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November 29, 2006

Michael D. Weeks, P.E., P.S.
TranSystems Corporation
5747 Perimeter Drive, Suite 240
Dublin, OH 43017

Re: **Pavement Design Information**
Phase 1 - Mainline and Side Road CBR Values
SCI-823-6.81 Portsmouth Bypass
Phase 1 – Stage I
DLZ Job No.: 0121-3070.03
PID No. 19415

Dear Mr. Weeks:

This document presents the findings of subsurface explorations performed for proposed side roads, ramps and the mainline alignment for Phase 1 of the SCI-823 Portsmouth Bypass project. The Phase 1 area is defined as being from station 352+00 to 537+50. Although the Lucasville-Minford Road widening and improvements are outside of this area, the results are included in this submission.

All side roads in the Phase 1 area have been independently evaluated for subgrade improvements and pavement design information. Please refer to these documents for more information.

It should be noted that minor changes were made to the recommendations presented in the relocated Shumway Hollow Road pavement design document. Please refer to the enclosed document found in Appendix A for more information.

Appendix A: Pavement Design Information – Revised
Relocated Shumway Hollow Road

Appendix B: Pavement Design Information
Lucasville-Minford Road

Appendix C: Pavement Design Information
SR 335 at Relocated Shumway Hollow Road

Appendix D: Phase 1 Recommended Mainline CBR Value

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We appreciate having the opportunity to be of service to you on this project. Please do not hesitate to call if you have any questions concerning our reports.

Respectfully submitted,

DLZ OHIO, INC.

Steven J. Riedy
Geotechnical Engineer

cc: File

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APPENDIX A

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November 28, 2006

Michael D. Weeks, P.E., P.S.
TranSystems Corporation
5747 Perimeter Drive, Suite 240
Dublin, OH 43017

Re: **Pavement Design Information - Revised**
Relocated Shumway Hollow Road
SCI-823-0.00 Portsmouth Bypass
DLZ Job No.: 0121-3070.03
Document # 0034

Dear Mr. Weeks:

This letter includes the findings of a subsurface exploration performed for relocated Shumway Hollow Road at the interchange with proposed SR 823. The findings included in this letter pertain to relocated Shumway Hollow Road only. The findings of other subsurface explorations for pavement design will be submitted in separate documents.

The findings in this letter have been modified slightly based upon the results of two culvert borings, C-47 and C-48, which were drilled after the original September 1, 2006 submission of these recommendations.

The depth at which bedrock was encountered in these borings indicates that the proposed subgrade will be founded in rock from approximately station 18+00 to 26+00. This area is 200 feet longer than previously reported.

The relocation will essentially consist of new construction of approximately 3,026 feet of two-lane roadway. Limits of construction are understood to be from approximate stations 10+91 to 41+17. However, the recommendations presented here pertain to the proposed roadway from station 10+91 to 31+75, at the rear abutment of the proposed Shumway Hollow Road over CSX structure. It is understood that a small portion of proposed roadway exists from approximately station 38+41 to 40+03. Recommendations for this portion are not included in this document. In lieu of boring information for this portion, it is recommended that the recommendations of the SR 335 widening and improvements be applied to this small portion of relocated Shumway Hollow Road. Plan and profile drawings indicate that the proposed grade will vary from approximately 16-foot embankment fills to 31-foot deep cuts in soil and rock. See attached plan and profile drawings for more information.

The recommendations presented in this report have been made on the basis of the foregoing information. If the proposed alignment or concept is changed or differs from that assumed, DLZ

Ohio, Inc. (DLZ) should be informed of the changes so that recommendations and conclusions presented in this letter may be revised as necessary.

The results of these evaluations are based in part upon the findings of seven subgrade borings. Boring B-1301 was drilled on January 1, 2006. Boring B-1303 was drilled on October 5, 2005. Borings B-1307A, B-1311A, B-1312A, B-1313A, and B-1314A were drilled on July 20 and July 21, 2006. Additional borings drilled in the area were also considered to better define the appropriate treatment methods and to better establish the limits of poor subgrade soils. Borings B-1307 and TR-24 through TR-26 were drilled for bridges and roadway embankments within the construction footprint of the proposed road relocation. All borings were drilled using a truck mounted rotary-type drill rig. Borings were planned and staked in the field by representatives of DLZ. The surveyed locations and ground surface elevations of the borings were determined by representatives from Lockwood, Lanier, Mathias & Noland, Inc. (2LMN). Subgrade (GB-1) borings were advanced to depths between 6.0 and 34.0 feet. In these borings, continuous sampling was performed from proposed grade to approximately 6.0 feet below proposed grade to evaluate the subgrade material properties. See attached Boring Plan and Boring Logs.

Boring B-1301 encountered 3 inches of asphalt concrete pavement at the ground surface. No aggregate base layer was observed. Below the pavement layer, boring B-1301 first encountered silt (A-4b) over sandy silt (A-4a).

Boring B-1303 encountered 2 inches of topsoil at the surface. Below the topsoil layer, boring B-1303 first encountered sandy silt (A-4a) over bedrock, which was encountered at 6.0 feet.

Borings B-1311A and B-1312A were drilled at stations 19+00 and 22+88, respectively. The proposed grade in this area will be in a cut, founded in bedrock. Borings B-1311A and B-1312A generally encountered hard gray sandstone at elevations 694 and 691, respectively.

Boring B-1307A was drilled at station 27+08. The proposed grade in this area will be in a cut section, founded in soil. Boring B-1307A encountered 8 inches of topsoil at the surface. Below the topsoil layer, boring B-1307A generally encountered silt and clay (A-6a) over clay (A-7-6).

Boring B-1313A was drilled at station 31+04 for proposed roadway embankments. Boring B-1313A encountered 8 inches of topsoil at the surface. Below the topsoil layer, this boring generally encountered silt (A-4b) to the bottom of the boring, at a depth of 8.0 feet.

Seepage was first encountered in the borings from 6.0 to 26.0 feet below ground surface. No groundwater was observed prior to adding drilling water.

Based upon the proposed grade and results of borings, the subgrade materials of relocated Shumway Hollow Road will vary greatly across the site. The proposed grade from approximate stations 10+91 to 18+00 will be essentially at grade with small embankment fills within six feet of the existing ground surface. From approximate stations 18+00 to 26+00, significant soil and rock cuts will be required. In this area, the proposed grade is anticipated to be in bedrock. Cuts will be as deep as 31 feet with cuts as deep as 8 feet in rock. From approximate stations 26+00 to 30+50, the proposed grade will be founded in soil. Soil cuts in this area are anticipated to be as deep as 31 feet near station 25+00 and will meet the existing grade near station 30+50. From approximate stations 30+50 to 31+75, the proposed grade will be constructed on embankment fill up to six feet within existing grade. From approximate stations 31+75 to 36+59 the proposed grade will be in embankment fill that is anticipated to be more than six feet from existing grade, and hence requires no subgrade treatment. A bridge structure is currently planned from approximately station 36+59 to 37+92. From station 37+92 to 41+17 the proposed grade will be essentially at the existing grade crossing existing SR 335.

Table 1 presents the amount of cut or fill anticipated at each boring location and the material encountered at the proposed grade.

Table 1: Summary of Material Encountered at Proposed Subgrade in Borings

Boring No.	Station	Existing Ground Surface Elev. (ft)	Proposed Grade (ft)	Fill / (Cut) (ft)	Material Type at Proposed Grade
B-1301	12+39	699.5	699.5	0	Silt (A-4b)*
B-1303	15+40	687.5	689.6	2.1	Sandy Silt (A-4a)*
B-1311A	19+00	718.1	687.7	(30.4)	Bedrock
B-1312A	22+88	714.0	688.1	(25.9)	Bedrock
B-1307	27+53	695.5	674.8	(20.7)	Clay (A-7-6)
B-1307A	27+08	696.6	676.2	(20.4)	Clay (A-7-6)
TR-24	28+55	686.2	671.9	(14.3)	Clay (A-7-6)
TR-25	29+95	674.6	669.0	(5.6)	Clay (A-7-6)
B-1313A	31+04	666.4	667.9	1.5	Silt (A-4b)*
TR-26	31+28	665.2	667.6	2.4	Clay (A-7-6)*
B-1314A	34+98	651.5	663.9	12.4	Silt and Clay (A-6a)*

* Denotes Soil Type at Existing Ground Surface

Pavement Design Information

Table 2 below lists the subgrade soils encountered by the borings and the group indices, CBR values, and number of samples tested for each soil type.

Table 2: Subgrade Soils

ODOT Classification	Group Index	CBR	No. Samples Tested
Sandy Silt (A-4a)	3	9	3
Silt (A-4b)	8	7	3
Clay (A-7-6)	17	3	14

Based upon averaging the results of the laboratory testing, a CBR value of 5 is recommended for pavement design.

Silt (A-4b) was encountered at the proposed subgrade surface in two out of eleven borings considered for this project. As per GB-1 "Plan Subgrades", when silt (A-4b) soil is encountered in natural ground or an existing embankment within 3 feet of top of subgrade, regardless of its consistency or moisture content, it shall be removed or chemically stabilized because of its susceptibility to frost heaving. For undercutting, silt (A-4b) should be undercut 3 feet deep and replaced with Item 203 Embankment. If the subgrade is going to be chemically stabilized to a depth of 16 inches, silt (A-4b) soils may not have to be removed.

Clay (A-7-6) having a liquid limit greater than 65 was encountered in boring TR-25 at station 29+95. As per GB-1 "Plan Subgrades", when a soil sample has a liquid limit greater than 65, it shall not be used in an embankment or subgrade. When the liquid limit is greater than 65, it indicates a soil of high clay content and low load-carrying capacity. Such soils will need to be removed or chemically stabilized. For undercutting, any material with a liquid limit greater than 65 should be completely removed, or if that is not feasible, depending on stability, a minimum of 24 inches. Chemical stabilization may be able to stabilize soils with a liquid limit greater than 65.

Subgrade Condition and Preparation

The existing subgrade soils along the project were evaluated for suitability according to the ODOT Geotechnical Bulletin GB-1 "Plan Subgrade." The optimum moisture content (MC) for each soil tested was estimated using the following criteria:

Optimum MC	=	plastic limit minus 3 (A-7-6 soils)
	=	plastic limit minus 5 (A-4 and A-6 soils)
	=	6 to 10 (granular soils)
	=	11 (non-plastic silts)

The results of this evaluation are presented in the attached spreadsheet. Note only samples within six feet of the proposed grade were evaluated. According to the referenced guidelines, any soils with moisture contents that exceed the optimum moisture content by three or more percentage points will likely require some form of subgrade treatment. In addition, any soils with standard penetration values (N-values) of 10 or less will also likely require some form of subgrade treatment.

To determine the appropriate option, the average standard penetration value (N-value) and the plasticity index (PI) of the subgrade soils were considered. The average N-value, PI, moisture content, and CBR are presented in Table 3 on the following page.

Table 3

Percent of Samples Over Optimum MC + 3 Percent	Average N_L*	Average PI	Average MC	CBR Average
40	10.0	20.4	22.2	5

* - N_L indicates lowest standard penetration value (N) in subgrade soil.

Based on GB-1 guidelines, cement treatment is the preferred stabilization option for soils with average N-values less than 10 and an average plasticity index (PI) less than 20. However, cement stabilization should not be considered an option for treating clays with a PI greater than 20, such as those found in borings B-1307A, B-1307, TR-25, B-1313A, and TR-26.

Lime stabilization is the preferred stabilization option for soils which have a PI of 20 or greater, such as the clay soils encountered in boring B-1307A. However, lime stabilization is not well suited for silt (A-4b) or sandy silt (A-4a) soils, such as those found in borings B-1301, B-1303, and B-1313A.

Because one chemical stabilization option is not well suited for a majority of subgrade soils, it is not recommended that chemical stabilization be used to treat the subgrade.

Another subgrade stabilization option that could be considered is to undercut the weak, soft or unsuitable soils and replace the subgrade material with compacted Type B or C granular material (ODOT Item 703.16.C). Geotextile Fabric Type D (Item 712.09) should be placed in the bottom

of the undercut. If cement stabilization is not selected as an option on this project, the silt (A-4b) should be completely removed from the top 3 feet of proposed subgrade. Additionally, the high liquid limit clays encountered in boring TR-25 should also be completely removed. Consequently, it is recommended that the subgrade soils be undercut in areas and to depths indicated in Table 4 below.

Table 4: Undercut and Replace Option

Begin Station	End Station	Depth of Undercut Below Proposed Grade
11+00	13+90	3.0'
18+00	26+00	2.0' In Bedrock
26+00	31+75	3.0'

For the undercut option recommended for this site, the subgrade treatment should be extended to 18 inches beyond the proposed edge of pavement, paved shoulders, or paved medians.

Seepage was encountered only in borings B-1313, B-1314, and TR-24 through TR-26. Observed seepage was first encountered in the borings from 6.0 to 26.0 feet below existing ground surface. With the addition of drilling water, groundwater levels were measured to be between 4.6 and 29.8 feet below existing ground surface. Although no groundwater was encountered in the borings prior to adding drilling water, the contractor should be prepared to maintain reasonable dry excavations if water from seepage or precipitation enters any excavations.

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We appreciate having the opportunity to be of service to you on this project. Please do not hesitate to call if you have any questions concerning our findings.

Respectfully submitted,

DLZ OHIO, INC.

Steven J. Riedy
Geotechnical Engineer

Dorothy A. Adams, MSCE, P.E.
Senior Geotechnical Engineer

Encl: As noted

cc: file

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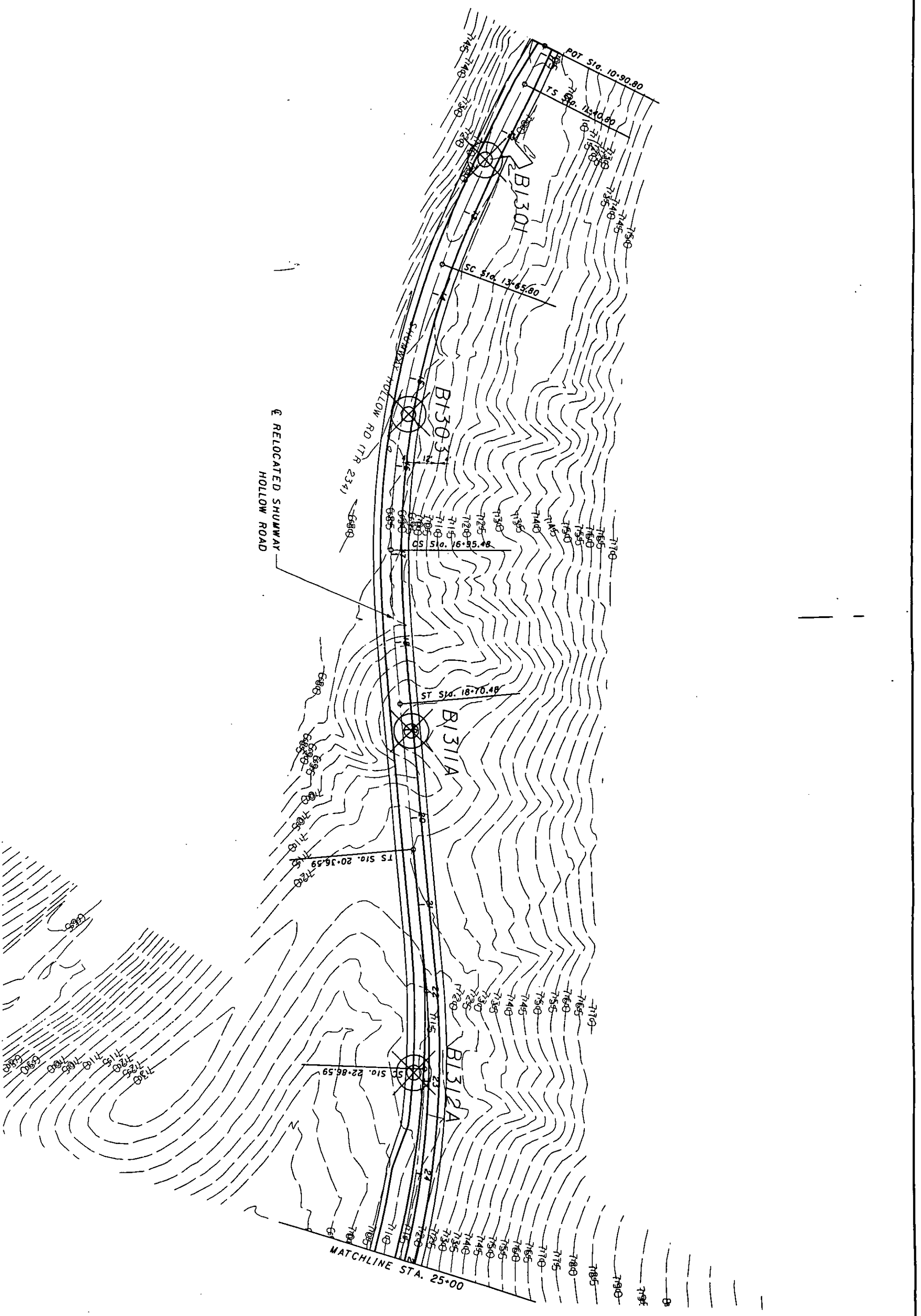
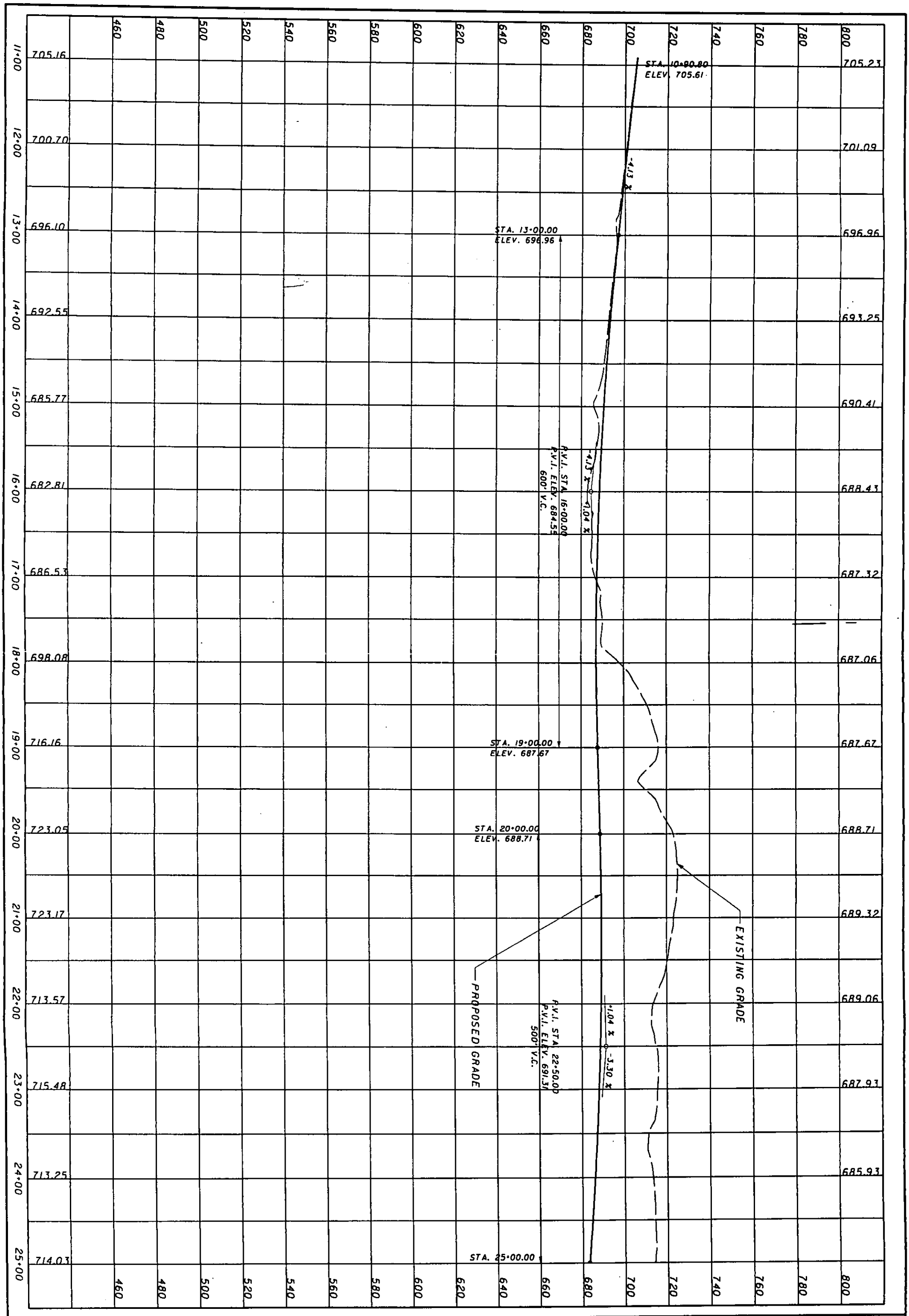


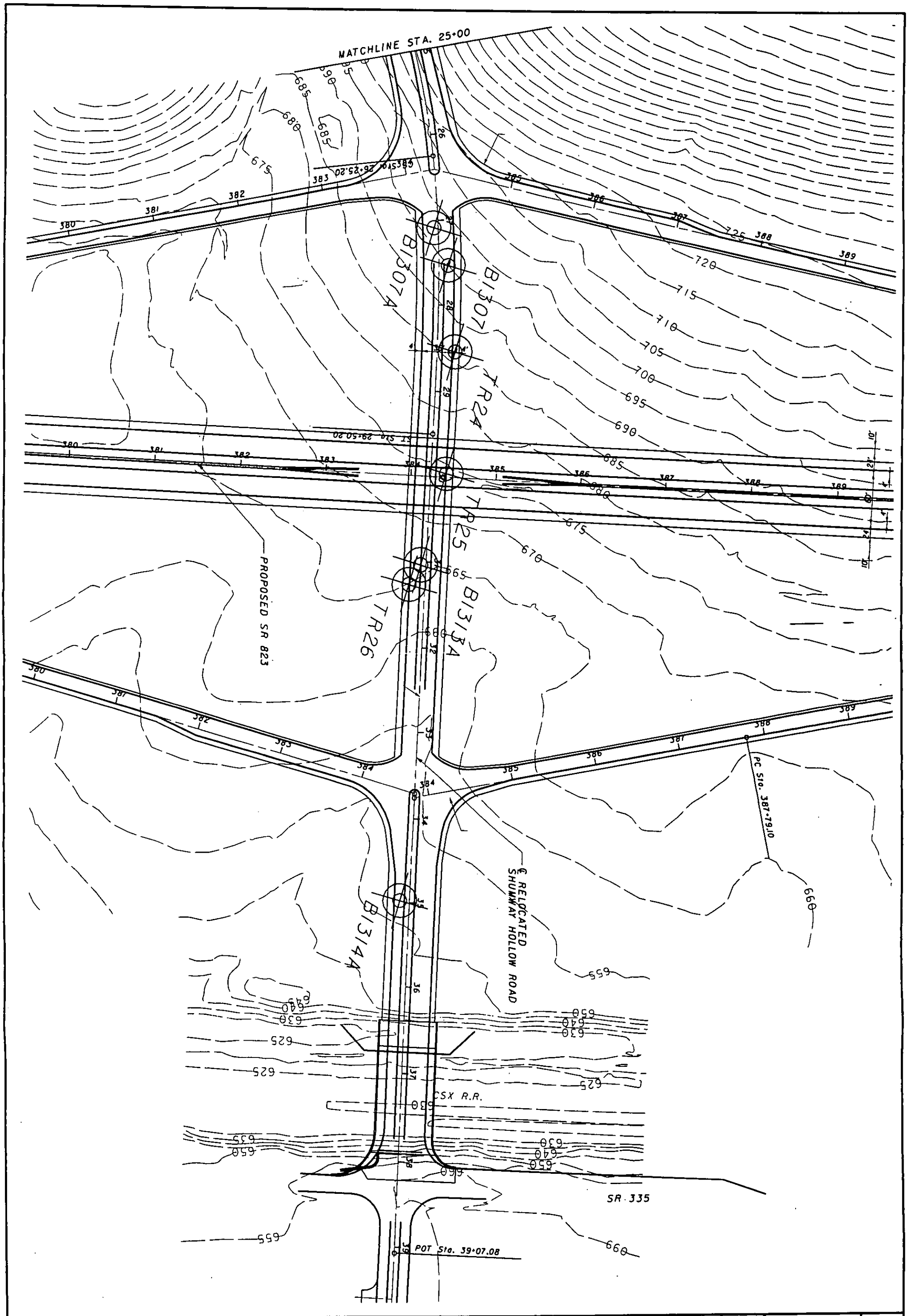
SCI-823-0.00	GB-1 BORING PLAN RELOCATED SHUMWAY HOLLOW ROAD	CALCULATED CHECKED	0 50 25 100 HORIZONTAL SCALE IN FEET



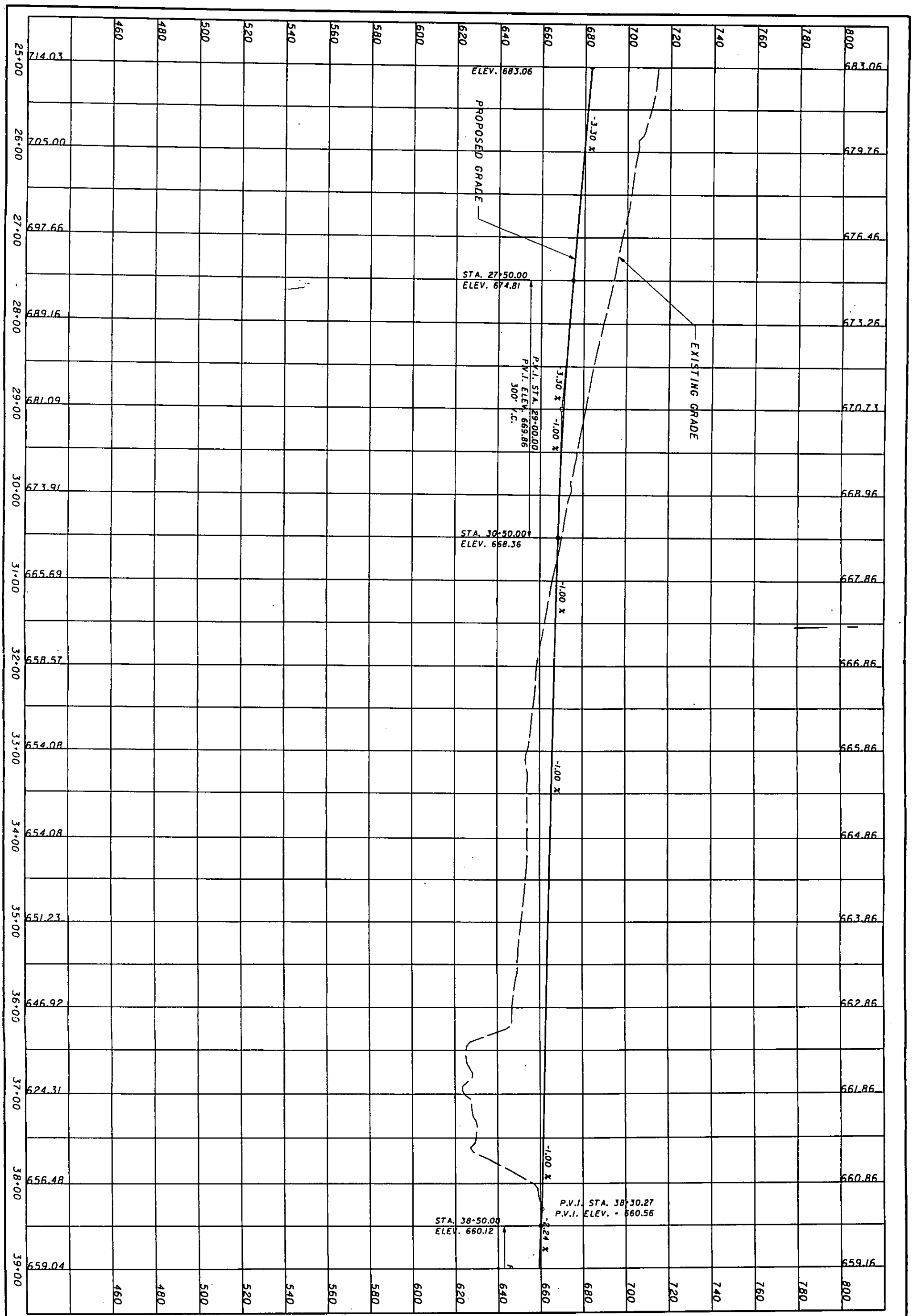
1A	SCI-823-0.00	PROFILE RELOCATED SHUMWAY HOLLOW ROAD

CALCULATED

CHECKED



2	SCI-823-0.00	GB-1 BORING PLAN RELOCATED SHUMWAY HOLLOW ROAD	CALCULATED / CHECKED	0 50 / 25 100 HORIZONTAL SCALE IN FEET



2A	SCI-823-0.00	PROFILE RELOCATED SHUMWAY HOLLOW ROAD	CALCULATED CHECKED

GENERAL INFORMATION
DRILLING PROCEDURES AND LOGS OF BORINGS

Drilling and sampling were conducted in accordance with procedures generally recognized and accepted as standardized methods of investigation of subsurface conditions concerning geotechnical engineering considerations. Borings were drilled with either a truck-mounted or ATV-mounted drill rig.

Drive split-barrel sampling was performed in 1.5 to 2 foot increments at intervals not exceeding 5 feet. In the event the sampler encountered resistance to penetration of 6 inches or less after 50 blows of the drop hammer, the sampling increment was discontinued. Standard penetration data were recorded and one or more representative samples were preserved from each sampling increment.

In borings where rock was cored, NXM or NQ size diamond coring tools were used.

In the laboratory all samples were visually classified by a geotechnical engineer. Moisture contents of representative fine-grained soil samples were determined. A limited number of samples, considered representative of foundation materials present, were selected for performance of grain-size analyses and plasticity characteristics tests. The results of these tests are shown on the boring logs.

The boring logs included in the Appendix have been prepared on the basis of the field record of drilling and sampling, and the results of the laboratory examination and testing of samples. Stratification lines on the boring logs indicating changes in soil stratigraphy represent depths of changes approximated by the driller, by sampling effort and recovery, and by laboratory test results. Actual depths to changes may differ somewhat from the estimated depths, or transitions may occur gradually and not be sharply defined. The boring logs presented in this report therefore contain both factual and interpretative information and are not an exact copy of the field log.

Although it is considered that the borings have disclosed information generally representative of site conditions, it should be expected that between borings conditions may occur which are not precisely represented by any one of the borings. Soil deposition processes and natural geologic forces are such that soil and rock types and conditions may change in short vertical intervals and horizontal distances.

Soil/rock samples will be stored at our laboratory for a period of six months. After this period of time, they will be discarded, unless notified to the contrary by the client.

LEGEND – BORING LOG TERMINOLOGY

Explanation of each column, progressing from left to right

1. Depth (in feet) – refers to distance below the ground surface.

2. Elevation (in feet) – is referenced to mean sea level, unless otherwise noted.

3. Standard Penetration (N) – the number of blows required to drive a 2-inch O.D., 1-3/8 inch I.D., split-barrel sampler, using a 140-pound hammer with a 30-inch free fall. The blows are recorded in 6-inch drive increments. Standard penetration resistance is determined from the total number of blows required for one foot of penetration by summing the second and third 6-inch increments of an 18-inch drive.

   50/n – indicates number of blows (50) to drive a split-barrel sampler a certain number of inches (n) other than the normal 6-inch increment.

4. The length of the sampler drive is indicated graphically by horizontal lines across the "Standard Penetration" and "Recovery" columns.

5. Sample recovery from each drive is indicated numerically in the column headed "Recovery".

6. The drive sample location is designated by the heavy vertical bar in the "Sample No., Drive" column.

7. The length of hydraulically pressed "Undisturbed" samples is indicated graphically by horizontal lines across the "Press" column.

8. Sample numbers are designated consecutively, increasing in depth.

9. Soil Description

   a. The following terms are used to describe the relative compactness and consistency of soils:

   Granular Soils – Compactness

Term	Blows/Foot Standard Penetration
Very Loose	0 – 4
Loose	4 – 10
Medium Dense	10 – 30
Dense	30 – 50
Very Dense	over 50

   Cohesive Soils – Consistency

Term	Unconfined Compression tons/sq.ft.	Blows/Foot Standard Penetration	Hand Manipulation
Very Soft	less than 0.25	below 2	Easily penetrated by fist
Soft	0.25 – 0.50	2 – 4	Easily penetrated by thumb
Medium Stiff	0.50 – 1.0	4 – 8	Penetrated by thumb with moderate pressure
Stiff	1.0 – 2.0	8 – 15	Readily indented by thumb but not penetrated
Very Stiff	2.0 – 4.0	15 – 30	Readily indented by thumb nail
Hard	over 4.0	over 30	Indented with difficulty by thumb nail

   b. Color – If a soil is a uniform color throughout, the term is single, modified by such adjective as light and dark. If the predominant color is shaded by a secondary color, the secondary color precedes the primary color. If two major and distinct colors are swirled throughout the soil, the colors are modified by the term "mottled".

   c. Texture is based on the Ohio Department of Transportation Classification System. Soil particle size definitions are as follows:

Description		Size	Description		Size
Boulders		Larger than 8"	Sand	– Coarse	2.0 mm to 0.42 mm
Cobbles		8" to 3"		– Fine	0.42 mm to 0.074 mm
Gravel	– Coarse	3" to ¾"	Silt		0.074 mm to 0.005 mm
	– Fine	¾" to 2.0 mm	Clay		smaller than 0.005 mm

d. The main soil component is listed first. The minor components are listed in order of decreasing percentage of particle size.

e. Modifiers to main soil descriptions are indicated as a percentage by weight of particle sizes.

trace	0 to 10%
little	10 to 20%
some	20 to 35%
"and"	35 to 50%

f. Moisture content of **cohesionless soils** (sands and gravels) is described as follows:

Term	Relative Moisture or Appearance
Dry	No moisture present
Damp	Internal moisture, but none to little surface moisture
Moist	Free water on surface
Wet	Voids filled with free water

g. The moisture content of **cohesive soils** (silts and clays) is expressed relative to plastic properties.

Term	Relative Moisture or Appearance
Dry	Powdery
Damp	Moisture content slightly below plastic limit
Moist	Moisture content above plastic limit but below liquid limit
Wet	Moisture content above liquid limit

10. Rock Hardness and Rock Quality Designation

a. The following terms are used to describe the relative hardness of the **bedrock**.

Term	Description
Very Soft	Permits denting by moderate pressure of the fingers. Resembles hard soil but has rock structure. (Crushes under pressure of fingers and/or thumb)
Soft	Resists denting by fingers, but can be abraded and pierced to shallow depth by a pencil point. (Crushes under pressure of pressed hammer)
Medium Hard	Resists pencil point, but can be scratched with a knife blade. (Breaks easily under single hammer blow, but with crumbly edges.)
Hard	Can be deformed or broken by light to moderate hammer blows. (Breaks under one or two strong hammer blow, but with resistant sharp edges.)
Very Hard	Can be broken only by heavy and in some rocks repeated hammer blows.

b. Rock Quality Designation, RQD – This value is expressed in percent and is an indirect measure of rock soundness. It is obtained by summing the total length of all core pieces which are at least four inches long, and then dividing this sum by the total length of the core run.

11. Gradation – when tests are performed, the percentage of each particle size is listed in the appropriate column (defined in Item 9c).

12. When a test is performed to determine the natural moisture content, liquid limit moisture content, or plastic limit moisture content, the moisture content is indicated graphically.

13. The standard penetration (N) value in blows per foot is indicated graphically.

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1301 | Location: Sta. 12+37.8, 2.4 ft. RT of Rel. Shumway Hollow CL | Date Drilled: 1/26/06

WATER OBSERVATIONS: Water seepage at: Not reported
Water level at completion: 6.5' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	699.5												
0.3	699.2						Asphalt Concrete Pavement - 3"						
		11 10 8 7	18	1		4.5+	Hard brown SILT (A-4b), some fine to coarse sand, trace gravel; damp.	2	14	--	14	51	19
2.5	697.0	4 6 9 10	20	2		4.5+	Hard brown SANDY SILT (A-4a), "and" fine to coarse sand, trace gravel; contains sandstone fragments; damp.	9	28	--	13	31	19
4.5	695.0	23 50/3	9	3			Severely weathered brown SANDSTONE fragments.						
5.5	694.0	Core 60"	Rec 47"	RQD 12%	R-1	*412	Hard brown SANDSTONE; very fine to fine grained, highly weathered, argillaceous, micaceous, thinly bedded to thickly bedded, highly fractured to broken. @ 7.1', 9.1', 9.4', low angle fractures. @ 6.6'-7.5',7.6'-7.7',8.0'-8.7', broken zones.						
10.5	689.0						Bottom of Boring - 10.5'						

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40
50+

FILE: 0121-3070-03 [11/24/2006 1:29 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1303 | Location: Sta. 15+40.1, 6.5 ft. LT of Rel. Shumway Hollow CL | Date Drilled: 10/05/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: None (Prior to coring)
4.6' (Includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0.2	687.5	4 5 7 8	20	1		--	Topsoil - 2"						
	687.3						Hard brown SANDY SILT (A-4a), some gravel; contains rock fragments; damp.	18	17	--	19	35	11
		14 18 18 20	18	2		--	@ 0.2'-2.0', stiff.	20	18	--	14	35	13
5		5 6 31 50/5	23	3		--							
6.0	681.5	50/4	2	4									
7.0	680.5						Severely weathered gray SANDSTONE fragments, argillaceous.						
10		Core 96"	Rec 96"	RQD 66%	R-1	*386	Medium hard to hard brown and gray SANDSTONE; very fine to fine grained, moderately to highly weathered, micaceous, argillaceous, massively bedded, moderately to highly fractured. @ 7.0'-9.0', rust stained. @ 7.9', 8.0', 9.1', 9.6', 9.7', 9.8', 10.0', low angle, rust stained fractures. @ 10.0', slightly to moderately fractured. @ 12.1', 12.3', 12.5', low angle fractures. @ 13.0' to 13.1', shale lamination.						
15.0	672.5						Bottom of Boring - 15.0'						
20													
25													
30													

GRADATION

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40
50+

FILE: 0121-3070-03 (11/24/2006 1:29 PM)

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [illegible]IBUS, OHIO 43229 * (614)888-0040

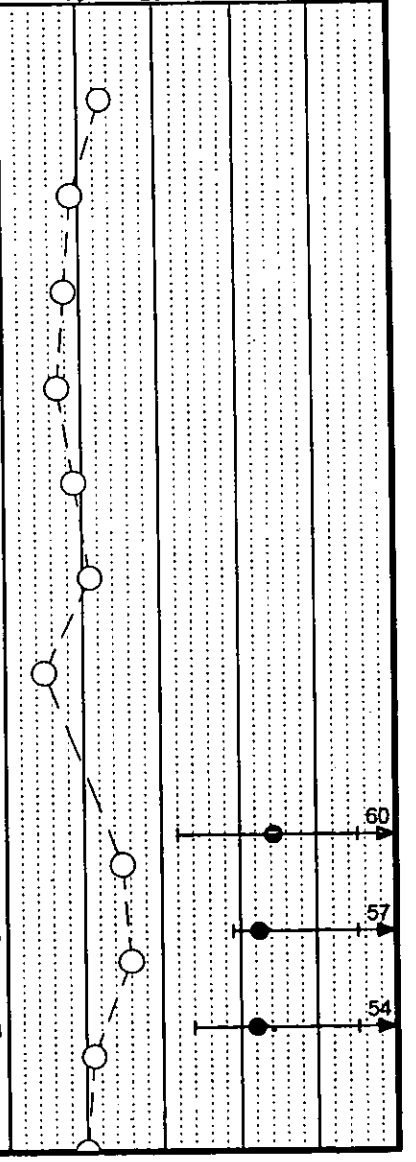
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1307 | Location: Sta. 27+52.9, 10.9 ft. LT of Rel. Shumway Hollow CL | Date Drilled: 08/18/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: Not reported

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	695.5												
0.7	694.8	7 6 7 7	10	1		4.5+	Topsoil - 8" Hard brown SILT AND CLAY (A-6a), little fine to coarse sand, trace gravel; damp.						
5		3 5 4 5	9	2		4.5+							
6.0	689.5	2 3 5	8	3		2.5	Stiff to very stiff brown CLAY (A-7-6), trace to little fine sand; damp to moist.						
		2 2 5	9	4		2.5							
10		2 4 5	9	5		2.25							
		2 5 6	16	6		2.75							
15		3 2 3	18	7		2.5							
					P1								
20		5 7 8	10	9		1.75	@ 21.0', becomes gray.	0	0	–	0	13	87
		4 7 9	9	10		2.0		0	0	–	0	12	88
25		4 6 5	6	11		1.25		0	0	–	1	21	78
		3 5 5	10	12		1.0							
30													

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40



FILE: 0121-3070-03 [11/14/2006 1:33 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]BUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1307 | Location: Sta. 27+52.9, 10.9 ft. LT of Rel. Shumway Hollow CL | Date Drilled: 08/18/05

WATER OBSERVATIONS: Water seepage at: None; Water level at completion: Not reported

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
30	665.5						Very stiff brown CLAY (A-7-6), little fine sand; damp.						
		8 8 9	7	13		4.0							
35													
		5 5 17	12	14		2.25	@ 40.0', 1/2" thick gravel seam.						
40													
42.0	653.5						Stiff gray SILT AND CLAY (A-6a), little fine to coarse sand; moist.						
		5 4 5	10	15		1.5							
45													
47.0	648.5						Stiff gray SILTY CLAY (A-6b), little fine to coarse sand; moist.						
		20 23 20	10	16A 16B		1.0							
49.5	646.0						Dense brown SANDY SILT (A-4a), some fine to coarse sand, little gravel; moist.						
50													
51.0	644.5	50/2	1	17		--	Hard gray SILTY CLAY (A-6b), some fine to coarse sand, trace gravel; moist.						
52.0	643.5						Hard gray SANDSTONE; very fine to fine grained, slightly weathered, micaceous , massively bedded, unfractured.						
55		Core 82"	Rec 70"	RQD 82%	R-1	*510							
58.8	636.7						Bottom of Boring - 58.8'						
60													

GRADATION

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40
50+

FILE: 0121-3070-03 [11/24/2006 1:33 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

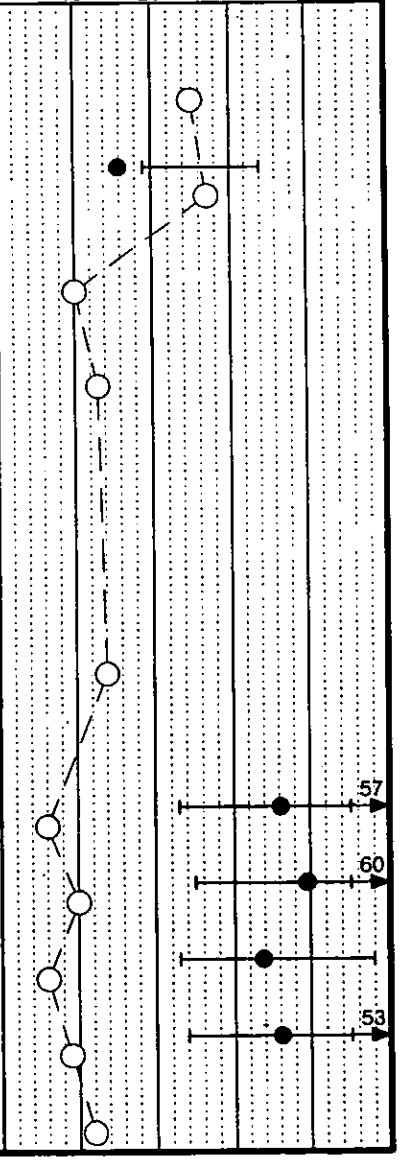
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1307A | Location: 27+08.1, 4.9 ft. RT of Rel. Shumway Hollow CL | Date Drilled: 07/21/06

WATER OBSERVATIONS: Water seepage at: None; Water level at completion: None

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	696.6												
0.5	696.1						Topsoil - 6"						
		5 8 17	16	1		--	Medium dense reddish brown SILT AND CLAY (A-6a), little to some gravel, trace clay; contains decomposed sandstone fragments; damp. @ 3.0', little clay, little gravel.						
		8 12 15	14	2		--		5	11	--	7	47	30
5													
6.0	690.6	3 4 6	12	3		2.75	Very stiff mottled red and brown SILTY CLAY (A-6b), trace fine sand; damp.						
8.5	688.1	4 6 7	18	4		2.0	Stiff to very stiff brown CLAY (A-7-6) (Varved), trace to little silt, trace fine sand; damp to moist.						
10					P-1								
					P-2								
15													
17.0	679.6	3 6 8	18	5A		1.25							
				5B		0.75	Medium stiff gray CLAY (A-7-6) (Varved), trace to little silt, trace fine sand; moist.						
					P-3								
20		2 3 3 6	24	6		0.75		0	0	--	0	8	92
		2 4 6 7		7		0.5	@ 21.5', encountered 1/4" gray silt seam. @ 22.0', soft to medium stiff.	0	0	--	0	12	88
25		2 3 3 4	24	8		0.5		0	0	--	1	12	87
		4 4 5 6	24	9		0.5	@ 26.0', brownish-gray.	0	0	--	0	20	80
		2 5 7 11	24	10A		0.5	@ 28.5', little gravel.						
30.0	666.6			10B		1.5	@ 29.0', Stiff, brown.						

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40



FILE: 0121-3070-03 (11/24/2006 1:13 PM)

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1307A | Location: 27+08.1, 4.9 ft. RT of Rel. Shumway Hollow CL | Date Drilled: 07/21/06

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetro-meter (tsf) / * Point-Load Strength (psi)	WATER OBSERVATIONS: Water seepage at: None; Water level at completion: None — DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL — LL Blows per foot - ○
30	666.6						Bottom of Boring - 30.0'							
35														
40														
45														
50														
55														
60														

10 20 30 40

FILE: 0121-3070-03 [11/24/2006 1:33 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

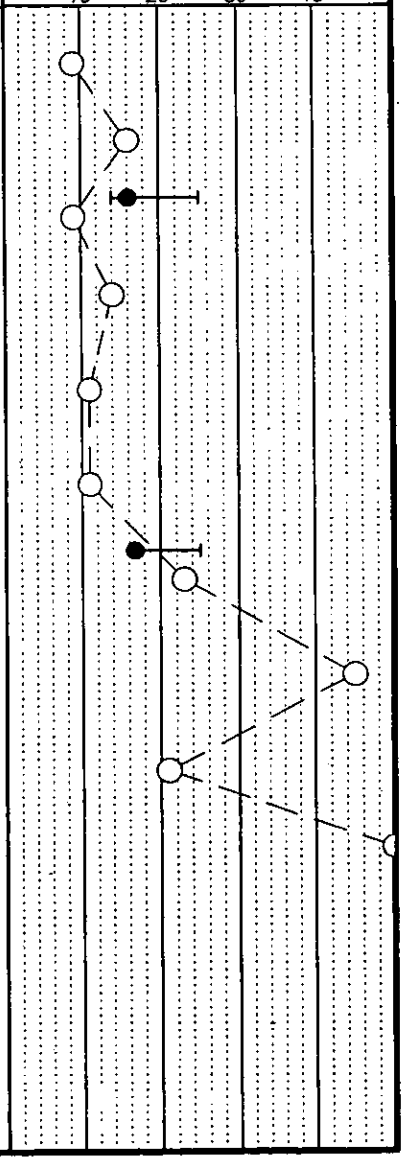
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1311A | Location: Sta. 19+01.9, 9.9 ft. LT of Rel. Shumway Hollow CL | Date Drilled: 07/21/06

WATER OBSERVATIONS: Water seepage at: None; Water level at completion: None (prior to coring); 4.0' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	718.1												
0.3	717.8	1 4 5 7	13	1		4.5+	Topsoil - 3" Hard brown SILT AND CLAY (A-6a), trace fine sand; contains organic material; damp.						
2.0	716.1	4 7 9 10	18	2		--	Medium dense brown SANDY SILT (A-4a), trace to little clay; damp. @ 3.5'; encountered organic debris.						
4.0	714.1	2 4 5 9	20	3		2.0	Stiff to very stiff mottled brown and gray SILT AND CLAY (A-6a) (Varved, very thin alternating silt/sand/clay layers), little fine sand; damp to moist.	0	0	--	17	52	31
5		4 5 9 12	24	4A		2.0							
		3 5 6	18	4		2.0							
10													
11.0	707.1	3 5 6	18	5		2.0	Stiff brown SILT AND CLAY (A-6a), trace fine sand; damp.						
13.5	704.6	7 10 13	18	6		4.0	Medium dense brown SILT (A-4b), some clay, trace fine sand; contains sandstone fragments; damp.	0	1	--	9	59	31
15		12 21 24	13	7		--							
20		6 10 11	16	8		4.5+	@ 18.5'-20.0', Encountered organic material.						
21.0	697.1	40 50/3	6	9		--	Very dense brown GRAVEL WITH SAND (A-1-b); contains sandstone fragments; damp.						
		50/3		10		--							
24.0	694.1						Hard yellowish brown SANDSTONE; fine grained, highly weathered, argillaceous, micaceous, highly fractured to moderately fractured, exhibits cross bedding.						
25													
28.0	690.1	Core 120"	Rec 117"	RQD 64%	R-1		Medium hard to hard gray SANDSTONE; fine to very fine grained, argillaceous, micaceous, massive, moderately						
30													

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40



FILE: 0121-3070-03 [11/24/2006 1:33 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1311A | Location: Sta. 19+01.9, 9.9 ft. LT of Rel. Shumway Hollow CL | Date Drilled: 07/21/06

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: None (prior to coring)
4.0' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetro-meter (tsf) / * Point-Load Strength (psi)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL ⊢—⊣ LL Blows per foot - ○ 10 20 30 40
30	688.1						fractured, contains clay filled fractures. @ 29.2' -29.3', 31.0'-31.2', 32.7'-32.8', 33.8'-34.0', 31.4'-31.8', shaley zones. @ 32.0', low angle fractures.							
34.0	684.1						@ 33.6'-33.8', possible core loss.							
35							Bottom of Boring - 34.0'							
40														
45														
50														
55														
60														

FILE: 0121-3070-03 [11/24/2006 1:33 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1312A | Location: Sta. 22+91.1, 12.3 ft. RT of Rel. Shumway Hollow CL | Date Drilled: 07/20/06 to 07/21/06

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	714.0						WATER OBSERVATIONS: Water seepage at: None; Water level at completion: None (prior to coring); 6.7' (includes drilling water)						
0.3	713.7						Topsoil - 4"						
		8 11 20	15	1		--	Medium dense to dense brown SILT (A-4b), little gravel, trace clay; contains decomposed sandstone fragments; damp. @ 3.0', little clay.						
		17 28 36	16	2		--		5	13	--	15	52	15
5		9 21 24	17	3		--	@ 8.0'; medium dense, reddish-brown, damp-moist.						
		4 13 12	14	4		--	@ 10.5'; little to some clay.						
10		10 7 11	5	5		--							
13.0	701.0						Very stiff mottled light brown and gray CLAY (A-7-6), trace fine sand; damp.						
		4 5 12	15	6		3.25		0	0	--	1	37	62
15		6 15 31	18	7		4.0	@ 16.5'; little gravel, encountered 0.3" gray silt seams.						
18.0	696.0						Medium dense to dense mottled light brown and gray SILT (A-4b), little fine sand, little clay, little gravel; damp.						
		9 14 14	16	8		--	@ 20.5'; trace fine to coarse sand, trace gravel.	2	6	--	9	65	19
20													
21.5	692.5	27 50/3	9	9A 9B		--	Brown decomposed SANDSTONE.						
23.5	690.5	50/0	0	10			Hard to very hard brown SANDSTONE; very fine to fine grained, moderately to highly weathered, siliceous, argillaceous, massive, moderately to highly fractured. @ 25.4'-26.7', possible core loss or broken zone. @ 26.7'-33.7', slightly fractured. @ 27.4', gray.						
25		Core 120"	Rec 105"	RQD 47%	R-1		@ 30.0', low angle fracture.						
30													

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40

64
50+
50+

FILE: 0121-3070-03 [11/24/2006 1:33 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1312A | Location: Sta. 22+91.1, 12.3 ft. RT of Rel. Shumway Hollow CL | Date Drilled: 07/20/06 to 07/21/06

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION
30	684.0						Hard to very hard brown SANDSTONE; very fine to fine grained, moderately to highly weathered, siliceous, argillaceous, massive, moderately to highly fractured.
33.7	680.3						Bottom of Boring - 33.7'
35							
40							
45							
50							
55							
60							

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: None (prior to coring)
6.7' (includes drilling water)

GRADATION: % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40

FILE: 0121-3070-03 [11/21/2006 1:33 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

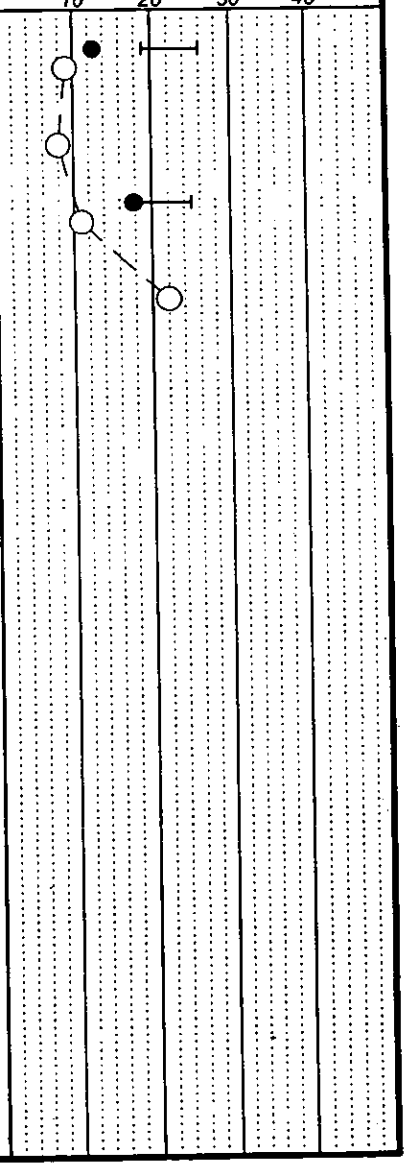
LOG OF: Boring B-1313A | Location: Sta. 31+03.5, 6.1 ft. RT of Rel. Shumway Hollow CL | Date Drilled: 07/21/06

WATER OBSERVATIONS: Water seepage at: None; Water level at completion: None

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	666.4												
0.7	665.7	3 4 5 3	20	1		–	Topsoil - 8"						
							Stiff to very stiff brown SILT (A-4b), trace fine to coarse sand, trace coarse sand; contains organic material; damp to moist.	0	2	–	5	73	20
		3 4 4 4	24	2		2.0							
5		4 4 7 11	24	3		2.25		3	6	–	8	59	24
		7 10 12 13	22	4		1.5	@ 6.5'; some fine sand, moist.						
8.0	658.4						Bottom of Boring - 8.0'						
10													
15													
20													
25													
30													

GRADATION

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40



FILE: 0121-3070-03 [11/24/2006 1:33 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1314A | Location: Sta. 34+98.1, 11.4 ft. RT of Rel. Shumway Hollow CL | Date Drilled: 07/21/06

WATER OBSERVATIONS: Water seepage at: None; Water level at completion: None

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	651.5												
0.8	650.7	1 3 4 3	18	1		2.0	Topsoil - 9" Stiff to very stiff brown SILT AND CLAY (A-6a), little fine sand; damp to moist.	0	2	--	14	53	31
2.0	649.5	3 4 4 5	24	2		1.0	Medium stiff to stiff mottled brown and gray SANDY SILT (A-4a), some fine sand; moist.	1	2	--	29	42	27
4.0	647.5	6 9 9 9	22	3		--	Medium dense brown COARSE AND FINE SAND (A-3a), trace to little silt, trace clay; damp to moist.						
6.0	645.5						Bottom of Boring - 6.0'						

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40

10 15 20 25 30

FILE: 0121-3070-03 [11/24/2006 1:34 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-24 | Location: Sta. 384+43.9 147.1 ft. LT of SR 823 CL | Date Drilled: 8/20/04 to 8/23/04

WATER OBSERVATIONS: Water seepage at: 6.0'
Water level at completion: 29.8' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	686.2						Topsoil - 12"						
1.0	685.2	6 10 13	18	1		4.5+	Hard brown SILT AND CLAY (A-6a), little fine to coarse sand; damp.						
5		13 10 10	18	2		4.5+							
6.0	680.2	3 3 8	12	3		2.75	Stiff to very stiff brown CLAY (A-7-6), little fine to coarse sand, little silt; varved; moist.						
10		2 3 5	18	4		2.0							
		2 2 3	18	5		2.0							
		2 4 5	18	6		2.25							
15		2 3 4	18	7		1.25							
		1 3 4	18	8		3.75							
20		2 3 3	18	9		1.0							
		3 4 5	18	10		1.5							
25													
27.0	659.2	4 3 12	18	11		1.75	Medium dense brown FINE SAND (A-3), trace gravel; damp.						
		5 5 5	18	12									
30													

GRADATION

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-24 | Location: Sta. 384+43.9 147.1 ft. LT of SR 823 CL | Date Drilled: 8/20/04 to 8/23/04

WATER OBSERVATIONS: Water seepage at: 6.0'
Water level at completion: 29.8' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
30	656.2						Medium dense brown FINE SAND (A-3), trace gravel; damp.						
34.0	652.2	4 2 2	18	13		0.5	Soft gray SILTY CLAY (A-6b), little fine to coarse sand, trace gravel; moist.						
37.0	649.2						Severely weathered gray SANDSTONE, argillaceous.						
40		10 17 22	18	14			@ 43.0', augers encountered difficult drilling.						
43.5	642.7						Medium hard to hard gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, argillaceous, micaceous, moderately to highly fractured. @ 44.8' to 44.9',45.2',45.4',47.0' contains argillaceous laminations and fractures. @ 47.0', slightly weathered, unfractured to slightly fractured.						
45													
50		Core 120"	Rec 118"	RQD 77%	R-1								
53.5	632.7						Bottom of Boring - 53.5'						
55													
60													

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40

FILE: 0121-3070-03 [11/24/2006 1:34 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-25 | Location: Sta. 384+41.0, 4.4 ft. LT of SR 823 CL | Date Drilled: 8/19/04 to 8/20/04

WATER OBSERVATIONS: Water seepage at: 16.0', 21.0'
Water level at completion: 16.4' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	674.6												
0.5	674.1						Topsoil - 6"						
		4 7 6	18	1		4.0	Hard brown SILT AND CLAY (A-6a), little fine to coarse sand, trace gravel; damp.						
		6 8 9	18	2		4.5		4	6	--	13	37	40
5													
5.5	669.1						Stiff to very stiff brown CLAY (A-7-6), little silt, trace fine sand; damp to moist.						
		2 3 5	18	3		2.0		0	0	--	1	11	88
		2 3 5	18	4		1.25							
10													
		2 4 4	18	5		1.75							
		3 3 5	18	6		2.5							
15													
		2 3 5	18	7		2.25							
18.0	656.6						Loose to medium dense brown FINE SAND (A-3), trace silt; damp to wet.						
		4 3 4	18	8									
20													
		1 1 3	18	9									
		9 11 12	18	10									
25													
		7 3 7	18	11									
28.0	646.6						Dense brown GRAVEL WITH SAND (A-1-b); contains sandstone fragments; moist.						
		2 14 16	18	12									
30													

GRADATION

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40

66

FILE: 0121-3070-03 [11/24/2006 1:34 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-25 | Location: Sta. 384+41.0, 4.4 ft. LT of SR 823 CL | Date Drilled: 8/19/04 to 8/20/04

WATER OBSERVATIONS: Water seepage at: 16.0', 21.0'
Water level at completion: 16.4' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ 10 20 30 40
	644.6													
30.0	644.6						Severely weathered brown and gray SANDSTONE.							
		27 50/5	6	13										50+
32.0	642.6						Hard gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, micaceous, argillaceous, massively bedded, slightly fractured. @ 32.0'-37.0', highly fractured.							
		Core 48"	Rec 46"	RQD 42%	R-1									
35														
		Core 72"	Rec 72"	RQD 100%	R-2									
40														
42.0	632.6						Bottom of Boring - 42.0'							
45														
50														
55														
60														

GRADATION

FILE: 0121-3070-03 [11/24/2006 1:34 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-26 | Location: Sta. 384+04.3, 126.8 ft. RT of SR 823 CL | Date Drilled: 8/19/04

WATER OBSERVATIONS: Water seepage at: 8.5'
Water level at completion: 8.5' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	665.2						Topsoil - 12"						
1.0	664.2	5 5 8	18	1		4.5	Hard brown CLAY (A-7-6), "and" fine to coarse sand, trace gravel, little silt; damp to moist.						
5		8 9 11	18	2		4.5+		0	2	--	38	12	48
5.5	659.7	7 7 8	18	3			Loose to medium dense brown COARSE AND FINE SAND (A-3a), little silty clay; moist to wet.	0	0	--	81	19	
		4 9 7	18	4									
10		3 4 6	18	5									
		4 5 10	18	6									
15		5 4 3	18	7			@ 16.0', wet.						
		2 3 4	18	8									
20													
20.5	644.7	4 8 13	18	9			Medium dense gray GRAVEL WITH SAND (A-1-b); contains sandstone fragments; moist.						
23.0	642.2						Hard gray SANDSTONE; very fine to fine grained, argillaceous, micaceous, slightly to moderately weathered, massively bedded, slightly fractured. @ 23.0'-25.5', moderately fractured. @ 23.1', 23.5', thin clay seams.						
25		Core 120"	Rec 111"	RQD 73%	R-1								
30													

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40

Non-Plastic

FILE: 0121-3070-03 (11/24/2006 1:35 PM)

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-26 | Location: Sta. 384+04.3, 126.8 ft. RT of SR 823 CL | Date Drilled: 8/19/04

WATER OBSERVATIONS: Water seepage at: 8.5'
Water level at completion: 8.5' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
30.0	635.2						Hard gray SANDSTONE; very fine to fine grained, argillaceous, micaceous, slightly to moderately weathered, massively bedded, slightly fractured.						
33.0	632.2						Bottom of Boring - 33.0'						

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40

35 40 45 50 55 60

FILE: 0121-3070-03 (11/24/2006 1:35 PM)

SUBGRADE EVALUATION
RELOCATED SHUMWAY HOLLOW ROAD
PROJECT SCI-823-0.00

Soil Investigation Summary

Do NOT Rubblize & Roll
Global CS is NOT an option
Global LS may be an option

Design CBR is 5

Number of Borings = 10

Classification Counts by Sample															
R	1a	1b	3	3a	2-4	2-5	2-6	2-7	4a	4b	5	6a	6b	7-5	7-6
7	0	0	0	0	0	0	0	0	4	4	0	0	0	0	14
24%									14%	14%					48%
24.1%	0.0%								75.9%						

Class @ Surface		
2-5	0	
4b	2	20%
5	0	
7-5	0	
7-6	5	50%
R	2	20%

% Borings	
N_L < 1	0%
N_L < 10	40%
N_L < 20	0%
M+	40%

% @ Surface	
100%	
50%	50%
% Borings	
80%	
50%	50%
20%	10%
50%	50%

	N	N_L		PI				M	M_{OPT}		GI
Average	13.9	10.0		20.4		54.4		22.2	17.2		12.65
Maximum	37	15	66	29	40	73	92	100	40	26	20
Minimum	6	6	21	18	3	8	11	46	4	10	2

SCI-823 Shumway Hollow Road

#	B #	Boring Location	Depth	To	Cut Fill	Standard Penetration n_2	n_3	N	N_L	Physical Characteristics LL	PL	PI	% Silt	% Clay	P 200	Moisture M	M_{OPT}	Classification Class	GI	Comments	Problem w/ Class	w/ MN	Treatments LS	CS	UC Class	UC MN
1	1301	As-Drilled Survey	0.5	2.5	0.0	10	8	18		22	19	3	51	19	70	14	14	4b	7		4b				3	
		Sta. 12+39	2.5	4.5		6	9	15		25	18	7	31	19	50	12	13	4a	3							
			4.5	5.5		30		30										R			BR				2	
									15																	
2	1303	As-Drilled Survey	2.3	4.1	2.1	5	7	12		21	18	3	35	11	46	4	13	4a	2							
		Sta. 15+40	4.1	6.1		18	18	36		23	19	4	35	13	48	6	14	4a	3							
			6.1	8.0		6	31	37								9	10	4a								
									12																	
3	1311A	As-Drilled Survey	ROCK		-30.4													R			BR				2	
		Sta. 19+00	ROCK															R			BR				2	
			ROCK															R			BR				2	
4	1312A	As-Drilled Survey	ROCK		-25.9													R			BR				2	
		Sta. 22+88	ROCK															R			BR				2	
			ROCK															R			BR				2	
5	1307A	As-Drilled Survey	0.0	1.6	-20.4	3	3	6		57	23	34	8	92	100	36	20	7-6	19			MN	–			3
		Sta. 27+08	1.6	3.6		4	6	10		60	25	35	12	88	100	40	22	7-6	20			MN	12			1
			3.6	5.6		3	3	6		48	23	25	12	87	99	34	20	7-6	16			MN	–			3
									6																	
6	1307	As-Drilled Survey	0.3	1.8	-20.7	7	8	15		60	22	38	13	87	100	35	19	7-6	20			M	12			1
		Sta. 27+53	2.8	4.3		7	9	16		57	29	28	12	88	100	33	26	7-6	19			M				1
			5.3	6.8		6	5	11		54	24	30	21	78	99	32	21	7-6				MN	12			1
									11																	
7	TR-24	As-Drilled Survey	0.0	0.7	-14.3	4	5	9									18	7-6	14			N				1
		Sta. 28+55	1.7	3.2		3	4	7									18	7-6	14			N				2
			4.2	5.7		3	4	7									18	7-6	14			N				2
									7																	
8	TR-25	As-Drilled Survey	0.4	1.9	-5.6	3	5	8		66	26	40	11	88	99	27	23	7-6	20		LL	MN	–		All	2
		Sta. 29+95	2.9	4.4		3	5	8									18	7-6	14			N				2
			5.4	6.9		4	4	8									18	7-6				N				2
									8																	
9	1313A	As-Drilled Survey	2.2	3.5	1.5	4	5	9		26	19	7	73	20	93	13	14	4b	8		4b	N		14	3	1
		Sta. 31+04	3.5	5.5		4	4	8									10	4b	8		4b	N			3	2
			5.5	7.5		4	7	11		25	18	7	59	24	83	18	13	4b			4b	MN		12	3	1
									8																	
10	TR-26	As-Drilled Survey	3.4	4.9	2.4	5	8	13									18	7-6	14							
		Sta. 31+28	5.9	7.4		9	11	20		44	19	25	12	48	60	20	18	7-6								
									13																	
11	1314A	As-Drilled Survey	12.4' Fill																							
		Sta. 34+98																								
		12.4' Fill																								

APPENDIX B

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July 19, 2006

Michael D. Weeks, P.E., P.S.
TranSystems Corporation
5747 Perimeter Drive, Suite 240
Dublin, OH 43017

Re: **Pavement Design Information**
Lucasville–Minford Road
SCI-823-0.00 Portsmouth Bypass
DLZ Job No.: 0121-3070.03
Document # 0016

Dear Mr. Weeks:

This letter includes the findings of a subsurface exploration performed for the Lucasville–Minford Road improvement and widening. The findings included in this letter pertain to Lucasville–Minford Road only. The findings of other subsurface explorations for pavement design will be submitted in separate documents.

The improvements will essentially consist of regrading and widening approximately 3,275 feet of existing Lucasville-Minford Road from station 4+56 to 37+31. It is understood that the proposed grade will be essentially at existing grade. See attached plan and profile sheets for more detailed information.

The recommendations presented in this report have been made on the basis of the foregoing information. If the proposed improvements or concept is changed or differs from that assumed, DLZ Ohio, Inc. (DLZ) should be informed of the changes so that recommendations and conclusions presented in this letter may be revised as necessary.

The results of these evaluations are based upon the findings of eight subgrade borings. Borings B-1201 through B-1208 were drilled on July 21, 2005 using a truck mounted rotary-type drill rig. Borings were planned and staked in the field by representatives of DLZ. The surveyed locations and ground surface elevations of the borings were determined by representatives from Lockwood, Lanier, Mathias & Noland, Inc. (2LMN). Borings were spaced approximately 300 to 400 feet apart. All borings were drilled to a depth of 10.0 feet. Continuous sampling was performed from below the pavement layers to approximately 6.0 feet below the ground surface to evaluate the subgrade soil properties.

At the road surface, borings encountered three to five inches of asphalt concrete pavement over five to eight inches of aggregate base. Below the pavement layers, borings B-1203, B-1207, and B-1208 first encountered stiff to very stiff silt (A-4b). Borings B-1201, B-1205, and B-1206 first

encountered stiff to very stiff silt and clay (A-6a) below the pavement layers. Similarly, below the pavement layers, borings B-1202 and B-1204 first encountered very stiff silty clay (A-6b) and dense sandy silt (A-4a) respectively. Below a depth of 3.0 feet, borings encountered primarily fine-grained, cohesive soils to the bottom of the borings at 10.0 feet. It should be noted that elastic clay (A-7-5) was encountered in boring B-1203 between depths of 5.0 and 10.0 feet.

Pavement Design Information

It is anticipated that the majority of the project will be at grade with the widening portion requiring small fill sections within five feet of existing grade. The following tables list the subgrade soils encountered by the borings and the group indices, CBR values, and number of samples tested for each soil type.

Subgrade Soils

ODOT Classification	Group Index	CBR	No. Samples Tested
Sandy Silt (A-4a)	5	8	5
Silt (A-4b)	8	7	4
Silt and Clay (A-6a)	8	7	8
Silty Clay (A-6b)	12	5	3
Elastic Clay (A-7-5)	20	3	1
Clay (A-7-6)	18	3	3

Based upon averaging the results of the laboratory testing, a CBR value of 6 is recommended for pavement design.

It should be noted that three borings encountered silt (A-4b) within the top three feet of subgrade. This soil type in the upper three feet of subgrade requires removal or chemical stabilization because of its susceptibility to frost heave. Additionally, when constructing an embankment, the use of silt (A-4b) within three feet of top of subgrade is prohibited per ODOT Item 203.03.

It should also be noted that boring B-1203 encountered elastic clay (A-7-5) between depths of 5.0 and 10.0 feet. A-7-5 soils have a lower plastic index in relation to the liquid limit than other clays, may be highly elastic, and subject to considerable volume change. It is unsuitable for a subgrade because of this elasticity and potential volume change. If A-7-5 soils are found during

construction in the upper three feet of subgrade, these soils shall be completely removed, or if that is not feasible, depending on stability, a minimum of 24 inches shall be removed.

Subgrade Condition and Preparation

The existing subgrade soils along the project were evaluated for suitability according to the ODOT Geotechnical Bulletin GB1 "Plan Subgrade." The optimum moisture content (MC) for each soil tested was estimated using the following criteria:

Optimum MC	=	plastic limit minus 3 (A-7-6 soils)
	=	plastic limit minus 5 (A-4 and A-6 soils)
	=	6 to 10 (granular soils)
	=	11 (non-plastic silts)

The results of this evaluation are presented in the attached spreadsheet. Note only samples within six feet of the existing grade were evaluated. According to the referenced guidelines, any soils with moisture contents that exceed the optimum moisture content by three or more percentage points will likely require some form of subgrade treatment.

Following these guidelines, half of the samples tested had moisture contents that exceeded the optimum moisture content by more than 3 percent. Since most of the subgrade will need some stabilization, it is recommended that the subgrade for the entire project be stabilized in accordance with the options presented in GB1.

The stabilization options available include undercutting and cement stabilization. To determine the appropriate option, the average standard penetration value (N-value) and the plasticity index (PI) of the subgrade soils were considered. The average N-value, PI, moisture content, and CBR are presented in the table below.

Percent of Samples Over Optimum MC + 3 Percent	Average N_L*	Average PI	Average MC	CBR Average
50	8	14	19.7	6

* - N_L indicates lowest standard penetration value (N) in subgrade soil.

All subgrade areas should be proofrolled to confirm areas that require treatment. Based on GB1 guidelines, cement treatment is the preferred stabilization option for soils with average N-values less than 10 and an average PI less than 20. Consequently, it is recommended that the subgrade soil be treated with cement in areas outlined in the table on the following page. Cement should

be applied at a rate of 6 percent by dry unit weight of soil, assuming a dry unit weight of 110 pounds per cubic foot. Proof rolling should also be performed after subgrade treatment to verify that stability is achieved.

Cement Stabilization Treatment Areas

Begin Station	End Station	Depth of Treatment
4+56	14+40	12 - inches
14+40	20+75	16 - inches
20+75	28+28	12 - inches
28+28	37+31	16 - inches

Another subgrade stabilization option that could be considered is to undercut the unsuitable soils and replace the subgrade with compacted Type B or C granular material (ODOT Item 703.16.C). However, the undercutting and replacement option is generally more expensive than chemical stabilization. The table below outlines the recommended undercut areas and depths. Alternatively, because 77 percent of the project requires undercutting, consideration could be given to undercutting the entire project area to a depth of 36 inches.

Undercut Option Treatment Areas

Begin Station	End Station	Depth of Undercut
4+56	14+40	12 - inches
14+40	20+75	36 - inches
28+28	37+31	36 - inches

Although no groundwater or seepage was noted in the borings during the drilling program, ground water conditions can change with time. The contractor should be prepared to maintain reasonably dry excavations if water from seepage or precipitation enters any excavations. It is not anticipated that the contractor will be required to make excavations deeper than four feet. However, if deeper excavations are deemed necessary, pumps may be required to maintain reasonably dry excavations if water from seepage or precipitation enters the culvert excavations.

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PLANNERS • SURVEYORS

We appreciate having the opportunity to be of service to you on this project. Please do not hesitate to call if you have any questions concerning our findings.

Respectfully submitted,

DLZ OHIO, INC.

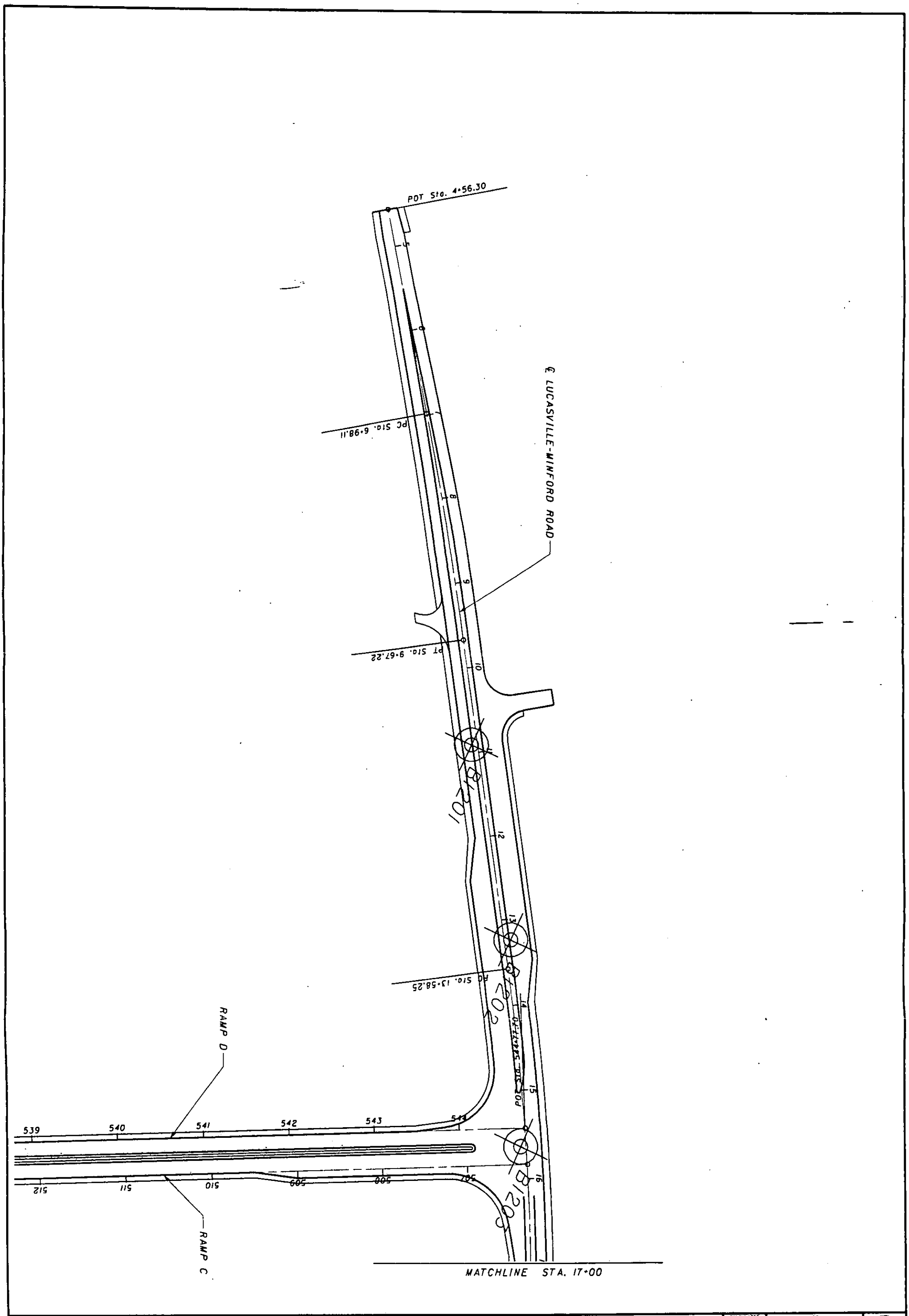
Steven J. Riedy
Geotechnical Engineer

Dorothy A. Adams, MSCE, P.E.
Senior Geotechnical Engineer

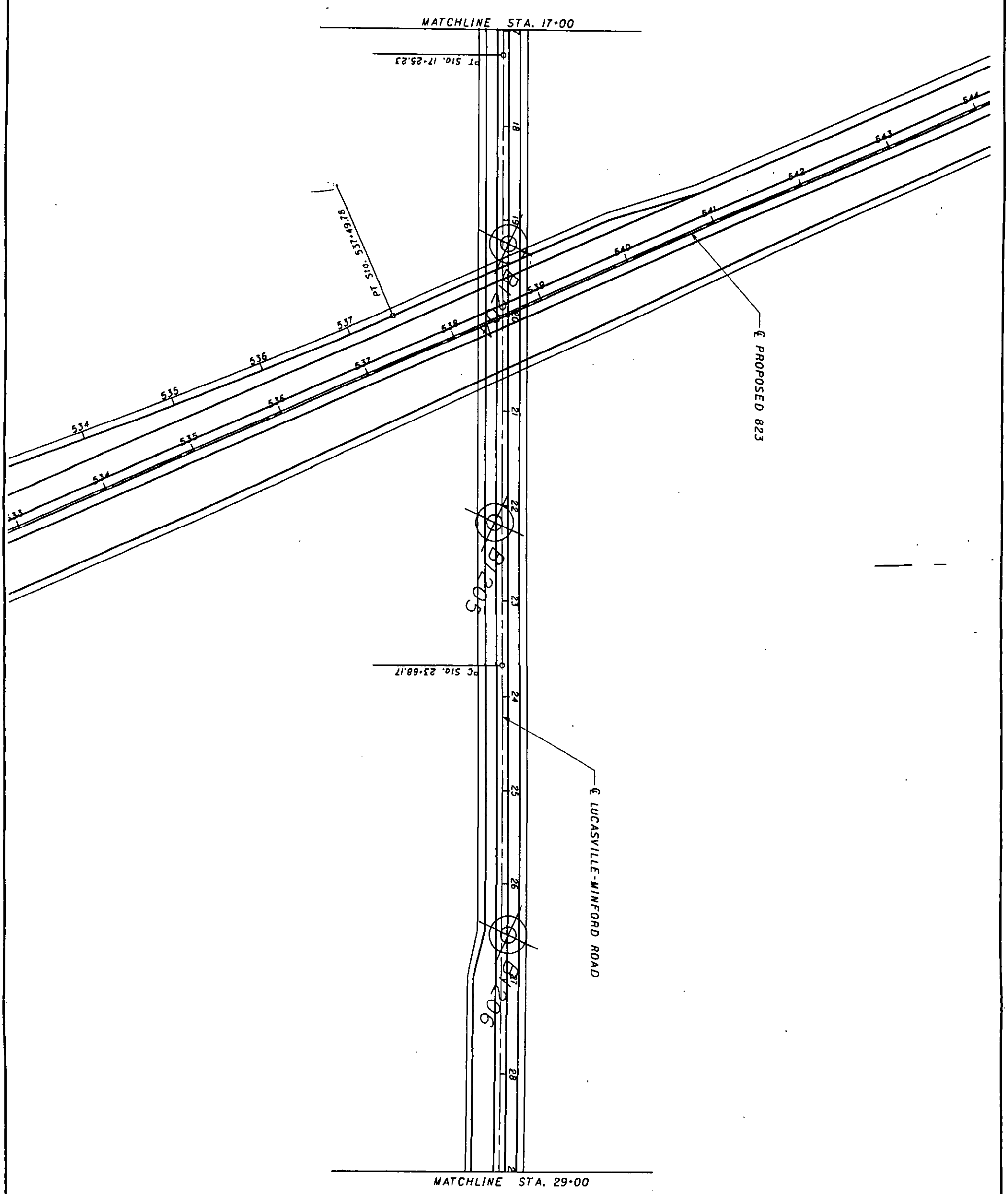
Encl: As noted

cc: file

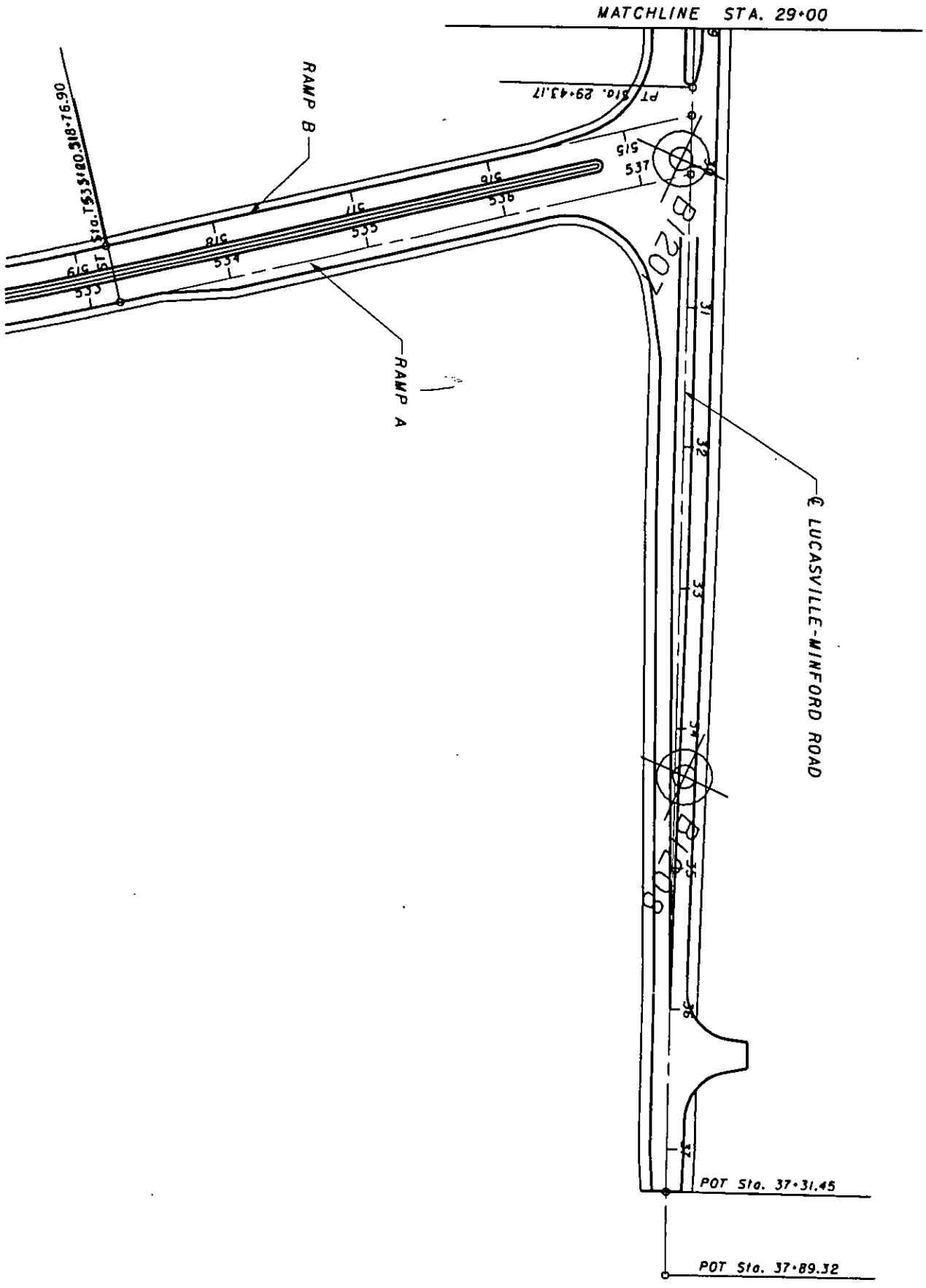
M:\proj\0121\3070.03\Pavement Design\Documents\Pavement Design - Lucasville - Minford Road ltr-sjr.doc



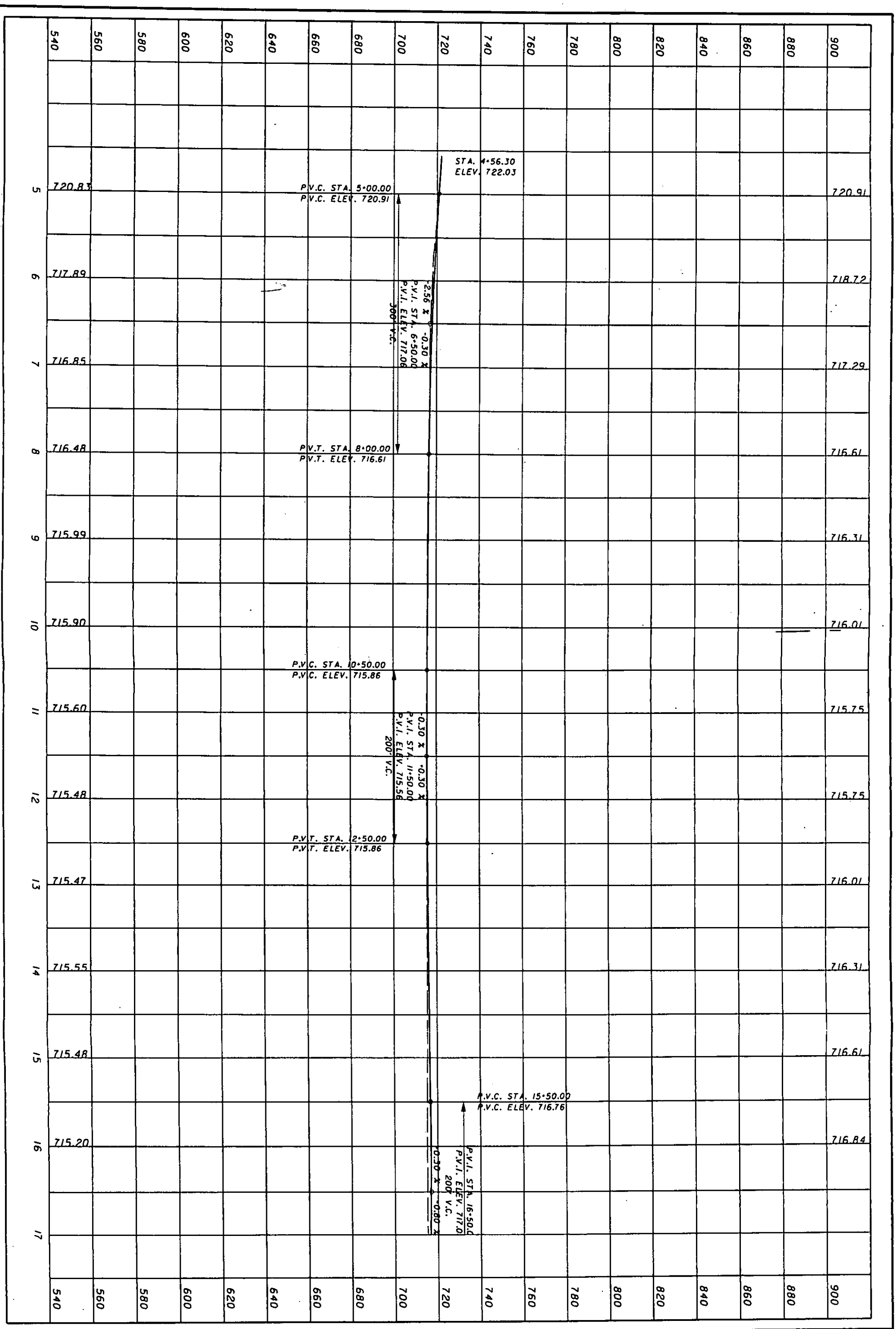
3 / —	SCI-823-0.00	GB-1 SUBSURFACE INVESTIGATION-BORING PLAN LUCASVILLE - MINFORD ROAD	CALCULATED CHECKED 0 50 25 100 HORIZONTAL SCALE IN FEET



3 / 2	SCI-823-0.00	GB-1 SUBSURFACE INVESTIGATION-BORING PLAN LUCASVILLE - MINFORD ROAD	CALCULATED CHECKED	0 50 25 100 HORIZONTAL SCALE IN FEET



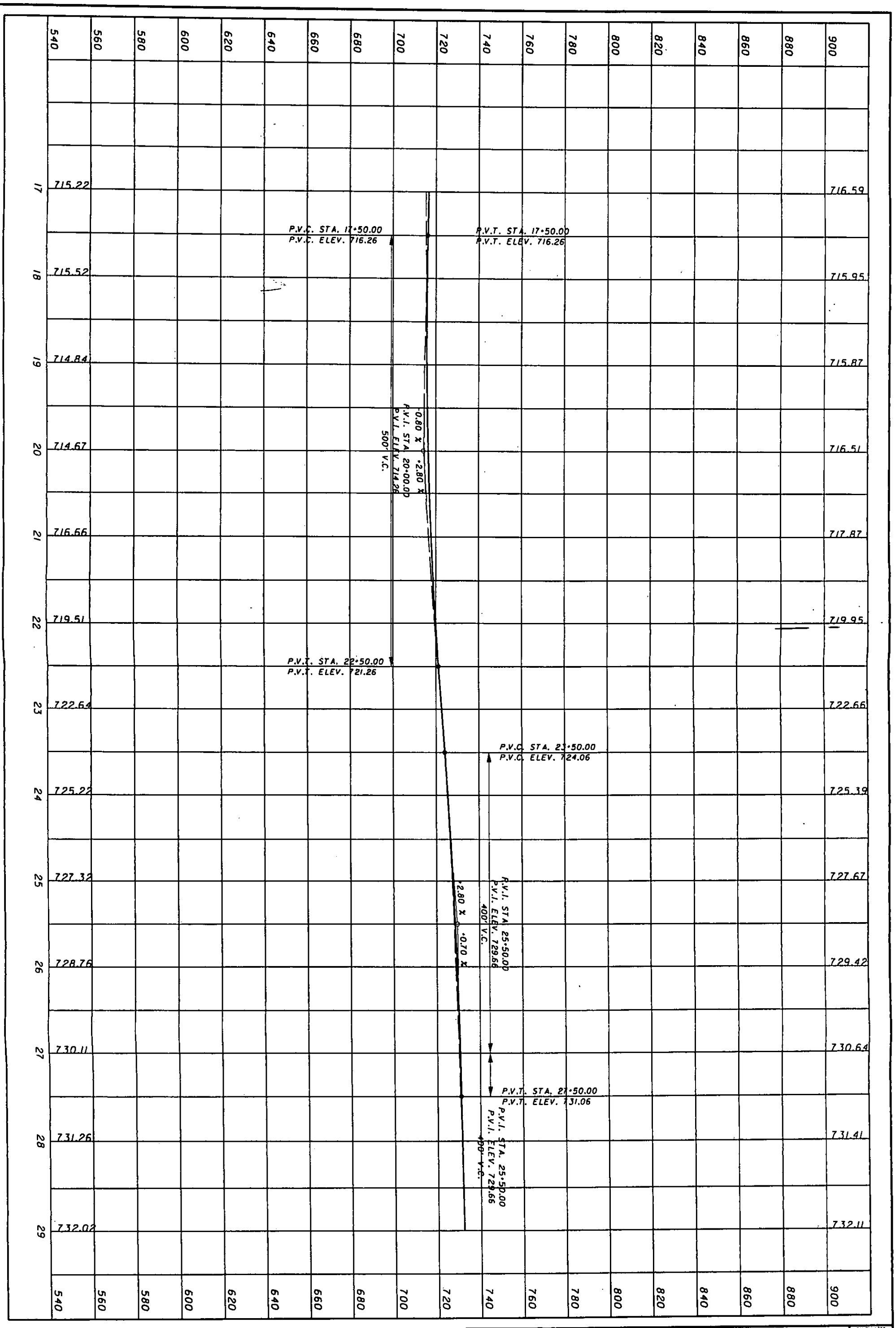
SCI-823-0.00	GB-1 SUBSURFACE INVESTIGATION-BORING PLAN LUCASVILLE - MINFORD ROAD	CALCULATED CHECKED	0 50 25 100 HORIZONTAL SCALE IN FEET



1 / 3	SCI-823-0.00	**PROFILE** **LUCASVILLE - MINFORD ROAD**

CALCULATED

CHECKED



2/3	SCI-823-0.00	PROFILE LUCASVILLE - MINFORD ROAD

CALCULATED

CHECKED

	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820	840	860	880	900
29	732.02																		732.11
30	732.34																		732.81
31	732.47																		733.29
32	732.49																		733.02
33	731.85																		731.98
34	730.38																		730.19
35	727.97																		728.18
36	725.96																		726.17
37	724.14																		724.16
	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820	840	860	880	900

+0.70 %
-2.01 %

P.V.I. STA. 32+00.00
P.V.I. ELEV. 734.21
350' V.C.

P.V.C. STA. 30+25.00
P.V.C. ELEV. 732.98

P.V.T. STA. 33+75.00
P.V.T. ELEV. 730.69

STA. 37+31.45
ELEV. 723.53

3 / 3

SCI-823-0.00

PROFILE
LUCASVILLE - MINFORD ROAD

CALCULATED

CHECKED

GENERAL INFORMATION
DRILLING PROCEDURES AND LOGS OF BORINGS

Drilling and sampling were conducted in accordance with procedures generally recognized and accepted as standardized methods of investigation of subsurface conditions concerning geotechnical engineering considerations. Borings were drilled with either a truck-mounted or ATV-mounted drill rig.

Drive split-barrel sampling was performed in 1.5 foot increments at intervals not exceeding 5 feet. In the event the sampler encountered resistance to penetration of 6 inches or less after 50 blows of the drop hammer, the sampling increment was discontinued. Standard penetration data were recorded and one or more representative samples were preserved from each sampling increment.

In borings where rock was cored, NXM or NQ size diamond coring tools were used.

In the laboratory all samples were visually classified by a geotechnical engineer. Moisture contents of representative fine-grained soil samples were determined. A limited number of samples, considered representative of foundation materials present, were selected for performance of grain-size analyses and plasticity characteristics tests. The results of these tests are shown on the boring logs.

The boring logs included in the Appendix have been prepared on the basis of the field record of drilling and sampling, and the results of the laboratory examination and testing of samples. Stratification lines on the boring logs indicating changes in soil stratigraphy represent depths of changes approximated by the driller, by sampling effort and recovery, and by laboratory test results. Actual depths to changes may differ somewhat from the estimated depths, or transitions may occur gradually and not be sharply defined. The boring logs presented in this report therefore contain both factual and interpretative information and are not an exact copy of the field log.

Although it is considered that the borings have disclosed information generally representative of site conditions, it should be expected that between borings conditions may occur which are not precisely represented by any one of the borings. Soil deposition processes and natural geologic forces are such that soil and rock types and conditions may change in short vertical intervals and horizontal distances.

Soil/rock samples will be stored at our laboratory for a period of six months. After this period of time, they will be discarded, unless notified to the contrary by the client.

LEGEND – BORING LOG TERMINOLOGY

Explanation of each column, progressing from left to right

1. Depth (in feet) – refers to distance below the ground surface.

2. Elevation (in feet) – is referenced to mean sea level, unless otherwise noted.

3. Standard Penetration (N) – the number of blows required to drive a 2-inch O.D., 1-3/8 inch I.D., split-barrel sampler, using a 140-pound hammer with a 30-inch free fall. The blows are recorded in 6-inch drive increments. Standard penetration resistance is determined from the total number of blows required for one foot of penetration by summing the second and third 6-inch increments of an 18-inch drive.

   50/n – indicates number of blows (50) to drive a split-barrel sampler a certain number of inches (n) other than the normal 6-inch increment.

4. The length of the sampler drive is indicated graphically by horizontal lines across the "Standard Penetration" and "Recovery" columns.

5. Sample recovery from each drive is indicated numerically in the column headed "Recovery".

6. The drive sample location is designated by the heavy vertical bar in the "Sample No., Drive" column.

7. The length of hydraulically pressed "Undisturbed" samples is indicated graphically by horizontal lines across the "Press" column.

8. Sample numbers are designated consecutively, increasing in depth.

9. Soil Description

   a. The following terms are used to describe the relative compactness and consistency of soils:

   Granular Soils – Compactness

Term	Blows/Foot Standard Penetration
Very Loose	0 – 4
Loose	4 – 10
Medium Dense	10 – 30
Dense	30 – 50
Very Dense	over 50

   Cohesive Soils – Consistency

Term	Unconfined Compression tons/sq.ft.	Blows/Foot Standard Penetration	Hand Manipulation
Very Soft	less than 0.25	below 2	Easily penetrated by fist
Soft	0.25 – 0.50	2 – 4	Easily penetrated by thumb
Medium Stiff	0.50 – 1.0	4 – 8	Penetrated by thumb with moderate pressure
Stiff	1.0 – 2.0	8 – 15	Readily indented by thumb but not penetrated
Very Stiff	2.0 – 4.0	15 – 30	Readily indented by thumb nail
Hard	over 4.0	over 30	Indented with difficulty by thumb nail

   b. Color – If a soil is a uniform color throughout, the term is single, modified by such adjective as light and dark. If the predominant color is shaded by a secondary color, the secondary color precedes the primary color. If two major and distinct colors are swirled throughout the soil, the colors are modified by the term "mottled".

   c. Texture is based on the Ohio Department of Transportation Classification System. Soil particle size definitions are as follows:

Description		Size	Description		Size
Boulders		Larger than 8"	Sand	– Coarse	2.0 mm to 0.42 mm
Cobbles		8" to 3"		– Fine	0.42 mm to 0.074 mm
Gravel	– Coarse	3" to ¾"	Silt		0.074 mm to 0.005 mm
	– Fine	¾" to 2.0 mm	Clay		smaller than 0.005 mm

d. The main soil component is listed first. The minor components are listed in order of decreasing percentage of particle size.

e. Modifiers to main soil descriptions are indicated as a percentage by weight of particle sizes.

trace	0 to 10%
little	10 to 20%
some	20 to 35%
"and"	35 to 50%

f. Moisture content of **cohesionless soils** (sands and gravels) is described as follows:

Term	Relative Moisture or Appearance
Dry	No moisture present
Damp	Internal moisture, but none to little surface moisture
Moist	Free water on surface
Wet	Voids filled with free water

g. The moisture content of **cohesive soils** (silts and clays) is expressed relative to plastic properties.

Term	Relative Moisture or Appearance
Dry	Powdery
Damp	Moisture content slightly below plastic limit
Moist	Moisture content above plastic limit but below liquid limit
Wet	Moisture content above liquid limit

10. Rock Hardness and Rock Quality Designation

a. The following terms are used to describe the relative hardness of the **bedrock**.

Term	Description
Very Soft	Permits denting by moderate pressure of the fingers. Resembles hard soil but has rock structure. (Crushes under pressure of fingers and/or thumb)
Soft	Resists denting by fingers, but can be abraded and pierced to shallow depth by a pencil point. (Crushes under pressure of pressed hammer)
Medium Hard	Resists pencil point, but can be scratched with a knife blade. (Breaks easily under single hammer blow, but with crumbly edges.)
Hard	Can be deformed or broken by light to moderate hammer blows. (Breaks under one or two strong hammer blow, but with resistant sharp edges.)
Very Hard	Can be broken only by heavy and in some rocks repeated hammer blows.

b. Rock Quality Designation, RQD – This value is expressed in percent and is an indirect measure of rock soundness. It is obtained by summing the total length of all core pieces which are at least four inches long, and then dividing this sum by the total length of the core run.

11. Gradation – when tests are performed, the percentage of each particle size is listed in the appropriate column (defined in Item 9c).

12. When a test is performed to determine the natural moisture content, liquid limit moisture content, or plastic limit moisture content, the moisture content is indicated graphically.

13. The standard penetration (N) value in blows per foot is indicated graphically.

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]BUS, OHIO 43229 * (614)888-0040

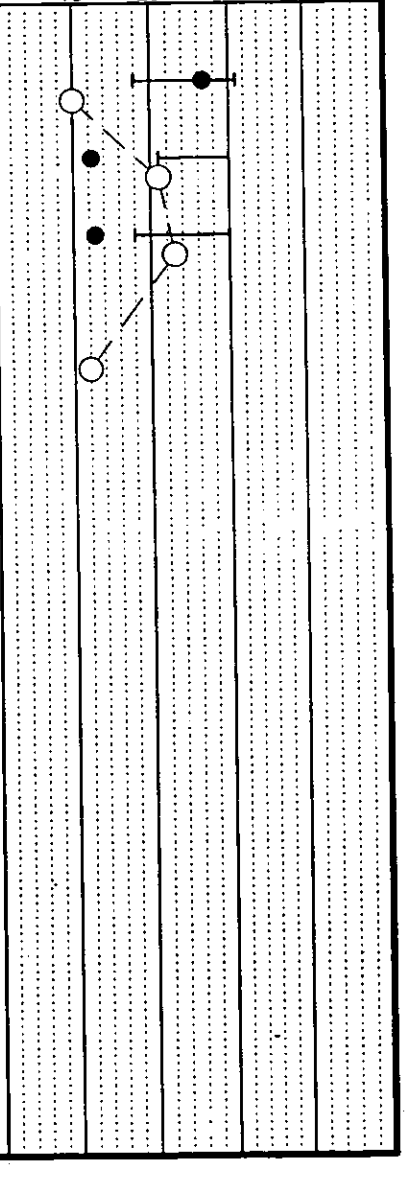
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1201 | Location: Sta. 10+90.4, 6.9 ft. RT of Lucasville Minford Rd. CL | Date Drilled: 07/21/05

WATER OBSERVATIONS: Water seepage at: None; Water level at completion: None

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	715.5						Asphalt - 3" Aggregate Base - 7"						
0.8	714.7	4 5 5 7	10	1		1.5	FILL: Stiff brown SILT AND CLAY (A-6a), some gravel, some fine to coarse sand; contains asphalt and glass fragments; moist.	25	9	--	12	36	18
3.5	712.0	6 10 11 10	15	2		4.5+	Hard brown SANDY SILT (A-4a), some gravel, little fine to coarse sand; damp.	24	4	--	11	41	20
5.0	710.5	10 13 10 13	24	3		4.0	Very stiff brown SILT AND CLAY (A-6a), some gravel, little fine to coarse sand; damp to moist.	24	4	--	11	42	19
		4 6 6 7	18	4		2.0							
10.0	705.5						Bottom of Boring - 10.0'						

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40



15 20 25 30

FILE: 0121-3070-03 [11/24/2005 1:23 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, C[redacted]BUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

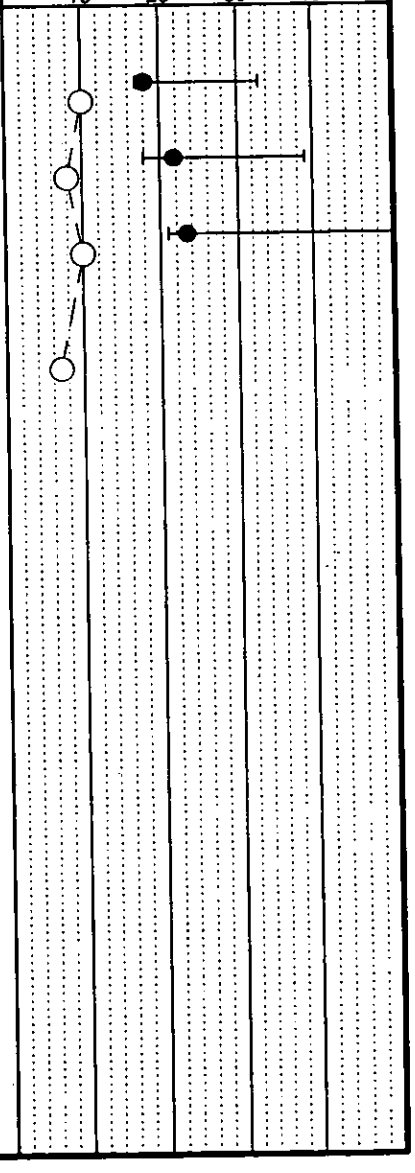
LOG OF: Boring B-1202 | Location: Sta. 13+24.7, 7.6 ft. LT of Lucasville Minford Rd. CL | Date Drilled: 07/21/05

WATER OBSERVATIONS: Water seepage at: None; Water level at completion: None

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	715.3												
0.8	714.5	6 5 5 6	19	1		3.0	Asphalt - 3" Aggregate Base - 7" FILL: Very stiff brown SILTY CLAY (A-6b), trace to little gravel, trace fine to coarse sand; contains asphalt fragments; moist.	11	3	--	5	46	35
		1 3 5 4	20	2		2.0		5	4	--	4	38	49
5													
5.5	709.8	3 5 5 5	18	3		2.0	Stiff mottled brown and gray CLAY (A-7-6), trace fine to coarse sand; moist.	0	1	--	1	33	65
		5 4 3 4	20	4		1.0	@ 8.0'-10.0', gray.						
10.0	705.3						Bottom of Boring - 10.0'						
15													
20													
25													
30													

GRADATION

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40



FILE: 0121-3070-03 [11/24/2006 1:23 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

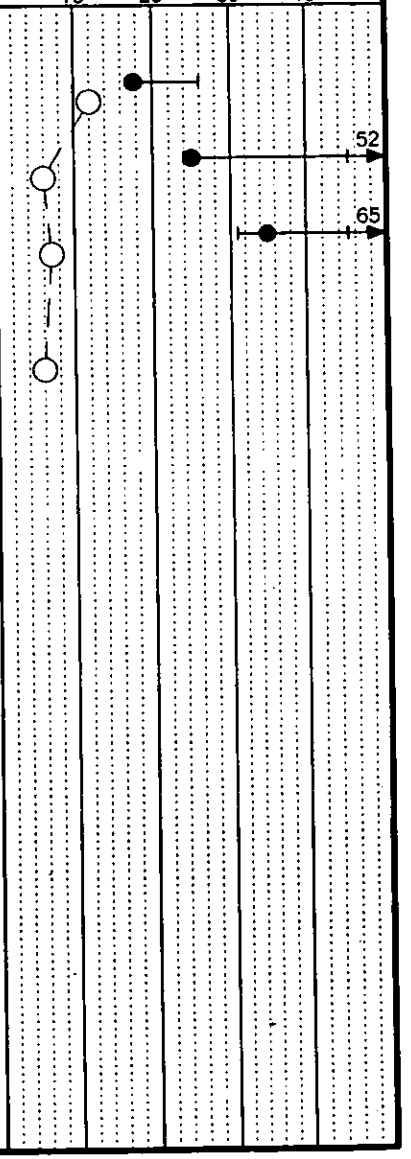
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1203 | Location: Sta. 15+63.3, 6.2 ft. RT of Lucasville Minford Rd. CL | Date Drilled: 07/21/05

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	WATER OBSERVATIONS: Water seepage at: None; Water level at completion: None — DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	715.0												
0.8	714.1	8 7 5 5	17	1		3.0	Asphalt - 4" Aggregate Base - 6" FILL: Very stiff gray SILT (A-4b), trace gravel, trace fine to coarse sand; moist.	2	3	--	3	58	34
3.0	712.0	2 3 3 4	12	2		2.5	Very stiff mottled brown and gray CLAY (A-7-6), trace fine to coarse sand, trace gravel; moist.	3	2	--	2	22	71
5.0	710.0	2 4 3 4	11	3		1.5	Stiff brown ELASTIC CLAY (A-7-5), trace fine to coarse sand; moist.	0	0	--	1	3	96
		2 3 3 4	24	4		1.5							
10.0	705.0						Bottom of Boring - 10.0'						
15													
20													
25													
30													

GRADATION

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40



FILE: 0121-3070-03 [11/24/2006 1:23 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]BUS, OHIO 43229 * (614)888-0040

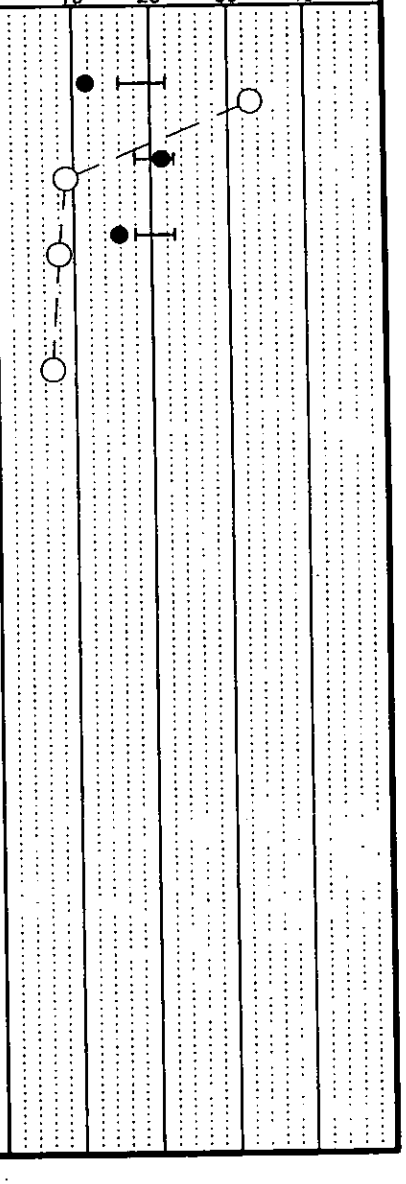
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1204 | Location: Sta. 19+24.7, 6.1 ft. LT of Lucasville Minford Rd. CL | Date Drilled: 07/21/05

WATER OBSERVATIONS: Water seepage at: None; Water level at completion: None

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	714.5						Asphalt - 4" Aggregate Base - 6"						
0.8	713.6	12 18 15 12	20	1		4.5+	FILL: Dense gray SANDY SILT (A-4a), little fine to coarse sand, little gravel, little clay ; damp.	14	9	--	10	48	19
3.0	711.5	3 4 5 5	18	2		1.0	Medium stiff to stiff brown SILT (A-4b), little fine to coarse sand; moist.	0	1	--	13	68	18
5.5	709.0	2 5 3 4	19	3		1.0	Medium stiff to stiff reddish brown SANDY SILT (A-4a), some fine to coarse sand, little gravel, little clay; damp to moist.	18	11	--	18	38	15
8.0	706.5	2 3 4 5	20	4		2.5	Very stiff gray CLAY (A-7-6), trace fine to coarse sand; laminated; moist.						
10.0	704.5						Bottom of Boring - 10.0'						

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢—⊣ LL
Blows per foot - ○
10 20 30 40



FILE: 0121-3070-03 [11/24/2006 1:23 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]BUS, OHIO 43229 * (614)888-0040

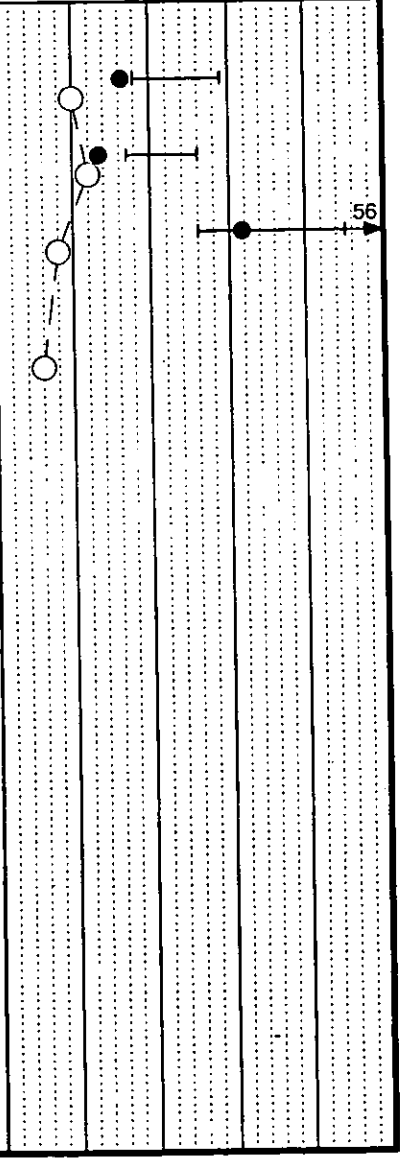
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1205 | Location: Sta. 22+17.7, 7.9 ft. RT of Lucasville Minford Rd. CL | Date Drilled: 07/21/05

WATER OBSERVATIONS: Water seepage at: None; Water level at completion: None

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	719.9						Asphalt - 4" Aggregate Base - 8"						
1.0	718.9	7 5 5 10	16	1		2.0	FILL: Stiff to very stiff mottled brown and gray SILT AND CLAY (A-6a), little fine to coarse sand, trace gravel; damp.	5	7	--	8	48	32
3.0	716.9	7 7 5 5	14	2		3.5	Very stiff gray SANDY SILT (A-4a), some fine to coarse sand, little gravel; damp.	14	12	--	11	39	24
5.0	714.9	3 5 3 5	20	3		1.5	Stiff brown CLAY (A-7-6), trace fine to coarse sand; moist.	0	0	--	1	15	84
		2 3 3 3	21	4		1.0							
10.0	709.9						Bottom of Boring - 10.0'						

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40



15 20 25 30

FILE: 0121-3070-03 (11/24/2006 1:24 PM)

DLZ OHIO INC. * 6121 HUNTLEY ROAD, C[illegible]BUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1206 | Location: Sta. 26+54.5, 7.1 ft. LT of Lucasville Minford Rd. CL | Date Drilled: 07/21/05

WATER OBSERVATIONS: Water seepage at: None; Water level at completion: None

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	729.6						Asphalt - 4" Aggregate Base - 8"						
1.0	728.6	5 5 5 5	20	1		2.0	FILL: Stiff to very stiff brown SILT AND CLAY (A-6a), little fine to coarse sand, trace gravel; damp to moist.	4	6	--	8	58	24
3.0	726.6	3 4 6 5	22	2		2.5	Very stiff mottled brown and gray SILTY CLAY (A-6b), trace fine to coarse sand; moist.	0	1	--	7	60	32
5.0	724.6	4 5 7 6		3		2.0	Stiff to very stiff brown SANDY SILT (A-4a), some fine to coarse sand, trace gravel; moist.	5	13	--	19	39	24
		3 8 11 11	21	4		2.0							
10.0	719.6						Bottom of Boring - 10.0'						

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢—⊣ LL
Blows per foot - ○
10 20 30 40

15 20 25 30

FILE: 0121-3070-03 [11/24/2006 1:24 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]BUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1207 | Location: Sta. 29+94.9, 7.1 ft. RT of Lucasville Minford Rd. CL | Date Drilled: 07/21/05

WATER OBSERVATIONS: Water seepage at: None Observed
Water level at completion: None

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press./Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	732.3												
0.8	731.5	13 12 8 5	17	1			Asphalt - 3" Aggregate Base - 7" Medium dense gray SILT (A-4b), little fine to coarse sand, trace gravel; damp to moist.	2	6	--	6	70	16
3.0	729.3	1 1 1 3	24	2		2.0	Very stiff mottled brown and gray SILT AND CLAY (A-6a), trace to little gravel, trace to little fine to coarse sand; moist.	3	3	--	4	58	32
5		4 6 7 7	24	3		2.0		11	5	--	5	54	25
		6 8 9 10	20	4		2.5							
10.0	722.3						Bottom of Boring - 10.0'						

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢—⊣ LL
Blows per foot - ○
10 20 30 40

15 20 25 30

FILE: 0121-3070-03 [11/24/2006 1:24 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]MBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1208 | Location: Sta. 34+35.0, 6.8 ft. LT of Lucasville Minford Rd. CL | Date Drilled: 07/21/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: None

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	729.6												
0.8	728.8	15 9 4 7	18	1		2.0	Asphalt - 5" Aggregate Base - 5" Stiff to very stiff mottled brown and gray SILT (A-4b), trace gravel, trace fine to coarse sand; damp to moist.	4	3	--	4	63	26
3.0	726.6	9 13 10 5	19	2		2.5	Very stiff mottled brown and gray SILT AND CLAY (A-6a), little gravel, trace to little fine to coarse sand; damp.	16	5	--	5	46	28
5		7 11 10 12	20	3		2.5		12	9	--	11	47	21
7.5	722.1	3 5 7 7	24	4		3.0	Very stiff gray CLAY (A-7-6), trace fine to coarse sand; laminated; moist.						
10.0	719.6						Bottom of Boring - 10.0'						

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40

Soil Investigation Summary

Do NOT Rubblize & Roll
Global CS may be an option
Global LS is NOT an option

Design CBR is 6

Number of Borings = 8

Classification Counts by Sample															
R	1a	1b	3	3a	2-4	2-5	2-6	2-7	4a	4b	5	6a	6b	7-5	7-6
0	0	0	0	0	0	0	0	0	5	4	0	8	3	1	3
									21%	17%		33%	13%	4%	13%
0.0%	0.0%								100.0%						

Class @ Surface		
2-5	0	
4b	3	38%
5	0	
7-5	0	
7-6	0	
R	0	

% Borings	
$N_L \leq 5$	13%
$N_L \leq 10$	88%
$N_L \geq 20$	0%
M+	88%

% @ Surface	
75%	
38%	38%
% Borings	
100%	
50%	100%
0%	75%
50%	100%

	N	N_L			PI			M	M_{OPT}		GI
Average	13.0	8.1			14.0		34.5		19.7	15.0	9.50
Maximum	33	13	65	31	34	70	96	99	35	23	20
Minimum	2	2	21	16	2	3	15	53	12	11	4

SCI-823-0.00 Lucasville-Minford Rd

						Standard Penetration				Physical Characteristics						Moisture		Classification		Comments	Problem		Treatments			
#	B #	Boring Location	Depth	To	Cut Fill	n_2	n_3	N	N_L	LL	PL	PI	% Silt	% Clay	P 200	M	M_{OPT}	Class	GI		w/ Class	w/ MN	LS	CS	UC Class	UC MN
1	1201	As Per Plan	1.0	3.0		5	5	10		31	18	13	36	18	54	27	14	6a	5			MN		12		1
			3.0	5.0		10	11	21		30	21	9	41	20	61	12	16	4a	5							
			5.0	7.0		13	10	23		30	18	12	42	19	61	13	14	6a	6							
									10																	
2	1202	As Per Plan	1.0	3.0		5	5	10		33	17	16	46	35	81	18	16	6b	10							
			3.0	5.0		3	5	8		39	18	21	38	49	87	22	16	6b	12			MN				2
			5.0	7.0		5	5	10		50	21	29	33	65	98	23	18	7-6	18			MN				1
									8																	
3	1203	As Per Plan	1.0	3.0		7	5	12		26	18	8	58	34	92	17	13	4b	8		4b	MN		12	3	1
			3.0	5.0		3	3	6		52	24	28	22	71	93	25	21	7-6	18			MN				3
			5.0	7.0		4	3	7		65	31	34	3	96	99	35		7-5	20		Un	N			All	2
									6																	
4	1204	As Per Plan	1.0	3.0		18	15	33		22	16	6	48	19	67	12	11	4a	6							
			3.0	5.0		4	5	9		23	18	5	68	18	86	21	13	4b	8		4b	MN		14	3	2
			5.0	7.0		5	3	8		23	18	5	38	15	53	16	13	4a	4			N		14		2
									8																	
5	1205	As Per Plan	1.0	3.0		5	5	10		29	18	11	48	32	80	16	14	6a	8							
			3.0	5.0		7	5	12		26	17	9	39	24	63	13	12	4a	6							
			5.0	7.0		5	3	8		56	26	30	15	84	99	32	23	7-6	19			MN				2
									8																	
6	1206	As Per Plan	1.0	3.0		5	5	10		27	16	11	58	24	82	16	14	6a	8							
			3.0	5.0		4	6	10		34	18	16	60	32	92	22	16	6b	10			MN		12		1
			5.0	7.0		5	7	12		31	22	9	39	24	63	22	17	4a	6			MN		12		1
									10																	
7	1207	As Per Plan	1.0	3.0		12	8	20		21	19	2	70	16	86	19	14	4b	8		4b				3	
			3.0	5.0		1	1	2		35	20	15	58	32	90	22	15	6a	10			MN		–		3+
			5.0	7.0		6	7	13		32	19	13	54	25	79	19	14	6a	9			MN		12		1
									2																	
8	1208	As Per Plan	1.0	3.0		9	4	13		28	18	10	63	26	89	18	13	4b	8		4b	MN		12	3	1
			3.0	5.0		13	10	23		30	18	12	46	28	74	17	14	6a	9							
			5.0	7.0		11	10	21		31	20	11	47	21	68	16	15	6a	7							
									13																	

APPENDIX C

DLZ

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August 17, 2006

Michael D. Weeks, P.E., P.S.
TranSystems Corporation
5747 Perimeter Drive, Suite 240
Dublin, OH 43017

Re: **Pavement Design Information**
SR 335 at Realigned Shumway Hollow Road
SCI-823-0.00 Portsmouth Bypass
DLZ Job No.: 0121-3070.03
Document # 0027

Dear Mr. Weeks:

This letter includes the findings of a subsurface exploration performed for the SR 335 improvement and widening near the intersection of realigned Shumway Hollow Road. The findings included in this letter pertain to SR 335 only. The findings of other subsurface explorations for pavement design will be submitted in separate documents.

The improvements will essentially consist of regrading and widening approximately 433 feet of existing SR 335. Although no profile drawings are currently available, it is understood that the proposed grade will be essentially at existing grade. Additionally, a turn lane will be added to the west side of SR 335. See attached plan sheet for more information.

The recommendations presented in this report have been made on the basis of the foregoing information. If the proposed improvements or concept is changed or differs from that assumed, DLZ Ohio, Inc. (DLZ) should be informed of the changes so that recommendations and conclusions presented in this letter may be revised as necessary.

The results of these evaluations are based upon the findings of four subgrade borings. Borings B-1331 through B-1334 were drilled on September 13 and September 14, 2005. All borings were drilled using a truck mounted rotary-type drill rig. Borings were planned and staked in the field by representatives of DLZ. The surveyed locations and ground surface elevations of the borings were determined by representatives from Lockwood, Lanier, Mathias & Noland, Inc. (2LMN). Borings were advanced to depths between 23.0 and 30.0 feet. Continuous sampling was performed from below the pavement layers to approximately 6.0 feet below the ground surface to evaluate the subgrade soil properties. See attached boring logs.

Borings B-1331 and B-1333 were drilled off the shoulder for the widening portion of the project. Additionally, borings B-1332 and B-1334 were drilled in the pavement. Borings drilled in the road surface encountered 8 to 9 inches of asphalt concrete pavement over 4 inches of aggregate base. Below the pavement layers, boring B-1332 first encountered medium dense sandy silt (A-

4a) over loose to medium dense coarse and fine sand (A-3a). Similarly, below the pavement layer, boring B-1334 encountered very stiff sandy silt (A-4a) over loose to medium dense coarse and fine sand (A-3a) and fine sand (A-3). Borings drilled off the road surface encountered 4 to 5 inches of topsoil at the ground surface. Below the topsoil layer, boring B-1331 first encountered medium dense sandy silt (A-4a) over medium stiff silt and clay (A-6a). Similarly, below the topsoil layer, boring B-1333 encountered loose gravel with sand and silt (A-2-4) over loose coarse and fine sand (A-3a).

It should be noted that elastic clay (A-7-5) was encountered in boring B-1334 between depths of 8.0 and 10.5 feet.

Pavement Design Information

It is anticipated that the majority of the project will be at grade with the widening portion requiring small fill sections within five feet of existing grade. The following tables list the subgrade soils encountered by the borings and the group indices, CBR values, and number of samples tested for each soil type.

Subgrade Soils

ODOT Classification	Group Index	CBR	No. Samples Tested
Coarse and Fine Sand (A-3a)	0	13	9
Gravel with Sand and Silt (A-2-4)	0	13	1
Sandy Silt (A-4a)	5	8	5
Silt and Clay (A-6a)	4	8	1

Based upon averaging the results of the laboratory testing, a CBR value of 10 is recommended for pavement design.

Elastic clay (A-7-5) was encountered in boring B-1334 between depths of 8.0 and 10.5 feet. Although these soils were not encountered within three feet of the proposed subgrade, they may be encountered across the site during construction. A-7-5 soils have a lower plastic index in relation to the liquid limit than other clays, may be highly elastic, and subject to considerable volume change. It is an unsuitable material for a subgrade because of this elasticity and potential volume change. If A-7-5 soils are found during construction in the upper three feet of subgrade,

these soils shall be completely removed, or if that is not feasible, depending on stability, a minimum of 24 inches shall be removed.

Subgrade Condition and Preparation

The existing subgrade soils along the project were evaluated for suitability according to the ODOT Geotechnical Bulletin GB-1 "Plan Subgrade." The optimum moisture content (MC) for each soil tested was estimated using the following criteria:

Optimum MC	=	plastic limit minus 3 (A-7-6 soils)
	=	plastic limit minus 5 (A-4 and A-6 soils)
	=	6 to 10 (granular soils)
	=	11 (non-plastic silts)

The results of this evaluation are presented in the attached spreadsheet. Note only samples within six feet of the proposed grade were evaluated. According to the referenced guidelines, any soils with moisture contents that exceed the optimum moisture content by three or more percentage points will likely require some form of subgrade treatment. In addition, any soils with standard penetration values (N-Values) of 10 or less will also likely require some form of subgrade treatment.

To determine the appropriate option, the average standard penetration value (N-value) and the plasticity index (PI) of the subgrade soils were considered. The average N-value, PI, moisture content, and CBR are presented in the table below.

Percent of Samples Over Optimum MC + 3 Percent	Average N_L*	Average PI	Average MC	CBR Average
56	4.0	8.5	13.7	10

* - N_L indicates lowest standard penetration value (N) in subgrade soil.

Based on GB-1 guidelines, cement treatment is the preferred stabilization option for soils with average N-values less than 10 and an average PI less than 20. However, cement stabilization is generally not effective in stabilizing subgrade soils with N-values less than 5 because the soils do not gain sufficient strength. One of the four borings was suitable for cement treatment. However, three of the four borings had at least one sample with an N-value less than 5. Consequently, it is not recommended that the subgrade soil be treated with cement.

Another subgrade stabilization option that could be considered is to undercut the unsuitable soils and replace the subgrade with compacted Type B or C granular material (ODOT Item 703.16.C).

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However, it should be noted, that the existing pavement is performing well. No excessive cracking, settlements, or rutting were observed in the project area. The majority of the subgrade soils are coarse-grained soils, which generally perform well when used as subgrade material. Based on the performance of the existing pavement, it is believed the subgrade will perform well without treatment. Instead of undercutting, it is recommended that the entire project be proof-rolled to identify any soft or weak areas that require subgrade stabilization. If soft or weak areas are encountered, it is recommended that the area be overexcavated and replaced with compacted Type B or C granular material (ODOT Item 703.16.C). If it is preferred to treat the entire subgrade, it is recommended that three feet of soil be overexcavated and replaced as described above.

Seepage was first encountered in the borings from 7.5 to 12.0 feet. No groundwater was noted prior to coring rock and adding drill water. Although no groundwater was encountered in the borings, the contractor should be prepared to maintain reasonable dry excavations if water from seepage or precipitation enters any excavations.

We appreciate having the opportunity to be of service to you on this project. Please do not hesitate to call if you have any questions concerning our findings.

Respectfully submitted,

DLZ OHIO, INC.

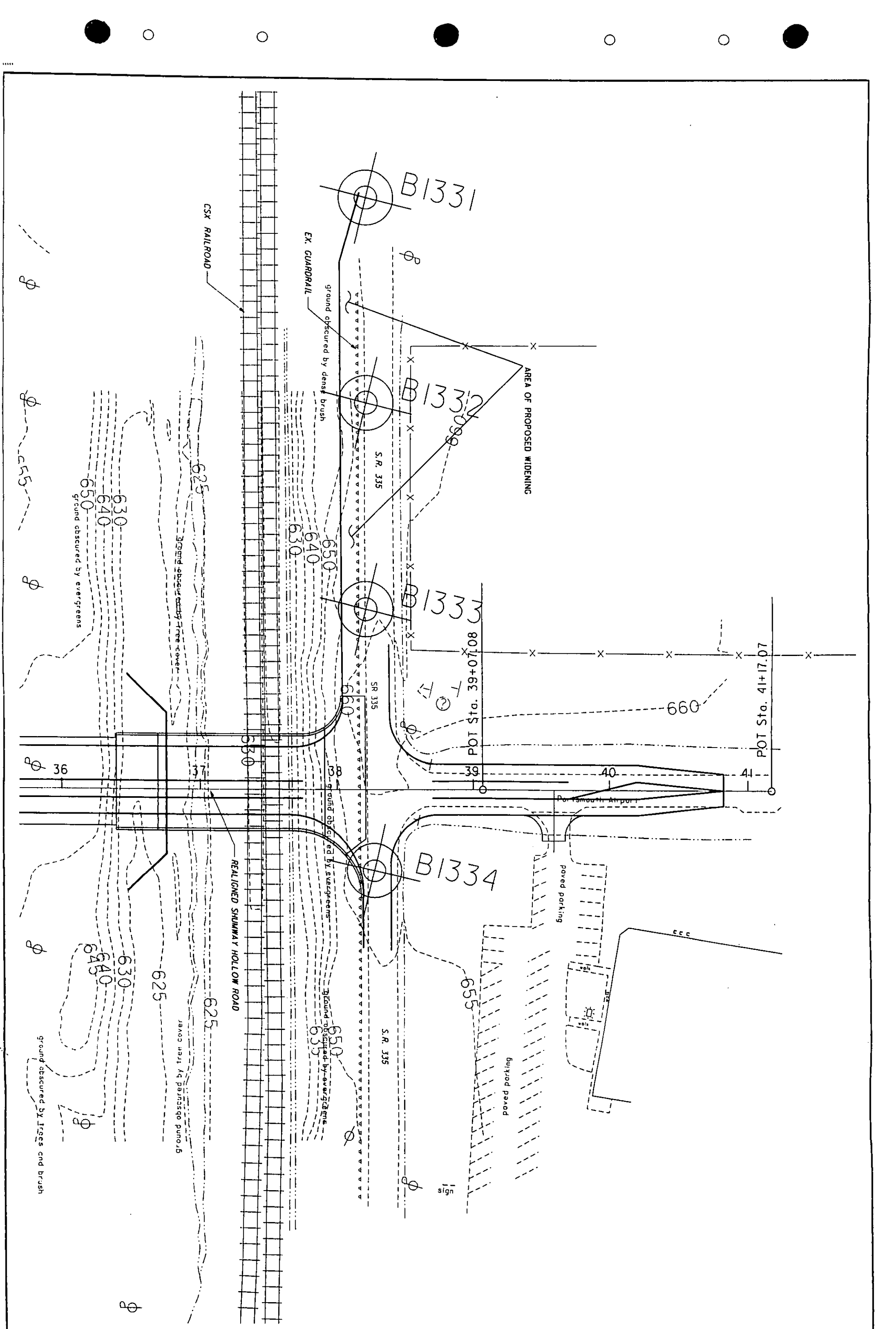
Steven J. Riedy
Geotechnical Engineer

Dorothy A. Adams

Dorothy A. Adams, MSCE, P.E.
Senior Geotechnical Engineer

Encl: As noted

cc: file



SCI-823

SR 335 AT REALIGNED SHUMWAY HOLLOW ROAD

GB-1 BORING PLAN

CALCULATED

CHECKED

0 30 60

HORIZONTAL SCALE IN FEET

N

GENERAL INFORMATION
DRILLING PROCEDURES AND LOGS OF BORINGS

Drilling and sampling were conducted in accordance with procedures generally recognized and accepted as standardized methods of investigation of subsurface conditions concerning geotechnical engineering considerations. Borings were drilled with either a truck-mounted or ATV-mounted drill rig.

Drive split-barrel sampling was performed in 1.5 to 2 foot increments at intervals not exceeding 5 feet. In the event the sampler encountered resistance to penetration of 6 inches or less after 50 blows of the drop hammer, the sampling increment was discontinued. Standard penetration data were recorded and one or more representative samples were preserved from each sampling increment.

In borings where rock was cored, NXM or NQ size diamond coring tools were used.

In the laboratory all samples were visually classified by a geotechnical engineer. Moisture contents of representative fine-grained soil samples were determined. A limited number of samples, considered representative of foundation materials present, were selected for performance of grain-size analyses and plasticity characteristics tests. The results of these tests are shown on the boring logs.

The boring logs included in the Appendix have been prepared on the basis of the field record of drilling and sampling, and the results of the laboratory examination and testing of samples. Stratification lines on the boring logs indicating changes in soil stratigraphy represent depths of changes approximated by the driller, by sampling effort and recovery, and by laboratory test results. Actual depths to changes may differ somewhat from the estimated depths, or transitions may occur gradually and not be sharply defined. The boring logs presented in this report therefore contain both factual and interpretative information and are not an exact copy of the field log.

Although it is considered that the borings have disclosed information generally representative of site conditions, it should be expected that between borings conditions may occur which are not precisely represented by any one of the borings. Soil deposition processes and natural geologic forces are such that soil and rock types and conditions may change in short vertical intervals and horizontal distances.

Soil/rock samples will be stored at our laboratory for a period of six months. After this period of time, they will be discarded, unless notified to the contrary by the client.

LEGEND – BORING LOG TERMINOLOGY

Explanation of each column, progressing from left to right

1. Depth (in feet) – refers to distance below the ground surface.

2. Elevation (in feet) – is referenced to mean sea level, unless otherwise noted.

3. Standard Penetration (N) – the number of blows required to drive a 2-inch O.D., 1-3/8 inch I.D., split-barrel sampler, using a 140-pound hammer with a 30-inch free fall. The blows are recorded in 6-inch drive increments. Standard penetration resistance is determined from the total number of blows required for one foot of penetration by summing the second and third 6-inch increments of an 18-inch drive.

   50/n – indicates number of blows (50) to drive a split-barrel sampler a certain number of inches (n) other than the normal 6-inch increment.

4. The length of the sampler drive is indicated graphically by horizontal lines across the "Standard Penetration" and "Recovery" columns.

5. Sample recovery from each drive is indicated numerically in the column headed "Recovery".

6. The drive sample location is designated by the heavy vertical bar in the "Sample No., Drive" column.

7. The length of hydraulically pressed "Undisturbed" samples is indicated graphically by horizontal lines across the "Press" column.

8. Sample numbers are designated consecutively, increasing in depth.

9. Soil Description

   a. The following terms are used to describe the relative compactness and consistency of soils:

   Granular Soils – Compactness

Term	Blows/Foot Standard Penetration
Very Loose	0 – 4
Loose	4 – 10
Medium Dense	10 – 30
Dense	30 – 50
Very Dense	over 50

   Cohesive Soils – Consistency

Term	Unconfined Compression tons/sq.ft.	Blows/Foot Standard Penetration	Hand Manipulation
Very Soft	less than 0.25	below 2	Easily penetrated by fist
Soft	0.25 – 0.50	2 – 4	Easily penetrated by thumb
Medium Stiff	0.50 – 1.0	4 – 8	Penetrated by thumb with moderate pressure
Stiff	1.0 – 2.0	8 – 15	Readily indented by thumb but not penetrated
Very Stiff	2.0 – 4.0	15 – 30	Readily indented by thumb nail
Hard	over 4.0	over 30	Indented with difficulty by thumb nail

   b. Color – If a soil is a uniform color throughout, the term is single, modified by such adjective as light and dark. If the predominant color is shaded by a secondary color, the secondary color precedes the primary color. If two major and distinct colors are swirled throughout the soil, the colors are modified by the term "mottled".

   c. Texture is based on the Ohio Department of Transportation Classification System. Soil particle size definitions are as follows:

Description		Size	Description		Size
Boulders		Larger than 8"	Sand	– Coarse	2.0 mm to 0.42 mm
Cobbles		8" to 3"		– Fine	0.42 mm to 0.074 mm
Gravel	– Coarse	3" to ¾"	Silt		0.074 mm to 0.005 mm
	– Fine	¾" to 2.0 mm	Clay		smaller than 0.005 mm

d. The main soil component is listed first. The minor components are listed in order of decreasing percentage of particle size.

e. Modifiers to main soil descriptions are indicated as a percentage by weight of particle sizes.

trace	0 to 10%
little	10 to 20%
some	20 to 35%
"and"	35 to 50%

f. Moisture content of **cohesionless soils** (sands and gravels) is described as follows:

Term	Relative Moisture or Appearance
Dry	No moisture present
Damp	Internal moisture, but none to little surface moisture
Moist	Free water on surface
Wet	Voids filled with free water

g. The moisture content of **cohesive soils** (silts and clays) is expressed relative to plastic properties.

Term	Relative Moisture or Appearance
Dry	Powdery
Damp	Moisture content slightly below plastic limit
Moist	Moisture content above plastic limit but below liquid limit
Wet	Moisture content above liquid limit

10. Rock Hardness and Rock Quality Designation

a. The following terms are used to describe the relative hardness of the **bedrock**.

Term	Description
Very Soft	Permits denting by moderate pressure of the fingers. Resembles hard soil but has rock structure. (Crushes under pressure of fingers and/or thumb)
Soft	Resists denting by fingers, but can be abraded and pierced to shallow depth by a pencil point. (Crushes under pressure of pressed hammer)
Medium Hard	Resists pencil point, but can be scratched with a knife blade. (Breaks easily under single hammer blow, but with crumbly edges.)
Hard	Can be deformed or broken by light to moderate hammer blows. (Breaks under one or two strong hammer blow, but with resistant sharp edges.)
Very Hard	Can be broken only by heavy and in some rocks repeated hammer blows.

b. Rock Quality Designation, RQD – This value is expressed in percent and is an indirect measure of rock soundness. It is obtained by summing the total length of all core pieces which are at least four inches long, and then dividing this sum by the total length of the core run.

11. Gradation – when tests are performed, the percentage of each particle size is listed in the appropriate column (defined in Item 9c).

12. When a test is performed to determine the natural moisture content, liquid limit moisture content, or plastic limit moisture content, the moisture content is indicated graphically.

13. The standard penetration (N) value in blows per foot is indicated graphically.

DLZ OHIO INC. * 6121 HUNTLEY ROAD, C[illegible]BUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1331 | Location: Sta. 14+29.4, 5.6 ft. LT of SR 335 CL | Date Drilled: 09/14/05

WATER OBSERVATIONS: Water seepage at: 7.5'
Water level at completion: 2.0' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	658.2												
0.4	657.8	7 7 5 7	2	1			Topsoil - 5"						
							Medium dense brown SANDY SILT (A-4a), some fine sand, little coarse sand, trace gravel, little to some clay; damp to moist.	7	15	--	26	52	
2.0	656.2	1 1 1 3	18	2		0.5							
							Soft to medium stiff brown SANDY SILT (A-4a), some to "and" fine sand, some clay, trace coarse sand; moist.	0	3	--	36	34	27
5.0	653.2	1 2 1 3	18	3		0.75							
							Medium stiff brown SILT AND CLAY (A-6a), "and" fine sand, trace coarse sand; moist.	0	3	--	43	25	29
6.5	651.7	4 6 6	18	4									
							Medium dense brown COARSE AND FINE SAND (A-3a), trace to little silty clay; moist to wet.	0	20	--	69	11	
		3 2 5	18	5			@ 8.5-10.0', loose to medium dense; moist.						
10		1 6 5	18	6									
		7 9 50/2	12	7			@ 13.5-16.1', dense to very dense.						
15		50/1	0	8									
18.0	640.2						Hard gray SANDSTONE interbedded with SILTSTONE (turbidites); very fine to fine grained, slightly weathered, argillaceous, micaceous, massively bedded, slightly fractured.						
20		Core 84"	Rec 85"	RQD 98%	R-1	*504							
25							@ 25.0'-25.4', 25.8'-26.3', broken.						
		Core 60"	Rec 58.5"	RQD 78%	R-2	*304							
30.0	628.2						Bottom of Boring - 30.0'						

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40

Non-Plastic
50+
50+
Non-Plastic

FILE: 0121-3070-03 (11/24/2006 1:37 PM)

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [redacted]IBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1331 | Location: Sta. 14+29.4, 5.6 ft. LT of SR 335 CL | Date Drilled: 09/14/05

WATER OBSERVATIONS: Water seepage at: 7.5'
Water level at completion: 2.0' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL ⊢—⊣ LL Blows per foot - ○ 10 20 30 40
30	628.2													
35														
40														
45														
50														
55														
60														

FILE: 0121-3070-03 (11/21/2006 1:37 PM)

DLZ OHIO INC. * 6121 HUNTLEY ROAD, [illegible]MBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1332 | Location: Sta. 12+80.2, 5.5 ft. LT of SR 335 CL | Date Drilled: 09/14/05

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N)
0	657.5						WATER OBSERVATIONS: Water seepage at: 13.5' Water level at completion: 3.1' (includes drilling water)							
1.0	656.5	8 9	6	1			Asphalt Concrete Pavement - 8" Aggregate Base - 4"	22	14	--	17	40	7	Non-Plastic
2.5	655.0	4 2 1 2	6	2			Medium dense brown SANDY SILT (A-4a), trace clay, little fine sand, little coarse sand, little to some gravel; damp.	49	19	--	13	19		Non-Plastic
4.5	653.0	2 1 1 2	6	3			Loose brown GRAVEL WITH SAND (A-1-b), little to some silty clay; damp.	0	6	--	42	36	16	Non-Plastic
6.0	651.5	2 3 3	18	4			Loose brown SANDY SILT (A-4a), little clay, "and" fine sand, trace coarse sand; moist.	0	25	--	59	16		Non-Plastic
		3 2 2	18	5			Loose brown COARSE AND FINE SAND (A-3a), trace to little silty clay; damp to moist.							
10														
10.5	647.0	1 1 6	18	6		0.25	Very soft to soft mottled brown and gray SILT AND CLAY (A-6a), trace fine sand, trace coarse sand; contains very fine sand seams; moist.	0	1	--	3	48	48	
14.0	643.5	4 50/2	5	7		0.25	@ 13.5'-14.0', little to some fine sand.							50+
15		50/2	0	8			Dense to very dense brown FINE SAND (A-3), trace silty clay; moist.							50+
18.0	639.5	Core 60"	Rec 60"	RQD 89%	R-1	*351	Medium hard to hard SANDSTONE (turbidites); very fine to fine grained, slightly weathered, argillaceous, micaceous, massively bedded, slightly fractured.							
23.0	634.5						Bottom of Boring - 23.0'							
25														
30														

GRADATION

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40

FILE: 0121-3070-03 (11/24/2006 1:37 PM)

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Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1333 | Location: Sta. 11+30.6, 6.3 ft. LT of SR 335 CL | Date Drilled: 09/13/05

WATER OBSERVATIONS: Water seepage at: 12.0'
Water level at completion: 2.6' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	660.1												
0.3	659.8	3 3 4 6	8	1			Topsoil - 4"						
							Loose brown GRAVEL WITH SAND AND SILT (A-2-4), little to some clay, little to some silt; trace to some gravel gravel; damp.	32	18	--	21	22	7
		3 2 4 6	18	2				0	7	--	61	10	22
4.0	656.1						Loose brown COARSE AND FINE SAND (A-3a), trace to little silt, little to some clay; damp to moist.						
5		3 4 5 6	18	3				0	2	--	69	9	20
		3 2 2	16	4				0	15	--	68	17	
8.0	652.1						Loose brown FINE SAND (A-3), some coarse sand, trace silty clay; moist.						
		2 3 3	17	5									
10							@ 11.0'-12.5', wet.	0	24	--	72	4	
		1 1 8	13	6									
13.0	647.1						Very soft brown SILT AND CLAY (A-6a), trace fine sand; moist.						
		1 1 1	18	7		<0.25		0	0	--	1	60	39
15													
16.0	644.1	50/4		8			Dense to very dense brown COARSE AND FINE SAND (A-3a) trace silty clay; damp to moist.						
18.0	642.1						Medium hard to hard gray SANDSTONE ; very fine to fine grained, slightly to moderately weathered, argillaceous, micaceous, medium bedded to thickly bedded, slightly to moderately fractured.						
20		Core 72"	Rec 63"	RQD 72%	R-1	*376	@ 19.6'-19.8', 20.2'-20.5', broken zones.						
25		Core 72"	Rec 72"	RQD 80%	R-2	*323	@ 25.0'-25.5', lost recovery.						
30.0	630.1						Bottom of Boring - 30.0'						

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢ LL
Blows per foot - ○
10 20 30 40

Non-Plastic
Non-Plastic
Non-Plastic
Non-Plastic
50+

FILE: 0121-3070-03 [11/24/2006 1:38 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, C[illegible]BUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1333 | Location: Sta. 11+30.6, 6.3 ft. LT of SR 335 CL | Date Drilled: 09/13/05

WATER OBSERVATIONS: Water seepage at: 12.0'
Water level at completion: 2.6' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetro-meter (tsf) / * Point-Load Strength (psi)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL ⊢—⊣ LL Blows per foot - ○ 10 20 30 40
30	630.1													
35														
40														
45														
50														
55														
60														

FILE: 0121-3070-03 [11/24/2006 1:38 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, C[illegible]BUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring B-1334 | Location: Sta. 8+81.4, 6.3 ft. LT of SR 335 CL | Date Drilled: 09/13/05

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf) / * Point-Load Strength (psi)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	655.5						WATER OBSERVATIONS: Water seepage at: 7.5' Water level at completion: 4.3' (Includes drilling water)						
0	655.5						Asphalt Concrete Pavement - 9"						
1.1	654.4	6 8	6	1		2.0	Aggregate Base - 4"	13	10	--	23	41	13
2.0	653.5	4 5 6 6		2			Very stiff dark brown SANDY SILT (A-4a), some fine sand, little clay, trace to little coarse sand, little gravel; damp.	0	14	--	70	16	
5		4 6 4 7	18	3			Loose to medium dense brown COARSE AND FINE SAND (A-3a), little silty clay; damp.	0	13	--	76	11	
6.0	649.5	3 4 4	18	4			Loose brown FINE SAND (A-3), trace silty clay; damp to moist.	0	20	--	74	7	
8.0	647.5	4 3 3	13	5		3.5	Very stiff brown ELASTIC CLAY (A-7-5), trace fine sand, trace coarse sand, trace gravel; damp to moist.	2	3	--	4	56	35
10													
10.5	645.0	6 12 15	10	6			Medium dense grayish brown COARSE AND FINE SAND (A-3a), trace to little silty clay, trace gravel ; damp to moist.						
14.0	641.5	50/3		7			Medium hard to hard gray SANDSTONE; fine to very fine grained, slightly weathered, argillaceous, micaceous, massively bedded, slightly fractured to unfractured.						
		Core 60"	Rec 59"	RQD 91%	R-1	*302							
19.0	636.5						Bottom of Boring - 19.0'						
20													
25													
30													

GRADATION

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40

Non-Plastic
Non-Plastic
Non-Plastic
50+

FILE: 0121-3070-03 [11/24/2006 1:38 PM]

Soil Investigation Summary

Do NOT Rubblize & Roll
Global CS is NOT an option
Global LS is NOT an option

Design CBR is 10

Number of Borings = 4

Classification Counts by Sample														
R	1a	1b	3	3a	2-4	2-5	2-6	2-7	4a	4b	5	6a	6b	7-5	7-6
0	0	0	0	9	1	0	0	0	5	0	0	1	0	0	0
				56%	6%				31%			6%			
0.0%				62.5%					37.5%						

Class @ Surface	
2-5	0
4b	0
5	0
7-5	0
7-6	0
R	0

% Borings	
N_L <	75%
N_L < 10	100%
N_L > 20	0%
M+	100%

% @ Surface	
25%	
0%	25%
% Borings	
100%	
0%	100%
0%	25%
0%	100%

	N	N_L	PI			M	M_{OPT}	GI
Average	7.9	4.0			8.5		13.6			13.7	9.3	2.33
Maximum	17	8	24	16	11	41	29	61	23	14		5
Minimum	2	2	21	13	7	3	4	7	6	8		0

SCI-823 SR 335 at Shumway Hollow Rd

#	B #	Boring Location	Depth	To	Cut Fill	Standard Penetration n_2	n_3	N	N_L	Physical Characteristics LL	PL	PI	% Silt	% Clay	P 200	Moisture M	M_{OPT}	Classification Class	GI	Comments	Problem w/ Class	w/ MN	Treatments LS	CS	UC Class	UC MN	Analysis
1	1331	As Per Plan	0.0	2.0		7	5	12		NP	NP	NP	26	26	52	14	11	4a	5								
		SR 335	2.0	4.0		1	1	2		21	13	8	34	27	61	18	10	4a	5			MN		–		3+	
		Off Shoulder	4.0	6.0		2	1	3		24	13	11	25	29	54	23	14	6a	4			MN		–		3+	
			6.0	7.5		6	6	12	2	NP	NP	NP	5	6	11	23	8	3a				MN				1	
2	1332	As Per Plan	1.0	2.0		8	9	17		NP	NP	NP	40	6	46	11	11	4a	5								
		SR 335	2.0	4.0		2	1	3		NP	NP	NP	9	10	19	8	8	3a	0			N				3+	
		In Pavement	4.0	6.0		1	1	2		NP	NP	NP	36	16	52	17	11	4a	5			MN		–		3+	
			6.0	7.5		3	3	6	2	NP	NP	NP	8	8	16	18	8	3a				MN				3	
3	1333	As Per Plan	0.0	2.0		3	4	7		NP	NP	NP	22	7	29	6	10	2-4	0			N		16		2	
		SR 335	2.0	4.0		2	4	6		24	16	8	10	22	32	14	8	3a	0			MN				3	
		Off Shoulder	4.0	6.0		4	5	9		NP	NP	NP	9	20	29	12	8	3a	0			MN				2	
			6.0	7.5		2	2	4	4	NP	NP	NP	8	9	17	12	8	3a				MN				3+	
4	1334	As Per Plan	1.0	2.0		6	8	14		21	14	7	41	14	55	9	10	4a	4								
		SR 335	2.0	4.0		5	6	11		NP	NP	NP	8	8	16	8	8	3a	0								
		In Pavement	4.0	6.0		6	4	10		NP	NP	NP	6	5	11	9	8	3a	0								
			6.0	7.5		4	4	8	8	NP	NP	NP	3	4	7	17	8	3a				MN				2	

APPENDIX D

DLZ

DLZ
ENGINEERS • ARCHITECTS • SCIENTISTS
PLANNERS • SURVEYORS

October 27, 2006

Michael D. Weeks, P.E., P.S.
TranSystems Corporation
5747 Perimeter Drive, Suite 240
Dublin, OH 43017

Re: **Pavement Design Information**
Phase 1 Mainline
SCI-823-0.00 Portsmouth Bypass
DLZ Job No.: 0121-3070.03
Document No. 0033

Dear Mr. Weeks:

We have evaluated the existing laboratory test results performed as of June 6, 2006, to estimate a recommended CBR value for the above-mentioned project. Because the vast majority of the project's alignment will be in rock cuts or on embankments, all of the laboratory test results for the project were considered.

The method used was essentially the same as the one used by the Office of Geotechnical Engineering to determine the design CBR for the Nelsonville Bypass project. The alignment for that project was similar to the Portsmouth Bypass alignment in that most of it will also be in rock cuts or on embankments.

The project has been divided into three phases, 1 through 3. Based upon the laboratory test results from the borings in each of the three phases, recommended CBR values have been established. The results of phase 1 only are presented in this letter. The results of the other phases will be presented in separate documents.

A total of 242 samples have been tested for particle size and plasticity where necessary. A summary of the soil samples tested is presented on the following page.

Based upon the results of the laboratory testing, an average CBR value of 5.6 was calculated for phase 1. Consequently, a CBR value of 6 is recommended for the pavement design on the mainline alignment and ramps of the new alignment in phase 1.

It is understood that the phase 1 area is inclusive of station 354+00 to 537+50.

All side roads in the phase 1 area have been independently evaluated for subgrade improvements and pavement design information. Please refer to these documents for more information.

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Michael D. Weeks, P.E., P.S.
October 27, 2006

Summary of Soil Samples Tested

ODOT Classification	Number of Samples Tested
Gravel with sand (A-1-b)	1
Fine sand (A-3)	4
Gravel, sand and silt (A-2-4)	16
Sandy silt (A-4a)	43
Silt (A-4b)	34
Silt and clay (A-6a)	28
Silty clay (A-6b)	17
Elastic clay (A-7-5)	4
Clay (A-7-6)	95

We appreciate having the opportunity to be of service to you on this project. Please do not hesitate to call if you have any questions concerning our report.

Respectfully submitted,

DLZ OHIO, INC.

Steven J. Riedy
Geotechnical Engineer

Pete Nix, P.E.
Geotechnical Division Manager

cc: File

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