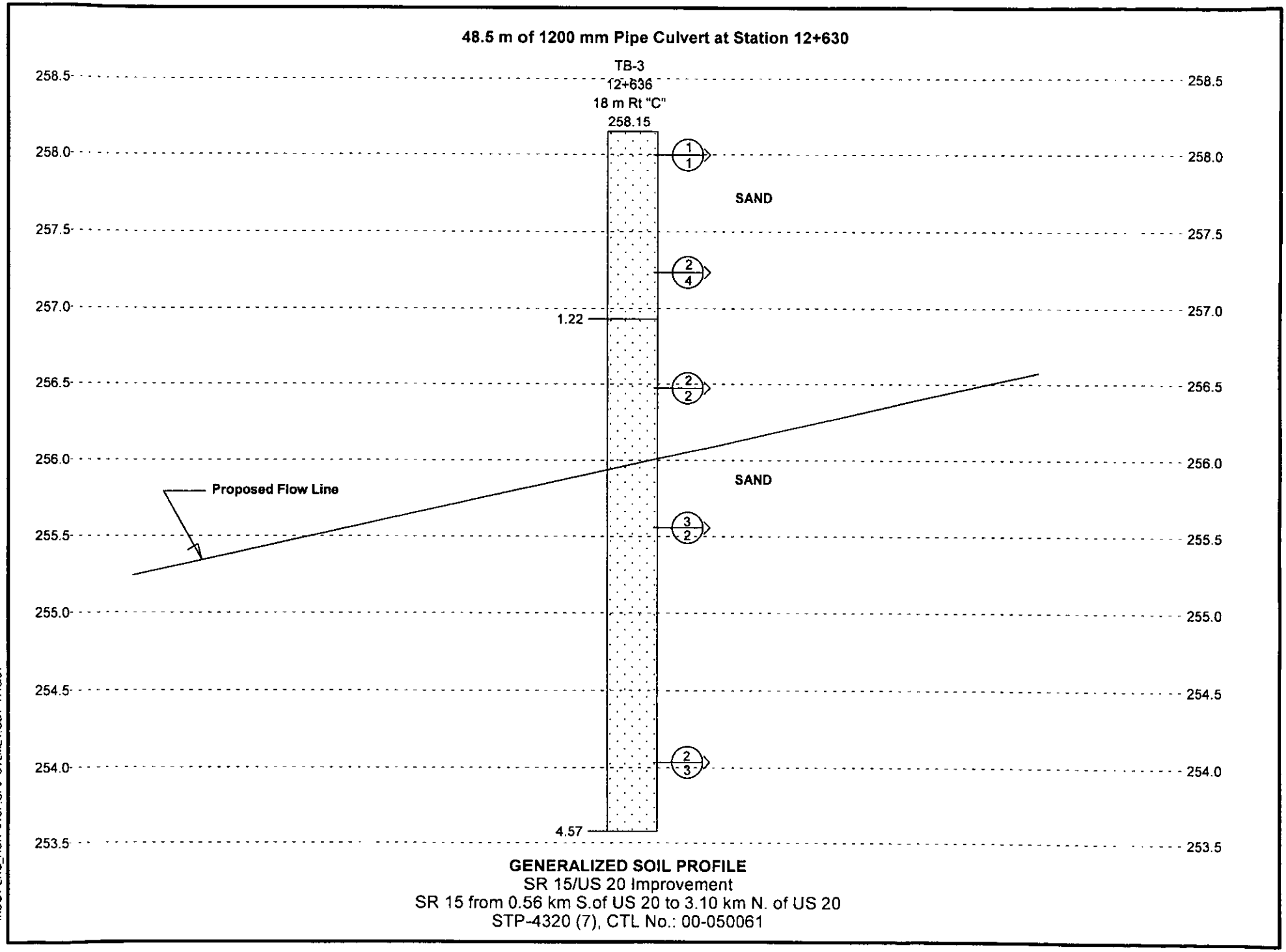

GENERALIZED SOIL PROFILE
SR 15/US 20 Improvement
SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20
STP-4320 (7), CTL No.: 00-050061

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APPENDIX E

SETTLEMENT ANALYSIS OF EMBANKMENT

APPENDIX C

LABORATORY TEST RESULTS

Summary of Classification Test Results
Grain Size Distribution Curves
Unconfined Compression Curves
Standard Moisture-Density Test Results
CBR Test Results
Summary of Special Laboratory Test Results

Lab No.	Boring No.	Station	Offset	Line	Sample No.	Depth	Soil Classification	AASHTO Group	Percent Passing (Sieve No.)			Grain Size Distribution (%)				WC	LL	PL	PI	Max. Dry Density (Kg/m^3)	Optimum Moisture Content (%)	CBR @ 93%	CBR @ 97%
									10	40	200	Gravel	Sand	Silt	Clay								
LAB 1	RB-3	10+240	10 m Rt	"C"	SS-3	1.83-2.29	SANDY CLAY LOAM	A-4 (0)	92.2	82.1	49.4	7.8	42.8	29.1	20.3	10	18	11	7				
LAB 2	RB-7	10+720	5 m Rt	"C"	BS-1	0.15-0.91	CLAY	A-6 (7)	95.4	90.2	67.1	4.6	28.3	32.0	35.1	15	29	14	15	1890.0	13.7	2.1	2.7
LAB 3	RB-10	11+020	20 m Lt	"C"	SS-5	4.11-4.57	SANDY LOAM	A-4 (0)	90.2	81.7	41.7	9.8	48.5	30.6	11.1	14	14	13	1				
LAB 4	RB-12	11+080	30 m Rt	"C"	SS-8	8.69-9.14	SAND	A-1-b (0)	85.7	19.4	19.0	14.3	66.7	19.0		5	NP	NP	NP				
LAB 5	RB-23	12+440	C/L	"C"	SS-4	2.59-3.05	LOAM (Till)	A-4 (1)	96.1	88.5	58.6	3.9	37.5	39.2	19.4	13	20	13	7				

SUMMARY_CLASSIFICATION 00-5061.GPJ CTLMET.GDT 7/15/01

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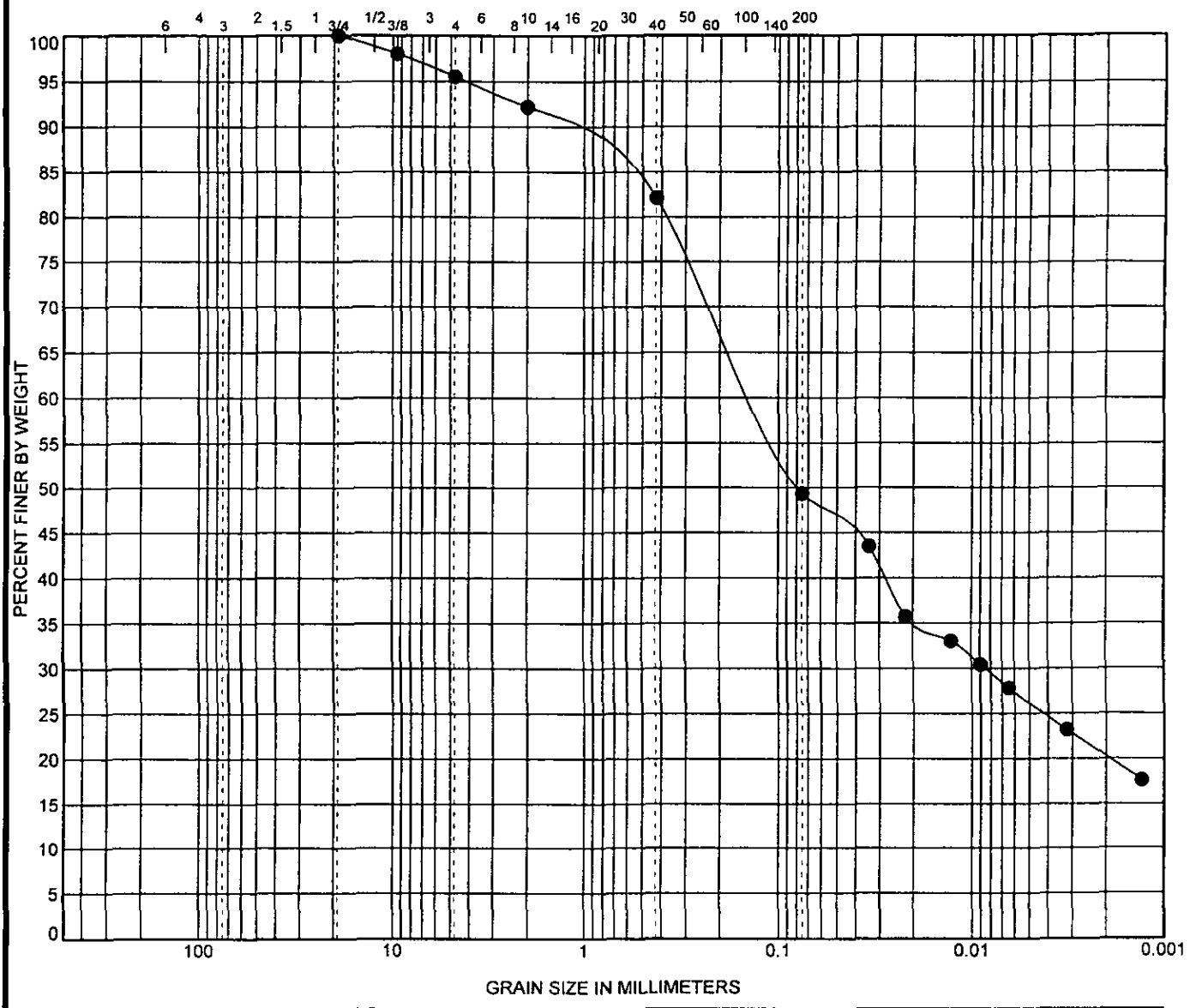
SUMMARY OF CLASSIFICATION TEST RESULTS

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20

Project Number: STP-4320 (7), CTL No.: 00-050061



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Boring No	RB-3	Classification	MC	LL	PL	PI	Cc	Cu
Sample	SS-3	SANDY CLAY LOAM	10	18	11	7		
Depth	1.83-2.29	A-4(0)						
Station	10+240	LAB 1						
Offset	10 m Rt							
Line	"C"							

Remarks	D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
	19	0.132	0.078	0.009		7.8	42.8	29.1	20.3

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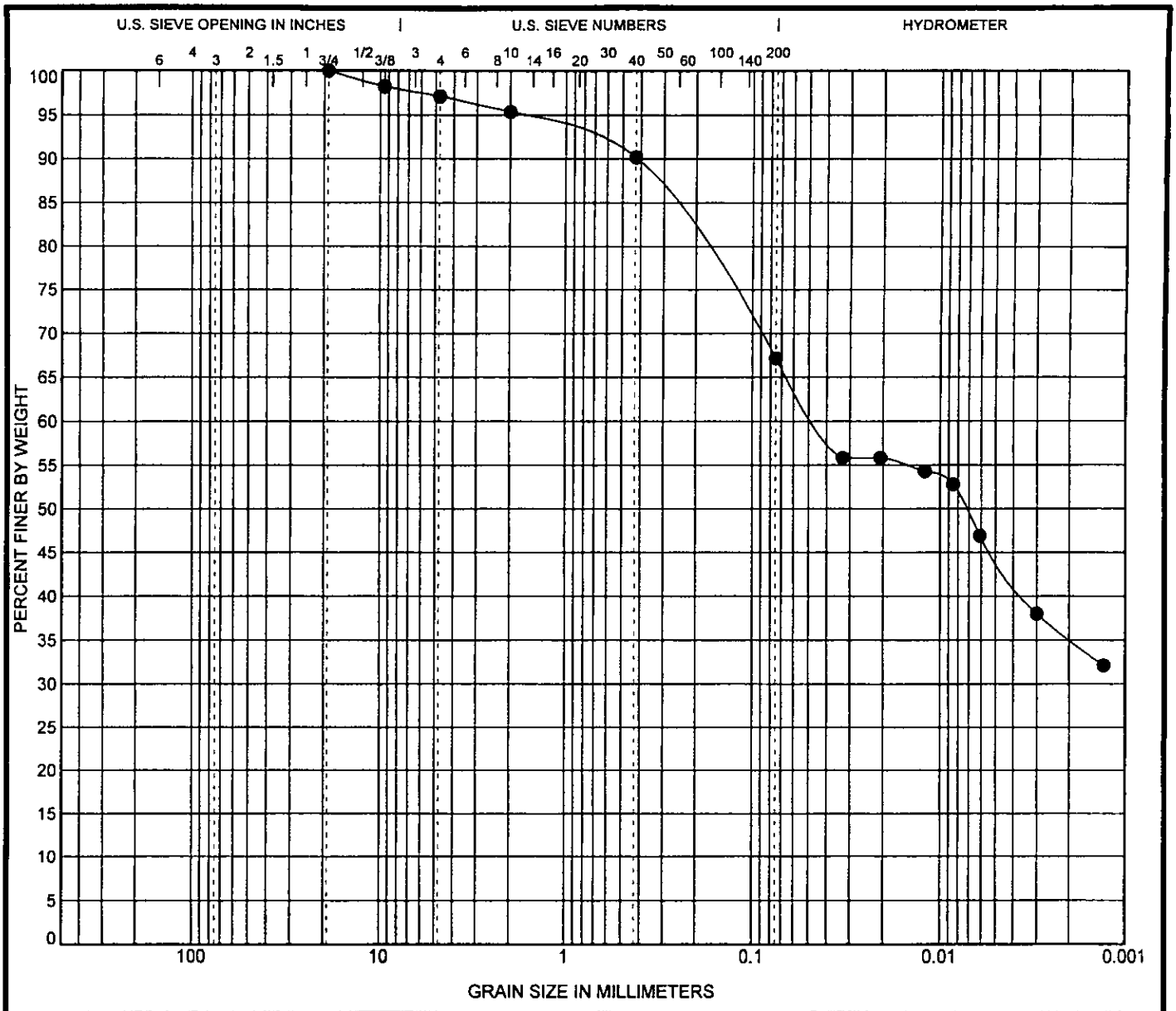
GRAIN SIZE DISTRIBUTION

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20

Project Number: STP-4320 (7), CTL No.: 00-050061



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Boring No.	RB-7	Classification	MC	LL	PL	PI	Cc	Cu
Sample	BS-1	CLAY	15	29	14	15		
Depth	0.15-0.91	A-6(7)						
Station	10+720	LAB 2						
Offset	5 m Rt							
Line	"C"							

Remarks	D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
	19	0.044	0.007			4.6	28.3	32.0	35.1

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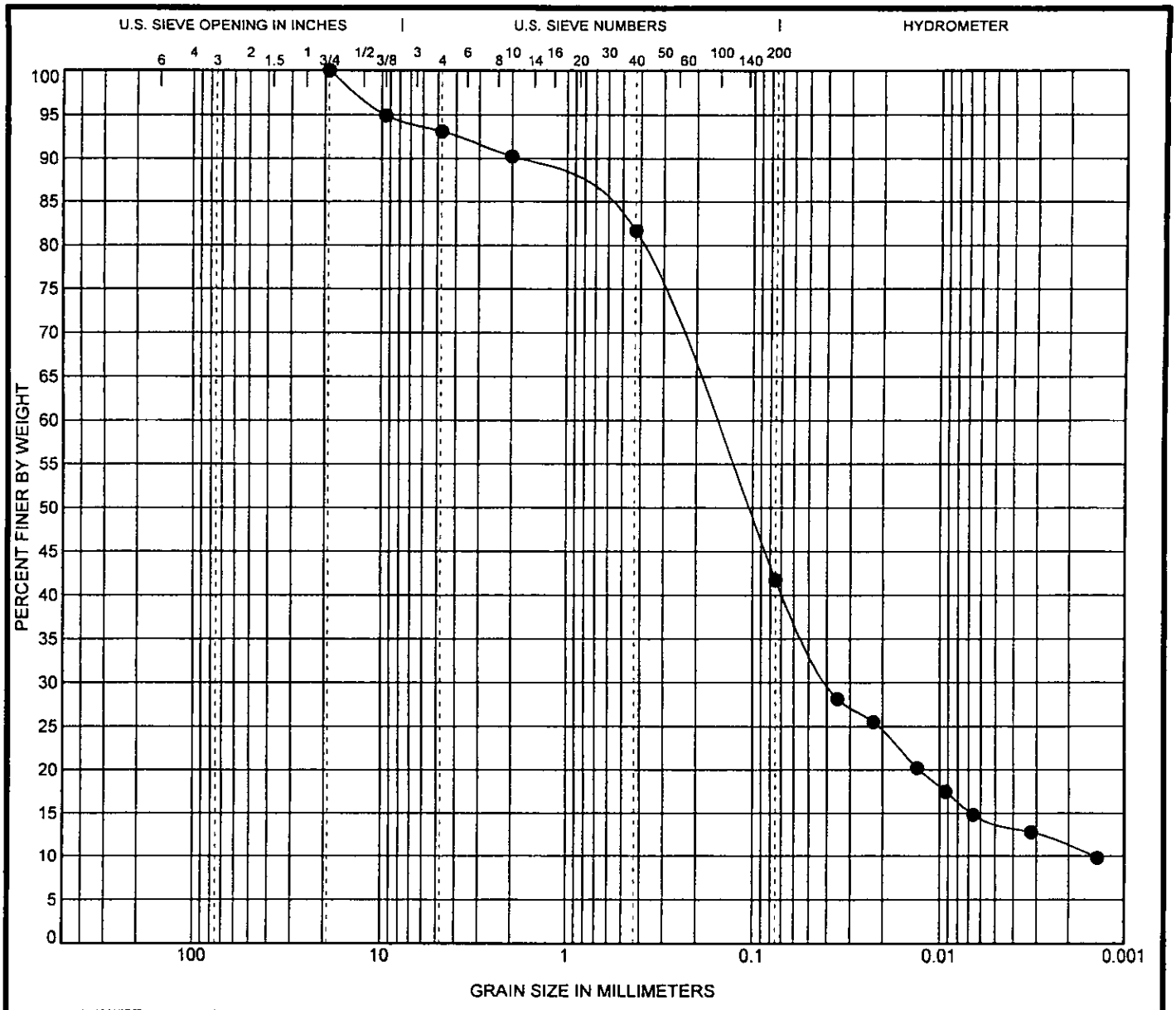
GRAIN SIZE DISTRIBUTION

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20

Project Number: STP-4320 (7), CTL No.: 00-050061



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Boring No.	RB-10	Classification	MC	LL	PL	PI	Cc	Cu
Sample	SS-5	SANDY LOAM	14	14	13	1	6.21	112.06
Depth	4.11-4.57	A-4(0)						
Station	11+020	LAB 3						
Offset	20 m Lt							
Line	"C"							

Remarks	D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
	19	0.166	0.107	0.039	0.001	9.8	48.5	30.6	11.1

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Indianapolis, Indiana 46250
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Fax: 317-585-8621
e-mail: ctlin@ctleng.com

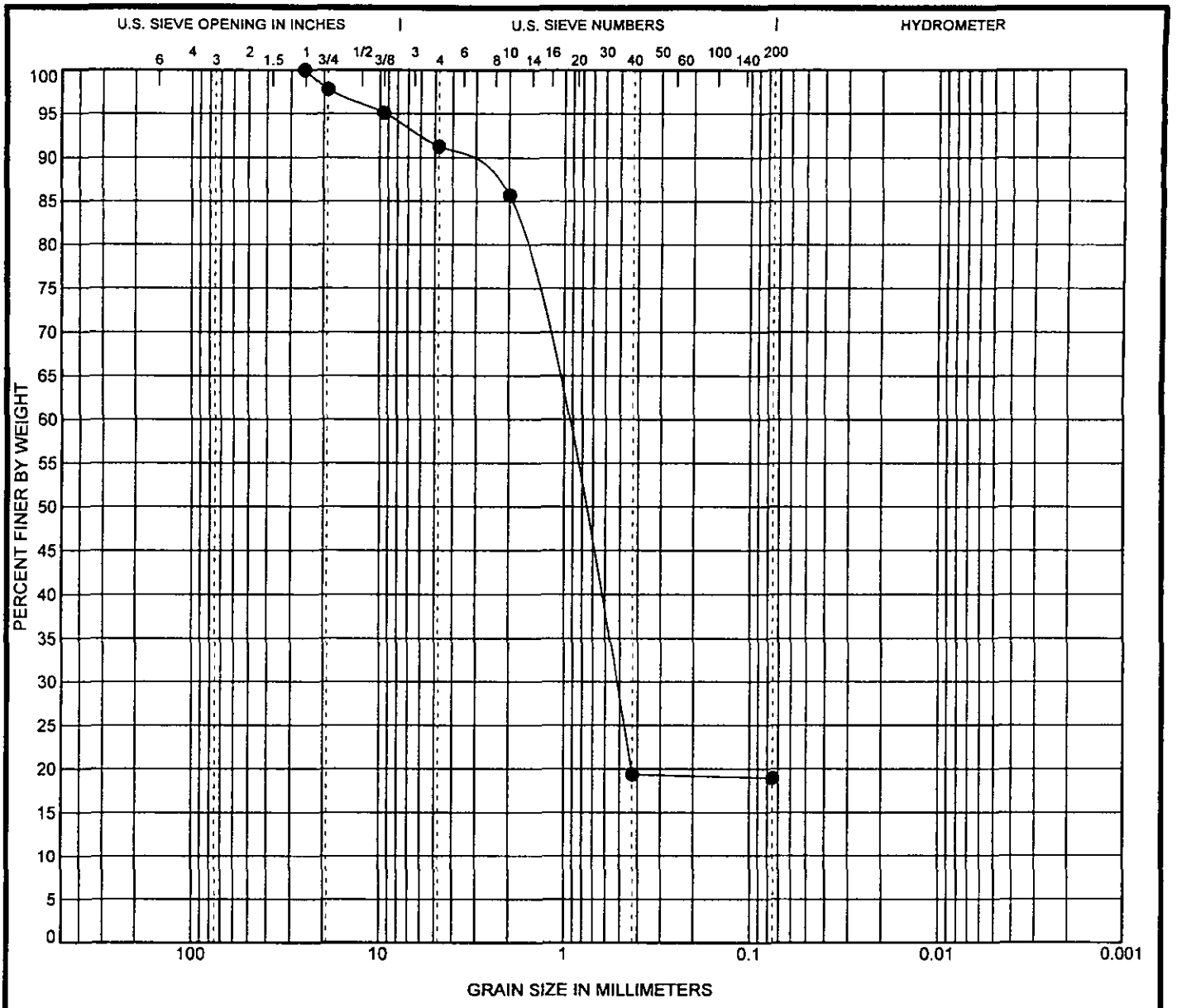
GRAIN SIZE DISTRIBUTION

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20

Project Number: STP-4320 (7), CTL No.: 00-050061

INDOT_GRAIN_SIZE 00-5061.GPJ CTLMET.GDT 7/9/01



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Boring No.	RB-12	Classification	MC	LL	PL	PI	Cc	Cu
Sample	SS-8	SAND	5	NP	NP	NP		
Depth	8.69-9.14	A-1-b(0)						
Station	11+080	LAB 4						
Offset	30 m Rt							
Line	"C"							

Remarks	D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
	25.4	1.098	0.869	0.545		14.3	66.7	19.0	

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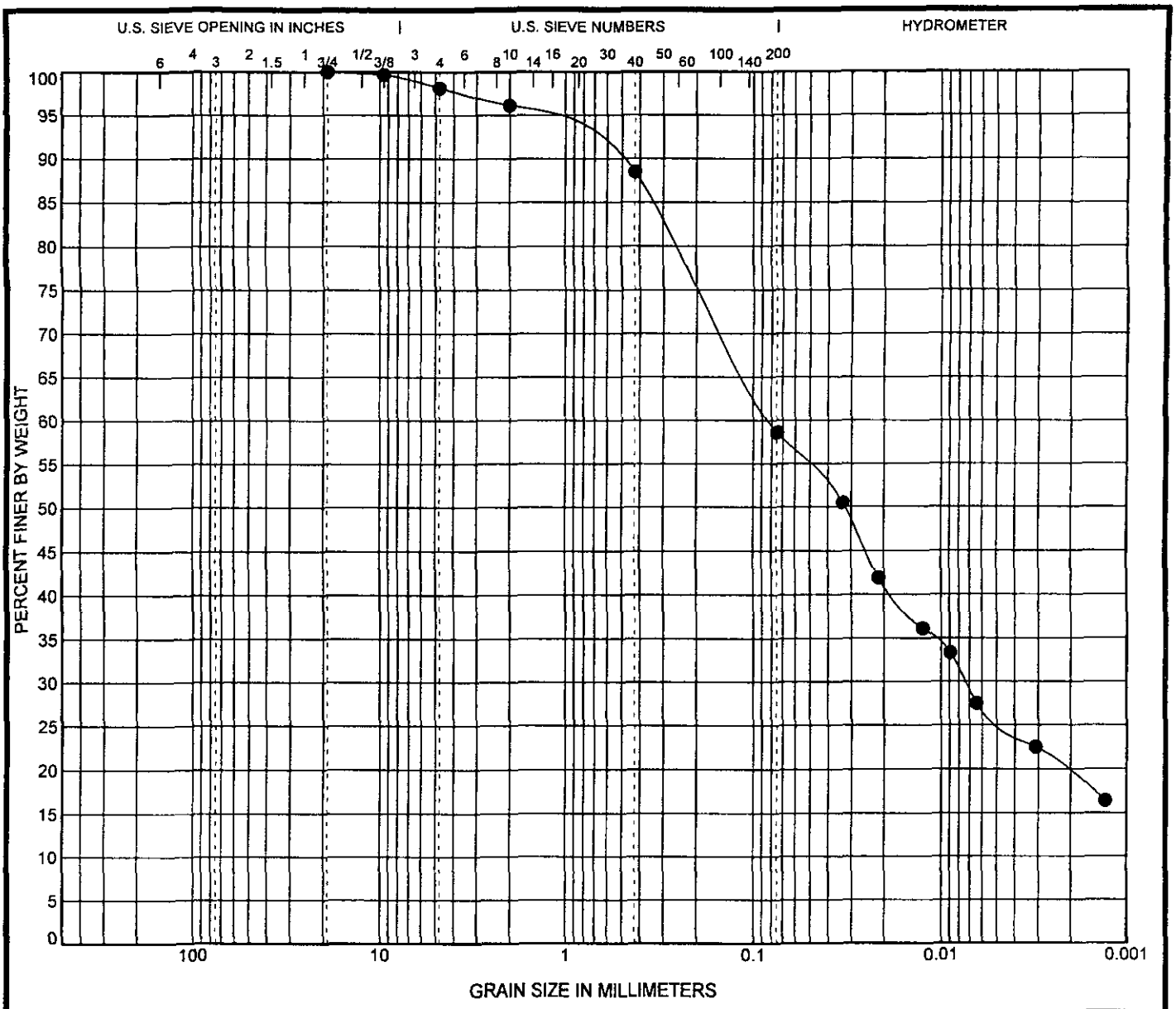
GRAIN SIZE DISTRIBUTION

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20

Project Number: STP-4320 (7), CTL No.: 00-050061



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Boring No.	RB-23	Classification	MC	LL	PL	PI	Cc	Cu
Sample	SS-4	LOAM (TIII)	13	20	13	7		
Depth	2.59-3.05	A-4(1)						
Station	12+440	LAB 5						
Offset	C/L							
Line	"C"							

Remarks	D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
	19	0.081	0.032	0.007		3.9	37.5	39.2	19.4

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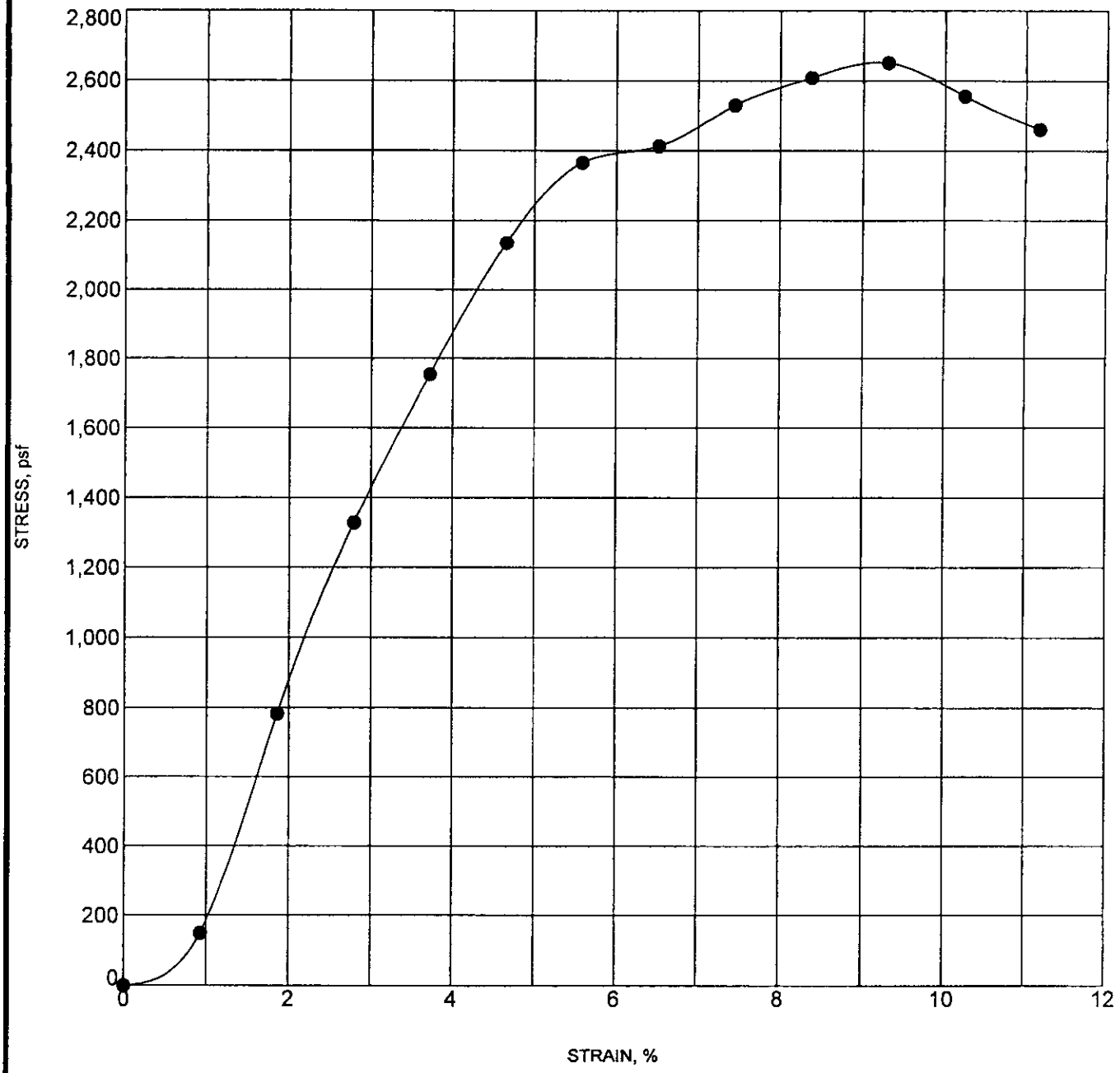
GRAIN SIZE DISTRIBUTION

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20

Project Number: STP-4320 (7), CTL No.: 00-050061



Boring Information		Test Results		
Boring No.	**RB-11**	Natural Moisture Content (%)	**17**	
Sample	**SS-5**	Natural Wet Density, pcf (kg/m^3)	**134.6**	**(2158)**
Depth (m)	**4.11 - 4.57**	Natural Dry Density, pcf (kg/m^3)	**115.1**	**(1844)**
Station	**11+020**	Unconfined Compression Strength, psf (kN/m^2)	**2651**	**(127)**
Offset	**20 m Rt**	Failure Strain (%)	**9.3**	
Line	**"C"**			

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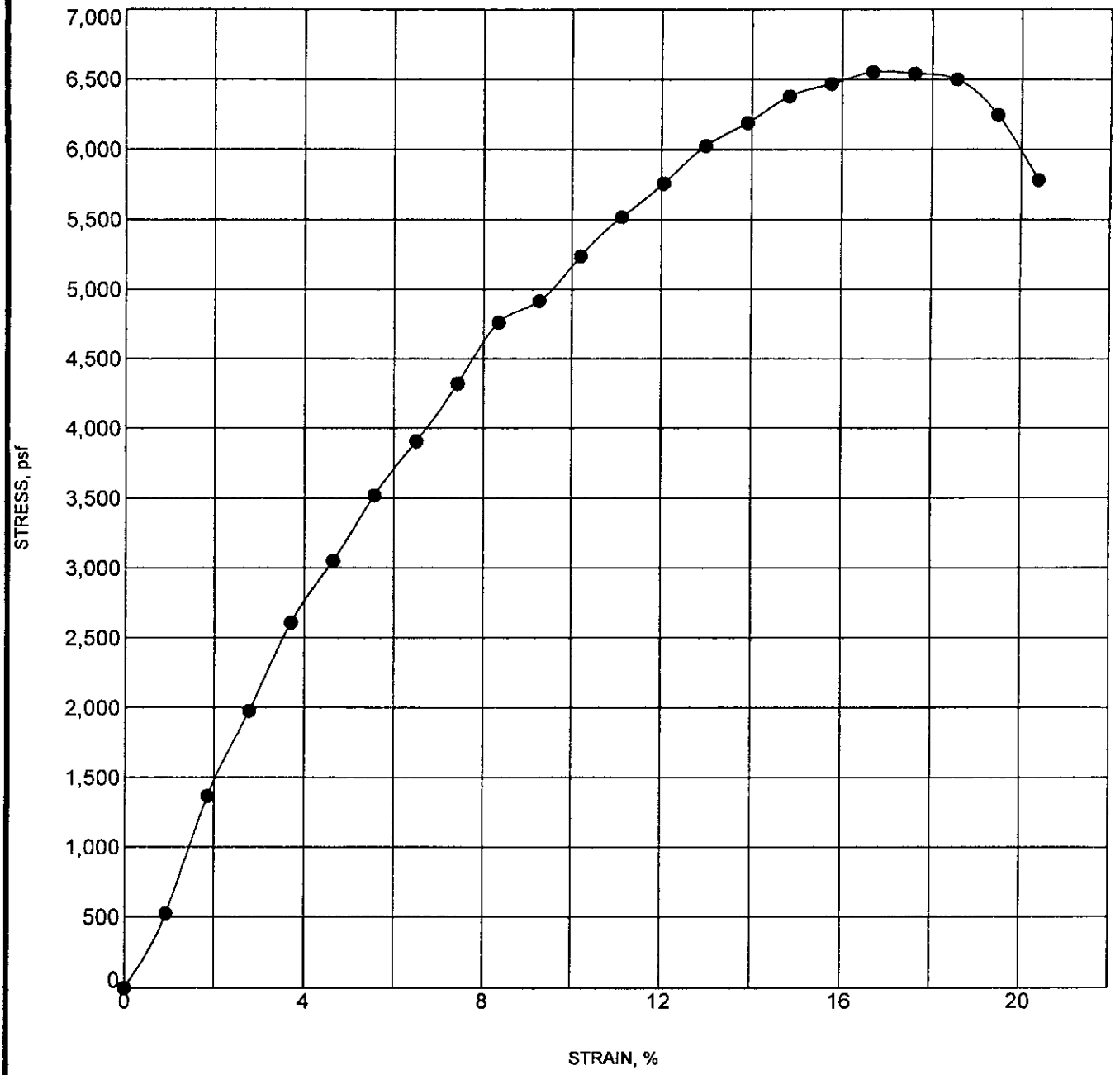
UNCONFINED COMPRESSION TEST

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20

Project Number: STP-4320 (7), CTL No.: 00-050061



Boring Information		Test Results		
Boring No.	**RB-12**	Natural Moisture Content (%)	**11**	
Sample	**SS-4**	Natural Wet Density, pcf (kg/m^3)	**141.5**	**(2268)**
Depth (m)	**2.59 - 3.05**	Natural Dry Density, pcf (kg/m^3)	**127.5**	**(2043)**
Station	**11+080**	Unconfined Compression Strength, psf (kN/m^2)	**6552**	**(314)**
Offset	**30 m Rt**	Failure Strain (%)	**16.7**	
Line	**"C"**			

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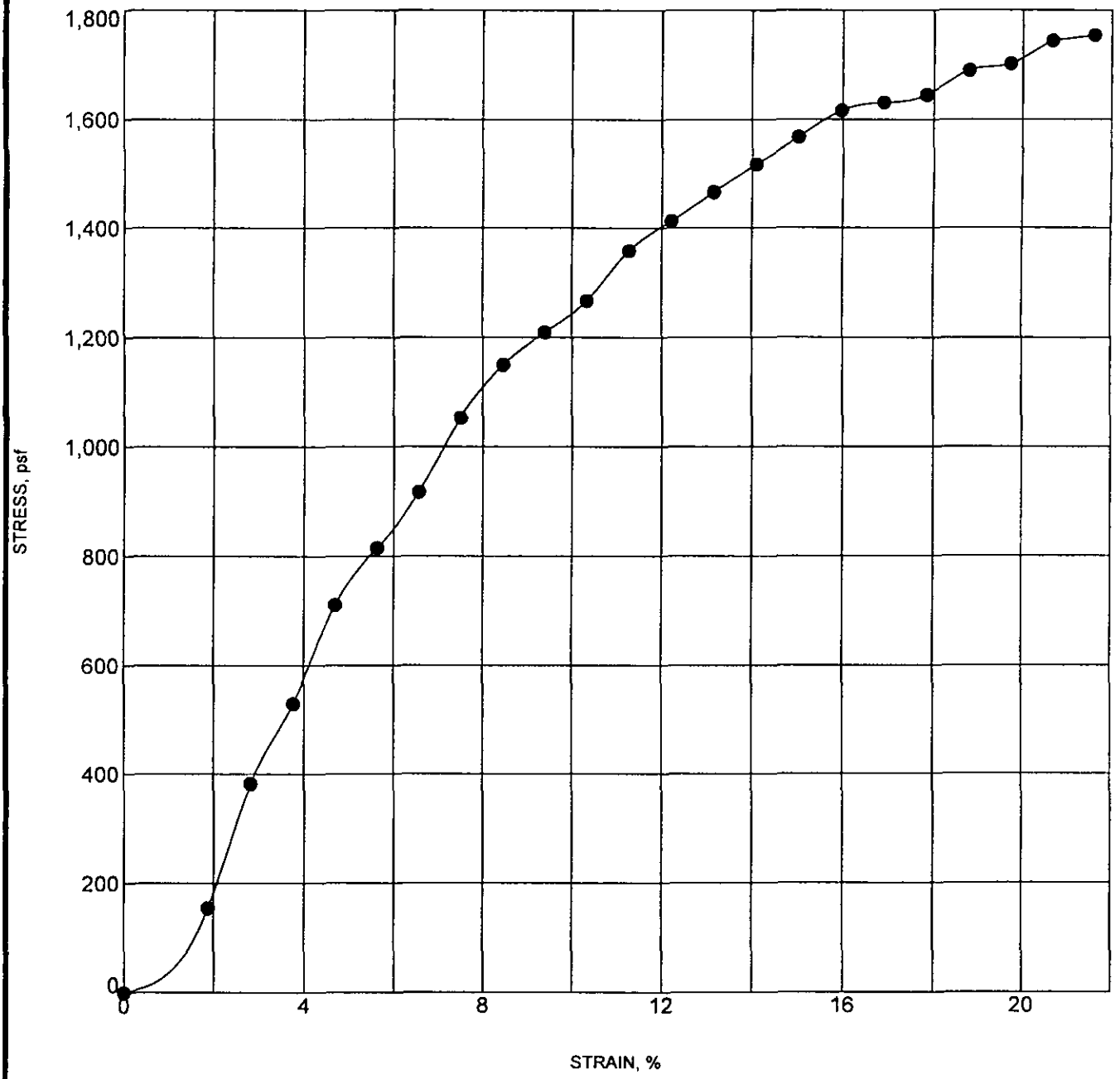
UNCONFINED COMPRESSION TEST

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20

Project Number: STP-4320 (7), CTL No.: 00-050061



Boring Information		Test Results		
Boring No.	RB-18	Natural Moisture Content (%)	18	
Sample	SS-3	Natural Wet Density, pcf (kg/m^3)	141.6	(2269)
Depth (m)	1.83 - 2.29	Natural Dry Density, pcf (kg/m^3)	120.0	(1923)
Station	11+800	Unconfined Compression Strength, psf (kN/m^2)	1754	(84)
Offset	5 m Lt	Failure Strain (%)	21.6	
Line	"C"			

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UNCONFINED COMPRESSION TEST

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20

Project Number: STP-4320 (7), CTL No.: 00-050061

SUBSURFACE INVESTIGATION
ADDENDUM 2

DES. NO.: 8354420
PROJECT NO.: STP-4320(7)
SR 15 FROM 0.34 MI. S. OF US 20 TO 1.92 MI. N. OF US 20
ELKHART COUNTY, INDIANA
CTL PROJECT NO.: 05050045IND

PREPARED FOR:

INDIANA DEPARTMENT OF TRANSPORTATION
MATERIALS AND TESTS DIVISION
120 SOUTH SHORTRIDGE ROAD
INDIANAPOLIS, INDIANA 46219

PREPARED BY:

CTL ENGINEERING OF INDIANA, INC.
6848 HILLSDALE COURT
INDIANAPOLIS, INDIANA 46250

NOVEMBER 23, 2005

CTL ENGINEERING

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November 23, 2005

Indiana Department of Transportation
Materials and Tests Division
120 South Shortridge Road
Indianapolis, Indiana 46219

Attention: Mr. Athar Khan, P.E.
Chief Geotechnical Engineer

Reference: Subsurface Investigation – Addendum 2
Des. No.: 8354420
Project No.: STP-4320(7)
SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20
Elkhart County, Indiana
CTL Project No.: 05050045IND

Dear Mr. Khan:

In accordance with your authorization to proceed, CTL Engineering, Inc. has completed the subsurface investigation on the above referenced site.

The report includes the results of our field and laboratory testing, and our analyses and recommendations for the foundations and earth related phases of the project.

Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact our office at (317) 585-8277.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.
Principal Engineer

cc: Mr. Shahid Siddiqui, INDOT - Materials and Tests Division

SUMMARY OF SUBSURFACE INVESTIGATION

A subsurface investigation report for the roadway reconstruction on SR 15 and US 20 was prepared and submitted on August 15, 2001. Also, a subsurface investigation – Addendum 1 report was prepared and submitted on March 2, 2004 for the proposed sewer lines. This report is being submitted as an addendum 2. Under this addendum, the project involves the design and construction of one culvert on SR 15 and a culvert extension on US 20 as described below.

Location	Structure No.	Station	Line	Box Culvert Size	Boring No.	Flow Line Elevation	
						Up Stream	Down Stream
SR 15	62	13+885	"B" & "C"	25m of 1194mm x 1804mm Pipe	TB-1 & TB-2	249.00	248.67
US 20	69	5+694	"S-US20-B"	6.0 m of 3910mm x 2235mm Multi Plate Box Culvert (Extension)	TB-3	N/A	N/A

A subsurface investigation for the subject sites has been completed and a summary of our findings and recommendations is reported below. Detailed foundation recommendations and construction considerations are provided in the subsurface investigation report.

FINDINGS

Test borings TB-1 and TB-2, drilled at Structure No. 62, encountered fill material to depths of 3.5 feet (1.07m) and 8.5 feet (2.59m). The fill is described as sand and gravel, sand, sandy loam and/or loam containing varying amounts of roots, organic matter and/or brick fragments. Below the fill, both test borings encountered sand deposits. Boring TB-3, drilled at Structure No. 69, encountered possible fill material over creek sediments to a depth of 8.5 feet (2.59m). Below, layers of clay loam, sand and silt were encountered throughout the drilled depth

Structure No. 62 on SR 15

The borings encountered very loose sand or on very stiff sandy loam fill at the culvert invert elevation. Groundwater is expected during excavation and placement of this culvert. It is recommended that all fill material and very loose sand be removed to a depth of 2 feet (600mm) and replaced with "B" Borrow material or No. 53 aggregate to provide a uniform subgrade below the culvert. A layer of geogrid Type 1 would be needed at the bottom of the excavation. The excavation should extend for a horizontal distance of 5 feet (1.5m) beyond the limits of the culvert.

Structure No. 69 on US 20

Very soft creek sediments containing organic matter was encountered at the proposed culvert extension invert elevation. Surface runoff and/or seepage water could be encountered. It is recommended that the soft creek sediments and/or soil containing organic matter be removed and replaced with "B" Borrow material or No. 53 aggregate. It is estimated that the excavation could extend to a depth of 2.5 feet (750mm) below the proposed invert elevation of the culvert. A layer of geogrid Type 1 would be needed at the bottom of the excavation. Removal of the undesirable soil deposits should extend for a horizontal distance of 5 feet (1.5m) beyond the limits of the culvert.

Wingwall footings may be designed using the soil parameters provided in the geotechnical report.

This summary is provided for general information only, and it should not be used as the only source for any design, estimating or bidding. Detailed recommendations are provided in the geotechnical report.

GTL ENGINEERING

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APPENDIX A — GENERAL SITE PLAN
BORING LOCATION PLANS

APPENDIX B — TEST BORING RECORDS

APPENDIX C — LABORATORY TEST RESULTS

APPENDIX D — STRUCTURE NO. 62

APPENDIX E — STRUCTURE NO. 69

I. PROJECT LOCATION AND DESCRIPTION

The project is identified as SR 15 from 0.34 miles south of US 20 to a point 1.92 miles north of US 20 in Elkhart County, Indiana. The project involves the design and construction of two culverts as described in Table 1.

Table 1 – Culverts

Location	Structure No.	Station	Line	Box Culvert Size	Boring No.	Flow Line Elevation	
						Up Stream	Down Stream
SR 15	62	13+885	"B" & "C"	25m of 1194mm x 1804mm Pipe	TB-1 & TB-2	249.00	248.67
US 20	69	5+694	"S-US20-B"	6.0 m of 3910mm x 2235mm Multi Plate Box Culvert (Extension)	TB-3	N/A	N/A

Note that a subsurface investigation report for the roadway reconstruction on SR 15 and US 20 was prepared and submitted on August 15, 2001. Also, a subsurface investigation – Addendum 1 report was prepared and submitted on March 2, 2004 for the proposed sewer lines. This report is being submitted as an addendum 2.

II. SUBSURFACE INVESTIGATION

Three (3) test borings, designated as TB-1, TB-2 and TB-3, were drilled near the proposed culverts to a depth of 20 feet (6.10m) each. TB-1 and TB-2 were drilled for Structure No. 62 and TB-3 was drilled for Structure 69. Locations of the test borings are shown on the Boring Location Plans in Appendix A.

The test borings were advanced with an All-Terrain Vehicle (ATV) drilling rig utilizing hollow stem augers (HSA) on October 25, 2005. Standard Penetration tests were conducted using a 140-pound automatic hammer falling 30 inches to drive a 2-inch O.D. split barrel sampler for 18 inches.

Soil samples obtained from the drilling operation were preserved in glass jars and visually classified in the field and laboratory. Representative soil samples were tested for Natural Moisture Content, pH, Loss on Ignition, Atterberg Limits and Grain Size Distribution.

Drilling, soil sampling and laboratory testing have been performed following INDOT, AASHTO and current ASTM procedures. Results from field and laboratory tests are shown in Appendix B and Appendix C.

Stations, offsets and surface elevations of the test borings were interpolated from the site plans and cross sections provided to us by INDOT.

III. FINDINGS

A. Soil Profile

Test boringsTB-1 and TB-3 encountered 10 to 12 inches of topsoil at the surface. Boring TB-2 encountered 5 inches of asphalt concrete over 4 inches of cement concrete.

Below the surface cover, TB-1 and TB-2 encountered fill material to depths of 3.5 feet (1.07m) and 8.5 feet (2.59m). The fill is described as sand and gravel, sand, sandy loam and/or loam containing varying amounts of roots, organic matter and/or brick fragments. Below the fill, both test borings encountered sand deposits. A layer of clay loam was encountered in TB-1 at a depth of 19 to 20 feet (5.79m to 6.10 m).

Below the surface cover in test boring TB-3, possible fill material was encountered to a depth of 4 feet (1.22m). Below, silty clay and sandy loam deposits were encountered to a depth of 8.5 feet (2.59m). These deposits are described as creek sediments, which contain traces to little organic matter. Below, layers of clay loam, sand and silt were encountered throughout the drilled depth of 20 feet (6.10m).

Detailed information of soil types, natural moisture content and standard penetration tests are shown on the enclosed test boring records in Appendix B and appended soil profile sheets in Appendix D and E.

B. Groundwater

Groundwater and/or seepage water was encountered in TB-1 and TB-2 at depths of 4.0 feet (1.22m) and 5.6 feet (1.70m), respectively. Groundwater was encountered in TB-3 at a depth of 13 feet (3.96m). Refer to the attached test boring records in Appendix B for detailed groundwater readings.

IV. DISCUSSION AND RECOMMENDATIONS

Based upon the soil data obtained from field and laboratory testing, foundation recommendations for each culvert are provided in the following paragraphs.

A. Structure No. 62 on SR 15

The borings encountered very loose sand or on very stiff sandy loam fill at the culvert invert elevation. Groundwater is expected during excavation and placement of this culvert.

Based upon the above findings, it is recommended that all fill material and very loose sand be removed to a depth of 2 feet (600mm) and replaced with "B" Borrow material or No. 53 aggregate to provide a uniform subgrade below the culvert. A layer of geogrid Type 1 would most likely be needed at the bottom of the excavation. The excavation should extend for a horizontal distance of 5 feet (1.5m) beyond the limits of the culvert.

B. Structure No. 69 on US 20

Very soft creek sediments containing organic matter were encountered at the invert elevation of the proposed culvert extension. Surface runoff and/or seepage water could be encountered depending upon the time of construction and amounts of precipitation.

Based upon the above findings, it is recommended that the soft creek sediments and/or soil containing organic matter be removed and replaced with "B" Borrow material or No. 53 aggregate. It is estimated that the excavation could extend to a depth of 2.5 feet (750mm) below the proposed invert elevation of the culvert. A layer of geogrid Type 1 would most likely be needed at the bottom of the excavation. Removal of the undesirable soil deposits should extend for a horizontal distance of 5 feet (1.5m) beyond the limits of the culvert.

Foundation and earthwork recommendations for both culverts are provided in the following paragraphs.

1. The recommended allowable soil bearing pressures and the soil parameters required for the design of footings and wingwalls are provided in Table 2. These values apply to all design loads. Additional soil information may be found in the enclosed Test Boring Records in Appendix B and the soil profiles in Appendix D and E. Note that the allowable soil bearing pressures provided in Table 2 are based on the assumption that the wingwall footings will be placed at 4 feet (1.3m) below the proposed flowline.

2. Settlements of footings may vary at the culvert location due to variations in soil composition, void ratio and loading. It is estimated that total and differential settlements would be within tolerable limits.

3. The pH values obtained from the laboratory testing ranged from 8.4 to 8.7.

4. Temporary excavations in excess of 5.0 feet in depth should be sloped, braced and/or shored according to OSHA requirements. Excavation to bottom of the recommended footing depth and in fill areas may be accomplished using standard excavation equipment.

5. Prior to placement of footings, the recommended soil bearing pressure should be verified and approved by a qualified Engineering Technician under the supervision of a Geotechnical Engineer. Soft and/or loose soils not meeting the recommended soil pressure, should be removed, dried and recompacted or undercut and replaced with lean concrete, No. 53 aggregate, or as otherwise directed by the Engineer.

6. Groundwater and/or surface runoff is expected during construction at Structure 62. At this Structure, the sand deposits containing groundwater extend to Elevation 244.2±. Surface runoff and/or seepage water could be encountered at Structure 69 depending upon the time of construction and amounts of precipitation. Dewatering, if needed, may be accomplished using construction sump pump(s), or any dewatering system approved by the engineer.

7. Borrow type and placement, and drainage structure installations including footings should be in accordance with INDOT Standard Specifications and the culvert manufacturer recommendations.

Table 2 – Soil Parameters for Wingwall Design

Soil Parameters	Estimated Values	
	Structure 62	Structure 69
Allowable Soil Bearing Pressure, psf *	**	1000 ***
Angle of Internal Friction of Foundation Soil (ϕ), degrees	30	0
Friction Angle between Foundation Soil and Concrete (δ), degrees	20	0
Ultimate Cohesion of Foundation Soil (C), psf	0	600
Ultimate Adhesion between Footings and Foundation Soil (C_a), psf	0	400
Friction Angle of Backfill Material, degrees	30	30
Friction Angle between Wall and Backfill (δ_f), degrees	20	20
Unit Weight of Foundation Soil, pcf	115	110

* Allowable soil bearing pressures are provided at a depth of 4 feet below the culvert invert elevations.

**

Width of Footings (feet)	Allowable Soil Bearing pressure (psf)
2	700
3	800
4	900
5	1000
6	1100

*** Undrained shear method used. Recommended soil bearing pressure is estimated for the clay loam encountered between a depth of 2.69 m and 3.96m.

V. CONCLUDING REMARKS

A. Changed Conditions

Should plans for the proposed culverts be changed from those used in preparing this report, CTL Engineering of Indiana, Inc. (CTL) should be notified to make the necessary modifications to our recommendations to account for the changed conditions.

B. Testing and Observation

Experience shows that the subsurface soil conditions in an area sometimes vary from the ones indicated in the test borings at their specific locations. It is therefore recommended that an Engineering Technician, under the supervision of a qualified Professional Engineer be retained on the site to monitor the construction of spread footings and earthwork operations.

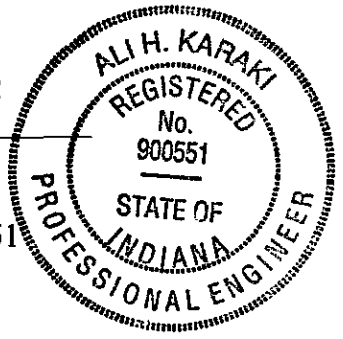
C. Closure

CTL has prepared this report for your use in accordance with generally accepted soil and foundation engineering practices. Analyses, conclusions, recommendations and other work product of CTL are instruments of service for this project only.

CTL assignment does not include, nor does this geotechnical report address the environmental aspects of this site.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.



Ali Karaki, P.E.
Principal Engineer
Indiana Reg. No. 60900551

Paul L. Douglass, P.E.
Principal Engineer
Indiana Reg. No. 60012388

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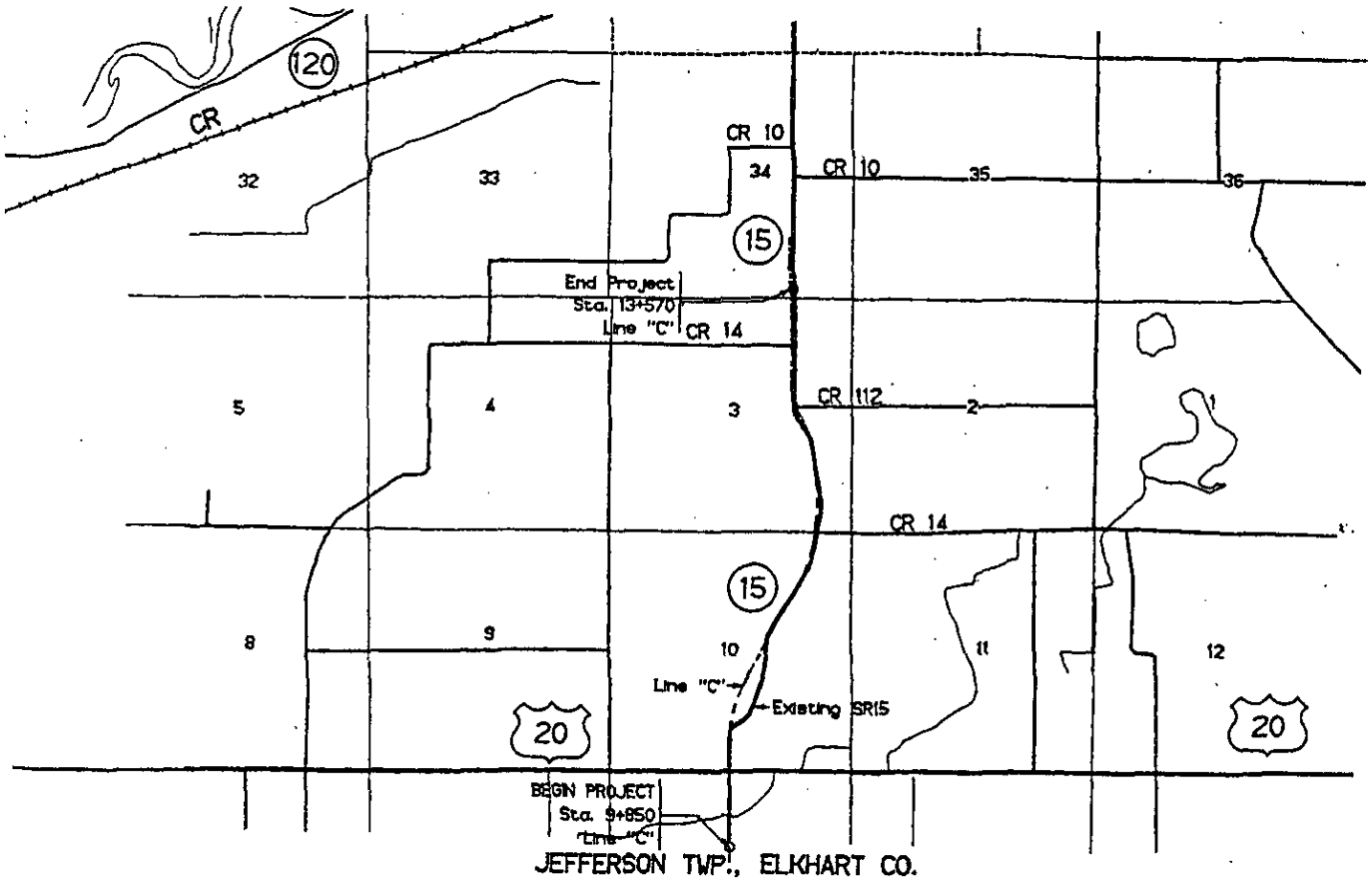
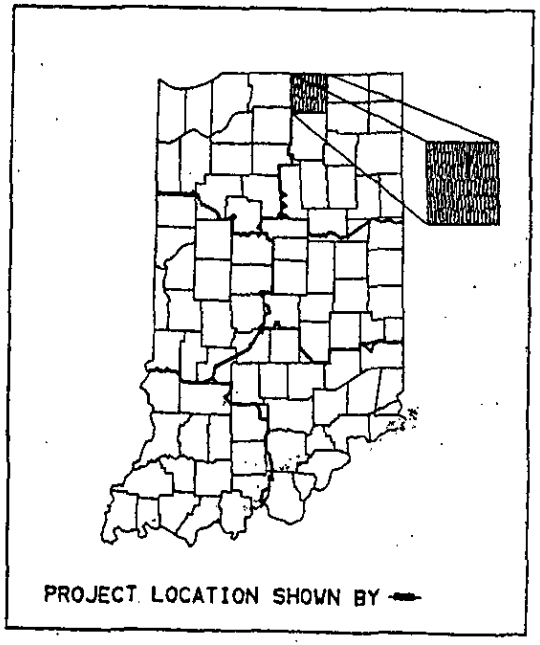
APPENDIX A

GENERAL SITE PLAN
BORING LOCATION PLANS





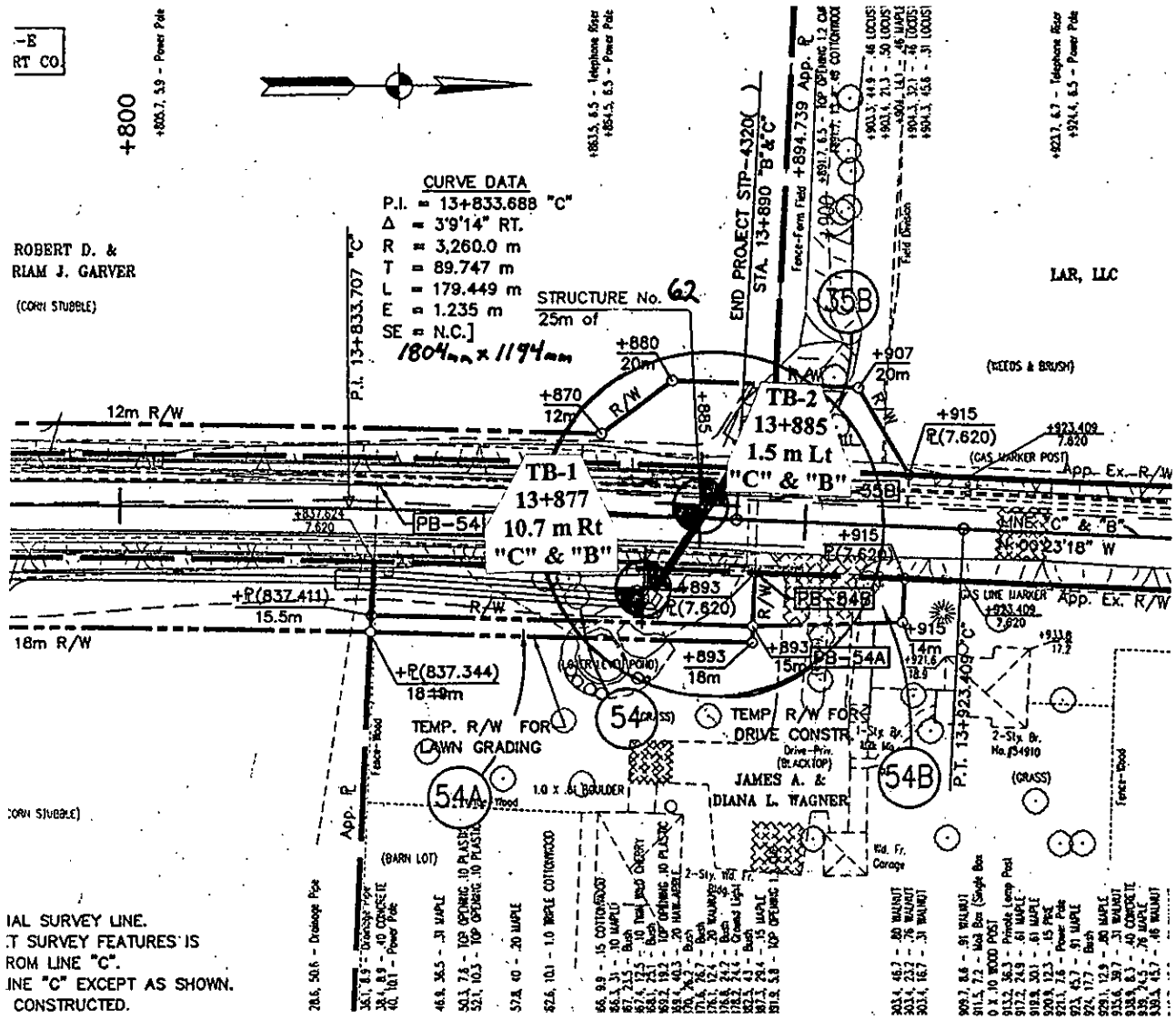
GENERAL SITE PLAN

SR 15/ US 20 Improvement

SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20

Des. No.: 8354420, Project No.:: STP-4320(7)

Elkhart County, Indiana



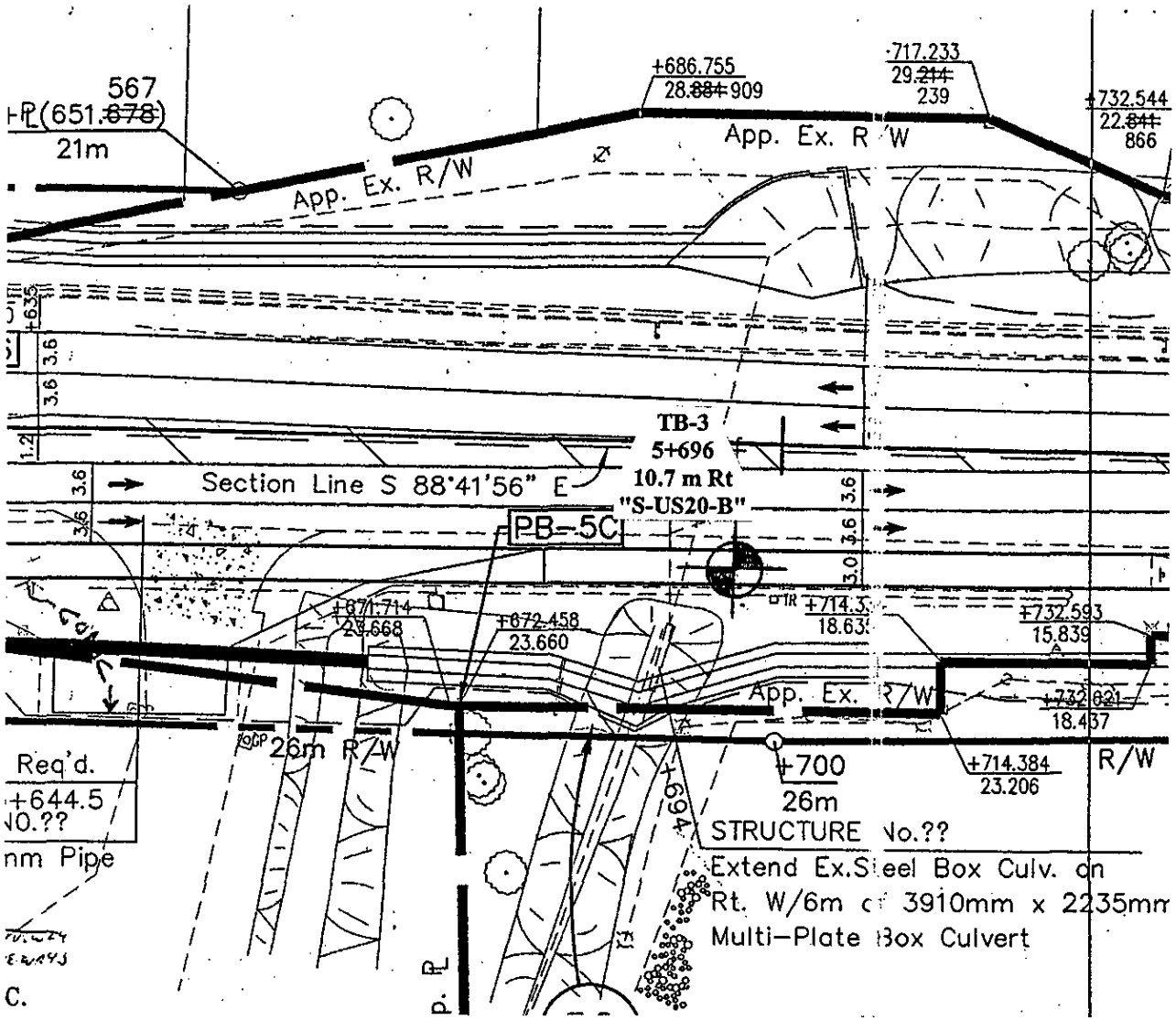
BORING LOCATION PLAN

SR 15/ US 20 Improvement

SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20

Des. No.: 8354420, Project No.:: STP-4320(7)

Elkhart County, Indiana



BORING LOCATION PLAN

SR 15/ US 20 Improvement

SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20

Des. No.: 8354420, Project No.:: STP-4320(7)

Elkhart County, Indiana

APPENDIX B

TEST BORING RECORDS

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20
LOCATION : Elkhart County, Indiana
DES NO. : 8354420; Project No.: STP-4320; CTL No.: 05050045IND

BORING NO.: TB-1
SHEET 1 OF 1
DATE STARTED : 10-25-05
DATE COMPLETED : 10-25-05

BORING					
ELEVATION	: 250.00 m (USC&GS)	BORING METHOD	: HSA	HAMMER	: Automatic
STATION	: 13+877	RIG TYPE	: CME-550 ATV	DRILLER	: ED
OFFSET	: 10.7m Rt	CASING DIA.	: 83 mm I.D.	TEMPERATURE	: 50° F
LINE	: "C" & "B"	CORE SIZE	: —	WEATHER	: Cloudy
DEPTH	: 6.10 m				

GROUNDWATER: ▼ Encountered at 1.22 m ▼ At Completion 1.22 m ▣ Caved in at 1.37 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
249.70		**TOPSOIL** (305mm) (Visual)	0.30										
		Brownish Black, Moist, Soft, **LOAM** with Traces of Roots and Organic Matter **(FILL)** (Visual)		SS-1	2 2 3	5	89	23					
248.93			1.07										
	1.5			SS-2	2 2 2	4	89						
				SS-3	3 4 6	10	100						
	3.0			SS-4	6 7 7	14	89						
		Brown, Wet, Very Loose to Medium Dense, **SAND** with Traces of Gravel Visual)											
	4.5			SS-5	4 5 7	12	100						
244.21			5.79		11								
	6.0	Gray, Moist, Very Stiff, **CLAY LOAM (TILL)** A-4 As Lab 2		SS-6	13 17	30	100	15					
243.90		**Bottom of Boring at 6.10 meters**	6.10										
		Boring performed for Structure No. 62.											
		Boring backfilled with soil cuttings.											

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CTL Engineering of Indiana, Inc.
Phone: 317-585-8277

BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	- Hollow Stem Auger	SS	- Split Spoon Sample	*	- Hand Penetrometer
SFA	- Solid Flight Auger	ST	- Shelby Tube Sample	LL	- Liquid Limit
RC	- Rock Coring	CR	- Rock Core Sample	PL	- Plastic Limit
MD	- Mud Drilling	BS	- Bag Sample	PI	- Plasticity Index
WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20
LOCATION : Elkhart County, Indiana
DES NO. : 8354420; Project No.: STP-4320; CTL No.: 05050045IND

BORING NO.: TB-2
SHEET 1 OF 1
DATE STARTED : 10-25-05
DATE COMPLETED : 10-25-05

BORING					
ELEVATION	: 250.70 m (USC&GS)	BORING METHOD	: HSA	HAMMER	: Automatic
STATION	: 13+885	RIG TYPE	: CME-550 ATV	DRILLER	: ED
OFFSET	: 1.5m Lt	CASING DIA.	: 83 mm I.D.	TEMPERATURE	: 50° F
LINE	: "C" & "B"	CORE SIZE	: ---	WEATHER	: Sunny
DEPTH	: 6.10 m				

GROUNDWATER: ▼ Encountered at 2.74 m ▼ At Completion 1.70 m 🖼 Caved in at 2.44 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
250.57		**ASPHALT CONCRETE** (127mm) (Visual)	0.13										
250.47		**CEMENT CONCRETE** (102mm) (Visual)	0.23										
		Brown, Slightly Moist, Medium Dense, **SAND & GRAVEL (FILL)** (Visual)		SS-1	8 9 10	19	78						
249.63			1.07										
	1.5	Brownish Gray, Moist, Medium Dense, **SAND** with Traces of Brick Fragments **(FILL)** (Visual)		SS-2	8 8 6	14	89						
248.87 ▼			1.83										
		Brown, Moist, Very Stiff, **SANDY LOAM** with Traces of Brick Fragments **(FILL)** A-4 As Lab 1		SS-3	11 14 16	30	33	14					
248.11 🖼 ▼			2.59										
	3.0			SS-4	8 10 12	22	100						
	4.5	Brown, Moist to Wet, Medium Dense, **SAND** (Visual)		SS-5	6 8 9	17	100						
	6.0			SS-6	4 5 6	11	100						
244.60			6.10										
		Bottom of Boring at 6.10 meters											
		Boring performed for Structure No. 62. Two attempts made on SS-3 due to low soil recovery. Boring backfilled with soil cuttings, and pavement restored with concrete patch.											

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	- Hollow Stem Auger	SS	- Split Spoon Sample	*	- Hand Penetrometer
SFA	- Solid Flight Auger	ST	- Shelby Tube Sample	LL	- Liquid Limit
RC	- Rock Coring	CR	- Rock Core Sample	PL	- Plastic Limit
MD	- Mud Drilling	BS	- Bag Sample	PI	- Plasticity Index
WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
BORING NO.: TB-3
PROJECT : SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20
SHEET 1 OF 1
LOCATION : Elkhart County, Indiana
DATE STARTED : 10-25-05
DES NO. : 8354420; Project No.: STP-4320; CTL No.: 05050045IND
DATE COMPLETED : 10-25-05

BORING					
ELEVATION	261.15 m (USC&GS)	BORING METHOD	HSA	HAMMER	Automatic
STATION	5+696	RIG TYPE	CME-550 ATV	DRILLER	ED
OFFSET	10.7m Rt	CASING DIA.	83 mm I.D.	TEMPERATURE	50° F
LINE	"S-US20-B"	CORE SIZE	—	WEATHER	Cloudy
DEPTH	6.10 m				

GROUNDWATER: ▼ Encountered at 3.96 m ▼ At Completion 5.49 m ▣ Caved in at 5.56 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
260.90		**TOPSOIL** (254mm) (Visual)	0.25										
		Brown, Moist, Very Loose, **SAND** with Traces of Roots (Possible Fill) (Visual)		SS-1	2 2 2	4	78						
259.93			1.22	SS-2T	2	3	89						
	1.5	Dark Brownish Black, Moist, Very Soft, **SILTY CLAY** with Little Organic Matter (Creek Sediments) (Visual)		SS-2B	1 2			47					
259.32		Organic Matter = 10.8%	1.83										
		Brown with Gray Streaks, Very Moist, Soft, **SANDY LOAM** with Traces of Roots (Creek Sediments) A-4 (0) Lab 1		SS-3	2 2 2	4	78	12			NP	NP	NP
258.56			2.59										
	3.0	Gray, Moist, Soft, **CLAY LOAM** (TILL) A-4 (3) Lab 2		SS-4	2 2 3	5	78	14			22	12	10
257.19 ▼			3.96										
	4.5	Gray, Wet, Medium Dense, **SAND** (Visual)		SS-5	3 5 6	11	100						
255.97			5.18										
▣		Gray, Moist, Medium Dense, **SILT** (Visual)		SS-6	4 6 8	14	100	18					
255.05	6.0		6.10										
		Bottom of Boring at 6.10 meters											
		Boring performed for Structure No. 69. Boring backfilled with soil cuttings.											

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

APPENDIX C

LABORATORY TEST RESULTS

Summary of Classification Test Results
Grain Size Distribution Curves
Summary of Special Laboratory Test Results

Boring No.	Lab No.	Station	Offset	Line	Sample No.	Depth	Soil Classification	AASHTO Group	Percent Passing (Sieve No.)			Grain Size Distribution (%)				WC	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture Content (%)	Resilient Modulus (psi)
									10	40	200	Gravel	Sand	Silt	Clay							
TB-3	Lab 1	5+696	10.7m Rt	"S-US20-B"	SS-3	1.83-2.29	Sandy Loam	A-4 (0)	88.3	77.3	40.6	11.7	47.7	29.2	11.4	12	NP	NP	NP			
TB-3	Lab 2	5+696	10.7m Rt	"S-US20-B"	SS-4	2.59-3.05	Clay Loam	A-4 (3)	97.5	90.6	63.4	2.5	34.0	40.4	23.1	14	22	12	10			

SUMMARY OF CLASSIFICATION TEST RESULTS

Project: SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20

Location: Elkhart County, Indiana

Des. No.: 8354420; Project No.: STP-4320; CTL No.: 05050045IND

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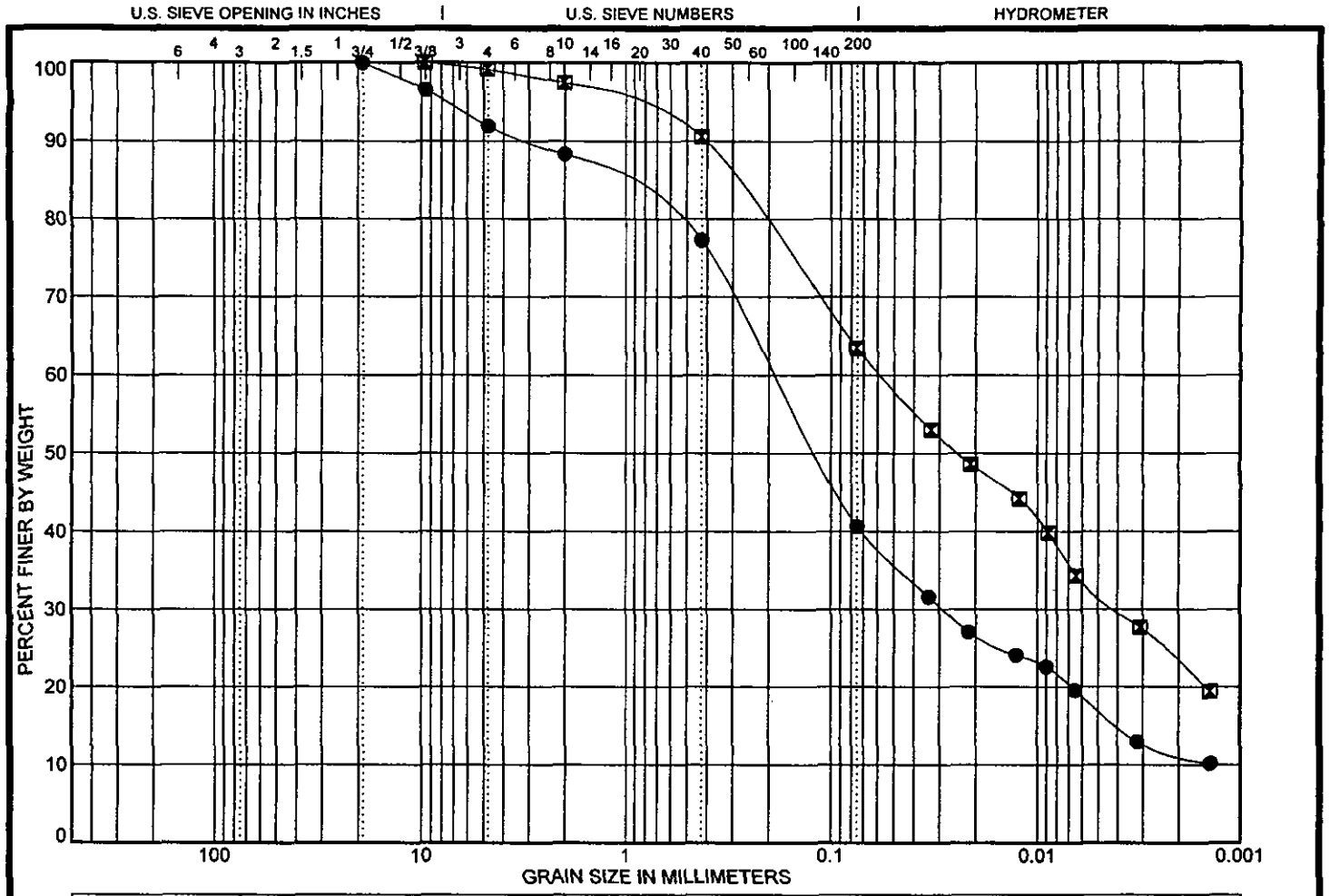

Cobbles	Gravel	Sand	Silt	Clay

Boring No.	TB-3	TB-3			
Sample	SS-3	SS-4			
Depth	1.83 - 2.29	2.59 - 3.05			
Station	5+696	5+696			
Offset	10.7m Rt	10.7m Rt			
Line	"S-US20-B"	"S-US20-B"			
Curve Designation	●	⊠			
Moisture Content	**12**	**14**			
Liquid Limit	**NP**	**22**			
Plastic Limit	**NP**	**12**			
Plasticity Index	**NP**	**10**			
% Gravel	**11.7**	**2.5**			
% Sand	**47.7**	**34.0**			
% Silt	**29.2**	**40.4**			
% Clay	**11.4**	**23.1**			
Classification	**Sandy Loam**	**Clay Loam**			
AASHTO Group	**A-4 (0)**	**A-4 (3)**			
Lab No.	**Lab 1**	**Lab 2**			

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GRAIN SIZE DISTRIBUTION

Project: SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20

Location: Elkhart County, Indiana

Des. No.: 8354420; Project No.: STP-4320; CTL No.: 05050045IND

Boring No.	Station	Offset	Line	Sample No.	Depth (m)	Moisture Content (%)		Loss on Ignition (%)	pH
TB-1	13+877	10.7m Rt	"C" & "B"	SS-1	0.30-0.76	23			
TB-1	13+877	10.7m Rt	"C" & "B"	SS-6	5.64-6.10	15			
TB-2	13+885	1.5m Lt	"C" & "B"	SS-3	1.83-2.29	14			
TB-3	5+696	10.7m Rt	"S-US20-B"	SS-2B	1.22-1.52	47		10.8	
TB-3	5+696	10.7m Rt	"S-US20-B"	SS-3	1.83-2.29	12			8.4
TB-3	5+696	10.7m Rt	"S-US20-B"	SS-4	2.59-3.05	14			8.7
TB-3	5+696	10.7m Rt	"S-US20-B"	SS-6	5.64-6.10	18			

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SUMMARY OF SPECIAL LABORATORY TEST RESULTS

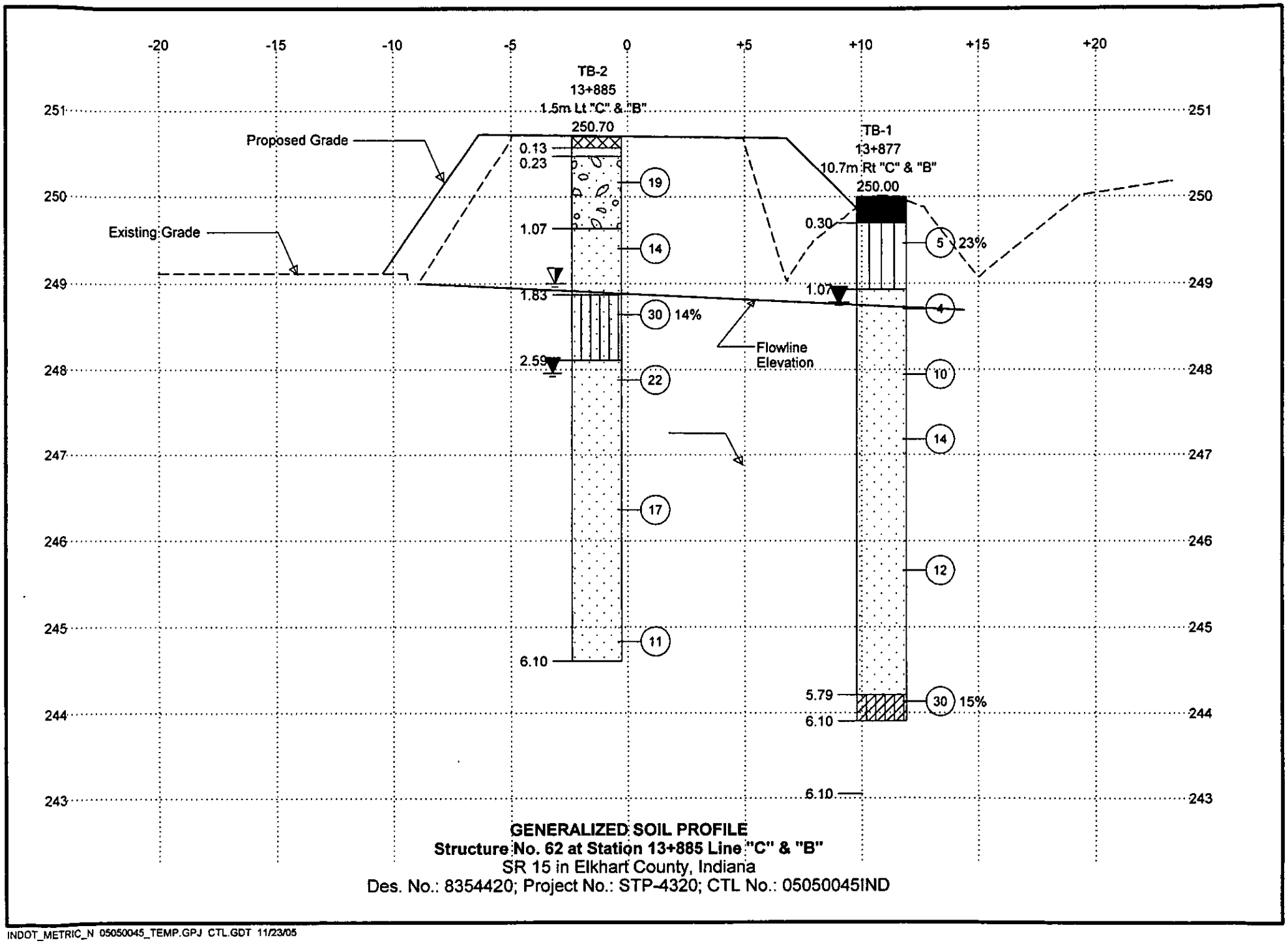
Project: SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20

Location: Elkhart County, Indiana

Des. No.: 8354420; Project No.: STP-4320; CTL No.: 05050045IND

APPENDIX D

Structure No. 62
Generalized Soil Profile
Soil Bearing Capacity Analysis



GENERALIZED SOIL PROFILE
Structure No. 62 at Station 13+885 Line "C" & "B"
SR 15 in Elkhart County, Indiana
Des. No.: 8354420; Project No.: STP-4320; CTL No.: 05050045IND

BEARING CAPACITY ANALYSES

Culvert.:	Box Culvert
Location:	SR 15 in Elkhart County
Structure No.:	62, 25m of 1194mm x 1804m Pipe **(Boring No. TB-1 and TB-2)**
Des. No.:	8354420
CTL No.:	05050045IND

SOIL BEARING CAPACITY

1. Very loose sand or very stiff sandy loam in-place fill exist below the proposed culvert. It is recommended that the in-place fill be removed and replaced with "B" Borrow to maintain uniform base for the culvert. Note that the 30 bpf encountered in the sandy loam fill may be due to striking on brick fragments. This value may not be represent the consistency of the entire in-place fill.

1. Footings for wingwalls would be founded on loose to medium dense sand with:
   N = 4 to 22 bpf
   Estimated Phi = 29 deg., C = 0, G = 115 pcf & G_{sub} = 115 - 62 = 53 pcf

2. Water expected above footings (longterm)

3. Assume depth of footings, D_f = At 4' below flow line, and
   B = 2'
   B = 3'
   B = 4'
   B = 5'
   B = 6'

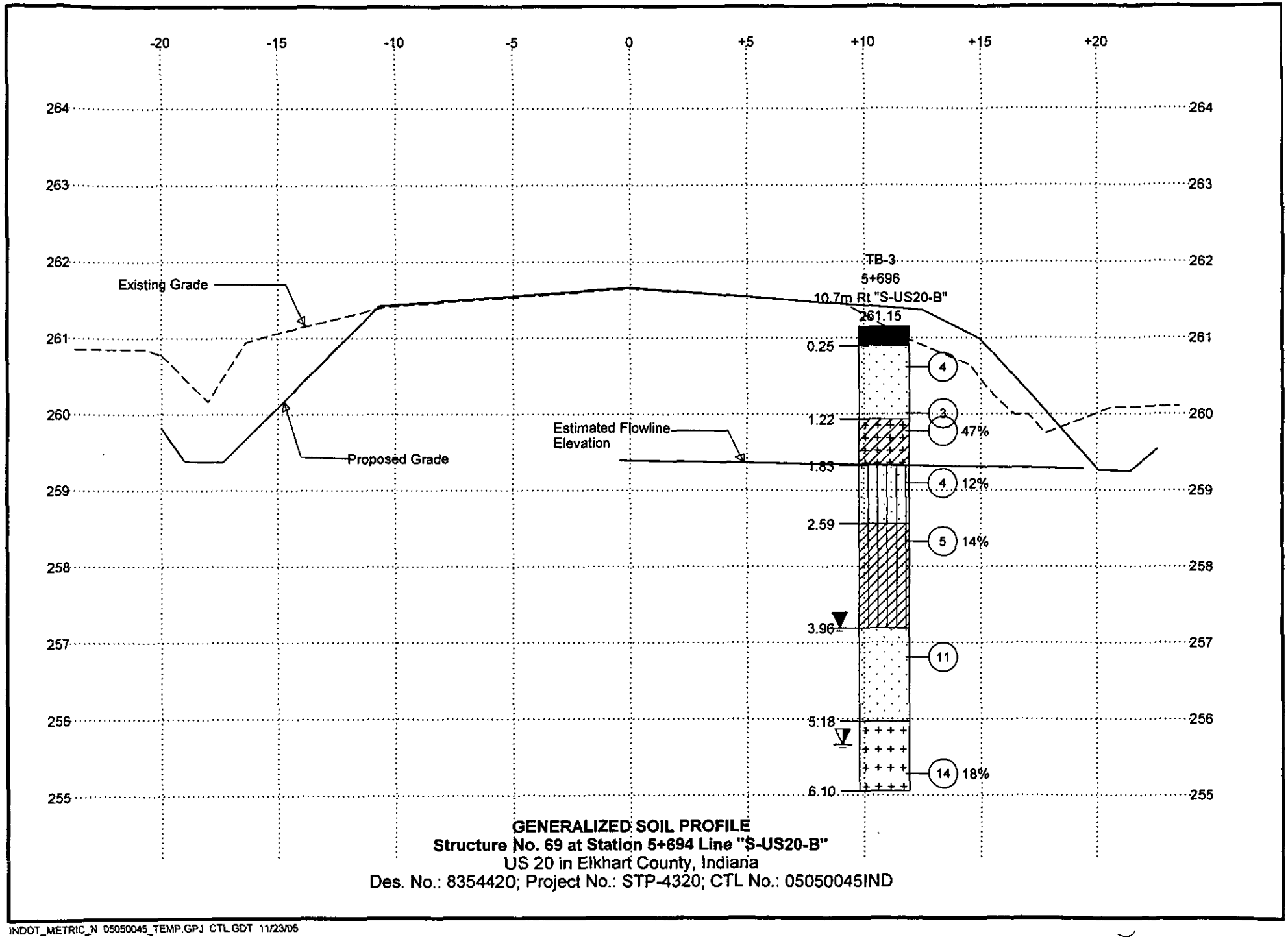
Ultimate Bearing Capacity, qult = c Nc + (Gsub Df Nq) + (0.5 Gsub B NGamma)
Allowable Bearing Capacity, qall = (qult - Gsub Df) / FS

Phi (degrees)	c (psf)	N_c	N_q	N_{Gamma}	D_f (feet)	B	G (pcf)	G_{sub} (pcf)	FS	Q_{ult} (psf)	Q_{all} (psf)	**USE Qall (psf)**
29	0	27.86	16.44	19.34	4	2	115	53	3	4510	1433	**1400**
29	0	27.86	16.44	19.34	4	3	115	53	3	5023	1604	**1600**
29	0	27.86	16.44	19.34	4	4	115	53	3	5535	1845	**1800**
29	0	27.86	16.44	19.34	4	5	115	53	3	6048	2016	**2000**
29	0	27.86	16.44	19.34	4	6	115	53	3	6560	2187	**2100**

N_c, N_q, N_{Gamma} after Meyerhof

APPENDIX E

Structure No. 69
Generalized Soil Profile
Soil Bearing Capacity Analysis



GENERALIZED SOIL PROFILE
Structure No. 69 at Station 5+694 Line "S-US20-B"
US 20 in Elkhart County, Indiana
Des. No.: 8354420; Project No.: STP-4320; CTL No.: 05050045IND

BEARING CAPACITY ANALYSES

Culvert.:	Box Culvert
Location:	US 20 in Elkhart County
Structure No.:	69, 6.0m of 3910mm x 2235mm Multi Plate Box Culvert **(Boring No.: TB-3)**
Des. No.:	8354420
CTL No.:	05050045IND

DATA

1. Box Culvert extending 6.0 meters to the right of Line "S-US20-B"

2. Invert Elevation = 260.3 (assumed). It is recommended that all creek sediment and/or soils with organic matter be removed to Elevation 258.5. The excavation should be backfilled with compacted No. 53 aggregate. A layer of geogrid Type 1 would be needed at the bottom of the excavation.

3. Groundwater is not expected. However, runoff and/or seepage water could be present.

SOIL BEARING CAPACITY

The soil bearing capacity provided below could be used for wingwall footings. It is assumed that footings will be constructed onto the clay loam soils.

Qu = 1200 psf (Estimated based on blowcounts).
Cu = 1200 / 2 = 600 psf
For Phi = 0, Nc = 5.14 (Meyerhof)

Ultimate Bearing Capacity, qult = c Nc = 600 x 5.14 = 3084 psf
Allowable Bearing Capacity, qall = qult / FS = 3084 / 3.0 = 1028 psf **USE qall = 1000 psf**

The Indiana Department of Transportation

Office of Geotechnical Engineering
120 South Shortridge Road P.O. Box 19389
Indianapolis, Indiana 46219-0389
Phone: (317) 610-7251 Fax: (317) 356-9351

Driving Indiana's Economic Growth

January 25, 2006

CTL Engineering, Inc.
6848 Hillsdale Court
Indianapolis, Indiana 46250

Attn: Mr. Ali Karaki

Subject: Des No: 8354420
Project No: STP – 4320 (7)
SR 15 from 0.34 Mi. S of US 20 to 1.92 N. of US 20
County: Elkhart
District: Fort Wayne

Gentlemen:

In accordance with the agreement dated January 16, 2004, the Final Quantities and Costs for the Geotechnical Investigation on the subject project have been calculated. Transmitted herewith is one copy of the following:

1. Itemization of Pay Quantities for Geotechnical Borings, and Tests.
2. Report of Final Costs for the Geotechnical Investigation.
3. Performance Evaluation of Consultant's Highway Development Services.

The total cost for the Geotechnical Work performed on the subject project is $5,442.45 Therefore, in order to finalize the payment, please submit an invoice voucher for $5,442.45 to:

Mr. Athar Khan, P.E.
Chief Geotechnical Engineer
INDOT Division of Materials and Tests
120 South Shortridge Road
P.O. Box 19389
Indianapolis, IN 46219-0389

If you have any questions concerning this matter, please call us.

Very truly yours,

Athar Khan
Chief Geotechnical Engineer

Somanath Hiremath
Geotechnical Engineering Group Leader

SSH/SS
cc: Mr. R. Asadi
File (Attachments)

			Unit		Unit Price	Total
			Subtotal (Geotechnical Engineering)			$2,000.00
	CONSTRUCTION INSPECTION AND MONITORING					
63.	Field inspector		0	hr	$53.00	
64.	Monitoring geotechnical instrumentation		0	hr	$53.00	
65.	Integrity testing	cost plus 10%	0	1.1	$0.00	$0.00
66.	Dynamic pile analysis		0	ea	$850.00	
67.	Static load test		0	ea	$850.00	
68.	Dynamic pile load test	cost plus 10%	0	1.1	$0.00	$0.00
69.	CAPWAP-C analysis		0	ea	$400.00	
70.	Final construction inspection report		0	ea	$80.00	
			Subtotal (Construction Inspection and Monitoring)			$0.00
	FOUNDATION EVALUATION BY NON-DESTRUCTIVE METHODS					
71.	a. Surface test/Pier or foundation	cost plus 10%	0	1.1	$0.00	$0.00
	b. Borehole test/Pier or foundation	cost plus 10%	0	1.1	$0.00	$0.00
	PAVEMENT INVESTIGATION					
1.	Mobilization of coring equipment		0	LS	$90.00	
2.	Mobilization mileage for coring equipment		0	mi	$1.40	
3.	Pavement core (partial depth)		0	ea	$106.00	
4.	Pavement core (full depth)		0	ea	$150.00	
5.	Sub-base sample		0	ea	$49.00	
6.	Cement concrete pavement core density determination		0	ea	$26.25	
7.	Cement concrete core compressive strength test		0	ea	$28.50	
8.	Bituminous extraction test		0	ea	$67.00	
9.	Sieve analysis of extracted aggregate test		0	ea	$47.00	
10.	Recovery of asphalt from solution by Abson method		0	ea	$360.00	
11.	Theoretical maximum specific gravity test		0	ea	$65.00	
12.	Bulk specific gravity test		0	ea	$27.00	
13.	Air voids calculation		0	ea	$23.00	
14.	Core report for partial depth core		0	ea	$27.00	
15.	Core report for full depth core		0	ea	$36.75	
16.	Pavement analysis and report		0	ea	$630.00	
			Subtotal (Pavement Investigation)			$0.00

Final Cost of Geotechnical Field	**$3,149.60**
Final Cost of Geotechnical Laboratory	**$292.85**
Final Cost of Geotechnical Engineering	**$2,000.00**
Final Cost of Construction Inspection and Monitoring	**$0.00**
Final Cost of Pavement Investigation	**$0.00**
Final Cost of Geotechnical and Pavement Investigation	**$5,442.45**

PREPARED BY: Alebachew Tilahun
CHECKED BY: Shahid Siddiqui
DATED: 1/24/2006

	Unit		Unit Price	Total
First mile	0	LS	$290.00	
Each additional mile	0	mi	$180.00	
55. Geotechnical report				
a. Without soil subgrade investigation				
First mile	1	LS	$1,200.00	$1,200.00
Each additional mile	0	mi	$525.00	
b. With soil subgrade investigation				
First mile	0	LS	$1,500.00	
Each additional mile	0	mi	$630.00	
c. Soil subgrade investigation (only)				
First mile	0	LS	$500.00	
Each additional mile	0	mi	$300.00	
56. Settlement analysis and recommendations for embankment				
a. Proposed embankment	0	ea	$400.00	
b. Proposed and existing embankment	0	ea	$450.00	
57 Ground modification design	0	ea	$1,155.00	
58. Sliding block slope stability analysis				
a. C, ø or C & ø analysis	0	ea	$520.00	
b. Corrective measures	0	ea	$650.00	
c. Stage construction corrective method	0	ea	$1,155.00	
59. Bridge foundation analysis and recommendations				
a. Shallow foundation	2	ea	$400.00	$800.00
b. Deep Foundation	0	ea	$690.00	
c. Settlement analysis for bridge pier foundation				
i. Bridge pier	0	ea	$300.00	
ii. Embankment plus pier	0	ea	$350.00	
iii. Embankment plus pier plus all other loads	0	ea	$400.00	
d. Foundation on bedrock	0	ea	$230.00	
60. Retaining structure analysis recommendations				
a. Conventional retaining structures and other types such as MSE Walls and Bin walls				
i. Shallow foundation	0	ea	$685.00	
ii. Deep foundation	0	ea	$865.00	
iii. Settlement analysis for retaining wall foundation	0	ea	$300.00	
b. Pile retaining structure analysis and recommendations				
i. Free standing structure	0	ea	$690.00	
ii. Retaining structure with tie-back system	0	ea	$1,155.00	
c. Drilled-in-pier retaining structure analysis				
i. Free standing structure	0	ea	$800.00	
ii. Retaining structure with tie-back system	0	ea	$1,185.00	
d. Soil nailing wall analysis	0	ea	$800.00	
61. Seepage analysis	0	ea	$1,090.00	
62. Deep dynamic compaction analysis	0	ea	$1,040.00	

			Unit		Unit Price	Total
36.	Traffic control					
	a. Flag crew		1	day	$450.00	$450.00
	b. Equipment Rental	cost plus 10%	0	1.1	$0.00	$0.00
37.	Centerline surveying	cost plus 10%	0	1.1	$0.00	$0.00
					Subtotal (Geotechnical Field)	**$3,149.60**
	GEOTECHNICAL LABORATORY					
38.	Sieve analysis		2	ea	$37.00	$74.00
39.	Hydrometer analysis		2	ea	$40.50	$81.00
40.	Moisture content test		7	ea	$5.00	$35.00
41.	Liquid limit		1	ea	$25.50	$25.50
42.	Plastic limit & plasticity index		2	ea	$18.50	$37.00
43.	a. Unconfined compression test		0	ea	$32.50	
	b. Remolding of 3 soil samples with chemical admixtures in chemical soil modification/stabilization (3 samples is equal to 1 unit)		0	ea	$90.30	
44.	Specific gravity test		0	ea	$30.00	
45.	Unit weight determination		0	ea	$14.25	
46.	Hydraulic conductivity test					
	a. Constant Head		0	ea	$200.00	
	b. Falling Head		0	ea	$235.00	
47.	Consolidation test		0	ea	$340.00	
48.	Triaxial test					
	a. Unconsolidated - Undrained (UU)		0	ea	$266.00	
	b. Consolidated - Undrained (CU)		0	ea	$400.00	
	c. Consolidated - Drained (CD)		0	ea	$580.00	
	d. Pore Pressure measurement with a. or b. and use of back pressure for saturation		0	ea	$210.00	
49.	Soil support testing					
	a. California bearing ratio		0	ea	$425.00	
	b. Subgrade resilient modulus		0	ea	$360.00	
50.	Standard moisture-density relationship test		0	ea	$100.00	
51.	Loss-on-ignition test		1	ea	$17.25	$17.25
52.	pH test		2	ea	$11.55	$23.10
53.	Collapse potential evaluation test		0	ea	$300.00	
					Subtotal (Geotechnical Laboratory)	**$292.85**
	GEOTECHNICAL ENGINEERING					
54.	Geotechnical profile and related work					
	a. Without soil subgrade drawings					
	First mile		0	LS	$950.00	
	Each additional mile		0	mi	$425.00	
	b. With soil subgrade drawings					
	First mile		0	LS	$1,150.00	
	Each additional mile		0	mi	$500.00	
	c. Soil subgrade drawings (only)					

			Unit		Unit Price	Total
	ii. Rental of support equipment and/or boat	cost plus 10%	0	1.1	$0.00	$0.00
	iii. Drill rig down time		0	hr	$112.00	
	b. Non-navigable water barge set-up		0	ea	$3,575.00	
16.	Additional disassembly and reassembly					
	a. Navigable water		0	ea	$1,620.00	
	b. Non-navigable water		0	ea	$1,420.00	
17.	Barge mounted borings with split spoon sampling		0	ft	$24.15	
18.	Barge mounted core drilling		0	ft	$32.00	
19.	Barge mounted boring through bedrock or boulders		0	ft	$38.00	
20.	Barge mounted soundings		0	ft	$14.75	
21.	Casing through water		0	ft	$6.40	
22.	Uncased sounding through water		0	ft	$4.30	
23.	Set up for borings and machine soundings					
	a. Borings and machine soundings less than 20 ft deep		0	ea	$52.00	
	b. Rock core borings less than 15 ft deep		0	ea	$94.50	
24	Additional 2-in. split spoon sampling		0	ea	$15.50	
25	3-in. split spoon samples		0	ea	$17.25	
26	3-in. Shelby tube samples		0	ea	$50.00	
27.	Bag samples					
	a. 300-lb sample		0	ea	$85.00	
	b. 25-lb sample		0	ea	$31.50	
28	Field vane shear test		0	ea	$85.00	
29.	4½-in. cased hole		0	ft	$9.50	
30.	Installation of Geotechnical Instruments					
	a. Inclinometer casing installation		0	ft	$13.50	
	b. Piezometer installation up to 25 ft below surface		0	ea	$225.00	
	c. Piezometer installation deeper than 25 ft below surface		0	ea	$320.00	
	d. Metal protective outer cover for inclinometer and piezometer casings		0	ea	$95.00	
31.	Geotechnical engineer		8	hr	$82.00	$656.00
32.	Railroad expenses	cost plus 10%	0	1.1	$0.00	$0.00
33.	Twenty-four hour water levels					
	a. Field measurements per borehole		0	ea	$28.75	
	b. PVC slotted pipe		0	ft	$4.60	
34	Special borehole backfilling					
	a. 10 to 30 ft					
	i. SPT		0	ea	$83.00	
	ii. CPT		0	ea	$35.00	
	b. More than 30 ft					
	i. SPT		0.0	ft	$5.00	
	ii. CPT		0	ft	$1.80	
	c. Pavement restoration		1	ea	$42.00	$42.00
35.	Dozer rental	cost plus 10%	0	1.1	$255.00	$0.00

INDIANA DEPARTMENT OF TRANSPORTATION
DIVISION OF MATERIALS AND TESTS
Geotechnical Section

REPORT OF FINAL COSTS FOR GEOTECHNICAL AND PAVEMENT INVESTIGATIONS BETWEEN INDOT AND CTL Engineering DATED 2/26/2004 IN ACCORDANCE WITH STATE WIDE GEOTECHNICAL INVESTIGATION.

DES NO: 8354420
PROJ NO: STP-4320
STR NO: N/A
ROAD NO: SR 20 & SR 15
County: Elkhart

			Unit		Unit Price	Total
1.	Mobilization and Field Coordination					
	a. SPT Rig		1	ea	$200.00	$200.00
	b. CPT		0	ea	$300.00	
	c. Field coordination with utilities		1	LS	$230.00	$230.00
	d. Field coordination with property owners					
	i. 1 - 10		0	LS	$300.00	
	ii. 11 - 25		0	LS	$430.00	
	iii. Over 25		0	LS	$580.00	
	e. Mileage		296	mi	$2.35	$695.60
2.	Truck mounted borings with split spoon sampling		60	ft	$14.60	$876.00
3.	Truck mounted borings with drilling fluid		0	ft	$14.75	
4.	Truck mounted core drilling		0	ft	$30.00	
5.	Truck mounted borings					
	a. Truck mounted borings through bedrock or boulders or concrete pavement		0	ft	$25.00	
	b. Bridge deck coring and restoration		0	ea	$250.00	
6.	Cone penetrometer testing					
	a. Set up		0	ea	$55.00	
	b. Subsurface profiling		0	ft	$10.30	
	c. Profiling with pore pressure measurement					
	i. Piezometric Saturation		0	ea	$80.00	
	ii . Penetration		0	ft	$11.50	
	iii. Pore water dissipation test		0	hr	$190.00	
	iv. Hydraulic conductivity and consolidation		0	ea	$66.00	
	d. Profiling with Shearwave Velocity Measurement		0	ft	$10.75	
	e. Sample		0	ea	$15.00	
7.	Hand or truck soundings		0	ft	$9.35	
8.	Hand auger drilling		0	ft	$10.50	
9.	Skid mounted borings with split spoon sampling		0	ft	$22.00	
10.	Skid mounted borings using drilling fluid		0	ft	$34.00	
11.	Skid mounted core drilling		0	ft	$34.00	
12.	Skid mounted boring through bedrock or boulders		0	ft	$34.00	
13.	Skid mounted soundings		0	ft	$13.15	
14.	Furnishing of a boat	cost plus 10%	0	1.1	$0.00	$0.00
15.	Barge set-up expenses					
	a. Navigable water					
	i. Barge set-up		0	ea	$4,000.00	

INDIANA DEPARTMENT OF TRANSPORTATION

ITEMIZATION OF PAY QUANTITIES FOR INDOT SOIL BORINGS, REPORTS & PROFILES (TD-356)

BY: CTL Engineering, Inc. FOR: INDOT SHEET: 1 OF 1

DES: 8354420 PROJECT NO: STP-4320 STRUCTURE NO: SR 62 & 69

LOCATION: SR 20 & SR 15 Intersection COUNTY: Elkhart

PREPARED BY: Alebachew Tilahun CHECKED BY: Shahid Siddiqui DATE: 1 / 24 / 06

Boring No.	1 Mobilization				2	31	34	36	38	39	40	41	42	51	52	55	59														
	a. Equipment	c. Field Coordination with Utilities		e. Mileage	Truck Borings with SPT	Geotechnical Engineer	c. Pavement Restoration	a. Flag Crew	Sieve Analysis	Hydrometer Analysis	Moisture Content	Liquid Limit	Plastic Limit	Loss on Ignition	pH Test	i. First Mile	a. Shallow Foundation														
TB-1					6.10						2																			
TB-2					6.10		1				1																			
TB-3					6.10				2	2	4	1	2	1	2															
Total	1	1		296	18.30	8	1	1	2	2	7	1	2	1	2	1	2													
Total *	**1**	**1**		**296**	**60.0**	**8**	**1**	**1**	**2**	**2**	**7**	**1**	**2**	**1**	**2**	**1**	**2**													

* English

The Indiana Department of Transportation

Office of Geotechnical Engineering
120 South Shortridge Road P.O. Box 19389
Indianapolis, Indiana 46219-0389
Phone: (317) 610-7251 Fax: (317) 356-9351

Driving Indiana's Economic Growth

January 11, 2006

Mr. Gerald Mroczka, Chief
Design Division
N642 - IGCN

Attn: Ms. Tamera Stoakes
Project Coordinator

Subject: Subsurface Investigation – Addendum 2
Des No: 8354420
Project No: STP-4320 (7)
SR 15 from 0.34 Mi. S. of US 20 to 1.92 Mi. N. of US 20
County: Elkhart
District: Fort Wayne

Gentlemen:

The additional Geotechnical Investigation for the subject project has been completed and copies of the Geotechnical Report are being forwarded to those listed below.

If you have any questions concerning this matter, please call us.

Very truly yours,

Steve Morris

for Athar A. Khan.
Chief Geotechnical Engineer

S. S. Hiremath

Somanath S. Hiremath
Geotechnical Engineering Group Leader

SSH/SS
cc: Mr. T. Seeman – Attn: Mr. W. Smith - Attachment
Mr. R. Alderman – Attn: Mr. J. Keefer – Attachment (2)
Mr. D. Cohen – Attachment
Ms. J. Somers – Attachment
Mr. J. Paauwe - Attachment
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The Indiana Department of Transportation

Office of Geotechnical Engineering
120 South Shortridge Road P.O. Box 19389
Indianapolis, Indiana 46219-0389
Phone: (317) 610-7251 Fax: (317) 356-9351

Driving Indiana's Economic Growth

Date: January,10.2006

TRANSMITTAL:

TO:

CTL Engineering Inc

6848 Hillsdale Court

Indianapolis, IN 46250

PROJECT: Addendum 2

Des No: 8354420

Project No:STP-4320(7)

S.R. 15

County: Elkhart

Dist: Fort Wayne

ATTN: Mr.A.Karaki

Gentlemen:

Please submit ten (10) copies of an addendum 2 for the Geotechnical report for the subject project. All ten (10) copies should be signed and sealed by the Approved Geotechnical Engineer. Also please send an itemization of pay quantities for this project.

The project will be considered completed when all of the above is received.

If you have any questions, please call us at our phone number (317) 610-7251 ext 220 or 219.

Very truly yours,

Steve Morris

for Athar A. Khan, P.E.
Chief Geotechnical Engineer

S. S. Hiremath

Somanath S. Hiremath, P.E.
Geotechnical Engineering Group Leader

SSH/jf
cc: File

CTL Engineering of Indiana, Inc.
6848 Hillsdale Court, Indianapolis, Indiana 46250
Phone: 317/585-8277 • Fax: 317/585-8621
e-mail: ctlin@ctleng.com

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January 10, 2005

Indiana Department of Transportation
Materials and Tests Division
120 South Shortridge Road
Indianapolis, Indiana 46219

Attention: Mr. Athar Khan, P.E.
Chief Geotechnical Engineer

Reference: Subsurface Investigation – Addendum 2
Des. No.: 8354420
Project No.: STP-4320(7)
SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20
Elkhart County, Indiana
CTL Project No.: 05050045IND

Dear Mr. Khan:

CTL Engineering has completed the subsurface investigation on the above referenced site. Enclosed are ten (10) copies of the report.

Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact our office at (317) 585-8277.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki

Ali Karaki, P.E.
Principal Engineer

cc: Mr. Som Hiremath, P.E., INDOT - Materials and Tests Division

ITEMIZATION OF PAY QUANTITIES FOR INDITE SOIL BORINGS

By: CTL Engineering, Inc. For: Indiana Department of Transportation Sheet: 1 of 1
Des. No.: 8354420 Project: STP-4320 Structure No.: 62 & 69
Location: SR 20 & 15 Intersection County: Elkhart
Prepared by: Randy Fladeland Checked By: Ali Karaki Date: January 6, 2006

Boring No.	1 Mobilization				2	31	34	36	38	39	40	41	42	51	52	55	59														
	a. Equipment	c. Field Coordination with Utilities		e. Mileage	Truck Borings with SPT	Geotechnical Engineer	c. Pavement Restoration	a. Flag Crew	Sieve Analysis	Hydrometer Analysis	Moisture Content	Liquid Limit	Plastic Limit	Loss on Ignition	pH Test	b.i. First Mile	a. Shallow Foundation															
TB-1					6.10						2																				
TB-2					6.10		1				1																				
TB-3					6.10				2	2	4	1	2	1	2																
Total	1	1		296	18.30	8	1	1	2	2	7	1	2	1	2	1	2														
Total *	**1**	**1**		**296**	**60.0**	**8**	**1**	**1**	**2**	**2**	**7**	**1**	**2**	**1**	**2**	**1**	**2**														

* English

ITEMIZATION OF PAY QUANTITIES FOR INDITE SOIL BORINGS

By:	CTL Engineering, Inc.	For:	Indiana Department of Transportation	Sheet:	1 of 1
Des. No.:	8354420	Project:	STP-4320	Structure No.:	62 & 69
Location:	SR 20 & 15 Intersection			County:	Elkhart
Prepared by:	Randy Fladeland	Checked By:	Ali Karaki	Date:	January 6, 2006

Boring No.	1 Mobilization				2	31	34	36	38	39	40	41	42	51	52	55	59													
	a. Equipment	c. Field Coordination with Utilities		e. Mileage	Truck Borings with SPT	Geotechnical Engineer	c. Pavement Restoration	a. Flag Crew	Sieve Analysis	Hydrometer Analysis	Moisture Content	Liquid Limit	Plastic Limit	Loss on Ignition	pH Test	...l. First Mile	a. Shallow Foundation													
TB-1					6.10						2																			
TB-2					6.10		1				1																			
TB-3					6.10				2	2	4	1	2	1	2															
Total *	1	1		296	18.30	8	1	1	2	2	7	1	2	1	2	1	2													
**Total ** **	**1**	**1**		**296**	**60.0**	**8**	**1**	**1**	**2**	**2**	**7**	**1**	**2**	**1**	**2**	**1**	**2**													

** English
* Metric

Indiana Department of Transportation

Materials and Tests Division

120 South Shortridge Road P. O. Box 19389
Indianapolis, Indiana 46219-0389
Phone: (317) 610-7251 Fax: (317) 356-9351

March 3, 2004

Mr. Gerald Mroczka, Chief
Design Division
N642 - IGCN

Attn: Ms. Sally Chesney
Project Coordinator

Subject: Subsurface Investigation – Addendum 1
Des No: 8354420
Project No: STP-4320 (3)
Proposed Storm Sewer Line, SR 15 Road Rehabilitation
County: Elkhart
District: Fort Wayne

Gentlemen:

The additional Geotechnical Investigation for the subject project has been completed and copies of the Geotechnical Report are being forwarded to those listed below.

If you have any questions concerning this matter, please call us.

Very truly yours,

Athar A. Khan.
Chief Geotechnical Engineer

S. S. Hiremath
Somanath S. Hiremath
Geotechnical Engineering Group Leader

SSH/SS
cc: Mr. T. Seeman – Attn: Mr. W. Smith - Attachment
Mr. D. Sturtz – Attn: Mr. J. Keefer – Attachment (2)
Mr. D. Cohen – Attachment
Ms. J. Somers – Attachment
Mr. J. Paauwe - Attachment
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SUBSURFACE INVESTIGATION

ADDENDUM 1
DES. NO.: 8354420
PROJECT NO.: STP-4320 (3)
PROPOSED STORM SEWER LINE
SR 15 FROM 0.56 KM S. OF US 20 TO
A POINT 3.10 KM N. OF US 20
ELKHART COUNTY
CTL PROJECT NO.: 00-050061

PREPARED FOR:

INDIANA DEPARTMENT OF TRANSPORTATION
MATERIALS AND TESTS DIVISION
120 SOUTH SHORTRIDGE ROAD
INDIANAPOLIS, INDIANA 46219

PREPARED BY:

CTL ENGINEERING OF INDIANA, INC.
6848 HILLSDALE COURT
INDIANAPOLIS, INDIANA 46250

FEBRUARY, 2004

CTL ENGINEERING

CTL Engineering of Indiana, Inc.
6848 Hillsdale Court, Indianapolis, Indiana 46250
Phone: 317/585-8277 • Fax: 317/585-8621
e-mail: ctlin@ctleng.com

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February 4, 2004

Indiana Department of Transportation
Materials and Tests Division
120 South Shortridge Road
Indianapolis, Indiana 46219

Attention: Athar Khan, P.E.
Chief Geotechnical Engineer

Reference: Subsurface Investigation – Addendum 1
Des. No.: 8354420
Project No.: STP-4320 (3)
Proposed Storm Sewer Line
SR 15 from 0.56 km S. of US 20 to a point 3.10 km N. of US 20
Elkhart County
CTL Project No. 00-050061

Dear Mr. Khan:

In accordance with your authorization to proceed, CTL Engineering, Inc. has completed the subsurface investigation study on the above referenced site.

This addendum report includes the results of our field and laboratory testing, analyses and estimated soil parameters for the proposed storm sewer line.

Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact our office at (317) 585-8277.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.
Principal Engineer

cc: Mr. Mr. Som Hiremath, P.E., INDOT - Materials and Tests Division

SUMMARY OF SUBSURFACE INVESTIGATION - ADDENDUM 1

The project is located on the west side of SR 15 between 283m (929') south of US 20 and 220m (722') north of US 20 in Elkhart County. The project involves design and construction of a new storm sewer line approximately 503m (1650') in length placed at depths of approximately 0.5m to 5.0m (2' to 16.5') beneath existing grade. The storm sewer will be 900mm to 1050mm in diameter.

A subsurface investigation for the subject project has been completed and a summary of our findings and recommendations is reported below. Detailed foundation recommendations and construction considerations are provided in the subsurface investigation report.

1. The test borings indicate that the underlying soil conditions are suitable for the construction of the proposed storm sewer line which would bear on sandy loam tills, and on sand at the outlet location.

2. Excavation into the underlying soils to the proposed invert elevations may be accomplished using conventional excavation equipment.

3. The test borings indicated that groundwater or trapped water is contained in the sand seams or layers embedded within the till deposits.

4. Groundwater may be encountered in isolated locations depending upon the depth of the sand layers within the till deposits. Note that the test borings were drilled in October where the groundwater may have been at its lowest level. Therefore, the groundwater may be encountered at higher elevations depending upon time of construction and amount of precipitation. Dewatering in open cut excavations may be accomplished using a dewatering system suggested by the Contractor and approved by the engineer.

5. For open cut methods, excavations in excess of 4.0 feet in depth should be sloped and or shored according to OSHA requirements. Preliminary analysis indicates that excavations extending to the proposed invert elevations may be laid back at a slope rate no steeper than 3/4:1 (Horizontal to Vertical). If excavations cannot be sloped as recommended, the excavated sidewalls should be shored using a trench box system using the estimated soil parameters shown in Table 2 of the subsurface investigation report.

6. On-site excavated soils, except topsoil, are considered suitable for use for backfill provided proper moisture content is maintained during placement.

7. Pipe installation, trench width, bedding and backfill compaction should be performed in accordance with ISS.

8. Directional drilling should be possible at this site. Additional test borings may be needed to confirm the soil conditions.

GTL ENGINEERING

TABLE OF CONTENTS

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I.	PROJECT LOCATION AND DESCRIPTION	1
II.	SUBSURFACE INVESTIGATION	1
III.	FINDINGS	2
IV.	ANALYSES AND RECOMMENDATIONS	3
V.	CHANGED CONDITIONS	5
VI.	TESTING AND OBSERVATION	5
VII.	CLOSURE	5

APPENDIX A	GENERAL SITE PLAN BORING LOCATION PLAN
APPENDIX B	TEST BORING RECORDS
APPENDIX C	LABORATORY TEST RESULTS
APPENDIX D	GENERALIZED SOIL PROFILE

I. PROJECT LOCATION AND DESCRIPTION

The project is located on the west side of SR 15 between 283m (929') south of US 20 and 220m (722') north of US 20 in Elkhart County, Indiana. The project involves the design and construction of a new storm sewer line between stations 10+117 and 10+620 for approximately 503m (1650'). The storm sewer will be 900mm to 1050mm in diameter.

Based upon the site plans provided by INDOT, the proposed storm sewer line will be constructed at invert elevations ranging from 260.95m at station 10+620 to 257.35 at station 10+117. Review of available X-sections for this project revealed that the storm sewer will be installed at depths of approximately 0.5m to 5.0m (2' to 16.5') beneath existing grade. We have assumed the storm sewer line will be constructed using conventional open cut excavation method. Also, we assumed directional drilling may be used where the storm line crosses US 20.

II. SUBSURFACE INVESTIGATION

Three (3) additional soil test borings, designated as SSL-1, SSL-2 and SSL-3, were drilled for this supplemental investigation at the locations shown on the enclosed test boring records. These test borings were drilled to depths ranging from 4.57m to 9.14m (15' to 30'). We have included in this report 5 borings that were drilled in 2001 for SR15/US20 roadway improvements and for a box culvert at station 10+122. These borings are designated as RB-3, RB-4, RB-5, TB-1 and TB-2,

The current test borings were advanced with an All-Terrain-Vehicle (ATV) mounted drilling machine utilizing hollow stem augers (HSA) on October 23, 2003. Standard Penetration tests were conducted using a 140-pound automatic hammer falling 30 inches to drive a 2-inch O.D. split barrel sampler for 18 inches.

Drilling, sampling, field and laboratory testing have been performed according to standard geotechnical engineering practices, INDOT and current ASTM procedures. Results from field and laboratory tests are shown on the enclosed boring records and soil profile.

Soil samples obtained from the drilling operation were preserved in glass jars, visually classified in the field and laboratory. Representative soil samples were tested for natural moisture content, Atterberg limits, grain size distribution, unconfined compression and pH.

Locations and ground surface elevations of the test borings were interpolated from the site plans provided by INDOT.

III. FINDINGS

The subsurface findings presented in this section are based upon the test borings drilled in 2003. The test borings drilled in 2001 are included in this report for additional information.

The test borings drilled along the proposed storm sewer line exhibited 3 to 12 inches (75 to 150mm) of topsoil at the surface.

Beneath the surface cover, SSL-1 through SSL-3 encountered mainly glacial till deposits described as sandy loam. Seams and/or layers of sand were encountered in isolated locations within the till deposits. TB-2 drilled near the proposed line outlet exhibited sand deposits throughout the drilled depth.

Standard penetration blowcount values ranged from 4 to 31 blows per foot (bpf) with natural moisture content values of 7 to 22 percent.

Groundwater and soil cave-in depths were recorded during the field investigation as shown in Table 1. Refer to the enclosed test boring records for information about the soils and groundwater encountered during this investigation.

Table 1 – Groundwater Level

Boring No.	During Drilling		At Completion		At 24-Hours		Cave-in Depth (m)
	Depth (m)	Elevation (m)	Depth (m)	Elevation (m)	Depth (m)	Elevation (m)	
RB-3	Dry	---	1.75	259.7	Dry	---	1.78
RB-4	0.91*	174.0*	2.51*	262.5*	0.91	264.1*	1.68
RB-5	Dry	---	Dry	---	Dry	---	2.29
TB-1	1.68	256.0	1.83	255.8	1.83	255.8	3.58
TB-2	1.83	255.2	1.52	255.5	0.91	256.1	1.22
SSL-1	Dry	---	Dry	---	Dry	---	---
SSL-2	8.53	256.0	5.64	258.9	5.49	259.0	---
SSL-3	3.96	258.5	1.68	260.8	1.52	261.0	2.44

* Possible trapped water in gravel base due to rain or surface runoff

IV. ANALYSIS AND RECOMMENDATIONS

The test borings indicate that the underlying soil conditions are suitable for the construction of the proposed storm sewer line. Generally, the storm sewer pipe would bear on sandy loam tills or sand at the outlet location. Based upon the above considerations and the soil data obtained from the field testing, the following recommendations are provided.

1. Excavation into the underlying soils to the proposed invert elevations may be accomplished using conventional excavation equipment. Generally, the soils at the proposed invert elevations of the pipe are expected to be medium stiff to stiff. However, due to removal of 16 feet of soil overburden, soft or loose soils may be encountered at or below the invert level in a form of soil swelling and/or liquefaction "boiling condition". In such an event, the soft/loose soils should be compacted or removed and replaced with suitable fill materials, or as otherwise directed by the Engineer.

2. The test borings indicated that groundwater or trapped water is contained in the sand seams or layers embedded within the till deposits. Based upon the groundwater levels observed during the field investigation and natural moisture content values of the recovered soil samples, groundwater may be encountered in isolated locations depending upon the depth of the sand layers within the till deposits. Note that the test borings were drilled in October where the groundwater may be at its lowest level. Therefore, the groundwater may be encountered at higher elevations depending upon time of construction and amount of precipitation. Dewatering in open cut excavations may be accomplished using sump pumps, well point system, or any dewatering system suggested by the Contractor and approved by the engineer.

3. For open cut methods, excavations in excess of 4.0 feet in depth should be sloped and or shored according to OSHA requirements. Preliminary analysis indicates that excavations extending to the proposed invert elevations may be laid back at a slope rate no steeper than 3/4:1 (Horizontal to Vertical).

   The recommended slope rates may be modified during construction depending upon groundwater levels and sand deposits within the glacial tills. The excavated side slope should be observed and approved during construction by an experienced Registered Engineer.

   If excavations cannot be sloped as recommended, the excavated sidewalls should be shored using a trench box system, or equivalent. The estimated soil parameters shown in Table 2 below may be used in designing the shoring system. The effects of surcharge loads from construction equipment, traffic and soil stockpiled adjacent to the excavated sidewalls should be considered in the design of the shoring system.

Table 2 – Estimated Soil Parameters for Shoring Design

Soil Parameters	Materials Type		
	In-place Fill	Sand Loam (Till)	Sand/Sand & Gravel
Total Unit Weight, pcf (kg/m^3)	120 (1925)	135 (2160)	125 (2000)
Undrained Shear Strength where Ø = 0°, psf (kN/m^2)	0	3000 (145)	0
Cohesion, psf (kN/m^2)	0	600 (29)	0
Angle of Internal Friction (Ø), Degrees	30	25	32
At Rest Pressure, Ko	0.50	0.58	0.47
Active Pressure, Ka	0.33	0.41	0.31
Passive Pressure, Kp	3.00	2.46	3.25

5. On-site excavated soils, except topsoil, are considered suitable for use for backfill provided proper moisture content is maintained during placement. A portion of the excavated soils may exhibit natural moisture content values above the optimum moisture. Such soils may require air-drying or other methods. Additional fill, if required, may consist of sandy silt, sand and gravel materials, flowable fill, or as otherwise directed by the Engineer.

6. Backfill materials should be placed and compacted in accordance with INDOT Standard Specifications. The engineered fill should not be placed in a frozen condition or over a frozen subgrade.

7. Pipe installation, trench width, bedding and backfill compaction should be performed in accordance with ISS.

8. Directional drilling should be possible at this site. Additional test borings may be needed to confirm the soil conditions in the area of the directional drilling operations are similar to those encountered in borings SSL-1 and SSL-2.

V. CHANGED CONDITIONS

Should details of the proposed storm sewer line be changed from those used in preparing this report, CTL should be notified to make the necessary modifications in our recommendations to account for the changed conditions.

VI. TESTING AND OBSERVATION

Experience shows that underlying soil conditions in an area sometimes vary from the ones indicated in the borings at their specific locations. It is therefore recommended that a Soils Engineering Technician, under the supervision of a qualified Geotechnical Engineer, be retained on site to observe all excavations, soils at bottom of excavations and placement of backfill.

VII. CLOSURE

CTL has prepared this report for your use in accordance with generally accepted soil and foundation engineering practices. Analysis, conclusions and other work product of CTL are instruments of service for this project only.

Soil samples will be retained in our laboratory for 60 days, after which they will be discarded unless instructions are received from you as to their disposal.

CTL's assignment does not include, nor does this geotechnical report address, the environmental aspects of the particular site.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.
Principal Engineer
Indiana Reg. No. 60900551

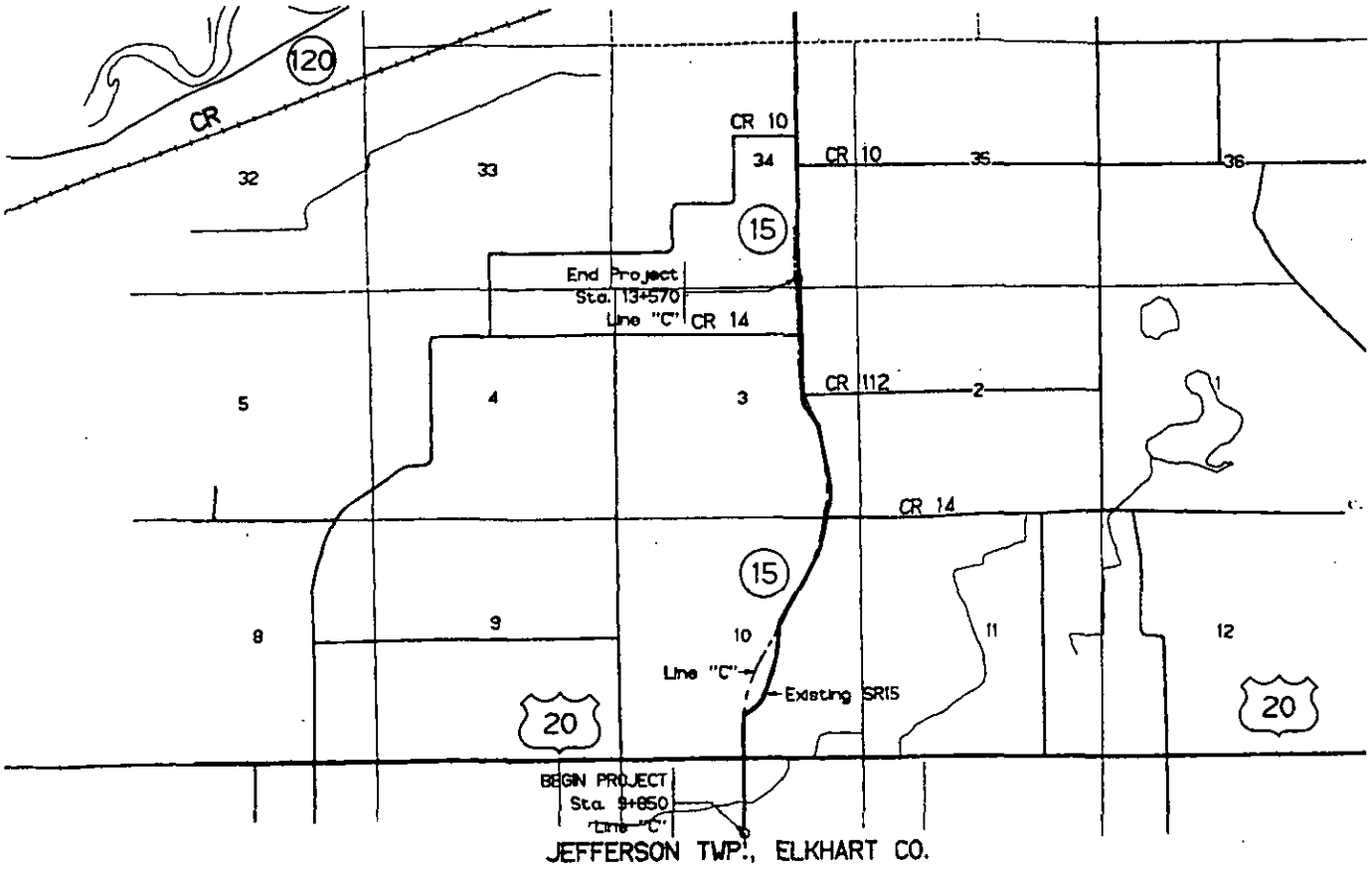
ALI H. KARAKI
REGISTERED
No.
900551
STATE OF
INDIANA
PROFESSIONAL ENGINEER

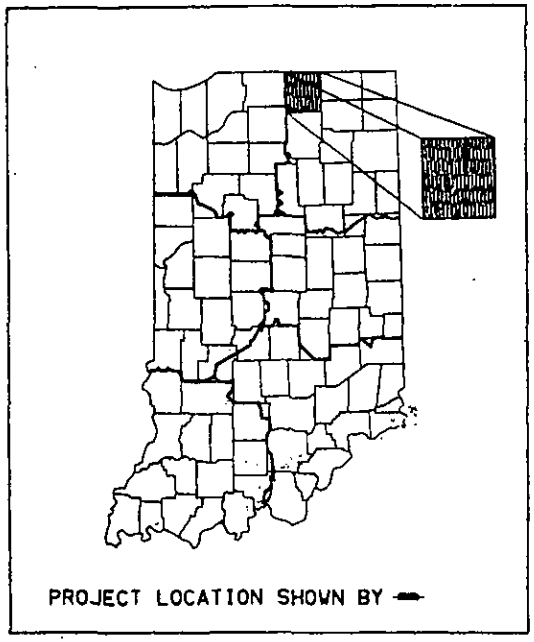
Paul L. Douglass, P.E.
Principal Engineer
Indiana Reg. No. 60012388

CTL ENGINEERING

APPENDIX A

GENERAL SITE PLAN





GENERAL SITE PLAN

SR 15/ US 20 Improvement

SR 15 from 0.56 km S. of US 20 to 3.10 km N. of US 20

Des. No.: 8354420, Project No.: STP-4320 (3)

Elkhart County, Indiana

APPENDIX B

TEST BORING RECORDS

SOIL DESCRIPTION

NON-COHESIVE SOIL DESCRIPTION	STANDARD PENETRATION BLOWCOUNTS PER FOOT (BPF)
Very Loose	0 - 5
Loose	6 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	Over 50

COHESIVE SOIL DESCRIPTION	STANDARD PENETRATION BLOWCOUNTS PER FOOT (BPF)
Very Soft	0 - 3
Soft	4 - 5
Medium Stiff	6 - 10
Stiff	11 - 15
Very Stiff	16 - 30
Hard	Over 30

GRADATION COMPONENT	SIZE
Boulders	Retained on 8"
Cobbles	Passing 8" Retained on 3"
Gravel	Passing 3" Retained on #10
Coarse Sand	Passing #10 Retained on #40
Fine Sand	Passing on #40 Retained on #200
Silt	0.075 mm to 0.002 mm
Clay	Smaller than 0.002 mm

MOISTURE TERMS	DESCRIPTION
Dry	Powdery
Slightly Moist	Below Plastic
Moist	Above Plastic, Below Liquid
Very Moist	At Liquid
Wet	Above Liquid

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TEST BORING RECORD

CLIENT	: Indiana Department of Transportation	BORING NO.:	SSL-1
PROJECT	: Proposed Storm Sewer Line	SHEET	1 OF 1
LOCATION	: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.	DATE STARTED	: 10-23-03
DES NO.	: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061	DATE COMPLETED	: 10-24-03

BORING ELEVATION	: 262.5 m USC&GS	BORING METHOD	: HSA	HAMMER	: Automatic
STATION	: 10+293	RIG TYPE	: CME 55 Truck	DRILLER	: TN
OFFSET	: 15 m Lt	CASING DIA.	: 83 mm	TEMPERATURE	: High 60's ° F
LINE	: "B"	CORE SIZE	: —	WEATHER	: Cloudy
DEPTH	: 1.67 m				

GROUNDWATER: Encountered at Dry At Completion Dry 24 hours Reading Dry Caved in at m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
262.35		TOPSOIL (150mm) (Visual)	0.15										
		Brown, Slightly Moist, Medium Stiff to Very Stiff, **SANDY LOAM** with Gray Streaks in SS-2 A-4 (1) Lab 1		SS-1	4 4 6	10	100	13			22	12	10
	1.5			SS-2	5 8 11	19	100						
260.67			1.83										
				SS-3	5 7 9	16	100	11			22	12	10
	3.0	Brown Changing to Gray, Damp, Very Stiff to Stiff, **SANDY LOAM (TILL)** A-4 (1) Lab 2		SS-4	5 7 10	17	100	11	2235	383 @ 15.0%			
	4.5			SS-5	4 6 7	13	100	12					
257.32			5.18										
257.01		Gray, Moist, Medium Stiff, **CLAY LOAM** (Visual)	5.49	SS-6	5 3 5	8	100	22					
		Bottom of Boring at 5.14 meters (18')											
	6.0	**NOTES** 1. Temporary slotted PVC pipe set at 18 feet 2. Boring backfilled with soil cuttings.											

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	- Hollow Stem Auger	SS	- Split Spoon Sample	*	- Hand Penetrometer
SFA	- Solid Flight Auger	ST	- Shelby Tube Sample	LL	- Liquid Limit
RC	- Rock Coring	CR	- Rock Core Sample	PL	- Plastic Limit
MD	- Mud Drilling	BS	- Bag Sample	PI	- Plasticity Index
WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
BORING NO.: SSL-2
PROJECT : Proposed Storm Sewer Line
SHEET 1 OF 2
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.
DATE STARTED : 10-23-03
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061
DATE COMPLETED : 10-24-03

BORING ELEVATION : 264.5 m USC&GS
STATION : 10+473
OFFSET : 15 m Lt
LINE : "B"
DEPTH : 2.79 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : TN
TEMPERATURE : High 60's ° F
WEATHER : Cloudy

GROUNDWATER: ▼ Encountered at 8.53 m ▽ At Completion 5.64 m ▽ 24 hours Reading 5.49 m ⊠ Caved in at m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
264.35		TOPSOIL (150mm) (Visual)	0.15										
				SS-1	2 3 7	10	100	11					
	1.5			SS-2	6 7 10	17	100	11	2120	569 @ 11.1%			
		Brown, Slightly Moist, Medium Stiff to Very Stiff, **SANDY LOAM (TILL)** with Sand Seams in SS-4 A-4 As Lab 2		SS-3	5 7 11	18	67						
	3.0			SS-4	3 5 7	12	67	12					
260.23			4.27										
	4.5			SS-5	4 3 10	13	100						
		Gray, Slightly Moist to Moist, Medium Stiff to Hard, **SANDY LOAM (TILL)** A-4 As Lab 2											
	6.0			SS-6	4 3 4	7	100	19					

Continued on next page

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

BORING NO.: SSL-2

PROJECT : Proposed Storm Sewer Line

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m^3)	Unconfined Compression (kN/m^2)	Atterberg Limits LL	PL	PI
	7.5	Gray, Slightly Moist to Moist, Medium Stiff to Hard, **SANDY LOAM (TILL)** A-4 As Lab 2		SS-7	13 16 15	31	33						
255.81			8.69		5								
255.51	9.0	Brown, Wet, Medium Dense, **SAND** (Visual)	8.99	SS-8	7	22	100	12					
255.36		Gray, Wet, Very Stiff, **SANDY LOAM (TILL)** (Visual)	9.14		15								
		Bottom of Boring at 9.14 meters (30')											
	10.5	**NOTES** 1. Temporary slotted PVC pipe set at 6.9 meters (22.5') 2. Boring backfilled with soil cuttings.											
	12.0												
	13.5												

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BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	Hollow Stem Auger	SS	Split Spoon Sample	*	Hand Penetrometer
SFA	Solid Flight Auger	ST	Shelby Tube Sample	LL	Liquid Limit
RC	Rock Coring	CR	Rock Core Sample	PL	Plastic Limit
MD	Mud Drilling	BS	Bag Sample	PI	Plasticity Index
WD	Wash Drilling	AC	Auger Cuttings	SPT	Standard Penetration Test
HA	Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : Proposed Storm Sewer Line
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: SSL-3
SHEET 1 OF 1
DATE STARTED : 10-23-03
DATE COMPLETED : 10-24-03

BORING ELEVATION : 262.5 m USC&GS
STATION : 10+600
OFFSET : 20 m Lt
LINE : "B"
DEPTH : 1.39 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : TN
TEMPERATURE : High 60's ° F
WEATHER : Cloudy

GROUNDWATER: ▼ Encountered at 3.96 m ▽ At Completion 1.68 m ▽ 24 hours Reading 1.52 m Caved in at 2.44 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
262.42		TOPSOIL (75mm) (Visual)	0.08										
		Brown, Moist, Medium Dense, **SAND & GRAVEL (FILL)** (Visual)		SS-1	10 14 15	29	100						
261.28			1.22	SS-2	4 4 5	9	33	20					
	1.5	Brown Changing to Brownish Black, Moist, Medium Stiff, **SANDY LOAM** with Traces of Organics **(Possible Fill)** (Visual)											
260.52			1.98	SS-3	4 3 4	7	100	7					
		Brown, Moist, Medium Stiff, **SANDY LOAM** A-4 As Lab 1											
259.91			2.59										
259.60		Brown, Wet, Very Loose, **SAND** (Visual)	2.90	SS-4	1 1 3	4	44						
	3.0	Brown, Wet to Moist, Soft to Stiff, **SANDY LOAM** A-4 As Lab 2											
				SS-5	4 8 5	13	100						
257.93	4.5	**Bottom of Boring at 4.57 meters (15.0')**	4.57										
		Boring backfilled with soil cuttings.											
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

Test Boring Records drilled in 2001
Within the Limits of the Proposed Storm Sewer Line

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TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-3
SHEET 1 OF 1
DATE STARTED : 05-15-01
DATE COMPLETED : 05-15-01

BORING ELEVATION : 261.40 m (USC&GS)
STATION : 10+240
OFFSET : 10 m Rt
LINE : "C"
DEPTH : 2.29 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion 1.75 m ▽ 24 hours Reading Dry Caved in at 1.78 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
261.25		TOPSOIL (152 mm) (Visual)	0.15										
		Brown, Moist, Loose, **SANDY LOAM** with Traces of Roots A-4 As Lab 3		SS-1	5 5 5	10	89	16					
260.64			0.76										
		Brown, Slightly Moist, Medium Stiff to Very Stiff, **SANDY CLAY LOAM** A-4 (0) Lab 1		SS-2	3 3 4	7	100						
	1.5			SS-3	6 9 10	19	100	10			18	11	7
259.11		**Bottom of Boring at 2.29 meters** Boring backfilled with soil cuttings.	2.29										
	3.0												
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-4
SHEET 1 OF 1
DATE STARTED : 06-20-01
DATE COMPLETED : 06-20-01

BORING ELEVATION : 265.00 m (USC&GS)
STATION : 10+360
OFFSET : 10 m Rt
LINE : "C"
DEPTH : 3.05 m

BORING METHOD : HSA
RIG TYPE : CME 550 ATV
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 80° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 0.91 m ▽ At Completion 2.51 m ▽ 24 hours Reading 0.91 m Caved in at 1.68 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
264.85		**GRAVEL** (Fill) (152 mm) (Visual)	0.15										
		Gray, Moist, Loose, **SANDY LOAM** A-4 As Lab 3		SS-1	7 5 2	7	78	15					
264.24			0.76										
		Brown with Gray Streaks, Moist, Medium Stiff to Stiff, **SANDY CLAY LOAM** A-4 As Lab 1		SS-2	2 2 5	7	94	18					
	1.5			SS-3	4 6 9	15	100						
262.71			2.29										
		Brown, Slightly Moist, Stiff, **LOAM** A-4 As Lab 5		SS-4	7 5 7	12	100						
261.95	3.0		3.05										
		Bottom of Boring at 3.05 meters Boring backfilled with soil cuttings. NOTE: The 24-hours groundwater reading may be due to rain accumulated in the borehole.											
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: RB-5
SHEET 1 OF 1
DATE STARTED : 05-15-01
DATE COMPLETED : 05-15-01

BORING ELEVATION : 264.50 m (USC&GS)
STATION : 10+480
OFFSET : 5 m Rt
LINE : "C"
DEPTH : 3.05 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : —

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▽ At Completion Dry ▽ 24 hours Reading Dry Caved in at 2.29 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
264.14		**ASPHALT CONCRETE** (356 mm) (Visual)	0.36										
		Gray changing to Brown, Slightly Moist, Medium Dense, **SANDY LOAM** A-4 As Lab 3		SS-1	6 8 5	13	100	13					
263.59			0.91										
	1.5			SS-2	3 6 10	16	67	11					
		Brown with Gray Streaks, Slightly Moist, Very Stiff, **LOAM (TILL)** A-4 As Lab 5		SS-3	4 7 10	17	100						
261.45	3.0		3.05	SS-4	3 7 9	16	100						
		Bottom of Boring at 3.05 meters											
		Boring backfilled with soil cuttings and pavement restored with concrete patch.											
	4.5												
	6.0												

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling	AC - Auger Cuttings	SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: TB-1
SHEET 1 OF 1
DATE STARTED : 05-22-01
DATE COMPLETED : 05-22-01

BORING ELEVATION : 257.65 m (USC&GS)
STATION : 10+128
OFFSET : 20 m Rt
LINE : "C"
DEPTH : 4.57 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 1.68 m ▽ At Completion 1.83 m ▽ 24 hours Reading 1.83 m ⊠ Caved in at 3.58 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
257.19		**TOPSOIL** (457 mm) (Visual)	0.46										
		Black to Dark Gray, Moist, Very Loose, **SANDY LOAM** A-4 As Lab 3		SS-1	2 2 1	3	94	28					
				SS-2	0 1 1	2	67						
256.13	1.5	Black to Dark Gray, Moist, Loose, **SAND** A-1-b As Lab 4	1.52										
255.67			1.98	SS-3	4 5 4	9	67						
	3.0	Brownish Gray, Wet, Medium Dense, **SAND** (Visual)		SS-4	4 5 6	11	67						
				SS-5	5 8 13	21	89						
253.08	4.5	**Bottom of Boring at 4.57 meters**	4.57										
		Boring backfilled with soil cuttings.											
		Dozer used to pull drilling rig.											
	6.0												

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BORING METHOD
HSA - Hollow Stem Auger
SFA - Solid Flight Auger
RC - Rock Coring
MD - Mud Drilling
WD - Wash Drilling
HA - Hand Auger

SAMPLING METHOD
SS - Split Spoon Sample
ST - Shelby Tube Sample
CR - Rock Core Sample
BS - Bag Sample
AC - Auger Cuttings

ABBREVIATIONS
* - Hand Penetrometer
LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index
SPT - Standard Penetration Test

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: TB-2
SHEET 1 OF 2
DATE STARTED : 05-11-01
DATE COMPLETED : 05-11-01

BORING ELEVATION : 257.00 m (USC&GS)
STATION : 10+126.5
OFFSET : 20 m Lt
LINE : "C"
DEPTH : 6.10 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 70° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at 1.83 m ▼ At Completion 1.52 m ▽ 24 hours Reading 0.91 m Caved in at 1.22 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
256.54		**TOPSOIL** (305 mm) (Visual)			3								
			0.46	SS-1	2	4	67	21					
256.24		Dark Gray to Black, Moist, Very Loose, **SAND** with Little Roots (Visual)	0.76		2								
	1.5				8								
				SS-2	24	31	72						
					7								
					6								
				SS-3	6	12	72						
					6								
	3.0				8								
				SS-4	10	18	89						
		Brownish Gray, Wet, Dense to Loose, **SAND** with Bouldery Zone at 1.52 m (Visual)			8								
		25 gallons of water was used to keep sand from heaving at 4.57 m											
					3								
	4.5			SS-5	4	9	83						
					5								
					8								
	6.0			SS-6	3	8	100						
250.90			6.10		5								
		Bottom of Boring at 6.10 meters											

Continued on next page

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BORING METHOD
HSA - Hollow Stem Auger
SFA - Solid Flight Auger
RC - Rock Coring
MD - Mud Drilling
WD - Wash Drilling
HA - Hand Auger

SAMPLING METHOD
SS - Split Spoon Sample
ST - Shelby Tube Sample
CR - Rock Core Sample
BS - Bag Sample
AC - Auger Cuttings

ABBREVIATIONS
* - Hand Penetrometer
LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index
SPT - Standard Penetration Test

TEST BORING RECORD

CLIENT : Indiana Department of Transportation

PROJECT : SR 15/US 20 Improvement

BORING NO.: TB-2

SHEET 2 OF 2

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits		
											LL	PL	PI
		Boring backfilled with soil cuttings.											
	7.5												
	9.0												
	10.5												
	12.0												
	13.5												

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CTL Engineering of Indiana, Inc.
6330 East 75th Street, Suite 178
Indianapolis, Indiana 46250
Phone: 317-585-8277
Fax: 317-585-8621

BORING METHOD		SAMPLING METHOD		ABBREVIATIONS	
HSA	- Hollow Stem Auger	SS	- Split Spoon Sample	*	- Hand Penetrometer
SFA	- Solid Flight Auger	ST	- Shelby Tube Sample	LL	- Liquid Limit
RC	- Rock Coring	CR	- Rock Core Sample	PL	- Plastic Limit
MD	- Mud Drilling	BS	- Bag Sample	PI	- Plasticity Index
WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

TEST BORING RECORD

CLIENT : Indiana Department of Transportation
PROJECT : SR 15/US 20 Improvement
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

BORING NO.: TB-3
SHEET 1 OF 1
DATE STARTED : 05-22-01
DATE COMPLETED : 05-22-01

BORING ELEVATION : 258.15 m (USC&GS)
STATION : 12+636
OFFSET : 18 m Rt
LINE : "C"
DEPTH : 4.57 m

BORING METHOD : HSA
RIG TYPE : CME 55 Truck
CASING DIA. : 83 mm
CORE SIZE : ---

HAMMER : Automatic
DRILLER : KO
TEMPERATURE : 75° F
WEATHER : Sunny

GROUNDWATER: ▼ Encountered at Dry ▼ At Completion Dry ▽ 24 hours Reading Dry ⊠ Caved in at 4.27 m

Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits LL	PL	PI
					2								
		Dark Gray, Moist, Very Loose, **SAND** with Little Traces of Roots (Visual)		SS-1	1	2	67						
					1								
					2								
256.93			1.22	SS-2	2	6	56						
	1.5				4								
					3								
				SS-3	2	4	67						
					2								
					3								
		Brown, Moist to Very Moist, Loose, **SAND** with **SANDY CLAY LOAM** between 1.98 m and 2.44 m (Visual)		SS-4	3	5	89						
	3.0				2								
					2								
				SS-5	2	5	89						
253.58	4.5		4.57		3								
		Bottom of Boring at 4.57 meters											
		Boring backfilled with soil cuttings.											
	6.0												

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WD	- Wash Drilling	AC	- Auger Cuttings	SPT	- Standard Penetration Test
HA	- Hand Auger				

APPENDIX C

LABORATORY TEST RESULTS

Summary of Classification Test Results
Grain Size Distribution Curves
Unconfined Compression Test Results
Summary of Special Laboratory Test Results

CTL ENGINEERING

Lab No.	Boring No.	Station	Offset	Line	Sample No.	Depth	Soil Classification	AASHTO Group	Percent Passing (Sieve No.)			Grain Size Distribution (%)				WC	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture Content (%)	CBR @ 93%	CBR @ 97%
									10	40	200	Gravel	Sand	Silt	Clay								
Lab 1	SSL-1	10+293	15 m Lt	"B"	SS-1	0.30-0.76	SANDY LOAM	A-4 (1)	91.5	73.3	42.1	8.5	49.4	26.4	15.7	13	22	12	10				
Lab 2	SSL-1	10+293	15 m Lt	"B"	SS-3	1.83-2.29	SANDY LOAM	A-4 (1)	92.5	76.0	45.6	7.5	46.9	28.1	17.5	11	22	12	10				

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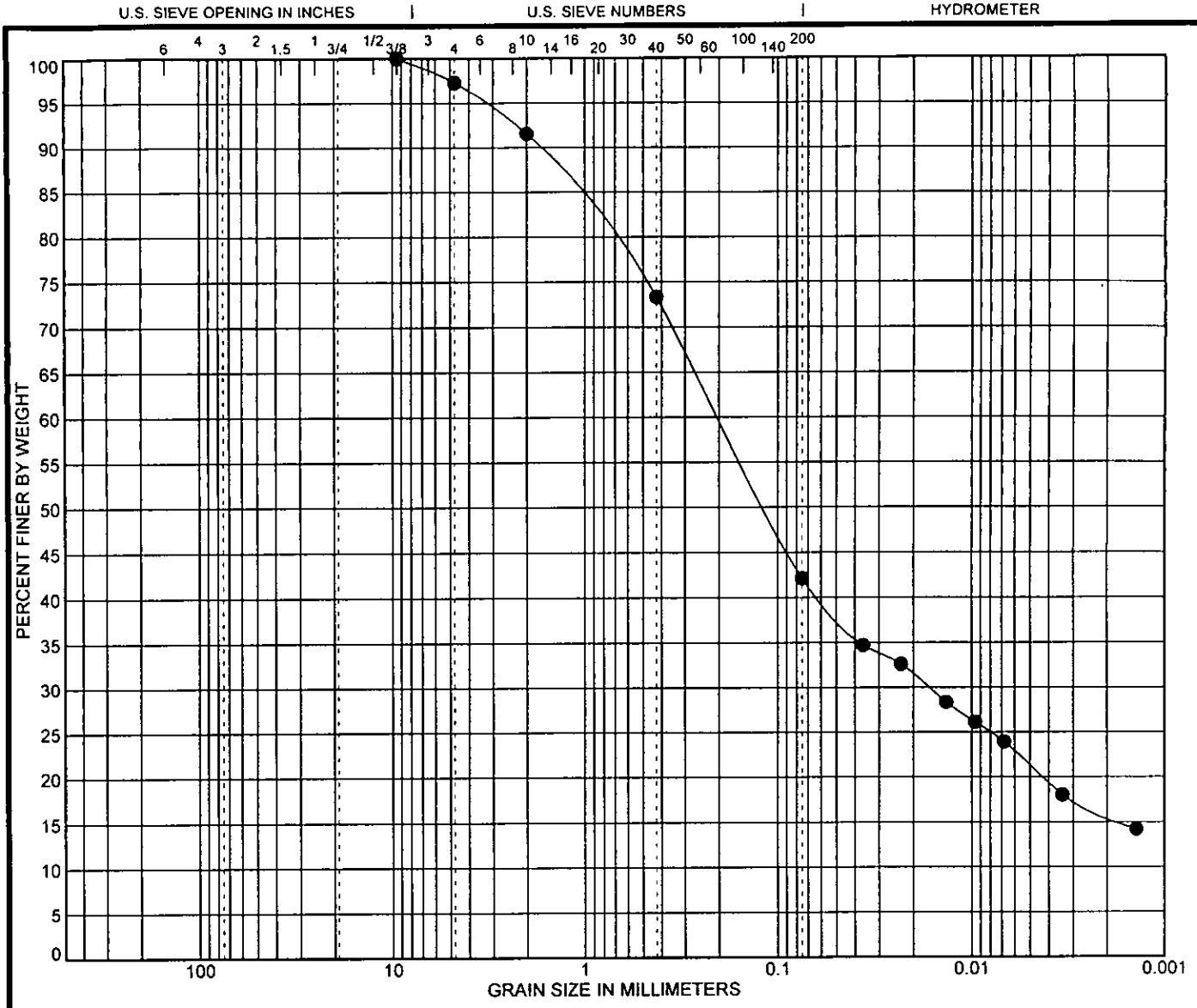
SUMMARY OF CLASSIFICATION TEST RESULTS

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Project No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Boring No.	SSL-1	Classification	MC	LL	PL	PI	Cc	Cu
Sample	SS-1	SANDY LOAM	13	22	12	10		
Depth	0.30-0.76	A-4(1)						
Station	10+293	Lab 1						
Offset	15 m Lt							
Line	"B"							

Remarks	D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
	9.5	0.202	0.116	0.017		8.5	49.4	26.4	15.7

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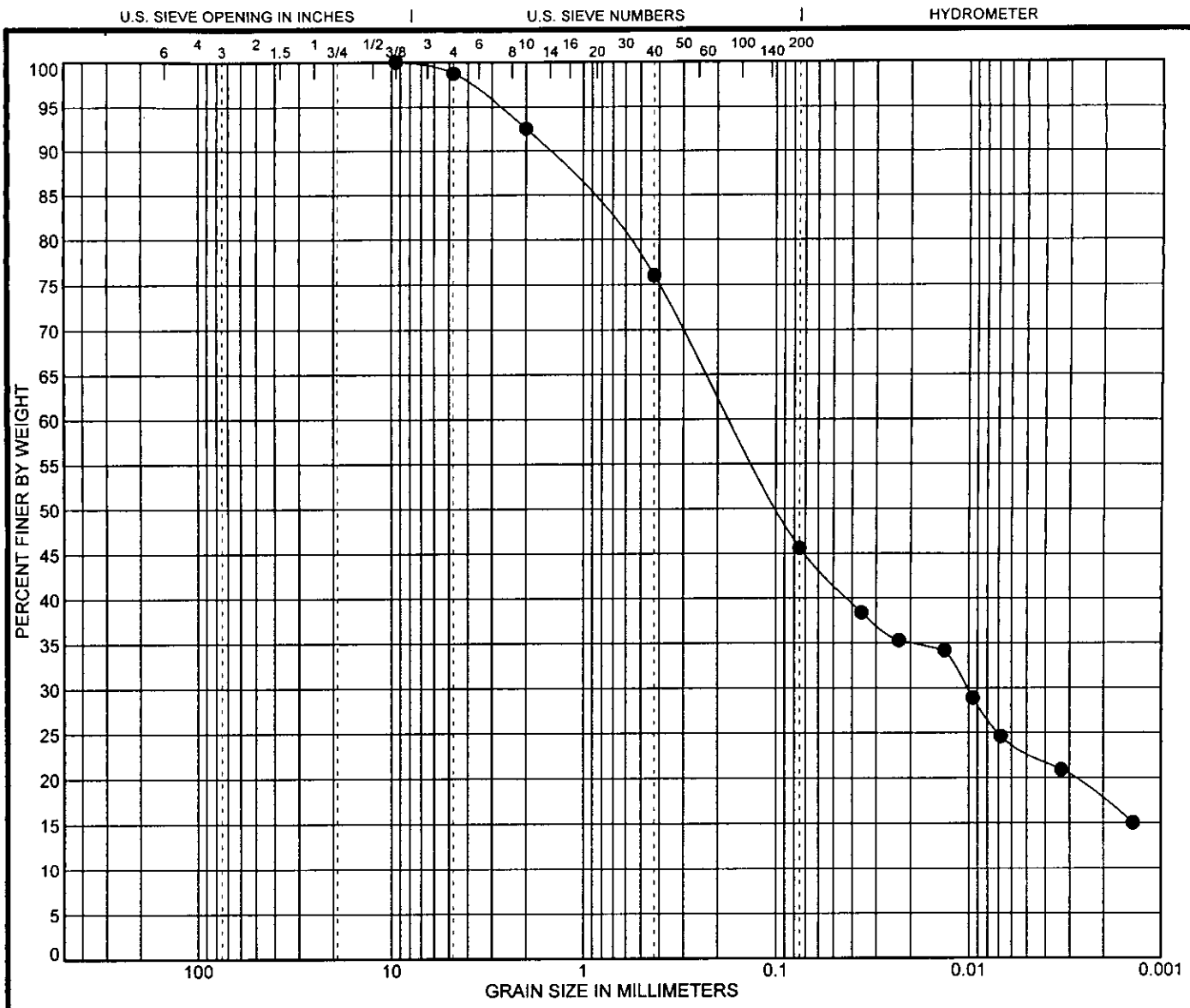
GRAIN SIZE DISTRIBUTION

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Boring No.	SSL-1	Classification	MC	LL	PL	PI	Cc	Cu
Sample	SS-3	SANDY LOAM	11	22	12	10		
Depth	1.83-2.29	A-4(1)						
Station	10+293	Lab 2						
Offset	15 m Lt							
Line	"B"							

Remarks	D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
	9.5	0.17	0.096	0.01		7.5	46.9	28.1	17.5

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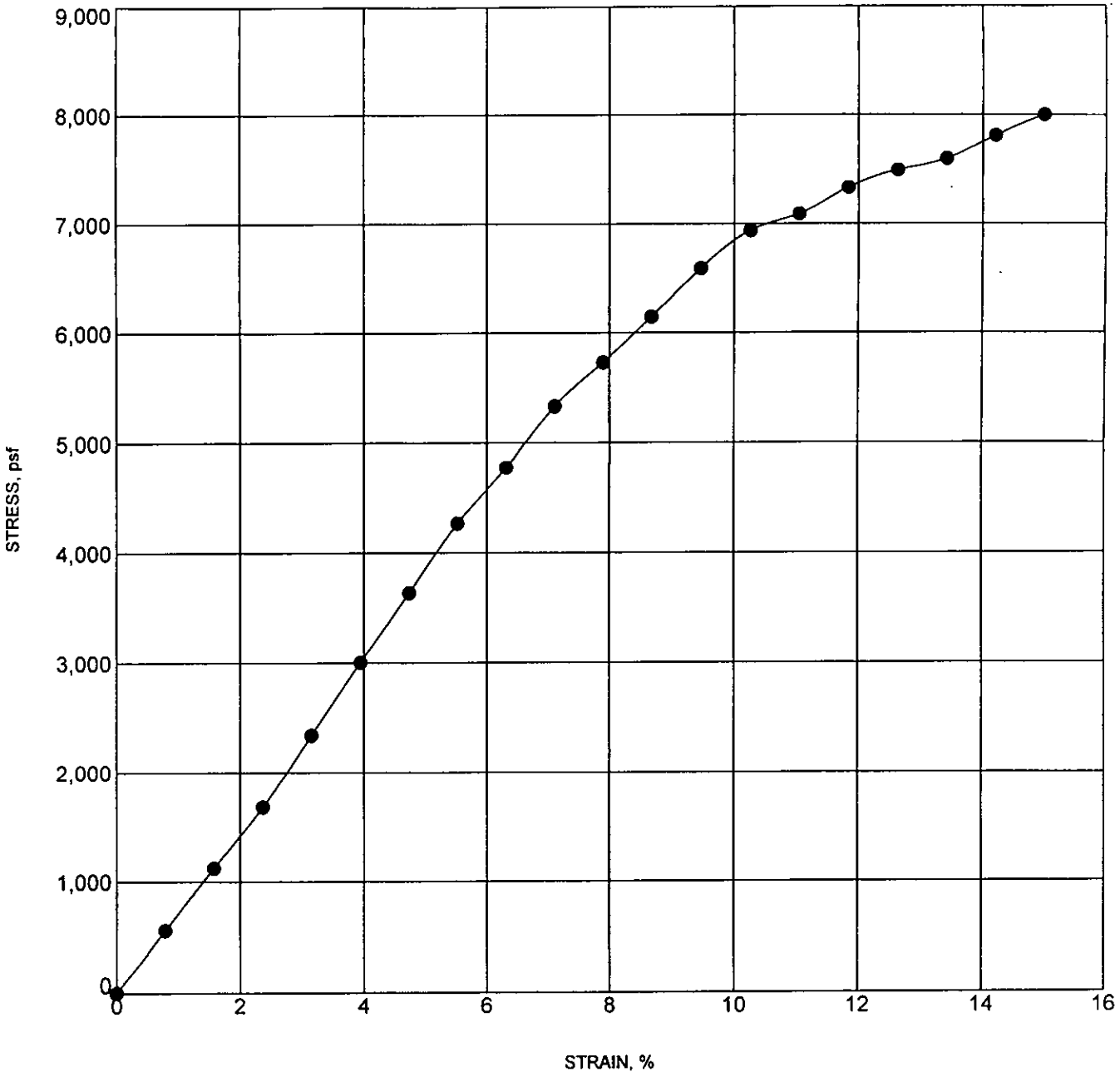
GRAIN SIZE DISTRIBUTION

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061



Boring Information		Test Results	English	Metric
Boring No.	SSL-1	Natural Moisture Content, %	11	11
Sample	SS-4	Natural Wet Density, pcf (kg/m^3)	139.4	(2235)
Depth	2.59 - 3.05	Natural Dry Density, pcf (kg/m^3)	125.3	(2008)
Station	10+293	Unconfined Compression Strength, psf (kN/m^2)	8003	(383)
Offset	15 m Lt	Failure Strain, %	15.0	15.0
Line	"B"	SOIL DESCRIPTION		

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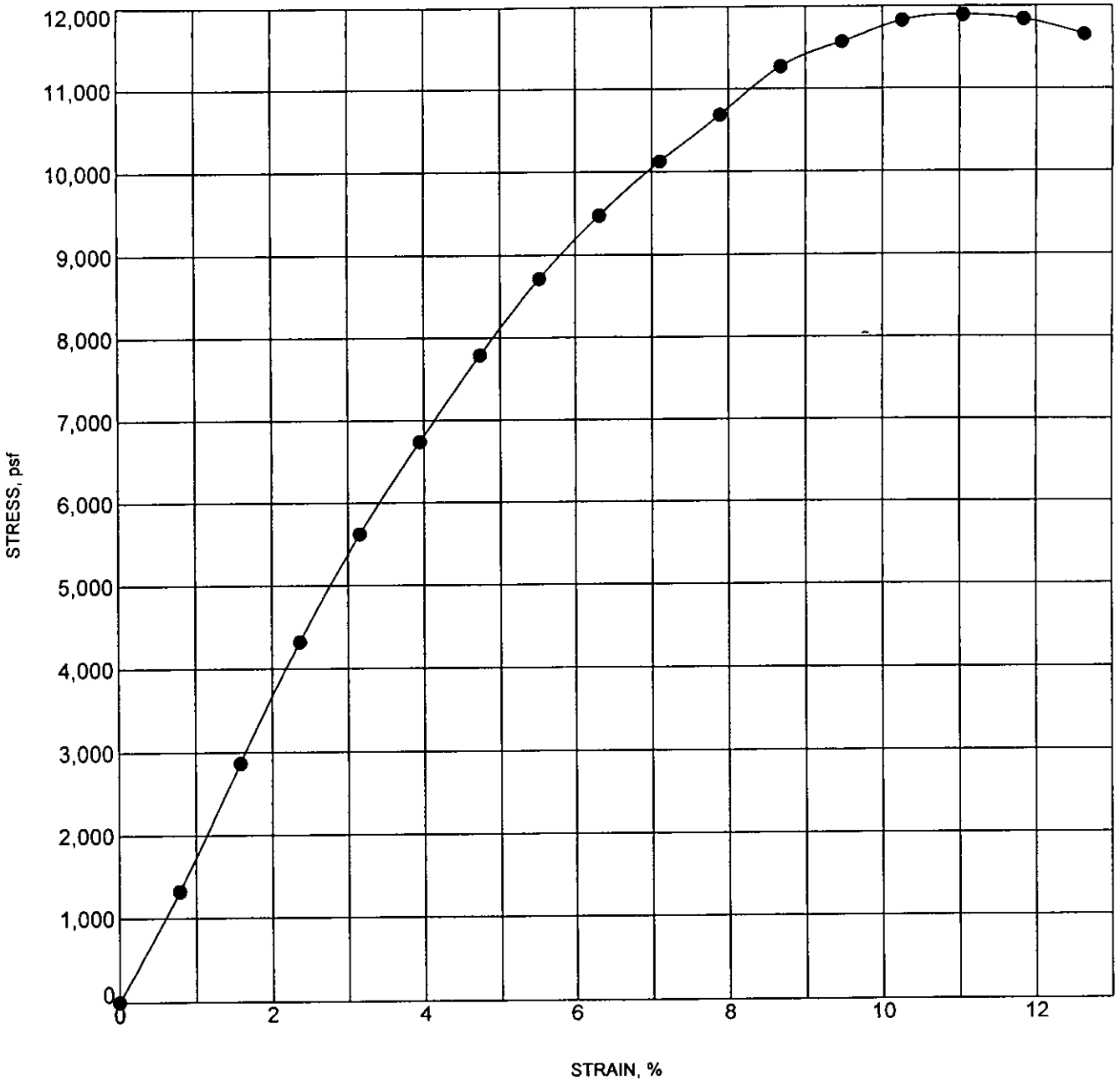
UNCONFINED COMPRESSION TEST

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061



Boring Information		Test Results	English	Metric
Boring No.	SSL-2	Natural Moisture Content, %	11	11
Sample	SS-2	Natural Wet Density, pcf (kg/m^3)	132.3	(2120)
Depth	1.07 - 1.53	Natural Dry Density, pcf (kg/m^3)	118.8	(1904)
Station	10+473	Unconfined Compression Strength, psf (kN/m^2)	11893	(569)
Offset	15 m Lt	Failure Strain, %	11.1	11.1
Line	"B"	SOIL DESCRIPTION		

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UNCONFINED COMPRESSION TEST

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

Boring No.	Station	Offset	Line	Sample No.	Depth (m)	Moisture Content (%)	Wet Density (pcf)	Dry Density (pcf)	Unconfined Compression (psf)	Failure Strain (%)	Loss on Ignition (%)	pH
SSL-1	10+293	15 m Lt	"B"	SS-1	0.30-0.76	13						8.34
SSL-1	10+293	15 m Lt	"B"	SS-3	1.83-2.29	11						8.39
SSL-1	10+293	15 m Lt	"B"	SS-4	2.59-3.05	11	139.4	125.3	8003	15.0		
SSL-1	10+293	15 m Lt	"B"	SS-5	4.11-4.57	12						
SSL-1	10+293	15 m Lt	"B"	SS-6	5.03-5.49	22						
SSL-2	10+473	15 m Lt	"B"	SS-1	0.30-0.76	11						
SSL-2	10+473	15 m Lt	"B"	SS-2	1.07-1.52	11	132.3	118.8	11893	11.1		
SSL-2	10+473	15 m Lt	"B"	SS-4	2.59-3.05	12						
SSL-2	10+473	15 m Lt	"B"	SS-6	5.64-6.10	19						
SSL-2	10+473	15 m Lt	"B"	SS-8	8.69-9.14	12						
SSL-3	10+600	20 m Lt	"B"	SS-2	1.07-1.52	20						
SSL-3	10+600	20 m Lt	"B"	SS-3	1.83-2.29	7						
TB-2	10+126.5	20m Lt	"C"	SS-1B	0.30-0.61	21						

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SUMMARY OF SPECIAL LABORATORY TEST RESULTS

Project: Proposed Storm Sewer Line

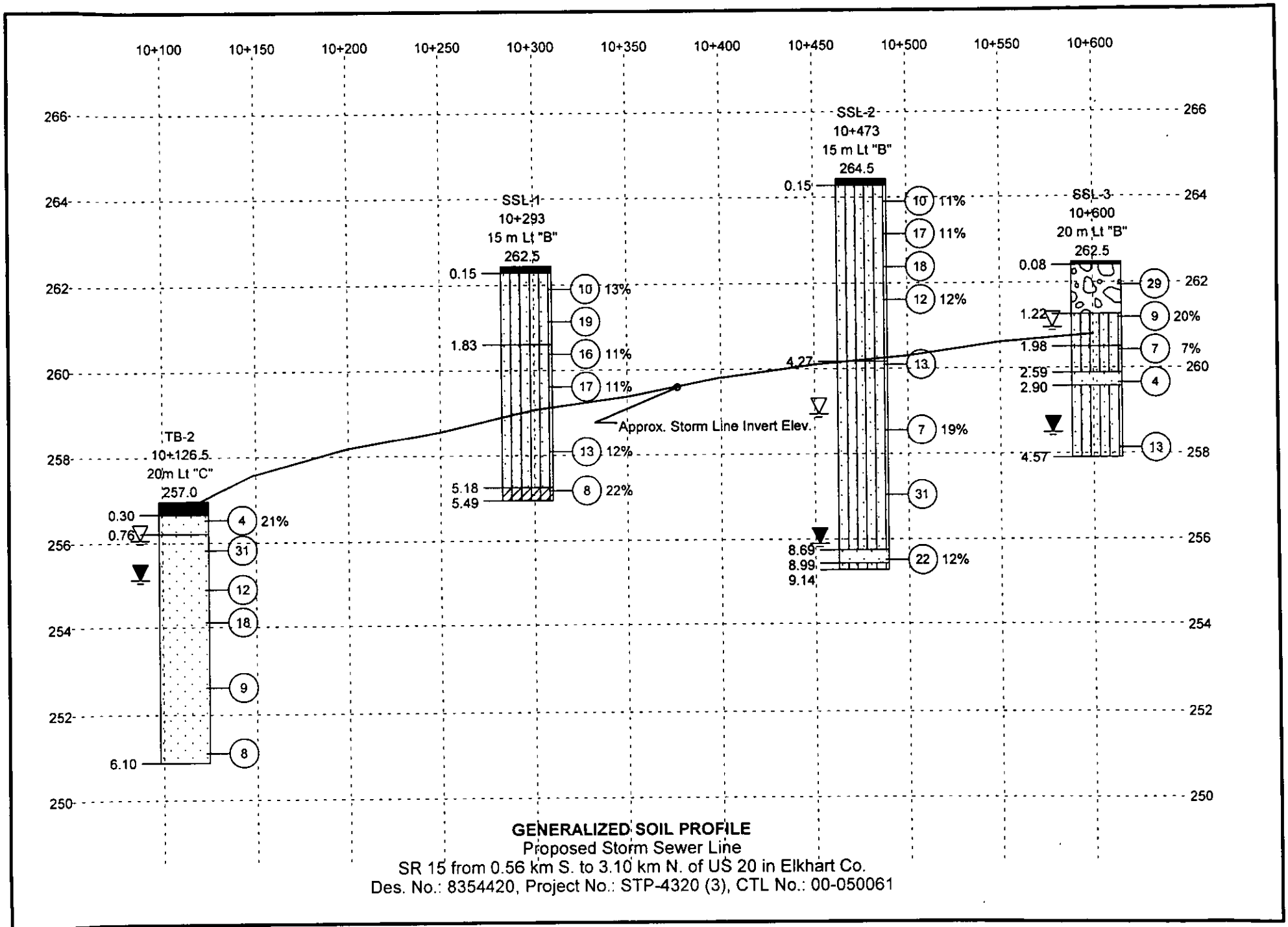
Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Project No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

APPENDIX D

GENERALIZED SOIL PROFILE

CTL ENGINEERING



GENERALIZED SOIL PROFILE
Proposed Storm Sewer Line
SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.
Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

IN_PROFILE_MET 00-61.GPJ CTLMET.GDT 2/3/04

Indiana Department of Transportation

Materials and Tests Division

120 South Shortridge Road P. O. Box 19389
Indianapolis, Indiana 46219-0389
Phone: (317) 610-7251 Fax: (317) 356-9351

March 30, 2004

CTL Engineering, Inc.
6330 E. 75th St. Suite 178
Indianapolis, Indiana 46250

Attn: Mr. Ali Karaki

Subject:
Des No: 8354420
Project No: STP - 4320 (3)
Structure No: N/A
SR 15, S. of US 20 to US 20 to 3.1 km N. of US 20
County: Elkhart
District: Fort Wayne

Gentlemen:

In accordance with the agreement dated November 8, 2001 the Final Quantities and Costs for the Geotechnical Investigation on the subject project have been calculated. Transmitted herewith is one copy of the following:

1. Itemization of Pay Quantities for Geotechnical Borings, and Tests.
2. Report of Final Costs for the Geotechnical Investigation.
3. Performance Evaluation of Consultant's Highway Development Services.

The total cost for the Geotechnical Work performed on the subject project is $3,459.00 Therefore, in order to finalize the payment, please submit an invoice voucher for $3,459.00 to:

Mr. Athar Khan, P.E.
Chief Geotechnical Engineer
INDOT Division of Materials and Tests
120 South Shortridge Road
P.O. Box 19389
Indianapolis, IN 46219-0389

If you have any questions concerning this matter, please call us.

Very truly yours,

Athar Khan
Chief Geotechnical Engineer

Somanath Hiremath
Geotechnical Engineering Group Leader

SSH/SS
cc: Mr. R. Asadi
File (Attachments)
H:bigal/OEA-356-357-evaluation

ITEMIZATION OF PAY QUANTITIES FOR INDOT SOIL BORINGS, REPORTS & PROFILES (TD-356)

BY: CTL Engineering, Inc. FOR: INDOT SHEET: 1 OF 1
DES: 8354420 PROJECT NO: STP - 4320 (7) STRUCTURE NO: N/A
LOCATION: Road Rehabilitation on SR 15 S.of US 20 to 3.1 km N. of US 20 COUNTY: Elkhart
PREPARED BY: Alebachew Tilahun CHECKED BY: Shahid Siddiqui DATE: 3 / 05 / 04

Boring No.	1 Mobilization			3	6	26	39	41		42	48	49	50	51	52	53	61																
	a. Equipment	b. Mileage	c. Field Coordination	Truck Borings	a. Through Boulders	a. Setup for borings < 20'	Resident Engineer	a. Field Measurements	b. 24-hr measurements-PVC Slotted Pipe	b. 10 to 30 feet	Moisture Content	Liquid Limit	Plastic Limit	Sieve Analysis	Hydrometer.	a. Unconfined Compression	pH																	
SSL-1				18.0		1		1	18	1	4	2	2	2	2	1	2																
SSL-2				30.0				1	30	1	4					1																	
SSL-3				15.0		1		1			2																						
Total	1	300	1	63.0		2	8	3	48	2	10	2	2	2	2	2	2																

INDIANA DEPARTMENT OF TRANSPORTATION
DIVISION OF MATERIALS AND TESTS
Geotechnical Section

REPORT OF FINAL COSTS FOR GEOTECHNICAL AND PAVEMENT INVESTIGATIONS BETWEEN INDOT AND CTL ENGINEERING, INC. DATED ~~August~~ November 2001 IN ACCORDANCE WITH STATE WIDE GEOTECHNICAL INVESTIGATION

DES NO: 8354420
PROJECT NO: STP - 4320(7)
STRUCTURE NO: N/A
LOCATION: SR 15,

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT PRICE	FINAL QUANTITY	FINAL COST
	A. GEOTECHNICAL FIELD INVESTIGATION				
(1)	**Mobilization**				
	a. Equipment	Each	$190.00	1.00	$190.00
	b. Mileage	per mile	$2.00	300.00	$600.00
	c. Field Coordination wth Utilities and Property owners	Each	$220.00	1.00	$220.00
(2)	Truck Mounted Borings with 2 feet Auger Head	LF	$9.00	0.00	$0.00
(3)	Truck Mounted Borings with Split-Spoon Sampling	LF	$14.10	63.00	$888.30
(4)	Truck Mounted Borings using Drilling Fluid	LF	$13.90	0.00	$0.00
(5)	Truck Mounted Core Drilling	LF	$28.00	0.00	$0.00
(6)	**Truck Mounted Borings**				
	a. Through Bedrock or Boulders	LF	$24.20	0.00	$0.00
	b. Bridge Deck Coring and Restoration	Each	$200.00	0.00	$0.00
(7)	Cone Penetrometre	LF	$12.00	0.00	$0.00
(8)	Hand or Truck Soundings	LF	$8.90	0.00	$0.00
(9)	Hand Auger Drilling	LF	$9.90	0.00	$0.00
(10)	Skid Mounted Borings with 2 feet Auger Head	LF	$13.40	0.00	$0.00
(11)	Skid Mounted Borings with Split-Spoon Sampling	LF	$21.00	0.00	$0.00
(12)	Skid Mounted Borings using Drilling Fluid	LF	$21.90	0.00	$0.00
(13)	Skid Mounted Core Drilling	LF	$33.00	0.00	$0.00
(14)	Skid Mounted Borings through Bedrock or Boulders	LF	$32.75	0.00	$0.00
(15)	Skid Mounted Sounding	LF	$12.50	0.00	$0.00
(16)	Furnishing of Boat for Hand Auger Soundings	Each	$240.00	0.00	$0.00
(17)	**Barge Set-Up Expenses**				
	a. Navigable Water				
	i. Barge Set-Up	Each	$3,850.00	0.00	$0.00
	ii. Rental of Support Equipment	Cost + 10%	$0.00	0.00	$0.00
	iii. Drill Rig Down Time	Per Hour	$99.00	0.00	$0.00
	b. Non-Navigable Water Barge Set-Up	Each	$3,400.00	0.00	$0.00
(18)	**Additional Disassembly and Reassemble**				
	a. Navigable Water	Each	$1,540.00	0.00	$0.00
	b. Non-Navigable Water	Each	$1,350.00	0.00	$0.00
(19)	Barge Mounted Borings with 2 feet Auger Head	LF	$14.90	0.00	$0.00
(20)	Barge Mounted Borings with Split-Spoon Sampling	LF	$23.00	0.00	$0.00
(21)	Barge Mounted Core Drilling	LF	$35.00	0.00	$0.00
(22)	Barge Mounted Boring through Bedrocks or Boulders	LF	$38.00	0.00	$0.00
(23)	Barge Mounted Soundings	LF	$14.40	0.00	$0.00
(24)	Casing through Water	LF	$6.50	0.00	$0.00
(25)	Uncased Sounding through Water	LF	$3.50	0.00	$0.00
(26)	Set-up for Boring and Machine Sounding				
	a. All Borings and Machine sounding Less Than 20 feet deep.	Each	$53.00	2.00	$106.00
	b. Roch Core Borings.	Each	$90.00	0.00	$0.00
(27)	Additional 2-inch Split-Spoon Samples	Each	$15.00	0.00	$0.00
(28)	3 inch Split-Spoon Samples	Each	$16.50	0.00	$0.00
(29)	3-inch Shelby Tube Samples	Each	$50.00	0.00	$0.00

ITEM NO	ITEM DESCRIPTION	UNIT	UNIT PRICE	FINAL QUANTITY	FINAL COST
(30)	2 -inch Shelby Tube Samples	Each	$44.50	0.00	$0.00
(31)	3-inch Stationary Piston Samples	Each	$81.00	0.00	$0.00
(32)	**Bag Samples**				
	a. 300 lb Sample	Each	$84.00	0.00	$0.00
	b. 25 lb Sample	Each	$30.00	0.00	$0.00
(33)	Field Vane Shear Test	Each	$86.00	0.00	$0.00
(34)	Denison Type Core Sample	Each	$121.00	0.00	$0.00
(35)	2 1/2 inch Cased Hole	LF	$6.30	0.00	$0.00
(36)	3 1/2 inch Cased Hole	LF	$7.50	0.00	$0.00
(37)	4 1/2 inch Cased Hole	LF	$9.40	0.00	$0.00
(38)	Special Field Services				
	a. Inclinometer Casing Installation.	LF	$17.00	0.00	$0.00
	b. Piezometer Installation Up to 26 feet Below Surface.	Each	$223.00	0.00	$0.00
	c. Piezometer Installation Deeper than 26 feet.	Each	$310.00	0.00	$0.00
	d. Metal Protective Outer Cover for Inclinometer and Piez. Casing	Each	$108.00	0.00	$0.00
	e. Special Field Services	Per hour	$113.00	0.00	$0.00
(39)	**Resident Field Geotechnical Engineer**				
	(See Section II - D of this Appendix)	Per Hour	$78.00	8.00	$624.00
(40)	Railroad Expenses	Cost + 10%	$0.00	0.00	$0.00
(41)	**Twenty Four Hour Water Levels**				
	a. Field Measurements	Each	$27.50	3.00	$82.50
	b. PVC Slotted Pipe	LF	$4.40	48.00	$211.20
(42)	**Special Backfilling of Boreholes**				
	a. 10 to 30 feet	Each	$82.00	2.00	$164.00
	b. More than 30 feet	LF	$5.00	0.00	$0.00
	c. Pavement Restoration	Each	$40.00	0.00	$0.00
(43)	Heavy Equipment Rental_(Dozer)	Cost + 10%	$0.00	0.00	$0.00
(44)	Skid Rig Moving Time in Excess of 1/2 Hour	Per Hour	$113.00	0.00	$0.00
(45)	**Traffic Control**				
	a. Worksite Setup 1 or 6	per day	$150.00	0.00	$0.00
	b. Worksite Setup 4	per day	$520.00	0.00	$0.00
	c. Worksite Setup 9	per day	$470.00	0.00	$0.00
	d. Worksite Setup 11	per day	$515.00	0.00	$0.00
	e. Worksite Setup 7	per day	$1,000.00	0.00	$0.00
(46)	Centerline Surveying	Cost + 10%	$0.00	0.00	$0.00
	SUBTOTALS				**$3,086.00**

ITEM NO	ITEM DESCRIPTION	UNIT	UNIT PRICE	FINAL QUANTITY	FINAL COST
	B. GEOTECHNICAL LABORATORY TESTING				
(47)	**Hydraulic Conductivity Test**	Each	$270.00	0.00	$0.00
(48)	Moisture Content Test	Each	$5.20	10.00	$52.00
(49)	Liquid Limit	Each	$25.30	2.00	$50.60
(50)	Plastic Limit and Plasticity Index	Each	$17.50	2.00	$35.00
(51)	Sieve Analysis	Each	$35.20	2.00	$70.40
(52)	Hydrometer Analysis	Each	$38.50	2.00	$77.00
(53)	a. Unconfined Compression Test	Each	$33.00	2.00	$66.00
	b. Remolding of three (3) Soil Samples with lime/cement (3 samples = one unit)	Each	$86.00	0.00	$0.00
(54)	Specific Gravity Test	Each	$28.50	0.00	$0.00
(55)	Unit Weight Determination	Each	$13.70	0.00	$0.00
(56)	Consolidation Test	Each	$360.00	0.00	$0.00
(57)	a Unconsolidated-Undrained (UU)	Each	$270.00	0.00	$0.00
	b Consolidated-Undrained (CU)	Each	$420.00	0.00	$0.00
	c. Consolidated-Drained (CD)	Each	$590.00	0.00	$0.00
	d. Pore Pressure Measurement with a. or b.				

	and Use of Back Pressure for Saturation	*Each*	*$200.00*	*0.00*	*$0.00*
(58)	*Soil Support Test*				
	a. California Bearing Ratio Test	*Each*	*$410.00*	*0.00*	*$0.00*
	b. Subgrade Resilient Modulus	*Each*	*$800.00*	*0.00*	*$0.00*
(59)	*Standard Moisture-Density Relationship Test*	*Each*	*$107.00*	*0.00*	*$0.00*
(60)	*Loss on Ignition Test*	*Each*	*$16.50*	*0.00*	*$0.00*
(61)	*pH Test*	*Each*	*$11.00*	*2.00*	*$22.00*
	SUBTOTALS				*$373.00*

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT PRICE	FINAL QUANTITY	FINAL COST
	C. GEOTECHNICAL ENGINEERING				
(62)	***Geotechnical Profile and Related Work***				
	a. Without Soil Subgrade DrawingsFirst Mile	*Lump Sum*	*$950.00*	*0.00*	*$0.00*
	a1 - Each Additional Mile	*per mile*	*$425.00*	*0.00*	*$0.00*
	b. With Soil Subgrade Drawings First Mile	*Lump Sum*	*$1,150.00*	*0.00*	*$0.00*
	b1 - Each Additional Mile	*per mile*	*$500.00*	*0.00*	*$0.00*
	c. Soil Subgrade Drawings (only) First Mile	*Lump Sum*	*$275.00*	*0.00*	*$0.00*
	c1 - Each Additional Mile	*per mile*	*175.00*	*0.00*	*$0.00*
(63)	***Geotechnical Report***				
	a. Without Soil Subgrade Investigation First Mile	*Lump Sum*	*$1,140.00*	*0.00*	*$0.00*
	a1 - Each Additional Mile	*per mile*	*$500.00*	*$0.00*	*$0.00*
	b. With Soil Subgrade Investigation First Mile	*Lump Sum*	*$1,500.00*	*0.00*	*$0.00*
	b1 - Each Additional Mile	*per mile*	*$600.00*	*$0.00*	*$0.00*
	c. Soil Subgrade Investigation (only) First Mile	*Lump Sum*	*$480.00*	*0.00*	*$0.00*
	c1 - Each Additional Mile	*per mile*	*$275.00*	*$0.00*	*$0.00*
(64)	***Settlement Analysis and Recommendations for Embankment***				
	a. Proposed Embankment	*Each*	*$660.00*	*0.00*	*$0.00*
	b. Proposed and Existing Embankment	*Each*	*$700.00*	*0.00*	*$0.00*
(65)	*Ground Modification Design*	*Each*	*$1,100.00*	*0.00*	*$0.00*
(66)	***Sliding Block Slope Stability Analysis***				
	a. C/O or C and O Analysis	*Each*	*$495.00*	*0.00*	*$0.00*
	b. Corrective Measures	*Each*	*$715.00*	*0.00*	*$0.00*
	c. Stage Construction Corrective Method	*Each*	*$935.00*	*0.00*	*$0.00*
(67)	***Rotational Slope Stability Analysis***				
	a. C/O or C and O Analysis	*Each*	*$550.00*	*0.00*	*$0.00*
	b. Corrective Measures	*Each*	*$670.00*	*0.00*	*$0.00*
	c. Stage Construction Corrective Method	*Each*	*$900.00*	*0.00*	*$0.00*
(68)	***Bridge Foundation Analysis and Recommendations***				
	a. Shallow Foundation	*Each*	*$380.00*	*0.00*	*$0.00*
	b. Deep Foundation	*Each*	*$675.00*	*0.00*	*$0.00*
	c. Settlement Analysis for Bridge Pier Foundations				
	1. Bridge Pier	*Each*	*$385.00*	*0.00*	*$0.00*
	2. Embankment Plus Pier	*Each*	*$655.00*	*0.00*	*$0.00*
	3. Embankment Plus Pier Plus All Other Loads	*Each*	*$825.00*	*0.00*	*$0.00*
	d. Foundation on Rock	*Each*	*$220.00*	*0.00*	*$0.00*
(69)	***Retaining Structure Analysis and Recommendations***				
	a. Conventional Retaining Structure and other types (MSE & Binwalls)				
	1. Shallow Foundation	*Each*	*$650.00*	*0.00*	*$0.00*
	2. Deep Foundation	*Each*	*$825.00*	*0.00*	*$0.00*
	3. Settlement Analysis for Retaining Wall Foundations	*Each*	*$480.00*	*0.00*	*$0.00*
	b. Pile Retaining Structure Analysis and Recommendations				
	1. Free Standing Structure	*Each*	*$660.00*	*0.00*	*$0.00*

	2. Retaining Structure with Tie-Back System	Each	$1,100.00	0.00	$0.00
	c. Drilled-in-Pier Retaining Structure Analysis				
	1. Free Standing Structure	Each	$770.00	0.00	$0.00
	2. Retaining Structure with Tie-Back System	Each	$1,130.00	0.00	$0.00
	d. Soil Nailing Wall Analysis	Each	$810.00	0.00	$0.00
(70)	Seepage Analysis	Each	$700.00	0.00	$0.00
(71)	Deep Dynamic Compaction Analysis	Each	$990.00	0.00	$0.00
	CONSTRUCTION INSPECTION AND MONITORING				
(72)	Field Inspector	Per hour	$52.50	0.00	$0.00
(73)	Monitoring Geotechnical Instrumentation	Per hour	$52.50	0.00	$0.00
(74)	Integrity Test	Cost + 10%	$0.00	0.00	$0.00
(75)	Dynamic Pile Analysis	Each	$770.00	0.00	$0.00
(76)	Static Load Test	Each	$760.00	0.00	$0.00
(77)	Dynamic Pile Load Test	Each	$0.00	0.00	$0.00
(78)	CAPWAP-C Analysis	Each	$600.00	$0.00	$0.00
(79)	Final Construction Inspection Report	Each	$800.00	0.00	$0.00
	SUBTOTALS				$0.00

ITEM NO	ITEM DESCRIPTION	UNIT	UNIT PRICE	FINAL QUANTITY	FINAL COST
	D. PAVEMENT INVESTIGATION				
(1)	Mobilization of Coring Equipment	Each	$85.00	0.00	$0.00
(2)	Mobilization Mileage for Coring Equipment	per mile	$1.40	0.00	$0.00
(3)	Pavemeint Core (Partial Depth)	Each	$105.00	0.00	$0.00
(4)	Pavement Core (Full Depth)	Each	$150.00	0.00	$0.00
(5)	Subbase Sample	Each	$47.00	0.00	$0.00
(6)	Cement Concrete Pavement Core Density Determination	Each	$25.00	0.00	$0.00
(7)	Cement Concrete Core Compressive Strength Test	Each	$29.00	0.00	$0.00
(8)	Bituminous Extraction Test	Each	$66.00	0.00	$0.00
(9)	Sieve Analysis of Extracted Aggregate Test	Each	$44.00	0.00	$0.00
(10)	Recovery of Asphalt from Solution by Abson Method	Each	$340.00	0.00	$0.00
(11)	Theoretical Maximum Specific Gravity Test	Each	$65.00	0.00	$0.00
(12)	Bulk Specific Gravity Test	Each	$28.00	0.00	$0.00
(13)	Air Voids Calculation	Each	$22.00	0.00	$0.00
(14)	Core Report for Partial Depth Core	Each	$26.00	0.00	$0.00
(15)	Core Report for Full Depth Core	Each	$35.00	0.00	$0.00
(16)	Pavement Analysis and Report	Each	$640.00	0.00	$0.00
	SUBTOTALS				$0.00
	TOTALS				$3,459.00

(1)	FINAL COST OF GEOTECHNICAL FIELD INVESTIGATION (A)	$3,086.00
(2)	FINAL COST OF GEOTECHNICAL LABORATORY TESTING (B)	$373.00
(3)	FINAL COST OF GEOTECHNICAL ENGINEERING (C)	$0.00
(4)	FINAL COST OF GEOTECHNICAL INVESTIGATION	$3,459.00
(5)	FINAL COST OF PAVEMENT INVESTIGATION (D)	$0.00
(6)	TOTAL FINAL COST OF GEOTECHNICAL AND PAVEMENT INVESTIGATION	$3,459.00

PREPARED BY: A.T

CHECKED BY: S.S

DATED: 3/09/2004

ITEMIZATION OF PAY QUANTITIES FOR INDOT SOIL BORINGS, REPORTS & PROFILES (TD-356)

BY: CTL Engineering, Inc. **FOR:** INDOT **SHEET:** 1 **OF.** 1
DES: 8354420 **PROJECT NO:** STP - 4320 (7) **STRUCTURE NO:** N/A
LOCATION: Road Rehabilitation on SR 15 S.of US 20 to 3.1 km N. of US 20 **COUNTY:** Elkhart
PREPARED BY: Alebachew Tilahun **CHECKED BY:** Shahid Siddiqui **DATE:** 3 / 05 / 04

Boring No.	1 Mobilization			3	6	26	39	41		42	48	49	50	51	52	53	61
	a. Equipment	b. Mileage	c. Field Coordination	Truck Borings	a. Through Boulders	a. Setup for borings < 20'	Resident Engineer	a. Field Measurements	b. 24-hr measurements-PVC Slotted Pipe	b. 10 to 30 feet	Moisture Content	Liquid Limit	Plastic Limit	Sieve Analysis	Hydrometer.	a. Unconfined Compression	pH
SSL-1				18.0		1		1	18	1	4	2	2	2	2	1	2
SSL-2				30.0				1	30	1	4					1	
SSL-3				15.0		1		1			2						
Total	1	300	1	63.0		2	8	3	48	2	10	2	2	2	2	2	2

Indiana Department of Transportation

Materials and Tests Division
120 South Shortridge Road P.O. Box 19389
Indianapolis, Indiana 46219-0389
Phone: (317) 232-5280 Fax: (317) 356-9351

September 4, 2001

CTL Engineering, Inc.
6330 E. 75th St. Suite 178
Indianapolis, Indiana 46250

Attn: Mr. Ali Karaki

Subject: Des No: 8354420
Project No: STP-4320 (7)
SR 15 from 0.56 km S. of US 20 to a point 3.10 km N. of US 20
County: Elkhart
District: Fort Wayne

Gentlemen:

In accordance with the agreement dated August 18, 1999, the Final Quantities and Costs for the Geotechnical Investigation on the subject project have been calculated. Transmitted herewith is one copy of the following:

1. Itemization of Pay Quantities for Geotechnical Borings, and Tests.
2. Report of Final Costs for the Geotechnical Investigation.
3. Performance Evaluation of Consultant's Highway Development Services.

The total cost for the Geotechnical Work performed on the subject project is ~~$27,911.75~~ 28511.75 Therefore, in order to finalize the payment, please submit an invoice voucher for ~~$27,911.75~~ 28511.75 to:

Mr. Athar Khan, P.E.
Chief Geotechnical Engineer
INDOT Division of Materials and Tests
120 South Shortridge Road
P.O. Box 19389
Indianapolis, IN 46219-0389

If you have any questions concerning this matter, please call us.

Very truly yours,

Steve Morris
for Athar Khan
Chief Geotechnical Engineer

Joey Franzino
For Somanath Hiremath
Geotechnical Engineering Group Leader

SSH/SS
cc: Mr. R. Asadi
File (Attachments)
H:JOEY/OEA-356-357-evaluation

ITEMIZATION OF PAY QUANITIES FOR INDOT SOIL BORINGS, REPORTS & PROFILES (TD-356)

BY: CTL-Engineering, Inc FOR: INDOT SHEET 1 OF 2
DES NO: 9354420 PROJECT NO: STP-4320(7) STRUCTURE NO: N/A
LOCATION: SR15 from 0.56 Km S. of US 20 to a point 3.10 Km N. of US. 20 COUNTY: Elkhart
PREPARED BY: Alebachew Tilahun CHECKED BY: Shahid Siddiqui DATE: 8/28/2001

Boring No.	1			3	6	7	25	31	38	40	41		42	44	47	48	49	50	51	52	57	58	60	62	63	66	67
	Mobilization			Truck	a. Truck	Truck	Set-up	a.	Res.	a.	a.	c.	Dozer	b.	WC	LL	PL	Sieve	Hydr.	a.	CBR	Std.	pH	a.	a.	a.	a.
	a. Equip.	b. Km	c. Fiel Coor.	SS Boring	Thru Boulder	Sound	< 6 m Deep	Bag Sample	Eng	24H Meas.	3-9 m	Pav't Restor.	Rental	Traffic Control						UC		Proct.					
RB-1				1.83	0.46		1			1		1															
RB-2				2.67	0.38		1			1		1			1												
RB-3				2.29			1			1					2	1	1	1	1				1				
RB-4				3.05			1			1					2												
RB-5				2.69	0.36		1			1		1			2												
RB-6				1.22			1			1																	
RB-6A						0.94	1																				
RB-6B						0.94	1																				
RB-6C						0.76	1																				
RB-7				5.33			1	1		1	1				3	1	1	1	1		1	1	1				
RB-8				4.57			1			1	1				2												
RB-9				4.57			1			1					2												
RB-10				13.72						1	1				3	1	1	1	1				1				
RB-11				13.72						1	1				1					1							
RB-12				13.72						1	1				4		1	1		1			1				
RB-13				7.62						1	1				3												
RB-14				5.82	0.28					1	1	1			2												
RB-15				5.33			1			1					1												
RB-16				3.05			1			1					1												
RB-17				4.57			1			1					1												
RB-18				10.31	0.36					1	1	1			2					1							
RB-19				2.49	0.56		1			1		1			1												
RB-20				7.32	0.30					1	1	1			1												
RB-21				7.62						1	1																
RB-21A						0.91									1												
RB-22				6.10						1																	
RB-23				2.92	0.13		1			1		1			1	1	1	1	1				1				
Sub-Total				132.53	2.83	3.55	17	1		23	10	8			36	4	5	5	4	3	1	1	5				

ITEMIZATION OF PAY QUANITIES FOR INDOT SOIL BORINGS, REPORTS & PROFILES (TD-356)

BY: CTL Engineering Inc FOR: INDOT SHEET 1 OF 2
DES NO: 8354420 PROJECT NO: STP-4320(7) STRUCTURE NO: N/A
LOCATION: SR 15 from 0.56 Km S of US 20 to a Point 3.10Km of US20 COUNTY: Elkhart
PREPARED BY: Alebachew Tilahun CHECKED BY: Shahid Saddiqui DATE: 8/28/2001

Boring No.	1 Mobilization a. Equip.	b. Km	c. Fiel Coor.	3 Truck SS Boring	6 a. Truck Thru Boulder	7 Truck Sound	25 Set-up < 6 m Deep	31 a. Bag Sample	38 Res. Eng	40 a. 24H Meas.	41 a. 3-9 m	c. Pav't Restor.	42 Dozer Rental	44 b. Traffic Control	47 WC	48 LL	49 PL	50 Sieve	51 Hydr.	52 a. UC	57 CBR	58 Std. Proct.	60 pH	62 a.	63 a.	66 a.	67 a.
RB-24				7.32	0.30					1	1	1															
RB-25				9.76	0.91					1	1	1															
RB-26				12.19						1	1				1												
RB-27				6.71						1	1																
RB-28				7.26	0.36					1	1	1			1												
RB-29				2.69	0.36		1			1		1															
RB-30				1.93	0.36		1			1		1															
RB-31				1.88	0.41		1			1		1															
RB-32				1.99	0.30		1			1		1			2												
RB-33				1.91	0.38		1			1		1			1												
RB-34				2.29			1			1																	
RB-35				2.29			1			1																	
RB-36				1.88	0.41		1			1		1			1												
RB-37				2.87	0.18		1			1		1															
RB-38				7.52	0.10					1	1	1			1					1							
RB-39				2.16	0.13		1			1		1			1												
RB-40				7.01							1																
TB-1				4.57			1			1	1				1												
TB-2				6.10						1					1												
TB-3				4.57			1			1	1																
Sub-Total				94.90	4.20	0.00	12	0		19	9	12			10	0	0	0	0	1	0	0	0				
TOTAL	1	550	2	227.43	7.03	3.55	29	1	32	42	19	20	*	7	46	4	5	5	4	4	1	1	5	5	1	1	1

* See Attached

STATEMENT

R.J. BONTRAGER EXCAVATING
15256 C.R. 28
GOSHEN, IN 46528

(219) 825-7271

DATE 6-11-01
NUMBER

CTL Engineering of Indy
6330 E. 75th Stret, Suite 176
Indianapolis, In. 46250

TERMS:

$

DATE	CHARGES AND CREDITS	BALANCE
	BALANCE FORWARD	
5/22	5.5 hr. Dozer time to pull drilling rig in + out of drilling sites	467.50
	St Rd 15 Project P.N. 01-05-0061	
	Project Engineer Ali Karaki	

R.J. BONTRAGER EXCAVATING

Thank You

PAY LAST AMOUNT IN THIS COLUMN

Post-it® Fax Note 7671	Date 8/28	# of pages ▶ 1
To Mr. Sam Hiremath	From Ali Karaki	
Co./Dept. INDOT	Co. CTL	
Phone #	Phone # 585-8277	
Fax #	Fax #	

INDIANA DEPARTMENT OF TRANSPORTATION
DIVISION OF MATERIALS AND TESTS

Geotechnical Section

REPORT OF FINAL COSTS FOR GEO. AND PAVEMENT
INVESTIGATIONS BETWEEN INDOT AND C. T. L. Inc.
DATED Aug. 13, 1999 IN ACCORDANCE
WITH STATE WIDE GEOTECHNICAL INVESTIGATION

DES NO: 8354420
PROJ NO: STP-4320(7)
STRUC NO: N/A
LOCATION: SR 15 from 0.56 Km S.of US 20
COUNTY: Elkhart

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT PRICE	FINAL QUANTITY	FINAL COST
	A. GEO. FIELD INVESTIGATION				
(1)	**Mobilization and Field Coordination**				
	a Equipment	Each	$180.00	1.00	$180.00
	b Mileage	per kilometer	$1.20	550.00	$660.00
	c Field Coordination with Utilities and property Owners	Each	$200.00	2.00	$400.00
(2)	Truck Mounted Borings with .6 Meter Auger Head	Meter	$28.00	0.00	$0.00
(3)	Truck Mounted Borings with Split-Spoon Sampling	Meter	$42.00	227.43	$9,552.06
(4)	Truck Mounted Borings using Drilling Fluid	Meter	$42.00	0.00	$0.00
(5)	Truck Mounted Core Drilling	Meter	$85.00	0.00	$0.00
(6)	**Truck Mounted Borings**			0.00	
	a. Through Bedrock or Boulders	Meter	$72.00	7.03	$506.16
	b. Bridge Deck Coring and Restoration	Each	$200.00	0.00	$0.00
(7)	Hand or Truck Soundings	Meter	$26.50	3.55	$94.08
(8)	Hand Auger Drilling	Meter	$29.50	0.00	$0.00
(9)	Skid Mounted Borings with .61 or Meter Auger Head	Meter	$41.50	0.00	$0.00
(10)	Skid Mounted Borings with Split-Spoon Sampling	Meter	$65.20	0.00	$0.00
(11)	Skid Mounted Borings using Drilling Fluid	Meter	$64.00	0.00	$0.00
(12)	Skid Mounted Core Drilling	Meter	$98.50	0.00	$0.00
(13)	Skid Mounted Borings through Bedrock or Boulders	Meter	$98.50	0.00	$0.00
(14)	Skid Mounted Sounding	Meter	$39.50	0.00	$0.00
(15)	Furnishing of Boat for Hand Auger Soundings	Each	$220.00	0.00	$0.00
(16)	**Barge Set-Up Expenses**				
	a. Navigable Water				
	1. Barge Set-Up	Each	$3,500.00	0.00	$0.00
	2. Rental of Support Equipment	Cost + 10%	$0.00	0.00	$0.00
	3. Drill Rig Down Time	Per Hour	$95.00	0.00	$0.00
	b. Non-Navigable Water Barge Set-Up	Each	$3,000.00	0.00	$0.00
(17)	**Additional Disassembly and Reassemble**				
	a. Navigable Water	Each	$1,480.00	0.00	$0.00
	b. Non-Navigable Water	Each	$1,290.00	0.00	$0.00
(18)	Barge Mounted Borings with .6 Meter Auger Head	Meter	$46.20	0.00	$0.00
(19)	Barge Mounted Borings with Split-Spoon Sampling	Meter	$68.75	0.00	$0.00
(20)	Barge Mounted Core Drilling	Meter	$112.00	0.00	$0.00
(21)	Barge Mounted Boring through Bedrocks or Boulders	Meter	$123.00	0.00	$0.00
(22)	Barge Mounted Soundings	Meter	$45.00	0.00	$0.00
(23)	Casing through Water	Meter	$19.50	0.00	$0.00
(24)	Uncased Sounding through Water	Meter	$11.50	0.00	$0.00
(25)	Set-up for Borings and Machine Soundings				
	a All Borings and Machine Soundings Less than 6m Deep	Each	$50.00	29.00	$1,450.00
	b Rock Core Borings	Each	$82.00	0.00	$0.00
(26)	Additional 51 millimeter Split-Spoon Samples	Each	$14.00	0.00	$0.00
(27)	76 millimeter Split-Spoon Samples	Each	$15.00	0.00	$0.00
(28)	76 millimeter Shelby Tube Samples	Each	$50.00	0.00	$0.00

ITEM NO	ITEM DESCRIPTION	UNIT	UNIT PRICE	FINAL QUANTITY	FINAL COST
(29)	51 millimeter Shelby Tube Samples	Each	$44.50	0.00	$0.00
(30)	76 millimeter Stationary Piston Samples	Each	$80.00	0.00	$0.00
(31)	**Bag Samples**				
	a. 136 Kg Sample	Each	$75.00	1.00	$75.00
	b. 11 Kg Sample	Each	$27.50	0.00	$0.00
(32)	Field Vane Shear Test	Each	$86.00	0.00	$0.00
(33)	Denison Type Core Sample	Each	$110.00	0.00	$0.00
(34)	63 millimeter Cased Hole	Meter	$20.00	0.00	$0.00
(35)	89 millimeter Cased Hole	Meter	$23.00	0.00	$0.00
(36)	114 millimeter Cased Hole	Meter	$28.00	0.00	$0.00
(37)	Special Field Services				
	a. Inclinometer Casing Installation	Meter	$80.00	0.00	$0.00
	b. Piezometer Installation up to 8 m below the surface	Each	$330.00	0.00	$0.00
	c. Piezometer Installation Deeper than 8 m below the surface	Each	$350.00	0.00	$0.00
	d. Metal Protective Outer Cover For Inclinometer and Piezometer Casings	Each	$135.00	0.00	$0.00
	e. Special Field Services	Per Hour	$110.00	0.00	$0.00
(38)	**Resident Field Geotechnical Engineer**				
	(See Section II - D of this Appendix)	Per Hour	$74.00	32.00	$2,368.00
(39)	Railroad Expenses	Cost + 10%	$0.00	0.00	$0.00
(40)	**Twenty Four Hour Water Levels**				
	a. Field Measurements	Each	$25.00	42.00	$1,050.00
	b. PVC Slotted Pipe	Meter	$13.00	0.00	$0.00
(41)	**Special Backfilling of Boreholes**				
	a. 3 to 9 Meters	Each	$81.00	19.00	$1,539.00
	b. More than 9 Meters	Meter	$15.00	0.00	$0.00
	c. Pavement Restoration	Each	$30.00	~~0.00~~ 20	~~$0.00~~ 600.00
(42)	Heavy Equipment Rental	Cost + 10%	$1.10	467.50	$514.25
(43)	Skid Rig Moving Time in Excess of 1/2 Hour	Per Hour	$108.00	0.00	$0.00
(44)	**Traffic Control**				
	a. Worksite Setup 1 or 6	per day	$115.00	0.00	$0.00
	b. Worksite Setup 4	per day	$490.00	7.00	$3,430.00
	c. Worksite Setup 9	per day	$400.00	0.00	$0.00
	d. Worksite Setup 11	per day	$430.00	0.00	$0.00
(45)	Centerline Surveying	Cost + 10%	$0.00	0.00	$0.00
	SUBTOTALS				$21,818.55

+ 600.00
22418.55

ITEM NO	ITEM DESCRIPTION	UNIT	UNIT PRICE	FINAL QUANTITY	FINAL COST
	B. GEO. LABORATORY TESTING				
(46)	**Field Permittivity Test**				
	a. 1-5 Tests Per Authorization	Each	$300.00	0.00	$0.00
	b. More than 5 Tests Per Authorization	Each	$230.00	0.00	$0.00
(47)	Moisture Content Test	Each	$5.20	46.00	$239.20
(48)	Liquid Limit	Each	$23.00	4.00	$92.00
(49)	Plastic Limit and Plasticity Index	Each	$16.00	5.00	$80.00
(50)	Sieve Analysis	Each	$32.00	5.00	$160.00
(51)	Hydrometer Analysis	Each	$35.00	4.00	$140.00
(52)	a. Unconfined Compression Test	Each	$30.00	4.00	$120.00

	b. Remolding of three (3) Soil Samples with lime/cement (3 samples = one unit)	Each	$78.00	0.00	$0.00
(53)	Specific Gravity Test	Each	$26.00	0.00	$0.00
(54)	Unit Weight Determination	Each	$13.10	0.00	$0.00
(55)	Consolidation Test	Each	$345.00	0.00	$0.00
(56)	Triaxial Test				
	a. Unconsolidated-Undrained (UU)	Each	$260.00	0.00	$0.00
	b. Consolidated-Undrained (CU)	Each	$400.00	0.00	$0.00
	c. Consolidated-Drained (CD)	Each	$565.00	0.00	$0.00
	d. Pore Pressure Measurement with a. or b. and Use of Back Pressure for Saturation	Each	$175.00	0.00	$0.00
(57)	Soil Support Testing	Each	$0.00	0.00	$0.00
	a. California Bearing Ratio Test	Each	$395.00	1.00	$395.00
	b. Subgrade Resilient Modulus	Each	$800.00	0.00	$0.00
(58)	Standard Moisture-Density Relationship Test	Each	$102.00	1.00	$102.00
(59)	Loss on Ignition Test	Each	$15.00	0.00	$0.00
(60)	pH Test	Each	$10.00	5.00	$50.00
	SUBTOTALS				**$1,378.20**

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT PRICE	FINAL QUANTITY	FINAL COST
	C. GEOTECHNICAL ENGINEERING				
(61)	**Geotechnical Profile and Related Work**				
	a. Without Soil Subgrade Drawings	per kilometer	$575.00	0.00	$0.00
	b. With Soil Subgrade Drawings	per kilometer	$700.00	0.00	$0.00
	c. Soil Subgrade Drawings (only)	per kilometer	$150.00	0.00	$0.00
(62)	**Geotechnical Report**				
	a. Without Soil Subgrade Investigation	per kilometer	$650.00	5.00	$3,250.00
	b. With Soil Subgrade Investigation	per kilometer	$925.00	0.00	$0.00
	c. Soil Subgrade Investigation (only)	per kilometer	$275.00	0.00	$0.00
(63)	**Settlement Analysis and Recommendations for Embankment**				
	a. Proposed Embankment	Each	$600.00	1.00	$600.00
	b. Proposed and Existing Embankment	Each	$650.00	0.00	$0.00
(64)	Sand Wick Drain System Design	Each	$1,100.00	0.00	$0.00
(65)	**Sliding Block Slope Stability Analysis**				
	a. C/O or C and O Analysis	Each	$450.00	0.00	$0.00
	b. Corrective Measures	Each	$650.00	0.00	$0.00
	c. Stage Construction Corrective Method	Each	$850.00	0.00	$0.00
(66)	**Rotational Slope Stability Analysis**				
	a. C/O or C and O Analysis	Each	$500.00	1.00	$500.00
	b. Corrective Measures	Each	$700.00	0.00	$0.00
	c. Stage Construction Corrective Method	Each	$850.00	0.00	$0.00
(67)	**Bridge Foundation Analysis and Recommendations**				
	a. Shallow Foundation	Each	$365.00	1.00	$365.00
	b. Deep Foundation	Each	$635.00	0.00	$0.00
	c. Settlement Analysis for Bridge Pier Foundations				
	1. Bridge Pier	Each	$350.00	0.00	$0.00
	2. Embankment Plus Pier	Each	$650.00	0.00	$0.00
	3. Embankment Plus Pier Plus All Other Loads	Each	$750.00	0.00	$0.00
	d. Foundation on Rock	Each	$200.00	0.00	$0.00
(68)	**Retaining Structure Analysis and Recommendations**				

	a. Conventional Retaining Structure & other typessuch as MSE Walls or Binwalls				
	1. Shallow Foundation	Each	$650.00	0.00	$0.00
	2. Deep Foundation	Each	$750.00	0.00	$0.00
	3. Settlement Analysis for Retaining Wall Foundations	Each	$450.00	0.00	$0.00
	b. Pile Retaining Structure Analysis and Recommendations				
	1. Free Standing Structure	Each	$600.00	0.00	$0.00
	2. Retaining Structure with Tie-Back System	Each	$1,075.00	0.00	$0.00
	c. Drilled-in-Pier Retaining Structure Analysis				
	1. Free Standing Structure	Each	$700.00	0.00	$0.00
	2. Retaining Structure with Tie-Back System	Each	$1,100.00	0.00	$0.00
	d. Soil Nailing Wall Analysis	Each	$735.00	0.00	$0.00
(69)	Seepage Analysis	Each	$650.00	0.00	$0.00
(70)	Deep Dynamic Compaction Analysis	Each	$900.00	0.00	$0.00
	CONSTRUCTION INSPECTION AND MONITORING				
(71)	Field Inspector	Per houe	$48.00	0.00	$0.00
(72)	Monitoring Geotechnical Instrumentation	Per houe	$48.00	0.00	$0.00
(73)	Integrity Testing	Cost + 10%	$0.00	0.00	$0.00
(74)	Dynamic Pile Analysis	Each	$700.00	0.00	$0.00
(75)	Static Load Test	Each	$1,073.00	0.00	$0.00
(76)	Dynamic Pile load test	Cost + 10%	$0.00	0.00	$0.00
(77)	Final Construction Inspection Report	Each	$800.00	0.00	$0.00
	SUBTOTALS				**$4,715.00**

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT PRICE	FINAL QUANTITY	FINAL COST
	D. PAVEMENT INVESTIGATION				
(1)	Mobilization of Coring Equipment	Each	$75.00	0.00	$0.00
(2)	Mobilization Mileage for Coring Equipment	per kilometer	$0.67	0.00	$0.00
(3)	Pavement Core (Partial Depth)	Each	$97.00	0.00	$0.00
(4)	Pavement Core (Full Depth)	Each	$134.00	0.00	$0.00
(5)	Subbase Sample	Each	$49.00	0.00	$0.00
(6)	Cement Concrete Pavement Core Density Determination	Each	$24.00	0.00	$0.00
(7)	Cement Concrete Core Compressive Strength Test	Each	$26.00	0.00	$0.00
(8)	Bituminous Extraction Test	Each	$60.00	0.00	$0.00
(9)	Sieve Analysis of Extracted Aggregate Test	Each	$43.00	0.00	$0.00
(10)	Recovery of Asphalt from Solution by Abson Method	Each	$315.00	0.00	$0.00
(11)	Theoretical Maximum Specific Gravity Test	Each	$60.00	0.00	$0.00
(12)	Bulk Specific Gravity Test	Each	$25.00	0.00	$0.00
(13)	Air Voids Calculation	Each	$20.50	0.00	$0.00
(14)	Core Report for Partial Depth Core	Each	$25.50	0.00	$0.00
(15)	Core Report for Full Depth Core	Each	$34.00	0.00	$0.00
(16)	Pavement Analysis and Report	Each	$580.00	0.00	$0.00
	SUBTOTALS				**$0.00**
	TOTALS				**$27,911.75**

(1) **FINAL COST OF GEOTECHNICAL FIELD INVESTIGATION (A)** ~~$21,818.55~~

22918.55

(2)	*FINAL COST OF GEOTECHNICAL LABORATORY TESTING (B)*	*$1,378.20*
(3)	*FINAL COST OF GEOTECHNICAL ENGINEERING (C)*	*$4,715.00*
(4)	*FINAL COST OF GEOTECHNICAL INVESTIGATION*	*$27,911.75*
(5)	*FINAL COST OF PAVEMENT INVESTIGATION (D)*	*$0.00*
(6)	*TOTAL FINAL COST OF GEOTECHNICAL AND PAVEMENT INVESTIGATION*	~~*$27,911.75*~~ 28 511.75

PREPARED BY: A.T.
CHECKED BY: S.S.H
DATED: 8-28-2001