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August 16, 2007

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

Re: **Bearing Capacity and Settlement Evaluation**
(Culvert at STA. 466+45)
SCI-823-0.00 Portsmouth Bypass
DLZ Job No.: 0121-3070.03
Document #0076

Dear Mr. Weeks:

This letter presents the findings of the preliminary evaluation of the proposed culvert and embankment at Station 466+45 on the above-referenced project. The findings of other culvert and embankment evaluations will be submitted in separate documents.

It is our understanding that a new culvert will be constructed at Station 466+45 for the above referenced project. The culvert will be an 84-inch Type A conduit in accordance with ODOT Item 707.03 (Structural Plate Corrugated Steel Structures). Preliminary plans indicate the flow line of the culvert varies from a few feet above to a few feet below existing grade along its alignment. It is therefore anticipated that a portion of the embankment fill will need to be placed prior to excavating for construction of the culvert (ODOT CMS Item 603.05 Method B). The maximum cover over the culvert at this location is approximately 66 feet. The inlet and outlet of the culvert will be supported by headwalls flush with the face of the pipe at both ends. At the time of preparing this letter no further information was available regarding the proposed culvert.

It should be noted that the results of this evaluation are based upon the findings of three borings (C-10 through C-12) located along the proposed alignment of the culvert. The borings were advanced to depths ranging between 14 and 19 feet below the ground surface. Logs of the borings, a plan and profile drawing showing the approximate locations of the borings, a legend of the boring log terminology and general information regarding the drilling procedures are attached. The surveyed ground surface elevations at the boring locations are reported on the logs.

Exploration Findings

The borings generally encountered 8.5 to 14.5 feet of soil overlying sandstone bedrock. The overburden consisted predominantly of very stiff to hard cohesive soil (A-4a, A-4b, A-7-6). The underlying sandstone bedrock was soft to medium hard and slightly fractured and weathered.

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Bearing Capacity Evaluation

The preliminary plans indicate that the invert elevations at the inlet and outlet of the proposed culvert are 666.28 and 656.63, respectively. The bottoms of the headwall footings were assumed to be 4 feet below the invert elevations to place them below the frost zone and prevent scour of the headwall (Ohio BDM Section 200). Based on the results of the borings, footings at these elevations will bear in hard silt (A-4b). Footings bearing in the hard cohesive soil should be designed based on an allowable bearing capacity not greater than 5,000 pounds per square foot (psf).

Settlement Evaluation

Soil parameters for use in the settlement calculations were estimated using correlations with moisture content and Atterberg limits. Settlement below the centerline of the embankment was evaluated using the maximum cover of the embankment (66 feet) as the surcharge load and using the soil profile encountered in boring C-12.

The settlement analysis indicated that the soil below the embankment will yield a total settlement of 4.4 inches. The analysis also indicated that 80% of the consolidation settlement (3.5 inches) will occur within approximately four months after the embankment load is applied, while the time required to achieve the total consolidation settlement (4.4 inches) will be approximately 19 months. Secondary compression of the foundation soils beneath the embankment is estimated to produce approximately 0.6 inches of additional settlement over a period of a few years after construction.

Settlement at the ends of the culvert, due to the embankment loading, is expected to be insignificant. Based on the preceding information, and including the secondary consolidation estimate, differential settlement between the center of the embankment and the inlet and outlet of the culvert is expected to be approximately 5.0 inches. The settlement analyses are attached.



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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 preliminary findings.

Respectfully submitted,
DLZ OHIO, INC.

Wael Alkasawneh, P.E.
Geotechnical Engineer

Bryan Wilson, P.E.
Senior Geotechnical Engineer



Encl: As noted.

cc: J. Greg Brown, P.E. (TranSystems Corporation), File

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 soils 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

<u>Terms</u>	<u>Blows/Foot Standard Penetration</u>
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	over 50

Cohesive Soils - Consistency

<u>Term</u>	<u>Unconfined Compression tons/sq.ft.</u>	<u>Blows/Foot Standard Penetration</u>	<u>Hand Manipulation</u>
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 - 1.00	4 - 8	Penetrated by thumb w/ moderate effort
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 ODOT Classification System. Soil particle size definitions are as follows:

<u>Description</u>	<u>Size</u>	<u>Description</u>	<u>Size</u>
Boulders	Larger than 8"	Sand-Coarse	2.00 mm. to 0.42 mm.
Cobbles	8" to 3"	-Fine	0.42 mm. to 0.074 mm.
Gravel-Coarse	3" to 3/4"	Silt	0.074 mm. to 0.005 mm.
-Fine	3/4" to 2.00" 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. The moisture content of cohesive soils (silts and clays) is expressed relative to plastic properties.

<u>Term</u>	<u>Relative Moisture or Appearance</u>
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

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

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

10. Rock hardness and rock quality description.

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

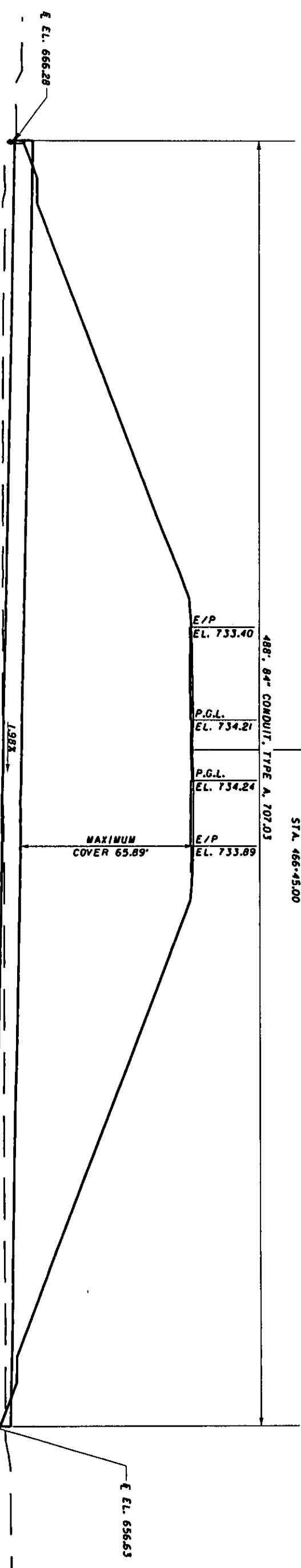
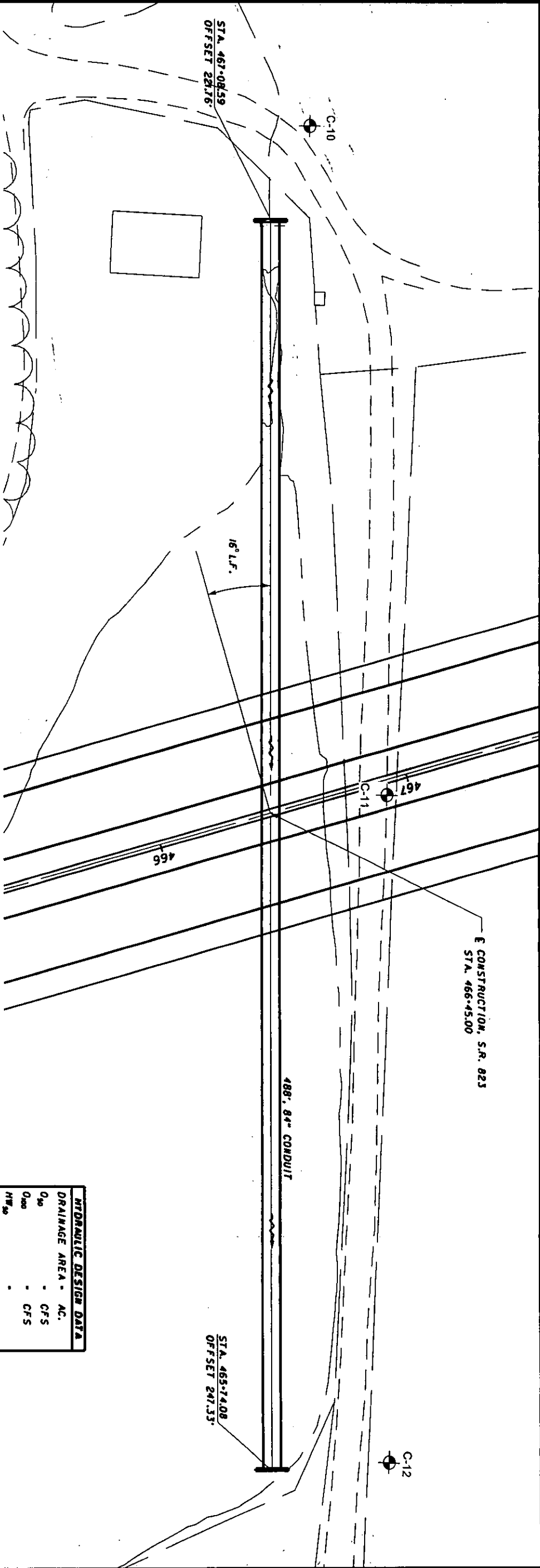
<u>Term</u>	<u>Description</u>
Very Soft	Difficult to indent with thumb nails; resembles hard soil but has rock structure
Soft	Resists indentation with thumb nail but can be abraded and pierced to a shallow depth by a pencil point.
Medium Hard	Resists pencil point, but can be scratched with a knife blade.
Hard	Can be deformed or broken by light to moderate hammer blows.
Very Hard	Can be broken only by heavy blows, and in some rocks, by 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.



488' 84" CONDUIT, TYPE A, 707.03
 Q CONSTRUCTION, S.R. 823
 STA. 466+45.00

E/P
 EL. 733.40
 P.G.L.
 EL. 734.21
 P.G.L.
 EL. 734.24
 E/P
 EL. 733.89

MAXIMUM
 COVER 65.89'

HYDRAULIC DESIGN DATA	
DRAINAGE AREA - AC.	
Q_{50}	- CFS
Q_{100}	- CFS
HW_{50}	-
HW_{100}	-
V_{50}	- FPS
V_{100}	- FPS

NOT FOR CONSTRUCTION

SCI-823-0.00

PHASE I HEADWALL LOCATION SUBMITTAL
 S.R. 823 STA. 466+45

CALCULATED
 JCB
 CHECKED
 HJS
 HORIZONTAL
 SCALE IN FEET



GENERAL INFORMATION DRILLING PROCEDURES AND LOGS OF BORINGS

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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.

Client: TranSystems, Inc.

Project: SCI-823-0.00

Job No. 0121-3070.03

LOG OF: Boring C-10

Location: Sta. 467+32.2, 239.2 ft. LT of SR 823 CL

Date Drilled: 06/28/06

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No.		Hand Penetrometer (tsf)	WATER OBSERVATIONS: Water seepage at: None Water level at completion: None (prior to coring) 3.5' (includes drilling water, inside hollowstem augers)	GRADATION						STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL ————— LL Blows per foot - ○ 10 20 30 40
				Drive	Press / Core			% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	
0	663.9						No topsoil Very stiff to hard brown and gray SILT (A-4b), little to some clay, little fine to coarse sand, trace gravel; damp. @ 4.0', mottled brown and gray.							
		5 6 8	17	1		4.5+		2	6	-	6	60	26	
		6 8 11	18	2		4.5+		2	9	-	9	62	18	
5		6 9 10	18	3		2.5								
7.0	656.9						Medium dense brown SANDY SILT (A-4a), trace to little clay; damp to moist.							
8.5	655.4						Severely weathered brown and gray SANDSTONE.							
9.1	654.8	34 50/1	5	4			Soft to medium hard gray SANDSTONE; very fine to fine grained, slightly weathered, laminated to very thinly bedded, slightly fractured.							
10		Core 60"	Rec 60"	RQD 93%	R-1									
14.1	649.8						Bottom of Boring - 14.1'							
15														
20														
25														
30														

Client: TranSystems, Inc.

Project: SCI-823-0.00

Job No. 0121-3070.03

LOG OF: Boring C-12

Location: Sta. 466+17.4, 247.6 ft. RT of SR 823 CL

Date Drilled: 06/28/06

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No.		Hand Penetrometer (tsf)	WATER OBSERVATIONS: Water seepage at: None observed. Water level at completion: None (prior to coring) 2.5' (includes drilling water, inside hollowstem augers)	GRADATION						STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL ——— LL Blows per foot - ○ 10 20 30 40					
				Drive	Press / Core			% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay						
0	661.8						No topsoil Medium stiff brown SILT AND CLAY (A-6a), trace fine to coarse sand; damp.												
		4	3	5	1														
		3	3	5															
4.0	657.8	3	5	6	2	3.25		Stiff to very stiff mottled brown and gray CLAY (A-7-6), "and" silt, trace fine sand; damp to moist. @ 6.0', trace to little gravel.	0	0	-	2	54	44					
5		3	3	7	3	1.25													
		4	15	18	4	--													
9.0	652.8	4	15	18	4	--	Hard light brown SILT (A-4b), little clay, trace to little fine to coarse sand, trace gravel; damp to moist.	1	3	-	8	71	17						
10		4	13	25	5	--													
14.0	647.8	50/5		4	6	--	Soft to medium hard gray SANDSTONE; very fine to fine grained, slightly weathered, laminated to very thin bedded, slightly fractured.												
15		Core 60"	Rec 57"			RQD 62% R-1													
18.5	643.3						Soft to medium hard gray CLAYSTONE; moderately weathered, arenaceous, slightly to moderately fractured. Bottom of Boring - 19.0'												
19.0	642.8																		
20																			
25																			
30																			

FILE: 0121-3070-03 [4/20/2007 10:14 AM]



CLIENT TranSystems Inc.
PROJECT Portsmouth Bypass
SUBJECT Culvert at Station 466+45
Bearing Capacity Analysis

JOB NUMBER 0121-3070-03
SHEET NO. 1 OF 1
COMP. BY BEW DATE 8/16/2007
CHECKED BY _____ DATE _____

Base analysis on results of borings C-10 and C-12.

From hand penetrometer measurements at and below footing elevation:

$$q_u = 4.5 \text{ tsf}$$

$$c = 4500 \text{ psf}$$

$$\text{Factor of Safety (FS)} = 3 \quad (\text{ODOT BDM 202.2.3.1})$$

For cohesive foundation soil:

Meyerhof's Method

$$q_u = S_c \cdot c \cdot N_c + q \cdot N_q \quad q = \gamma \cdot D \quad \text{Can be neglected since footing depth is less than 5 ft}$$

Since footing Dimensions are not known assume $S_c = 1.0$. For $\phi = 0$, use $N_c = 5.14$ and $N_q = 1$

$$q_a = q_u / \text{FS} = 7710 \text{ psf}$$

Conservatively use $q_a < 5000 \text{ psf}$



Client TranSystems Inc.
 Project Portsmouth Bypass
 Item Culvert at STA. 466+45

JOB NUMBER 0121-3070.03
 SHEET NO. 1 OF 4
 COMP. BY WMA DATE 8/10/2007
 CHECKED BY BEW DATE 8/16/07

Calculations Data

Boring	Sample	w	PL	LL	PI	Cc ¹	Cr ²	e _s ³	
C-10	1	17	17	26	9	0.12	0.033	0.9715	
C-10	2	15	19	29	10	0.14	0.037	0.9609	
C-11	1	18	18	25	7	0.09	0.032	0.9797	
C-11	3	15	21	27	6	0.08	0.034	0.9765	
C-11	5	15	24	30	6	0.08	0.038	0.9765	
C-12	2	24	19	41	22	0.30	0.052	0.9575	
C-12	4	17	17	21	4	0.05	0.027	0.9873	
						Average	0.12	0.036	0.9728
						Maximum	0.30	0.052	0.9873

1) Cc=PI/74
 2) Cr=0.000483xLLxGs
 3) Based on CR below

Boring	Sample	LL	C _v ⁴ (ft ² /day)	C _v ⁴ (ft ² /sec)	
C-10	1	26	0.85	9.89E-06	
C-10	2	29	0.63	7.24E-06	
C-11	1	25	0.96	1.11E-05	
C-11	3	27	0.77	8.88E-06	
C-11	5	30	0.57	6.58E-06	
C-12	2	41	0.23	2.70E-06	
C-12	4	21	1.57	1.82E-05	
			Minimum	0.23	2.70E-06
			Average	0.80	9.22E-06
			Maximum	1.57	1.82E-05

⁴C_v(ft²/day) = 9343.5*LL^{1.4}(-2.8542) (Kulhawy and Mayne- 1990)

Typical Values
 Source: Holtz and Kovacs (1981) Terzaghi, Peck and Mesri (1995)

Soil	C _v /C _c
Organic Silts	0.035-0.06
Amorphous and Fibrous Peat	0.035-0.085
Organic Clays and Silts	0.04-0.06
Granular Soils	0.01-0.03
Shale and mudstones	0.02-0.04
Silty Clay	0.03-0.06
Peat	0.05-0.07

Correlation Values-Source: Lamb and Whitman (1969)

w%	CR=(C _v /1+e _s)
9.983	2.389
11.785	2.547
14.487	3.016
17.099	3.825
19.816	4.892
25.352	6.931
28.328	8.079
34.174	10.369
42.400	13.490
51.139	16.388
79.829	23.326
152.740	33.469
341.288	46.114
501.494	52.174

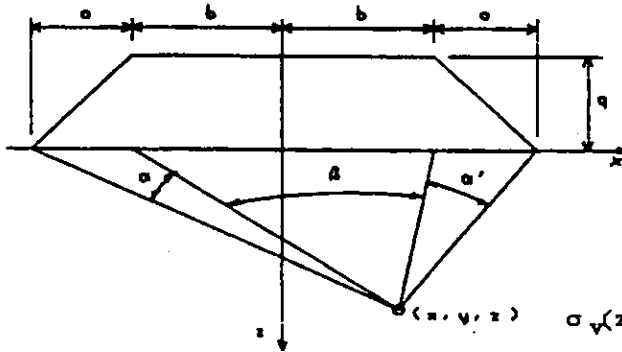
Correlation: CR=-4E-09w⁴ + 5E-06w³ - 0.0021w² + 0.4695w - 3.1337
 R²=0.9992

Boring	Sample	w	PL	LL	PI	LI*	Consolidation*
C-10	1	17	17	26	9	0	Overconsolidated
C-10	2	15	19	29	10	-0.4	Overconsolidated
C-11	1	18	18	25	7	0	Overconsolidated
C-11	3	15	21	27	6	-1	Overconsolidated
C-11	5	15	24	30	6	-1.5	Overconsolidated
C-12	2	24	19	41	22	0.227	Overconsolidated
C-12	4	17	17	21	4	0	Overconsolidated

*Overconsolidated when LI<0.7
 Soils and Foundations Workshop Reference Manual- NHI-00-045 (p. 6.11)

SETTLEMENT ANALYSIS - EMBANKMENT

Embankment Information:



Groundwater Table: D= 100.0 ft
 Embankment Height: H= 66 ft
 Fill Unit Weight: $\gamma_{emb} = 120$ pcf $q = 7,920$ psf
 Width of Slope: a = 186
 Top half-width of Emb: b = 58
 Distance from CL: x = 0
 Output Range: z = 0 to 25 ft

*See Data output Attached

$$\sigma_v(z) := \left(\frac{q}{\pi a}\right) (a(\alpha(z) + \beta(z) + \alpha'(z)) + b(\alpha(z) + \alpha'(z)) + x(\alpha(z) - \alpha'(z)))$$

$$\beta(z) := \text{atan}\left[\frac{(b-x)}{z}\right] + \text{atan}\left[\frac{(b+x)}{z}\right]$$

$$\alpha'(z) := \text{atan}\left[\frac{(a+b-x)}{z}\right] - \text{atan}\left[\frac{(b-x)}{z}\right]$$

$$\alpha(z) := \text{atan}\left[\frac{(a+b+x)}{z}\right] - \text{atan}\left[\frac{(b+x)}{z}\right]$$

Reference: US Army Corps of Engineers EM 1110-1-1904 "Settlement Analysis", Table C-1

Cohesionless

Soil Properties: Settlement is calculated at mid-point of layer

No.	Bot. of Laye	Soil Type	γ_{soil} (pcf)	σ'_c (psf)	σ'_o (psf)	$\Delta\sigma_z$ (psf)	σ'_r (psf)	Soils			
								C'	C _r	C _c	e _o
1	9.0 ft	Silt and Clay	120	8,500	540	7,920	8,460	0.0	0.05	0.30	0.960
2	14.0 ft	Silt	120	9,500	1,380	7,916	9,296	0.0	0.04	0.14	0.980
3	0.0		0	0				0.0	0.00	0.00	0.000
4	0.0		0	0							
5	0.0		0	0							
6	0.0		0	0							
7	0.0		0	0							
8	0.0		0	0							
9	0.0		0	0							
10	0.0		0	0							

Reference: Geotechnical Engineering Principles and Practices; Coduto, 1999

Overconsolidated Soils - Case I ($\sigma'_o < \sigma'_c$) Eqn:11.24

$$(\delta_c)_{ult} = \sum \frac{C_r}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_o}\right)$$

Overconsolidated Soils - Case II ($\sigma'_o < \sigma'_c < \sigma'_f$) Eqn:11.25

$$(\delta_c)_{ult} = \sum \left[\frac{C_r}{1+e_0} H \log\left(\frac{\sigma'_c}{\sigma'_o}\right) + \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_c}\right) \right]$$

Normally Consolidated Soils ($\sigma'_o = \sigma'_c$) Eqn: 11.23

$$(\delta_c)_{ult} = \sum \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_o}\right)$$

Cohesionless Soils ($\sigma'_o = \sigma'_c$)

$$(\delta_c)_{ult} = \sum \frac{1}{C'} H \log\left(\frac{\sigma'_f}{\sigma'_o}\right)$$

No. Settlement:

Total Settlement

1 0.285 ft

2 0.077 ft

0.363 ft

3

4

5

4.4 in

6

7

8

9

10



SUBJECT	Client	TranSystems, Inc.	JOB NUMBER	0121-3007.03		
	Project	SCI-823-0.00	SHEET NO.	3	OF	4
	Item	Culvert at STA. 466+45	COMP. BY	WMA	DATE	08/10/07
	Based on Boring C-12		CHECKED BY	BEW	DATE	08/16/07

TIME RATE SETTLEMENT

Coefficient of consolidation (c_v) = 2.70E-06 ft²/s

Assumed Life Time = 5 yrs

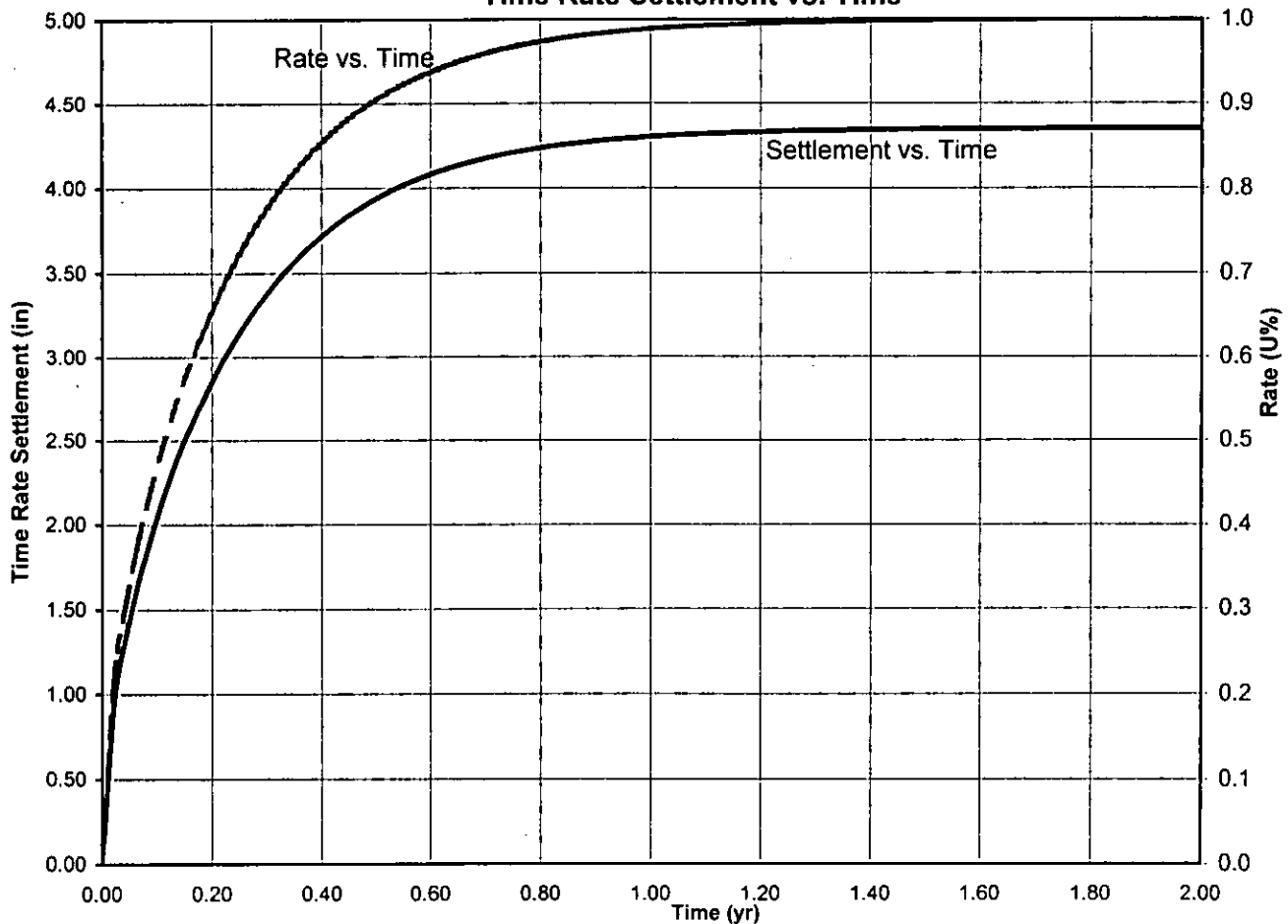
Drainage Path Condition = 1 (0 for single drainage; 1 for double drainage)

Thickness of Layer = 14 ft

Maximum Time Rate Settlement = 4.4 inches

Settlement at (U% =80%) = 3.48 inches 113 days after the end of construction

Time Rate Settlement vs. Time





SUBJECT

Client TranSystems, Inc.

JOB NUMBER 0121-3007.03

Project Portsmouth Bypass

SHEET NO. 4 OF 4

Item Culvert at STA. 474+10

COMP. BY WMA DATE 08/10/07

Based on Boring C-14

CHECKED BY BEW DATE 08/16/07

SECONDARY SETTLEMENT ANALYSIS - EMBANKMENT

Thickness (H) 14 ft
c_v = 2.70E-06 ft^2/s
T = 2.71 (assuming U=0.999)
t_p = 1.6 yrs

Time to end of primary consolidation (t_p) = 1.6 yrs

Table with 6 columns: No., Soil, H(ft), w(%), C_alpha, S(inch). Row 1: 1, Silt and Clay, 14, 17, 0.0039, 0.65

Total Secondary Settlement = 0.6 inches

Secondary Settlement* (delta_secondary) = C_alpha H

t_p = (T * H^2) / c_v Assume U = 0.999

* Ref: Soils and Foundations Workshop Reference Manual- NHI-00-045 (p. 6.14)